FINAL

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

NAVAL STATION NEWPORT AND OUTLYING PARCELS
NEWPORT, RHODE ISLAND

Prepared for:

Navy Region Mid-Atlantic
Naval Facilities Engineering Command Mid-Atlantic
Public Works Department Newport

September 2021

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Prepared by:

Gulf South Research Corporation

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Naval Station Newport
Newport, Rhode Island

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 USC 670a et seq.) as amended and Department of Defense Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1E. This document was prepared and reviewed in coordination with U.S. Department of Interior, Fish and Wildlife Service, and the Rhode Island Department of Environmental Management– Division of Fish and Wildlife, in accordance with the 2013 Memorandum of Understanding for a Cooperative Integrated Natural Resource Management Program on Military Installations.

Approving Official's Signature:

J. R. MCIVER Commanding Officer Naval Station Newport Installation	**Date**

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Naval Station Newport
Newport, Rhode Island

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Approving Official's Signature:

Wendy Weber Regional Director North Atlantic-Appalachian Region United States Fish and Wildlife Service	**Date**

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Newport, Rhode Island

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Approving Official's Signature:

______________________________________ ________________________

Rhode Island Department of Environmental Management Division of Fish and Wildlife

Date

NAVAL STATION NEWPORT INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN ADDENDUM FOR OUTLYING PARCELS:

Fishers Island Annex, Southold New York
Seneca Lake Detachment, Dresden, New York
and
Dodge Pond Field Station, Niantic, Connecticut

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J. R. MCIVER Commanding Officer Naval Station Newport Installation	**Date**

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Approving Official's Signature:

Regional Director, North Atlantic-Appalachian Region United States Fish and Wildlife Service	**Date**

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Approving Official's Signature:

Connecticut Department of Energy and Environmental Protection	**Date**

NAVAL STATION NEWPORT INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN ADDENDUM FOR OUTLYING PARCELS:

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and
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Approving Official's Signature:

New York State Department of
Environmental Protection

Date

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EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) has been prepared and will be implemented in accordance with the Sikes Act Improvement Act, as amended (SAIA or Sikes Act) of 1997 and the Navy Environmental Readiness Program (Chief of Naval Operations [OPNAV] Instruction [OPNAVINST] 5090.1E). Section 101(a)(1)(B) of the SAIA requires the secretary of all military departments to "prepare and implement an INRMP for each military installation in the United States" that contains habitat that is suitable for conservation and management of natural ecosystems. This INRMP has been prepared for Naval Station Newport, located in Newport, Rhode Island (NAVSTA Newport or installation) and three ancillary parcels that are managed by NAVSTA Newport, in accordance with the following authorities, which were current at the time the INRMP was prepared. Revisions to the following authorities and guidance documents would replace the older version, and any necessary changes in the INRMP would be documented during the annual review or incorporated into the INRMP at the time it is updated:

- Department of Defense (DOD) Instruction 4715.03 (*Natural Resources Conservation Program*, 18 March 2011)
- U.S. Department of the Navy (Navy) Instruction OPNAVINST 5090.1E and associated OPNAV Environmental Readiness Program Manual 5090.1 (OPNAV M-5090.1) *Environmental Readiness Program*, 3 September 2019)
- SAIA of 1997 (16 U.S. Code [USC] § 670a *et seq*.)
- Naval Facilities Engineering Command (NAVFAC) Natural Resources Management Procedural Manual (P-73, Chapter 2: Integrated Natural Resources Management Plans, 07 December 2005)
- Navy INRMP Guidance dated 10 April 2006
- Endangered Species Act (ESA) (16 U.S.C. 1531-1544, 87 Stat. 884)

In addition to these authorities, NRMs are encouraged to use geographic information systems (GIS) as the basis for their INRMPs (OPNAV M-5090.1 [Navy 2019a]), and to incorporate the guidance and recommendations provided in *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008). OPNAV M-5090.1 is the manual implemented by OPNAVINST 5090.1E.

The INRMP addresses future requirements and identifies projects that are intended to be implemented over the duration of the plan. The INRMP will be reviewed annually in coordination with the U.S. Fish and Wildlife Service (USFWS), the Rhode Island Department of Environmental Management (RIDEM), the New York State Department of Environmental Conservation (NYSDEC), the Connecticut Department of Energy and Environmental Protection (CT DEEP), and NOAA-NMFS. The purpose of the annual reviews is to ensure that information contained within the plan is current, that implementation and maintenance of conservation measures are on schedule, and that funding for conservation and maintenance activities is included in the annual budget. The review also identifies any natural resources positions that need to be, or are in the process of being filled; ensures that all necessary coordination has taken place, and that upcoming projects and activities are identified and included; and confirms that the INRMP contains any significant changes in the installation's military mission requirements or its natural resources. The annual review provides an opportunity to incorporate changes in accepted environmental conservation practices and scientific advances associated with evaluation and implementation of natural resources management. If necessary, the annual review will include an update of the INRMP that includes an updated project list, documentation of significant changes in natural ecosystems, and updates to information contained in the INRMP appendices. However, the plan will be reviewed for operation and effect no less than every five years, per the requirements of Section 101(b)(2) of the SAIA. Forms to document periodic reviews are included at the beginning of this document, immediately following the Approving Officers' signature page. Plan Update forms will be used to compile proposed updates throughout the course of each year and will serve to provide an outline for revisions to be incorporated during the review for operation and effect.

The INRMP is organized into the following chapters:

- **Chapter 1 – Overview**. This chapter describes the INRMP's purpose, authority, scope, goals and objectives, and authorities that are applicable to the plan, and includes a brief discussion of management strategy and other plan integration.
- **Chapter 2 – Location, Mission, and Land Use**. This chapter provides a general description of the installation including land areas, regional land uses, a brief history, and the military mission and operations of NAVSTA Newport. The section also describes the existing physical and natural conditions of NAVSTA Newport. A general site description is included in this section, along with information including, but not limited to, climate; geology; topography; soils; water resources, including surface waters, wetlands, and ground water; and flora and fauna, including vegetative communities, invasive species, threatened and endangered species, species of concern, and habitats of special concern.
- **Chapter 3 – Natural Resources Management and Mission Sustainability**. This chapter includes discussion of integrating the military mission and natural resources management, consultation requirements, National Environmental Protection Act (NEPA) compliance, encroachment, and the Rhode Island Wildlife Action Plan.
- **Chapter 4 – Natural Resources Program Overview.** This chapter includes a discussion of natural resources management issues that are relevant to NAVSTA Newport, a description of regulatory drivers for natural resources management on DOD installations, and specific recommendations for issues, as appropriate. The management measures and projects planned for implementation under this INRMP also are identified in this section.
- **Chapter 5 – Project Descriptions.** This chapter describes the natural resources management projects introduced in Chapter 4. It includes descriptions of each project, with corresponding potential collaborators.
- **Chapter 6 – Implementation.** This chapter outlines means for implementing this INRMP, including guidelines on supporting the sustainability of the military mission and the natural environment, natural resources consultation requirements, achieving no net loss, NEPA compliance, project development and classification, funding sources, commitment, and use of cooperative agreements.

- **Chapter 7 – References**. This chapter includes a list of all references used in the development of the INRMP. A list of Internet resources of useful information that are accessible through the natural resources manager (NRM) is also provided in this section.
- **Appendix A – List of Acronyms and Abbreviations**. Appendix A defines all acronyms and abbreviations used in the INRMP.
- **Appendix B – Threatened and Endangered Species Fact Sheets.** Appendix B contains printed fact sheets for the federally endangered, threatened, and candidate species and state endangered, threatened, and species of concern that occur on the installation.
- **Appendix C – NAVSTA Newport Natural Resources Project List.** Appendix C contains the summary table for all funding-dependent natural resources projects recommended in the INRMP and includes the proposed implementation schedule, prime legal driver/initiative, class, Navy Environmental Readiness Level (ERL), cost estimate, and potential funding sources for each natural resources project.
- **Appendix D – Species Lists**. Appendix D contains tables of all plant and animal species that have been confirmed to occur at NAVSTA Newport through focused field surveys.
- **Appendix E – Threatened and Endangered Species and Species of Special Concern.** Appendix E includes the list of all species documented at NAVSTA Newport that are listed as endangered, threatened, or as a species of special concern by federal or state agencies.
- **Appendix F – Maps.** Appendix F contains removable, blueprint standard size D (11” x 17”) maps produced after or apart from the completion of this INRMP.
- **Appendix G – NAVSTA Newport Wildlife Brochures.** Appendix G contains pamphlets for public education regarding interaction with certain wildlife species found on NAVSTA Newport.
- **Appendix H – Essential Fish Habitat (EFH) Worksheet.** Appendix H contains a blank National Marine Fisheries Service (NMFS) EFH Worksheet, which should be completed to assess possible impacts of new Navy actions that are under consideration to occur in the nearshore environment, that have the potential to affect EFH.
- **Appendix I – Federal and State Mutual Agreement Letters.** Appendix I contains copies of correspondence between the Navy, RIDEM Division of Fish and Wildlife, National Oceanic and Atmospheric Administration (NOAA), and USFWS to obtain agency concurrence with this INRMP.
- **Appendix J – Environmental Assessment (EA) and FONSI.** Appendix J includes a copy of the EA prepared for the 2001 INRMP as part of the NEPA compliance process, and the Finding of No Significant Impact (FONSI).
- **Appendix K – INRMP Benefits for Endangered Species, Critical Habitat, and Migratory Birds.** Appendix K describes how this INRMP, as implemented, can benefit federal trust species (e.g., migratory birds) and other federally listed, proposed, and candidate species that are confirmed to occur, or may occur, on NAVSTA Newport.
- **Appendix L – NAVSTA Newport Bat Survey Report.** This appendix includes a final report that summarizes the results of most recent bat surveys.

- **Appendix M – NAVSTA Newport Pinniped Survey Reports.** This appendix includes a final report that summarizes the results of the 2015-2016 pinniped haul-count and photo identification surveys conducted concurrently with the development of this INRMP.
- **Appendix N – NAVSTA Newport Nearshore Survey Reports.** This appendix includes a final report that summarizes the results of the 2016-2017 nearshore surveys conducted concurrently with the development of this INRMP.
- **Appendix O – NAVSTA Newport Instruction 5090.26B Recreational Fishing Procedures.** Appendix O includes the fishing procedures allowable along the shoreline.
- **Appendix P – Fort Belvoir Policy Memorandum #27, Tree Removal and Protection.** Appendix P includes a copy of the Fort Belvoir Policy Memorandum on Tree Removal and Protection, which is an example of how a military installation has adopted tree ordinances to preserve ecosystem services and protect important tree species.
- **Appendix Q – Federal Stray Animal Policy and Guidance.** Appendix Q contains the DOD's feral cat and dog policy, which presents guidelines on how to prevent and reduce these feral populations. It also includes the Armed Forces Pest Management Board technical guide on Integrated Management of Stray Animals on Military Installations, which provides examples of stray animal control policies and methods.
- **Appendix R – Species List for Native Plantings.** This appendix includes a list of native plant species recommended for landscaping in Rhode Island.
- **Appendix S – Memorandums of Understanding / Agreement (MOUs/MOAs).** Appendix S contains the Memorandum of Agreement (MOA) between NAVSTA Newport and NOAA Fisheries Service's Northeast Regional Office regarding marine mammal stranding and response; the Memorandum of Understanding (MOU) between NAVSTA Newport, the Rhode Island Lobsterman's Association, and Ocean State Fisherman's Association, to establish the boundaries and area of access for lobster fishers into NAVSTA Newport's navigable waters; and the Addendum to the MOU, giving tribal lobstermen permission to fish in restricted areas.
- **Appendix T – Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing.** This appendix provides voluntary technical guidance for assessing the effects of underwater anthropogenic sound on the hearing of marine mammal species under the jurisdiction of the NMFS.
- **Appendix U – Stranding Procedures.** Appendix U contains the reporting procedures for marine mammal strandings on Navy installations.
- **Appendix V – INRMP for Outlying Parcels.** Relevant text for the three outlying parcels (Dodge Pond Field, Seneca Lake Detachment, and Fishers Island Annex).
- **Appendix W – Annual Review Tracking Form.**

This INRMP has been prepared to comply with the Office of the Under Secretary of Defense INRMP format (Office of the Under Secretary of Defense [OSD] 2006). Table ES-1 provides a cross-reference of the recommended format and the corresponding sections of this INRMP update.

Table ES-1. Cross Reference to the OSD INRMP Format.

Office of the Under Secretary of Defense Recommended INRMP Format	Cross Reference to Required Information in this Document
Cover Page	**Cover Page**
Signature Page	**Signature Page**
Executive Summary	**Executive Summary**
Table of Contents	**Table of Contents**
Chapter 1 – Overview	**1.0 Overview**
1.a – Purpose	1.1 Purpose
1.b – Scope	1.3 Scope
1.c – Goals and Objectives Summary	1.4 Goals and Objectives
1.d – Responsibilities	1.9 Roles and Responsibilities
(1) Installation stakeholder (2) External stakeholder	1.9.1 Installation stakeholder 1.9.2 External stakeholder
1.e – Authority	1.2 Authority
1.f – Stewardship of Compliance	1.6 Compliance and Stewardship Discussion
1.g – Review and Revision Process	1.8 Review and Revision Process
1.h – Management Strategy	1.10 INRMP Management Strategy
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2.0 – Installation Information	2.1 Installation Description
2.a.1 – Location Statement (concise)	2.1.1 General Location Description
2.a.2 – Regional Land Use	2.1.2 Regional Land Uses
2.a.3 – History and Pre-Military Land Use (abbreviated)	2.1.3 Historic and Pre-Military Land Use
2.a.4 – Military Mission (concise)	2.1.4 Military Mission 2.1.5 Natural Resources Necessary to Support NAVSTA Newport's Mission
2.a.5 – Operations and Activities	2.1.6 Operations and Activities that may Affect Natural Resources
2.a.6 – Constraints Map	3.1.2.1 Encroachment and Training Constraints
2.a.7 – Opportunities Map	3.1.2.1 Encroachment and Training Constraints
2.b – General Physical Environment and Ecosystems	2.2 Physical Environment 2.2.1 Geology and Topography 2.2.2 Soils 2.2.3 Hydrology 2.2.4 Climate
2.c – General Biotic Environment	2.3 Biotic Environment
2.c.1 – Threatened and Endangered Species and Species of Concern	2.3.5 Threatened and Endangered Species and Species of Concern
2.c.2 – Wetlands and Deep Water Habitats	2.3.2 Narragansett Bay Watershed 2.3.3 Water Resources 2.3.4 Aquatic Habitats

Office of the Under Secretary of Defense Recommended INRMP Format	Cross Reference to Required Information in this Document
2.c.3 – Fauna	2.3.7 Fauna
2.c.4 – Flora	2.3.6 Flora
Chapter 3 – Environmental Management Strategy and Mission Sustainability	**3.0 Natural Resources Strategy and Mission Sustainability**
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3.a.1 – Integrate Military Mission and Sustainability Land Use	3.1.1 Integrating Military Mission and Sustainable Use
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Office of the Under Secretary of Defense Recommended INRMP Format	**Cross Reference to Required Information in this Document**
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Office of the Under Secretary of Defense Recommended INRMP Format	Cross Reference to Required Information in this Document
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Appendix 3. List of Projects	Appendix C NAVSTA Newport Natural Resources Project List
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Source: OSD 2006

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1.0 OVERVIEW

1.1 PURPOSE

This Integrated Natural Resources Management Plan (INRMP) for Naval Station Newport (NAVSTA Newport or installation) was prepared to comply with the Sikes Act Improvement Act of 1997, as amended (Sikes Act or SAIA) (16 United States [U.S.] Code [USC] 670a *et seq.*), Department of Defense (DOD) Instruction (DODI) 4715.03 (DOD 2018), 32 Code of Federal Regulations (CFR) Part 190 (DOD Natural Resources Management Program) (CFR 2002), Chief of Naval Operations (OPNAV) Instruction (OPNAVINST) 5090.1E: *Environmental Readiness Program* (Navy 2019b), and all other applicable federal and state laws, regulations, and guidance. These regulations require that the Secretary of Defense implement a program to provide for the conservation and rehabilitation of natural resources on military installations. The secretaries of each military department are authorized to carry out the program, consistent with the use of military installations, to ensure the preparedness of the U.S. Armed Forces. The Secretary of the Navy implements and maintains a balanced and integrated natural resources management program for all Navy and U.S. Marine Corps installations. The update of NAVSTA Newport's INRMP has included a thorough review of the natural resources management programs in place at the installation, incorporated the most up-to-date information and data available, and taken into account the most recent guidance, including *Integrated Natural Resources Management Plan Guidance for Navy Installations: How to Prepare, Implement, and Revise Integrated Natural Resources Management Plans (INRMP)* (Navy 2006a); the DOD memorandum, *DOD Integrated Natural Resources Management Plan (INRMP) Template* (OSD 2006); *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008); and DOD Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual* (DOD 2018).

1.2 AUTHORITY

The secretary of each military department is directed to prepare and implement an INRMP for each military installation under their jurisdiction. The INRMP must be prepared in cooperation with the U.S. Secretary of the Interior, acting through the director of the U.S. Fish and Wildlife Service (USFWS), the head of the appropriate fish and wildlife agencies of the state in which the military installation is located, and NOAA NMFS when appropriate. The Sikes Act acknowledges that the principal use of military installations is to ensure the preparedness of the U.S. Armed Forces. In accordance with the SAIA, the INRMP shall, to the extent appropriate and applicable, provide for the following:

- implementation of an ecosystem-based program that provides for conservation and rehabilitation of natural resources consistent with the military mission;
- integration and coordination of all natural resources management activities;
- provision for sustainable multipurpose uses of natural resources;
- provision for public access for use of natural resources within safety and military security considerations; and
- enforcement of applicable natural resources laws (including regulations).

Regulatory drivers that restrict the Navy's operations with respect to natural resources, and that have implications for the management of particular natural resources at NAVSTA Newport, are listed in Chapter 4.0 *Natural Resources Program Overview*. (Refer to Section 7 for applicable World Wide Web sites.)

> An INRMP **guides** the management of installation natural resources in order to **ensure consistency with the installation's military mission**, while **protecting and enhancing natural resources** for multiple uses, sustainable yield, and biological integrity.

1.3 SCOPE

An INRMP's scope comprises all lands, ranges, nearshore areas, and leased areas (1) owned by the U.S. and administered by the Navy; (2) used by the Navy via license, permit, or lease, for which the Navy has been assigned management responsibility; or (3) withdrawn from the public domain for use by the Navy, for which the Navy has been assigned management responsibility (Navy 2006a).

Two parcels of land define NAVSTA Newport (totaling approximately 1,341 acres; refer to Section 2.1.1 for additional detail and maps of the installation and parcels). Located on Aquidneck Island in Narragansett Bay, in the southeastern Rhode Island (RI) communities of Newport, Middletown, and Portsmouth, NAVSTA Newport is situated along the western shore of the island, with more than 10 miles of frontage on the East Passage of Narragansett Bay. In addition to these land areas, this INRMP also covers the coastal/nearshore area to better address any NAVSTA Newport activities on marine and coastal environments (e.g., eelgrass [*Zostera* spp.] beds).

In addition, three ancillary parcels are managed by NAVSTA Newport:

- Dodge Pond Field Station in Niantic, Connecticut (0.96 acres);
- Seneca Lake Detachment in Dresden, New York (4.5 acres); and
- Fishers Island Annex (79 acres), on Fishers Island in Block Island Sound, New York.

As a group, these are referred to as the "Outlying Parcels," and the natural resources of these three parcels are included within this INRMP. An addendum to this INRMP that further discusses natural resources at the Outlying Parcels was completed in 2017 (NAVSTA Newport 2017; see Appendix V).

1.4 GOALS AND OBJECTIVES

This INRMP is a long-term planning document that helps ensure consistency with the installation's military mission, while protecting and enhancing natural resources, to the extent practicable. This INRMP has established the following vision and mission for its program:

NAVSTA Newport Natural Resources Program Vision Statement
NAVSTA Newport's vision for the INRMP is to manage natural resources using sound ecological principles and to provide opportunities for future generations to access and use these resources consistent with the Sikes Act Improvement Act and resource conservation initiatives. The program will integrate local, regional, and national ecological initiatives that are appropriate to the installation mission and that can be funded. The program will be supported by a core natural resources team comprised of professionally trained, multi-disciplinary, experienced staff supported by properly trained and experienced experts and partners. The program will have inherent flexibility to support future changes in mission or the regulatory environment.

NAVSTA Newport Natural Resources Program Mission Statement
NAVSTA Newport's mission for the INRMP is to manage natural resources as an integral part of the military mission and operations. As the guardian of public lands, it is the mission of the INRMP to maintain the existing level of biodiversity using sound ecological principles and land management strategies to ensure that economic and aesthetic values of government lands are maintained. The program's mission involves ensuring installation compliance with natural resources laws and regulations, as well as providing public access, quality of life, and customer service support to installation operations, tenants, Navy personnel and their families, the research and education community, and the general public.

In accordance with the Integrated Natural Resources Management Program (CFR 2002, Appendix to Part 190), the SAIA, and OPNAV M-5090.1: *Environmental Readiness Program Manual* (Navy 2019a), each INRMP must provide for the following, consistent with military operations at the applicable installation:

- management of fish and wildlife, land, and forest resources;
- identification of fish and wildlife-oriented recreational use activities and areas;
- enhancement or modification of fish and wildlife habitat;
- protection, enhancement, and restoration of wetlands, where necessary, for support of fish, wildlife, or plants;
- integration of, and consistency among, the various activities conducted under the INRMP;
- establishment of specific natural resources management goals and objectives, and timeframes for proposed actions;
- sustainable use by the government of natural resources, to the extent that such use is consistent with the needs of fish and wildlife management and subject to installation safety and security requirements;
- enforcement of natural resources laws and regulations;
- no net loss in the capability of military lands to support the military mission of the installation; and

- annual review of this INRMP and its effects, and updated if necessary as determined from the five year review for operation and effect.

For NAVSTA Newport, the goals and objectives that follow have been defined to address INRMP regulatory requirements and the installation-specific needs of NAVSTA Newport and its operations.

Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.

Objective 1.1 Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation.

Objective 1.2 Enhance the function(s) and value(s) of NAVSTA Newport's aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible.

Objective 1.3 Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable.

Goal 2. Sustain and enhance terrestrial habitats on NAVSTA Newport by preserving urban trees, using native plants in landscaping, and conserving riparian areas.

Objective 2.1 Increase urban tree canopy, and conserve individual trees and groups of historic trees within the urban environment.

Objective 2.2 Design and maintain landscaped areas using native trees, shrubs, and herbaceous plants to reduce maintenance requirements.

Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.

Objective 3.1 Identify, monitor, and manage rare, threatened, and endangered (RTE) species in the terrestrial, aquatic, and marine (nearshore) environments.

Objective 3.2 Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species, as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport.

Objective 3.3 Restore and enhance wildlife habitats on NAVSTA Newport.

Objective 3.4 Monitor populations and herd health of select game species

Objective 3.5 *Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species.*

Objective 3.6 *Implement integrated pest management (IPM) controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.*

Goal 4. Provide sustainable natural resources-related outdoor recreation opportunities.

Objective 4.1 *Manage NAVSTA Newport's fishing program to allow for the maximum public participation possible without compromising the military mission, and to enable recreational fishers to harvest the annual quotas recommended to maintain sustainable populations.*

Objective 4.2 *Develop and implement a comprehensive fisheries management program for NAVSTA Newport that will include sustainable harvest via the recreational fishing program.*

Objective 4.3 *Develop and promote additional opportunities/sites for passive outdoor recreation, including establishment of watchable wildlife areas and nature trails.*

Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among NAVSTA Newport's internal and external stakeholders.

Objective 5.1 *Provide adequate staffing, equipment, technology, and training at NAVSTA Newport to ensure proper implementation of this INRMP.*

Objective 5.2 *Implement training, education, outreach, and stewardship initiatives for ecosystem management.*

Objective 5.3 *Provide opportunities for public access among regional stakeholders for environmental education and scientific research and study consistent with resource conservation, in coordination with this INRMP.*

Objective 5.4 *Educate NAVSTA Newport employees, tenants, housing residents, contractors, and academic institutions about natural resources issues on NAVSTA Newport and best management practices to protect Narragansett Bay watershed, and engage these parties in NAVSTA Newport's INRMP and conservation initiatives.*

Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.

Objective 6.1 *Maintain interagency cooperation with the USFWS and Rhode Island Department of Environmental Management (RIDEM).*

Objective 6.2 *Develop partnerships with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), Rhode Island Natural Heritage Program, Save the Bay, Rhode Island Coastal Resources Management Council (RICRMC), DOD Partners in Flight (PIF), academic institutions, and other local agencies and organizations to implement wildlife monitoring and protection programs and habitat restoration projects.*

Objective 6.3 *Coordinate natural resources activities with local community groups, conservation organizations, and private groups.*

Goal 7. Assess the potential impacts of climate change on natural resources of NAVSTA Newport; identify significant natural resources at the installation that are likely to be affected by potential changes in climate and respective sea-level rise; and identify and implement adaptive management strategies to ensure the long-term sustainability of those resources and the military mission.

Objective 7.1 *Participate in, contribute to, or at least monitor the findings of regional partnerships focused on regional or landscape-scale assessment, monitoring, and adaptation of natural resources to climate change.*

Objective 7.2 *Conduct a vulnerability assessment of how climate change may impact the natural resources of interest for NAVSTA Newport, and develop and implement a climate adaptation plan.*

Objective 7.3 *Implement natural resource management strategies and best management practices that provide conservation benefits to the ecosystem and are intended to address risks posed by climate change.*

1.4.1 Related NAVSTA Newport Natural Resources Policies

In addition to the authorities cited in Section 1.1, the NAVSTA Newport INRMP process has reviewed and incorporated the following NAVSTA Newport Natural Resources policies and plans.

NAVSTA Newport Recreational Fishing Procedures. NAVSTA Newport Instruction 5090.26B allows recreational fishing on the installation, with line fishing the only authorized method allowed. Anglers are not authorized to harass, injure, or take any other wildlife other than the permitted fish within the appropriate seasons and daily limits as per the state regulations (Appendix O). All fishing in an area must cease if an angler sights a marine mammal or sea turtle in the vicinity (NAVSTA Newport 2014a, NAVSTA 2018).

NAVSTA Newport Environmental Division. The Environmental Division on the installation is the lead on all environmental protection programs including pollution prevention, conservation, compliance, and cleanup. In addition to the activities of the INRMP, the following environmental programs are directly contributing to the protection and enhancement of natural resources, as well as human safety, on and near the installation:

- Air Pollution Control Program: Prevent and control air pollutants to stay within federal permit levels

- Hazardous Materials Program: Ensure proper acquisition, storage, and disposal of hazardous materials
- Lead-based Paint Program: Minimize contamination of the environment during facility construction, demolition, and renovation
- Pollution Prevention Program: Reduce or eliminate pollution at its source
- Spill Preparedness Program: Prevent the accidental discharge of hazardous materials into coastal waters or where it may affect natural resources
- Stormwater Program: Manage stormwater under a National Pollution Discharge Elimination System (NPDES) permit to protect the water quality of streams and Narragansett Bay
- Tank Program: Prevent contamination of soil and ground water
- Installation Restoration Program (IRP): Identify, evaluate, and cleanup contaminated facilities

1.5 GUIDANCE AND REQUIRED ELEMENTS

The Sikes Act is the driver behind the NAVSTA Newport INRMP and INRMP, and states, "Consistent with the use of military installations to ensure the preparedness of the Armed Forces, each [INRMP]… shall, where appropriate and applicable, provide for:

- Fish and wildlife management, land management, forest management, and fish and wildlife oriented recreation;
- fish and wildlife habitat enhancement or modifications;
- wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants;
- integration of, and consistency among, the various activities conducted under the plan;
- establishment of specific natural resource management goals and objectives and timeframes for proposed actions;
- sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources;
- public access to the military installation that is necessary or appropriate subject to the requirements necessary to ensure safety and military security;
- enforcement of applicable natural resource laws (including regulations);
- no net loss in the capability of military installation lands to support the military mission of the installation; and
- such other activities as the Secretary of the military department determines appropriate."

According to the SAIA, the primary purposes of a military conservation program are conservation and rehabilitation of natural resources, sustainable multipurpose use of those resources, and public access to military lands, subject to safety requirements and military security. Moreover, the conservation program must be consistent with the mission-essential use of the installation and its lands. The SAIA requires the preparation of an INRMP to facilitate the conservation program. The INRMP must be cooperatively developed with the USFWS and the state fish and wildlife agency, which for NAVSTA Newport is RIDEM Department of Fish and Wildlife (RIDEM DFW). The resulting plan reflects the mutual agreement of all three parties concerning conservation, protection, and management of natural resources on the installation.

The SAIA states that "the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the U.S. under the jurisdiction of the Secretary, unless the Secretary determines that the absence of significant natural resources on a particular installation makes preparation of such a plan inappropriate." DODI 4715.03 (DOD 2018) prescribes procedures for integrated management of natural and cultural resources, including preparing an INRMP as required by the SAIA. DODI 4715.03 also states that "INRMPs shall be prepared, maintained, and implemented for all lands and waters under DOD control that have suitable habitat for conserving and managing natural resources." OPNAVINST 5090.1E (Navy 2019b), the Navy's Environmental Readiness Program, implements these provisions. This OPNAV instruction includes the requirements and procedures that shore activities should follow to ensure compliance with state and federal laws, regulations, and executive orders concerning use, management, and protection of natural resources.

1.6 COMPLIANCE AND STEWARDSHIP DISCUSSION

Stewardship is the responsibility to inventory, manage, conserve, protect, and enhance the natural resources entrusted to one's care in a way that respects the intrinsic value of those resources and the needs of present and future generations (OPNAV M-5090.1 [Navy 2019a]). Installations are required to recognize and balance environmental stewardship with mission readiness in retaining control and use of Navy land, sea, and air space for the purpose of maintaining the military mission. Conscious and active concern for the inherent value of natural resources must be given in all Navy plans, actions, and programs (OPNAV M-5090.1 [Navy 2019a]). Stewardship projects and programs enhance an installation's natural resources, promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership. Examples include education and public awareness projects, biological surveys or habitat protection for non-listed species, or management and execution of volunteer and partnership programs. Stewardship is an important component of the Navy's Environmental Readiness Program, and because stewardship projects can occur on an indefinite timescale, these projects are prioritized after compliance projects.

Compliance in terms of an INRMP refers to actions that must be taken in order to abide by the statutes and regulations applicable to natural resources. These are actions that an installation is legally mandated or obligated to take in order to meet current or recurring natural and cultural resources conservation management requirements, and for which it *must* obtain funding. Examples of compliance actions include developing, updating, and revising INRMPs; conducting biological surveys to determine population status of endangered, threatened, and sensitive species; and conducting wetland surveys for planning, monitoring, and/or permit applications. Compliance is essential, so these projects are of the utmost priority.

1.7 REVIEW AND REVISION PROCESS

This INRMP is a long-term planning document designed to guide the installation Natural Resources Manager (NRM) in the management of natural resources to support the installation mission while protecting and enhancing installation resources for multiple use, sustainable yield, and biological integrity. INRMPs should contain the most up-to-date natural resources information, and updates and revisions may be necessary to maintain a proactive management plan. NRMs are encouraged to use GIS to supplement their INRMP and to incorporate the guidance and recommendations contained in *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008 and Navy 2019a).

In accordance with the Integrated Natural Resources Management Program (CFR 2002, Appendix to Part 190), the SAIA, and the Navy *Environmental Readiness Program Manual* (OPNAV M-5090.1 [Navy 2019a]), Navy INRMPs are to be long term plans that are reviewed annually by the installation with formal reviews for operation and effect with the USFWS, state fish and wildlife agencies field-level office, and when applicable, with NOAA-NMFS (Navy, 2006). Certain developments may necessitate an INRMP revision. These developments include:

- A change in mission requirements or intensity of land use,
- significant change in natural resources baseline condition; for example, a substantial change in the population of a listed species or a new invasive species,
- the existing INRMP has proven inadequate, was unable to be implemented, or monitoring has shown projects to be ineffective in meeting natural resources management goals,
- natural resources management goals have changed or planning horizon of the previous INRMP has expired, and
- Base Realignment and Closure (BRAC) actions.

The Installation Commanding Officer must participate in the annual NRC program and INRMP metrics review because INRMPs are prepared to assist the installation commander with his or her natural resources responsibilities, and to ensure adequate and appropriate conservation support for operational requirements (OPNAV M-5090.1). The annual INRMP review must be completed with the cooperation of the USFWS, the NMFS, and the appropriate state fish and wildlife agency. Measurement of the success of the INRMP and identification of any issues associated with implementation of the INRMP will result from collaboration with cooperating partners (OPNAVINST 5090.1E and Navy 2006a).

The annual review also provides an opportunity to incorporate changes in accepted environmental conservation practices and scientific advances associated with evaluation and implementation of natural resources management. If necessary, the annual review will include an update to the INRMP that includes an updated project list, documentation of significant changes to natural ecosystems, and updates to information contained in the INRMP appendices. Forms to document annual reviews are included in this document, and should be used to document changes to the INRMP that will improve natural resources management. Each entry in the update form should reference the plan section and page number that is being updated to facilitate quick cross-referencing.

Installation natural resources managers are not required to revise their INRMP within a specified time interval; however, a formal review for operation and effect is required at least once every five years, in coordination with USFWS and the appropriate state partners' fish and wildlife agency when possible (OPNAVINST 5090.1E, OPNAV M-5090.1, and Navy 2006a). Minor updates to the INRMP should be completed annually to reduce the need for a more costly and time consuming revision following the review for operation and effect. Annual reviews should be fully documented each year to provide each installation the option to utilize the annual review documentation to fulfill the formal review requirement whenever possible. If results of the formal review determine that the existing INRMP is current and operational, the INRMP need not be revised. Any updates to the authorities and guidance documents driving INRMP update requirements would be implemented as appropriate during the annual or formal review periods.

A review for operation and effect of this INRMP will occur every five years with the cooperation of the USFWS, NMFS, and the RIDEM. The review for operation and effect shall verify that all environmental compliance projects have been budgeted for and implemented on schedule; that all required natural resource positions are filled with trained staff or are in the process of being filled; that projects and activities identified for the coming year are included in the INRMP; that all required coordination has been conducted; and that all significant changes to the Installation's mission requirements or its natural resources have been identified. It is recommended that the review for operation and effect be conducted during an annual INRMP metrics review. Mutual agreement on operation and effect must be documented in writing from the parties in the form of a new signature page for the INRMP.

1.8 COORDINATION AND DEVELOPMENT

This INRMP was developed under guidance comprised of internal and external stakeholders and subject matter experts who have a vested interest in natural resources management on the installation. The INRMP reflects the review and involvement of a cross section of land users and land managers of NAVSTA Newport.

1.9 ROLES AND RESPONSIBILITIES

Successfully implementing an INRMP requires the support of natural resources personnel, other installation staff, command personnel, and installation tenants. The following section discusses the responsibilities for INRMP implementation within the Navy.

1.9.1 Installation Stakeholders

1.9.1.1 Installation Commander Officer (ICO)

The Installation Commander Officer (ICO) is responsible for the overall management of the facilities and for successfully carrying out NAVSTA Newport's mission. The ICO is also responsible for implementing and enforcing this INRMP and managing installation operations, including the facilities and security directorates, and contingency operations. To fulfill the environmental stewardship component of NAVSTA Newport's mission, the ICO is responsible for ensuring that NAVSTA Newport has the funding, staffing, and other resources necessary to effectively manage the installation's natural resources.

1.9.1.2 Public Works Department (PWD)

The Public Works Department (PWD) manages real property, natural resources, environmental protection, and pollution abatement programs; and coordinates master planning, engineering, construction, operation, and maintenance of buildings, structures, grounds, and utilities. Its divisions include the Environmental Division, Facilities Maintenance Division, and Facilities Engineering and Acquisition Division.

The PWD Environmental Division is responsible for advising the installation on environmental compliance, planning, and decision-making consistent with Navy regulations and policies. The NAVSTA Newport Environmental Division currently consists of 12 professionals, which include program managers, technicians, and the environmental director. These positions have responsibilities for natural resources management, cultural resources stewardship, pest management, hazardous waste and hazardous materials management, solid waste, wastewater, stormwater, drinking water, air, noise, pollution prevention, contingency planning, environmental management systems, NEPA, and environmental permitting.

1.9.1.3 Public Affairs Office (PAO)

The Public Affairs Office (PAO) is responsible for formulating, implementing, and disseminating all command information to the public, including information about natural resources management. The PAO, through the Environmental Division, is responsible for providing timely and accurate information about this INRMP and related activities to the public as the mission will allow.

1.9.1.4 Navy GeoReadiness Program

The Navy GeoReadiness Program provides, builds, sustains, and advances Commander Naval Installations Command (CNIC)/ Naval Facilities Engineering Command (NAVFAC) capabilities to support DOD shore installation management missions. The program develops, maintains, and shares a comprehensive geographic information system (GIS) that includes data relating to installation infrastructure and environmental topics. In addition, the program oversees the development of analytical geospatial applications and the process of spatially enabling existing business applications.

1.9.1.5 Morale Welfare and Recreation (MWR)

Morale, Welfare, and Recreation (MWR) manages installation community affairs, families, education, military personnel operations, non-appropriated funds, appropriated funds, recruitment and retention programs, and business operations for MWR activities. MWR has a primary role in managing the facilities and recreational resources along Narragansett Bay and the recreational vehicle (RV) park. MWR also rents recreational equipment.

1.9.1.6 Directorate of Contracting (DOC)

The Directorate of Contracting (DOC) performs contracting functions in accordance with the Federal Acquisition Regulation, Defense Federal Acquisition Regulation, Army Federal Acquisition Regulation, and NAVFAC regulations.

1.9.1.7 Other Installation and Tenant Organizations

In addition to the directorates and offices mentioned above, INRMP implementation requires assistance from, or coordination with, a variety of other installation organizations, tenants, and contract personnel. Among the approximately 37 tenants are the Naval War College Naval Academy Preparatory School, the Naval Undersea Warfare Center, and the U.S. Coast Guard. The two formal mechanisms by which the INRMP can be integrated with facility-wide activities are through PWD Environmental Division representation and participation on the Environmental Quality Control Committee (EQCC). The EQCC is a communications forum for environmental planning and management of NAVSTA Newport lands. The ICO chairs the EQCC and the PWD Environmental Division chief, or an elected representative, facilitates the quarterly committee meetings. The EQCC responsibilities with respect to the INRMP include the following:

- identifying and evaluating management issues and concerns;
- providing policy, guidance, and oversight for development of goals and objectives;
- identifying staffing and funding resources for implementing the INRMP;
- overseeing development, implementation, and revision of the INRMP fostering environmental awareness and sound stewardship; and
- providing input on siting facilities and installation planning.

The installation could also establish an Environmental Quality Review Board (EQRB). Board members include representatives from the command operations (including the PWD Environmental, Engineering, and Planning divisions), as well as mission partners. The EQRB would guide the development and implementation of the installation Master Plan and its component plans (see section 1.9), and would advise the ICO on changes to the Master Plan.

The establishment of an EQCC and the EQRB is discussed further in Chapter 4 (Natural Resources Program Overview).

1.9.2 External Stakeholders

1.9.2.1 U.S. Fish and Wildlife Service (USFWS)

The USFWS is a signatory agency of installation INRMPs in accordance with the SAIA. In addition, the DOD and Navy consult formally and informally with the USFWS on threatened and endangered species, as well as candidate species and wetland issues, pursuant to applicable legislation including the Endangered Species Act (ESA) and the Clean Water Act (CWA). The USFWS office with responsibility for NAVSTA Newport is the New England Field Office in Concord, New Hampshire (NH). Additional partnership and collaboration opportunities with the USFWS are discussed in Section 3.6 *Partnerships and Collaboration*.

1.9.2.2 NOAA/NMFS

NAVSTA Newport will coordinate with NOAA/NMFS on the development of this INRMP. The DOD and Navy conduct ESA, Section 7 consultation and coordination for federally listed and candidate species (for marine species and anadromous fish). The NMFS Section 7 coordinator is located in the Northeast Regional Office, Protected Resources Division, in Gloucester, Massachusetts (MA). Additional partnership and collaboration opportunities with the USFWS are discussed in Section 3.6 *Partnerships and Collaboration*.

1.9.2.3 The State of Rhode Island

RIDEM is a signatory agency for this INRMP and oversees the management and use of the state's forests and parks, fisheries, and wildlife. It has statewide responsibilities for assessing and restoring water quality and habitat; managing and regulating recreational boating and fishing; and managing wetlands, wildlife, and rare, threatened, and endangered species.

RIDEM is the state agency that is largely responsible for administering the state's environmental laws, regulations, and environmental permits related to wetlands, water withdrawal, discharges, stormwater, and water and sewage treatment. The mission of RIDEM is to protect the state's natural resources and ensure compliance with all environmental conservation laws.

1.9.2.4 Narragansett Bay Stakeholders

Narragansett Bay Estuary Program (NBEP) was established to protect and preserve the Bay and its watershed through partnerships that conserve and restore natural resources, enhance water quality, and promote community involvement. The NBEP is part of the National Estuary Program (NEP), a national network of 28 programs working for collaborative solutions for estuaries designated by Congress as critically important. Section 320 of the CWA, as amended, states that one of the main purposes of the NEP is to develop a comprehensive watershed ecosystem plan for conservation and management of natural resources in NEP estuaries. NEPs are required to have inclusive stakeholder representation on any management or advisory committee. Such a committee might comprise representatives of state and federal agencies (including the U.S. Environmental Protection Agency [EPA]), interstate or regional agencies, local governments, industry and business, public and private educational institutions, and the general public. The following program priorities are outlined in the NBEP work plan:

- Narragansett Bay planning and policy on an ecosystem/watershed basis;
- ecosystem monitoring;
- Narragansett Bay and watershed water quality, and living resources; and
- habitat inventory, restoration, and protection.

Many of the initiatives included in this INRMP align with NBEP's program priorities. In addition, this INRMP presents partnership and collaboration opportunities with many of the NBEP partners (see Section 3.6 *Partnerships and Collaboration*).

1.9.3 Technical Assistance

Technical assistance to implement this INRMP may be provided to the commanding officer (CO) and natural resources manager (NRM) from the Navy or by outside agencies. Assistance from outside agencies is normally provided through individual agency requests and formal cooperative agreements, while assistance from within the Navy is normally less formal. During the five-year management period of this INRMP, additional cooperative agreements may be implemented.

Technical assistance from organizations outside the Navy may include USFWS, NOAA, NMFS, or the State of Rhode Island. Technical assistance from within the Navy may be provided by staff from the Installation Environmental Office, NAVFAC biologists, foresters, soil conservationists, and additional staff, as needed and subject to funding, to be hired by the Installation to complete the continuous work to ensure successful implementation of this INRMP.

1.10 INRMP MANAGEMENT STRATEGY

DODI 4715.03 (DOD 2018) and OPNAV M-5090.1 (Navy 2019a) state that the INRMP must incorporate the principles of ecosystem management as the basis for natural resources management on Navy lands. These principles include

- a focus on multiple species conservation;
- formation of partnerships to manage ecosystems across boundaries; and
- use of the best available scientific information and adaptive management techniques.

In accordance with this policy, the Navy will strive to maintain healthy, contiguous ecosystems on its own lands; where ecosystem boundaries extend onto adjoining lands, the Navy will strive to work cooperatively with neighboring landowners to manage these ecosystems.

One lesson emphasized in *Conserving Biodiversity on Military Lands: A Guide for Natural Resource Managers* (Benton et al. 2008) is that ecosystem management should be guided by ecological principles, such that historic natural disturbance regimes may be approximated (e.g., the use of prescribed fire), while always being cognizant of the overarching need to support the military mission. In "Chapter 8: The Effects of Natural and Man-Made Disturbances," it is argued that doing so should help to improve and maintain the structure and function of the disturbance-dependent communities.

Adaptive management is another strategy that is encouraged in Benton et al. (2008). This strategy supports the idea that policies and plans are not set in stone, but rather, will be monitored closely and modified, if necessary, to ensure the continued mutual support of natural resources management goals and the military mission. NRMs must calculate over time the responses of the ecosystem to the changes they have made; that is, they must learn from the outcome of their actions (Benton et al. 2008). The INRMP review process, with its annual monitoring, self-evaluation, and subsequent modifications, is conducive to adaptive management.

1.11 INRMP INTEGRATION WITH OTHER INSTALLATION PLANS

Internal and external factors place demands on natural resources on NAVSTA Newport that necessitate that natural resources management be integrated and coordinated with other disciplines, plans, and programs on the installation. In addition, the preparation and development of an INRMP must be coordinated with the development of other installation plans, planning processes, and NEPA documents as required by the *DOD INRMP Template* (OSD 2006). Some of these plans include installation master plans, range plans, training plans, IRP site management plans, Integrated Cultural Resources Management Plans (ICRMPs), and Integrated Pest Management Plans (IPMPs). All EAs going forward will reference this INRMP.

The following existing NAVSTA Newport plans have been reviewed to ensure consistency and integration with this INRMP.

NAVSTA Newport Master Plan

The Master Plan, developed in 2008, is a 25-year development and land use guide for NAVSTA Newport. It incorporates recently completed, ongoing, and future planning initiatives at the installation. One of the major goals stated for the Master Plan is to use sustainable development principles to guide the planning process. This includes minimizing the use of non-renewable resources, reducing impacts on natural systems, and improving the quality of living conditions. The Master Plan includes guidelines and recommendations for selecting sustainable sites for development (i.e., avoiding wetlands and floodplains, site new projects more than 50 feet from any open waterbody, site new projects on previously developed sites, where possible), as well as siting new buildings with access to alternative transportation. Other pertinent recommendations incorporated into the Master Plan include: (1) restore natural habitat where possible; (2) require stormwater retention basins for any new building projects; (3) reduce stormwater runoff in new parking areas through the use of pervious pavers; (4) plant shade trees to reduce heat island effect; and (5) encourage green areas to reduce asphalt cover (NAVSTA Newport 2008a).

NAVSTA Newport Environmental Division personnel works with the Planning Division to integrate the INRMP goals and objectives and ensure that projects are integrated with the Master Plan and other similar plans for NAVSTA Newport development.

Specific items that should be addressed in the Master Plan during the next update include the following:

- listing natural resources management encroachment challenges in addition to development encroachment challenges;
- adopting low-impact development (LID) design standards to reduce impervious surfaces;
- adopting LID design standards to reduce stormwater runoff (i.e., biofilters, swales, rain gardens);
- removing surplus parking and restoring natural habitat;
- recommendations for natural resource educational signage along recreation trails and areas;
- language on how recommended Leadership in Energy and Environmental Design (LEED) standards will benefit natural resources;
- guidelines and opportunities for habitat enhancement/restoration projects;
- opportunities for offshore remediation and eelgrass restoration site projects; and
- listing of natural resource habitat/land uses to the proposed land use maps.

Integrated Cultural Resources Management Plan (ICRMP)

The NAVSTA Newport Integrated Cultural Resources Management Plan (ICRMP) was completed in 2015, and provides guidelines and procedures for management of the station's cultural resources through 2018 (Navy 2015). Because of NAVSTA Newport's history, the major cultural resource management issues on the station are related to historic districts and historic buildings; although Native American archaeological resources and submerged archaeological resources are also present along the coastline, railroad, and nearshore area. The plan does not include specific discussion on natural resources. The INRMP has be reviewed by the NAVSTA Newport Cultural Resources Manager to ensure that the goals, objectives, and projects contained within this plan do not contradict those within the ICRMP. Coordination among staff will ensure that INRMP activities will not affect cultural resources, and that ICRMP activities will not affect natural resources.

The following cultural resource items should be addressed in the Master Plan during the next update:

- reducing or preventing impacts on natural resources during excavation and standard operating procedures (SOPs);
- SOPs to prevent erosion during excavation activities;
- SOPs to prevent habitat disturbance, destruction, or loss during excavation activities; and
- opportunities to work with natural resources personnel to dispatch invasive plant species during excavation projects.

Hazardous Material Control and Management Plan (CMP)

The 5090.14C Instruction titled "Hazardous Material Control and Management" for NAVSTA Newport outlines the issue, storage, use, and management of hazardous materials to promote the health and safety of all workers and the environment. It does not address spills or releases of hazardous materials. Coordination among staff should also occur so that storage and handling of hazardous material will not adversely affect natural resources.

Hazardous Waste Contingency Plan

The NAVSTA Newport Hazardous Waste Contingency Plan was last updated in June 2018 (Michael Baker Jr., Inc. 2011). This plan provides guidance to ensure that hazardous waste storage facilities on NAVSTA Newport are properly designed and equipped to minimize the risk of a spill. It also provides information for how to minimize hazards to human health and the environment in the event that hazardous waste is spilled. Staff should coordinate with each other to ensure that environmentally sensitive areas and species are protected in the event of a spill.

Spill Prevention Control and Countermeasure Plan (SPCC)

Spill Prevention Control and Countermeasure Plans (SPCCs) are intended to help prevent oil from being discharged into navigable waters or abutting shorelines. The most recent SPCC for NAVSTA Newport was prepared in June 2016. It outlines protocols for storing, transferring, and processing oils in order to prevent spills, as well as mitigating the effects of spilled oil product on the environment. Further, it describes training protocols to ensure that NAVSTA Newport staff are aware of proper procedures and are capable of carrying them out.

Integrated Pest Management Plan (IPMP)

The NAVSTA Newport Integrated Pest Management Plan (IPMP) establishes methods and strategies for conducting an IPM program for the station. The plan, completed in 2014 and updated with pen and ink changes annually, focuses on safe, environmentally sound, and cost-effective control of pests (DODI PMP 2018). The NAVSTA Newport Environmental Division currently provides environmental protection and compliance oversight concerning pest management operations. The installation pest management coordinator (IPMC) is an Environmental Division employee. Invasive species management falls under pest management, so the Environmental Division is responsible for conducting some pest management operations, including providing information on protected species, threatened or endangered species, noxious or invasive plants, and environmentally sensitive sites, as well as providing guidance on the management of nuisance wildlife.

The IPMP recommends pest management procedures that minimize impacts on the environment and natural resources including: (1) use of non- or low-toxic pesticides; (2) use of non-chemical methods to reduce mosquito breeding habitat (such as ditch clearing); (3) use of biological control methods where possible (such as mosquito fish); (4) use of non-chemical methods for weed removal (such as mechanical removal or elimination by steam or hot water); and (5) precision targeting of pesticide application where the pest is located.

NAVSTA Newport Environmental Division personnel will continue to provide input during updates to the IPMP to ensure that it is consistent with the goals, objectives, and projects contained within this INRMP.

Site Management Plan (SMP)

The Site Management Plan (SMP) for NAVSTA Newport provides guidance for planning, reviewing, and setting priorities for environmental investigations and remediation to be conducted as part of the Naval IRP. The plan identifies areas of NAVSTA Newport where remediation has taken place, and describes the nature of those remedial activities. It also ranks those sites in terms of the relative risks they pose to human health and the environment, and provides a schedule of activities for addressing those threats. The SMP is updated annually and the most recent version is dated 2020. The potential for remediation of these sites has been considered in the context of the goals and objectives in this INRMP.

Industrial Stormwater Management Plan (SWMP)

Stormwater runoff is generated from rain or snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground. The runoff picks up pollutants like trash, chemicals, oils, and dirt/sediment that can harm rivers, lakes and coastal waters. To protect these resources, communities, construction companies, industries, and others use stormwater controls known as best management practices (BMPs). These BMPs help to filter pollutants and/or prevent pollution by controlling it at its source. The EPA developed the National Pollution Discharge Elimination Program (NPDES), which regulates stormwater discharge from three potential sources: municipal separate storm sewer systems (MS4s), construction activities, and industrial activities. The NPDES program requires certain facilities to develop a Stormwater Management Plan (SWMP). The NAVSTA Newport SWMP, updated in 2019, identifies regulated industrial activities on the installation and describes best management practices (BMPs) for preventing pollution from stormwater runoff. Utilizing these BMPs will help prevent pollution from harming ecosystems on NAVSTA Newport.

Phase II Stormwater Management Program Plan

Polluted stormwater runoff is commonly transported through an MS4 conveyance and then discharged, untreated, into local water bodies. The NAVSTA Newport Phase II Stormwater Management Program was developed in 2004. Owners/operators of a regulated MS4 are required to develop, implement, and enforce a SWMP. The focus of the SWMP is to describe how the MS4 will reduce the discharge of pollutants from its sewers system and addresses these program areas:

- Construction Site Runoff Control
- Illicit Discharge Detection and Elimination
- Pollution Prevention/Good Housekeeping
- Post-Construction Runoff Control
- Public Education and Outreach
- Public Involvement/Participation
- Program Effectiveness
- Total Maximum Daily Loads

Stormwater management at NAVSTA Newport has a direct bearing on the health of ecosystems on and adjacent to the installation, especially in coastal areas near stormwater outfalls. It is important that NAVSTA Newport staff coordinate to ensure that proper measures are in place to keep stormwater pollutants below levels where they can harm species, ecosystems, and recreational opportunities.

Grounds Maintenance Activities

Grounds maintenance activities include mowing, weeding, mulching, spraying pesticides, trimming shrubbery, clearing roads and trails of debris, maintaining ball fields and fences, plowing snow, and putting salt on roads and walkways are performed under contract that specifies levels of grounds maintenance for different areas of NAVSTA Newport. Grounds maintenance activities are relevant to this INRMP for two primary reasons. First, landscaped areas, trails, and roadsides provide habitat for some species; and second, grounds maintenance activities can indirectly affect species and their habitats, as when road salt damages plant life and amphibians by altering the acidity of soil, or when pesticides used to control weeds affect pollinators.

NAVSTA Newport Environmental Division staff should coordinate with the appropriate staff on the Grounds Maintenance Contract to ensure this INRMP and its management measures are taken into account, including:

- the selection of pesticides for the control of invasive species and pests,
- the selection of compounds to be used for snow and ice control, and
- the identification of areas that could be mowed less frequently in order to allow growth of native vegetation and habitat for native species.

Mission Compatibility Analysis Tool (MCAT) Encroachment Management Implementation (EMI) (Formerly Encroachment Action Plan [EAP])

The Mission Compatibility Analysis Tool (MCAT) is a web-based system that has replaced Encroachment Action Plans (EAPs). MCAT enables efficient evaluation, documentation, and communication of potential developments that may encroach upon the military mission. The Encroachment Management Implementation (EMI) module of MCAT is a "living" EAP. The EMI module documents encroachment management strategies and progress toward resolution of existing and emerging encroachment issues. The issues include presence of wetlands, competition for air, land, and sea space, presence of threatened and endangered species, competition for scarce resources, infringement on explosive safety arcs and footprints, competition of finite spectrum resources, internal encroachment, and urban development. Urban development is ranked as the most frequent and highest ranking encroachment risk for NAVSTA. The NAVSTA Newport EAP was used to develop the Encroachment and Training Constraints and Encroachment Partnering sections of this INRMP, but as resource managers and environmental planners move forward, the MCAT will be the primary tool for analyzing and documenting future encroachment threats to NAVSTA Newport. The natural resources staff can benefit from working with NAVSTA Newport planning staff on some of the natural resources-oriented encroachment factors that are monitored (such as urban development, wetlands, water quality, threatened and endangered species, and invasive species).

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2.0 LOCATION, MISSION, AND LAND USE

2.1 INSTALLATION DESCRIPTION

2.1.1 General Location Description

NAVSTA Newport is located on the west coast of Aquidneck Island in southeastern Rhode Island. Aquidneck Island is comprised of three towns—Newport, Middletown, and Portsmouth—and is surrounded by Narragansett Bay to the west, Rhode Island Sound to the south, the Sakonnet River to the east, and Mount Hope Bay to the north. NAVSTA Newport is located at the mouth of Narragansett Bay, a large, sheltered, deep (up to 184 feet [56 meters] in depth) body of water in close proximity to Atlantic shipping channels. See Figure 2-1 for a map depicting the local and regional context of NAVSTA Newport in Rhode Island.

The 1,388-acre (562 hectares [ha]) NAVSTA Newport complex comprises more than 10 miles of shorefront on Aquidneck Island on Narragansett Bay. Aquidneck Island itself is only 16 miles in length, north to south, and less than 5 miles in width, east to west. NAVSTA Newport is located partially within the city of Newport and extends northward, incorporating the entire western shoreline of the town of Middletown and one-fifth of the town of Portsmouth's western shoreline.

The main installation of NAVSTA Newport consists of Coasters Harbor Island, Coddington Point, and Coddington Cove. Other areas considered to be part of the installation but categorized as "outlying parcels" are located north of the main installation along the Defense Highway and Narragansett Bay. Figure 2-2, Sheets 1 and 2 depict the full extent of NAVSTA Newport, while Figure 2-2, Sheets 3 through 9 show the seven sub-areas of the installation.

Coasters Harbor Island and Coddington Point consist of the primary training and administrative areas. Bachelor housing is also concentrated in these areas on NAVSTA Newport in proximity to the training campuses. Personnel and community support functions, such as the Commissary, are also located on Coddington Point. The former Naval Hospital is located near Coasters Harbor Island.

Coddington Cove is the industrial core of NAVSTA Newport. Directly north of the industrial area on Coddington Cove are the principal Research Development Test & Evaluation (RDT&E) functions under the Naval Undersea Warfare Center (NUWC). The waterfront of Coddington Cove is limited to NUWC research facilities and RDT&E buildings, as well as use by the U.S. Coast Guard. NAVSTA Newport's two piers are located off of Coddington Cove and provide berthing for two inactive ships, the U.S. Coast Guard, and other visiting vessels. They are not currently designated for any Navy missions.

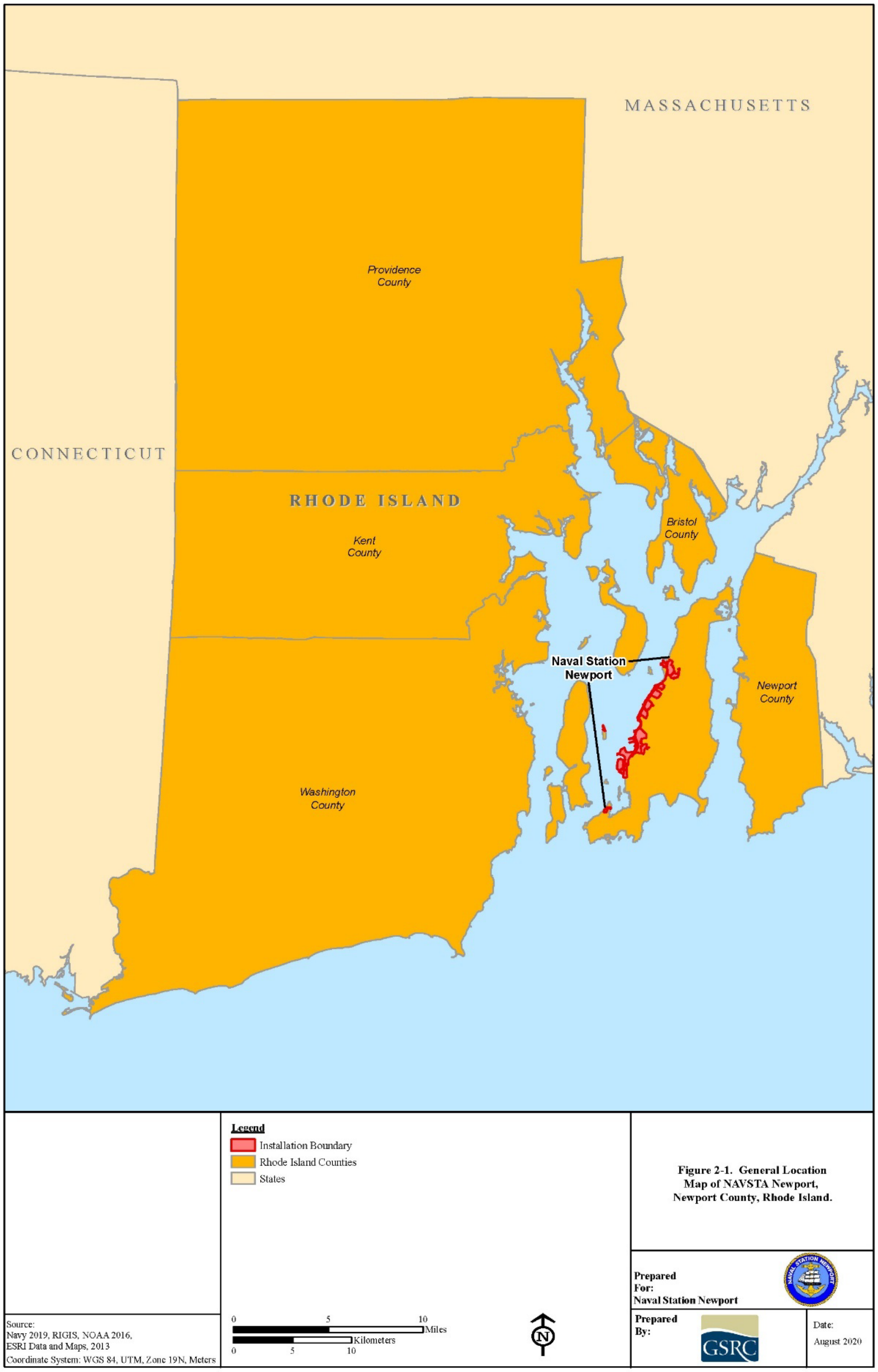

Figure 2-1. General Location Map of NAVSTA Newport, Newport County, Rhode Island.

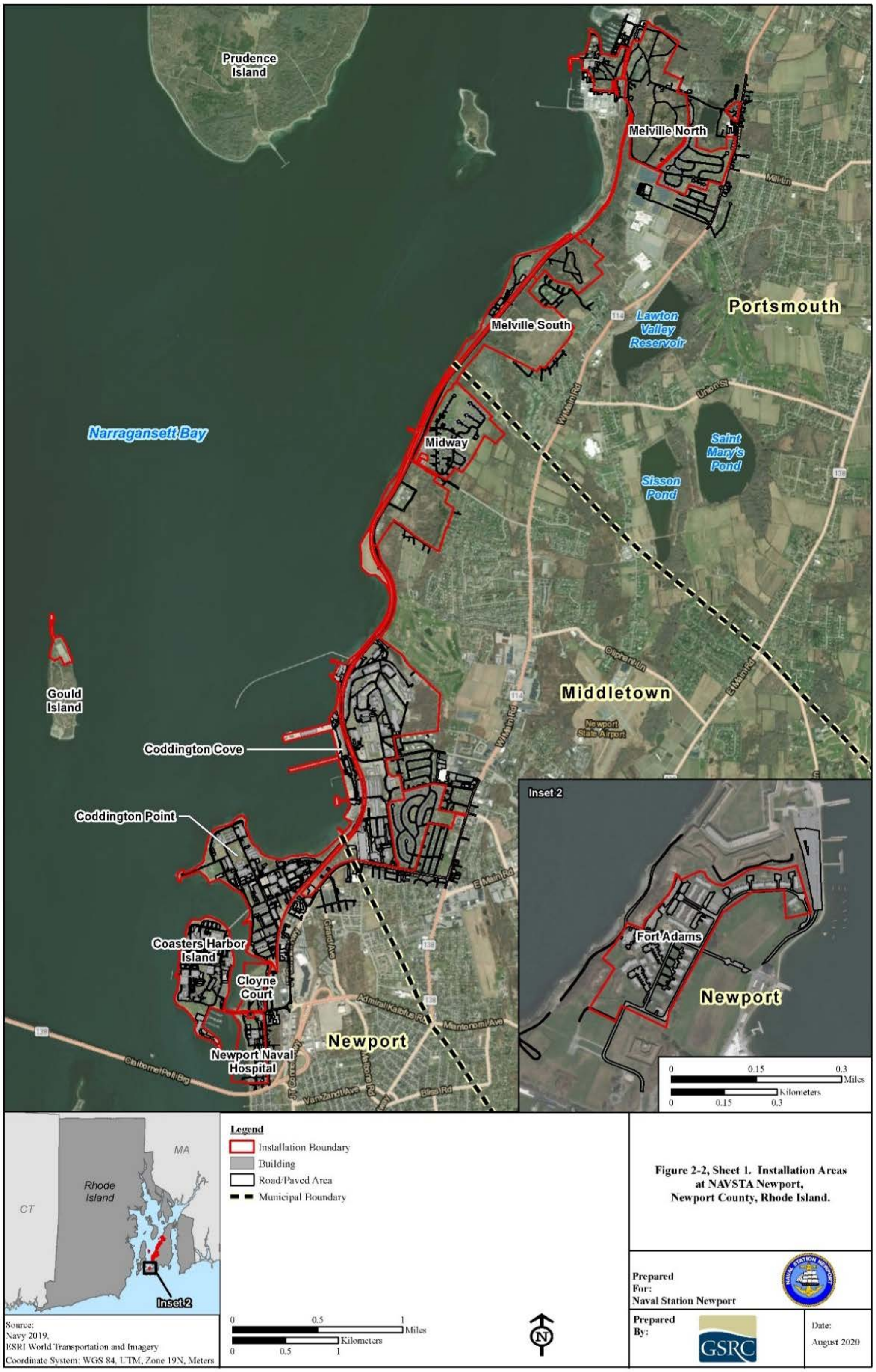

Figure 2-2, Sheet 1. Installation Areas at NAVSTA Newport, Newport County, Rhode Island.

Figure 2-2, Sheet 2. Installation Areas at NAVSTA Newport, Newport County, Rhode Island.

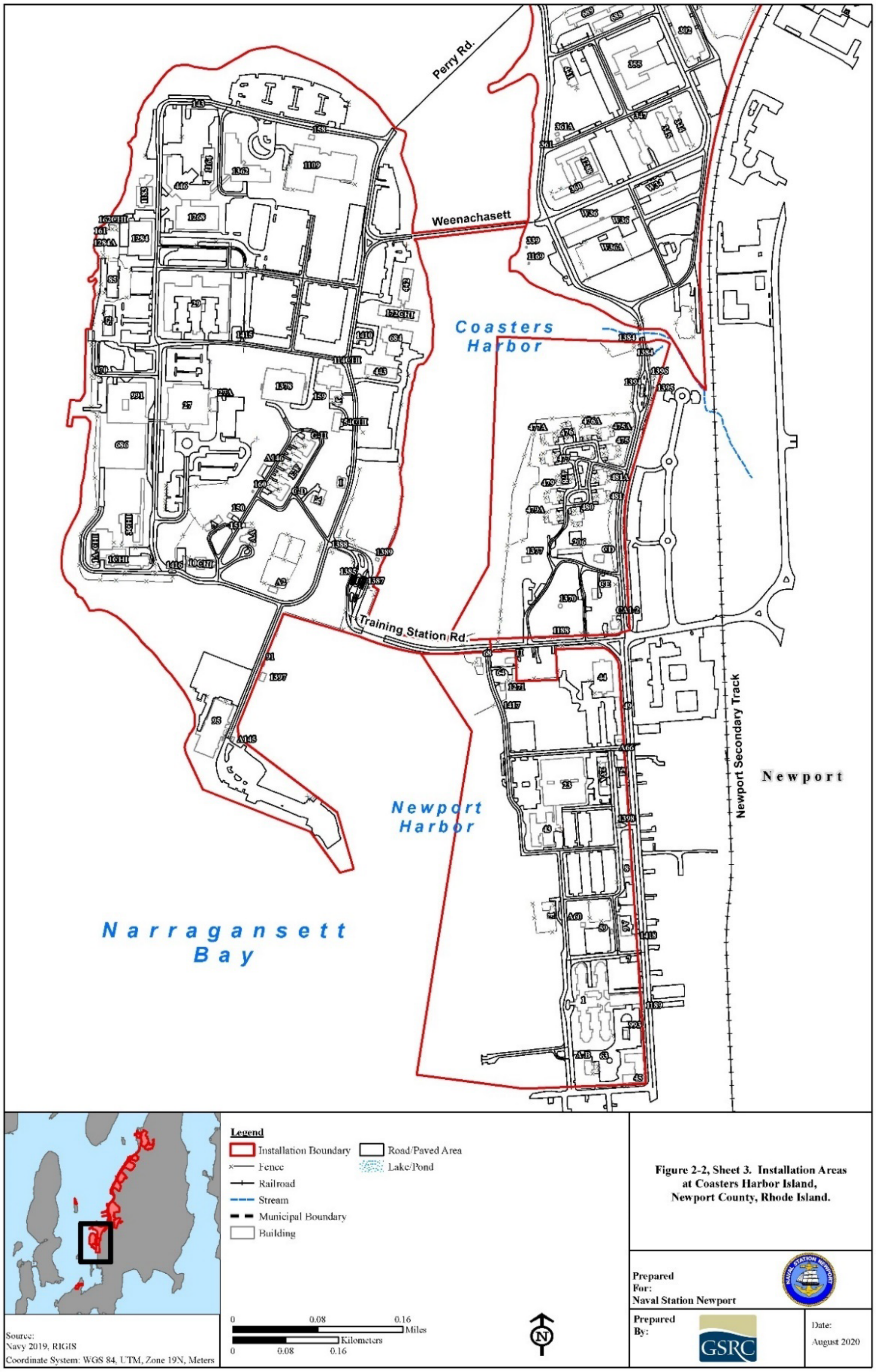

Figure 2-2, Sheet 3. Installation Areas at Coasters Harbor Island, Newport County, Rhode Island.

Figure 2-2, Sheet 4. Installation Areas at Coddingtion Point, Newport County, Rhode Island.

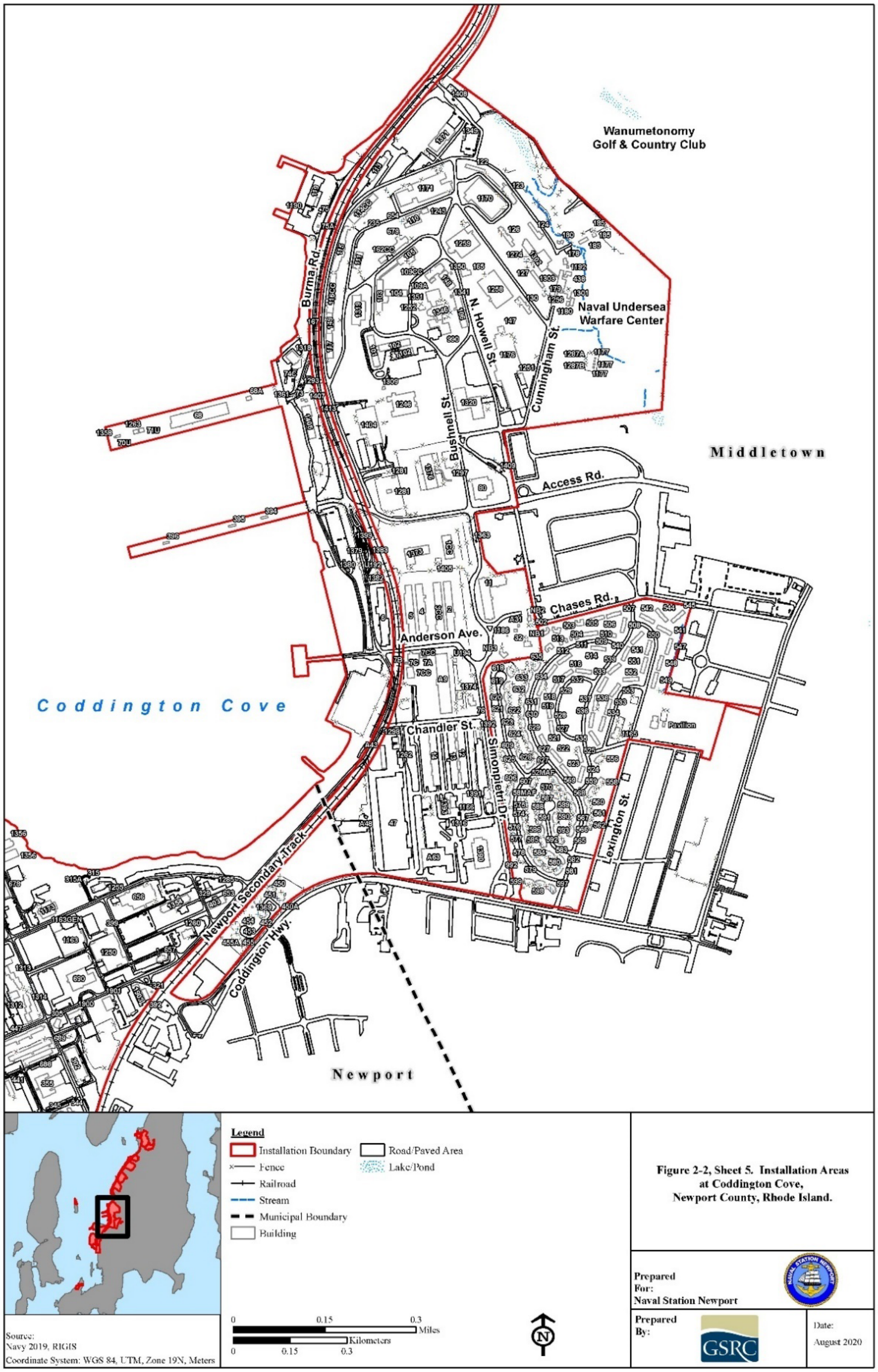

Figure 2-2, Sheet 5. Installation Areas at Coddington Cove, Newport County, Rhode Island.

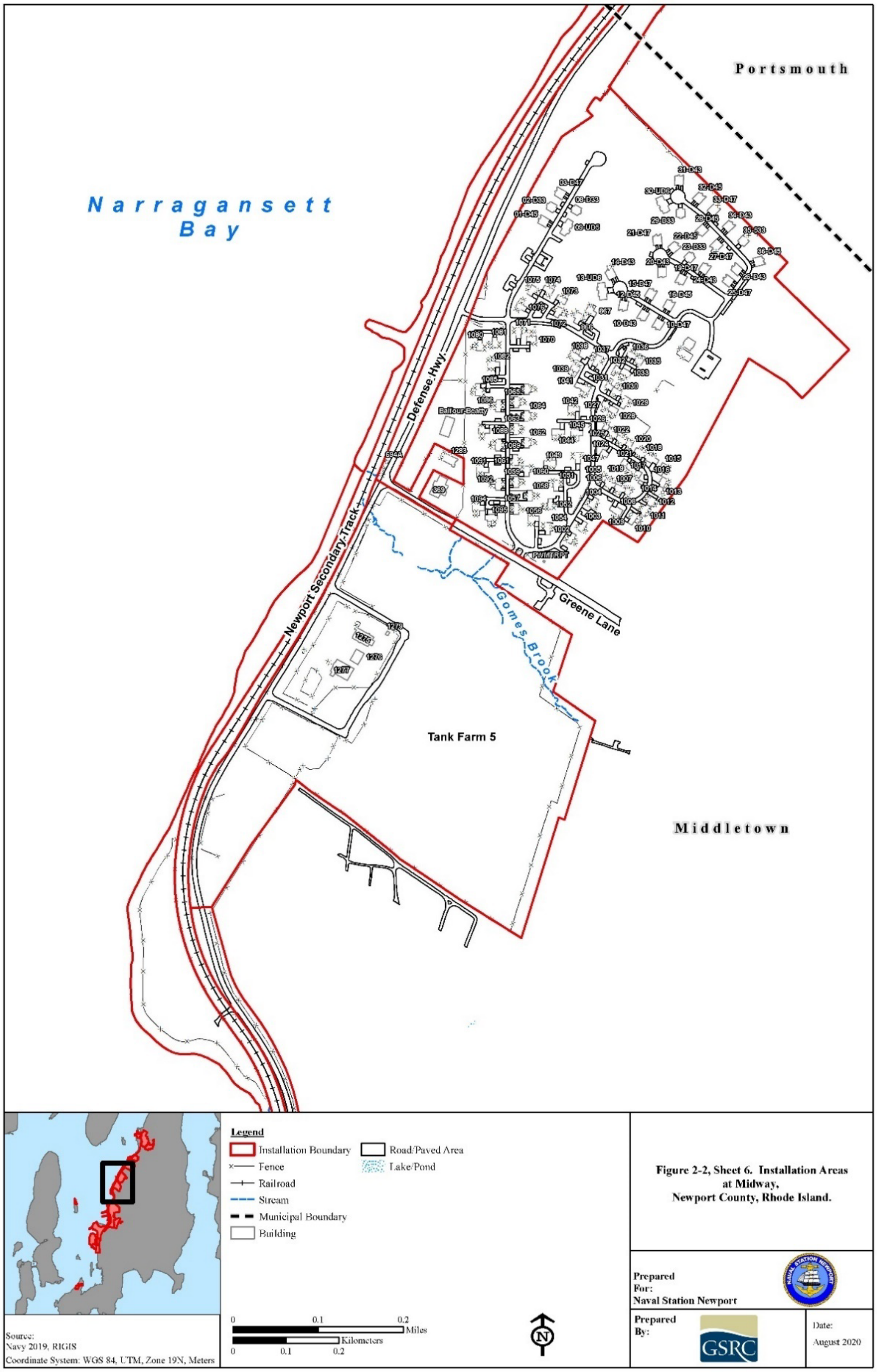

Figure 2-2, Sheet 6. Installation Areas at Midway, Newport County, Rhode Island.

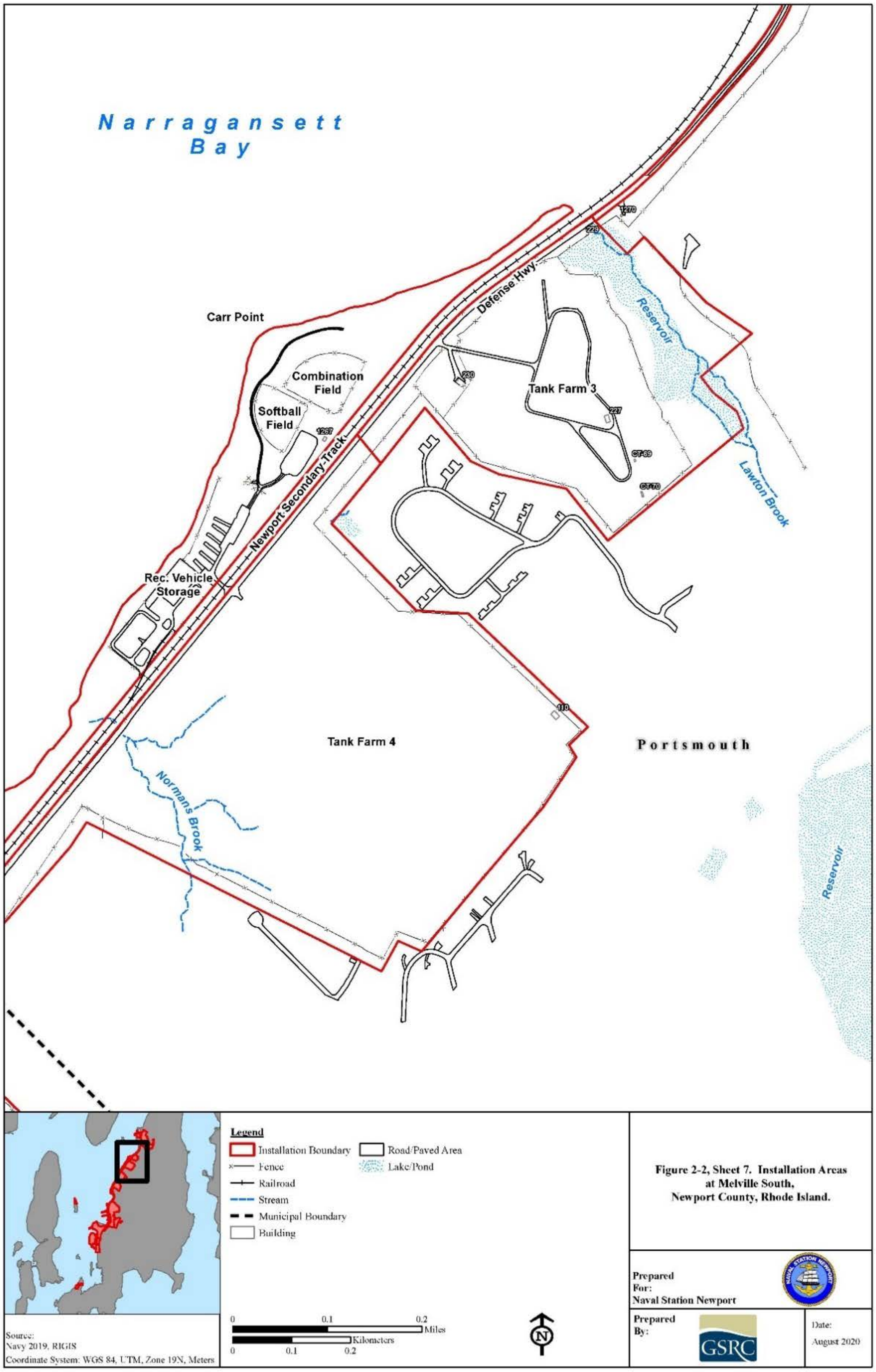

Figure 2-2, Sheet 7. Installation Areas at Melville South, Newport County, Rhode Island.

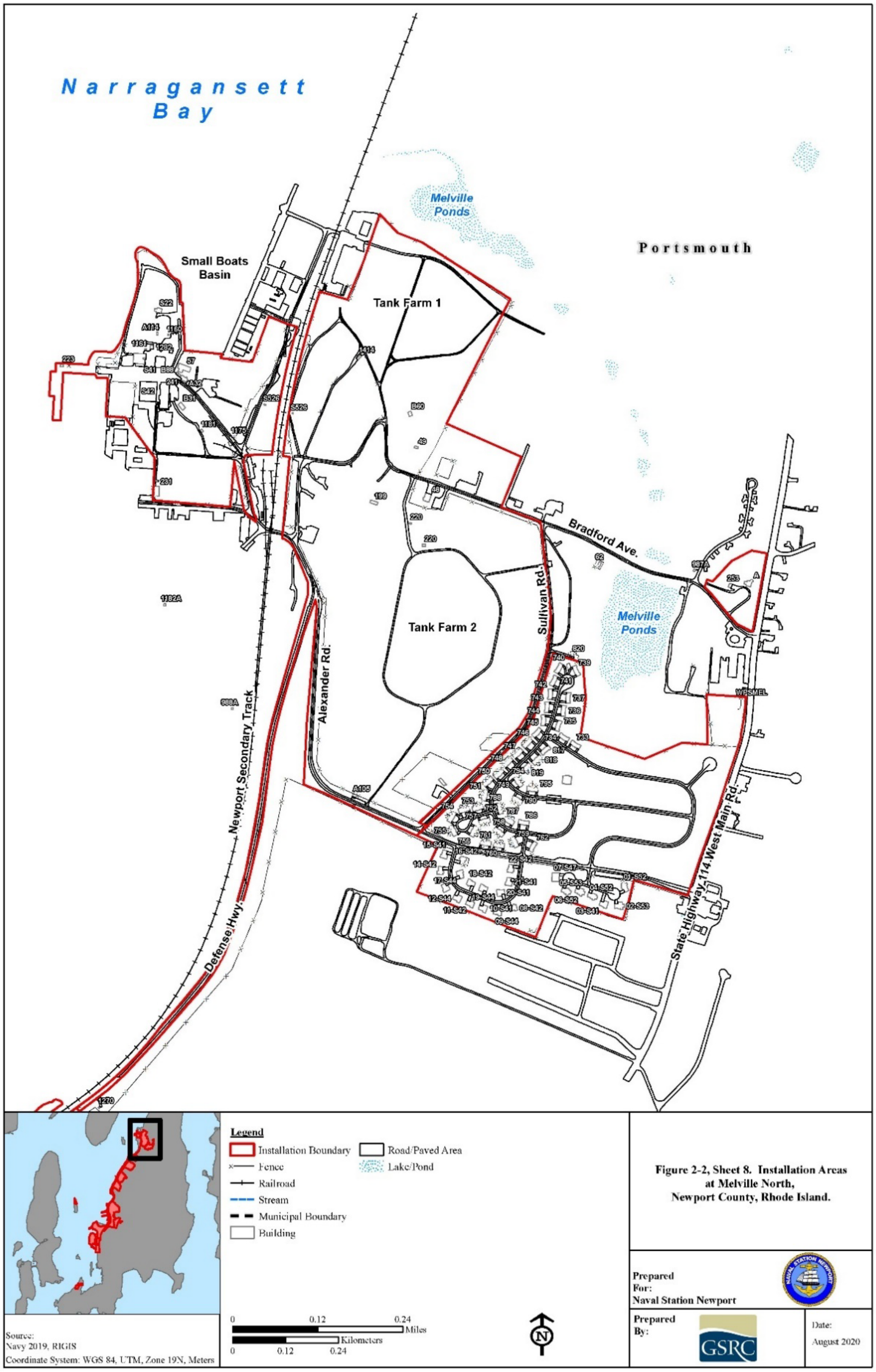

Figure 2-2, Sheet 8. Installation Areas at Melville North, Newport County, Rhode Island.

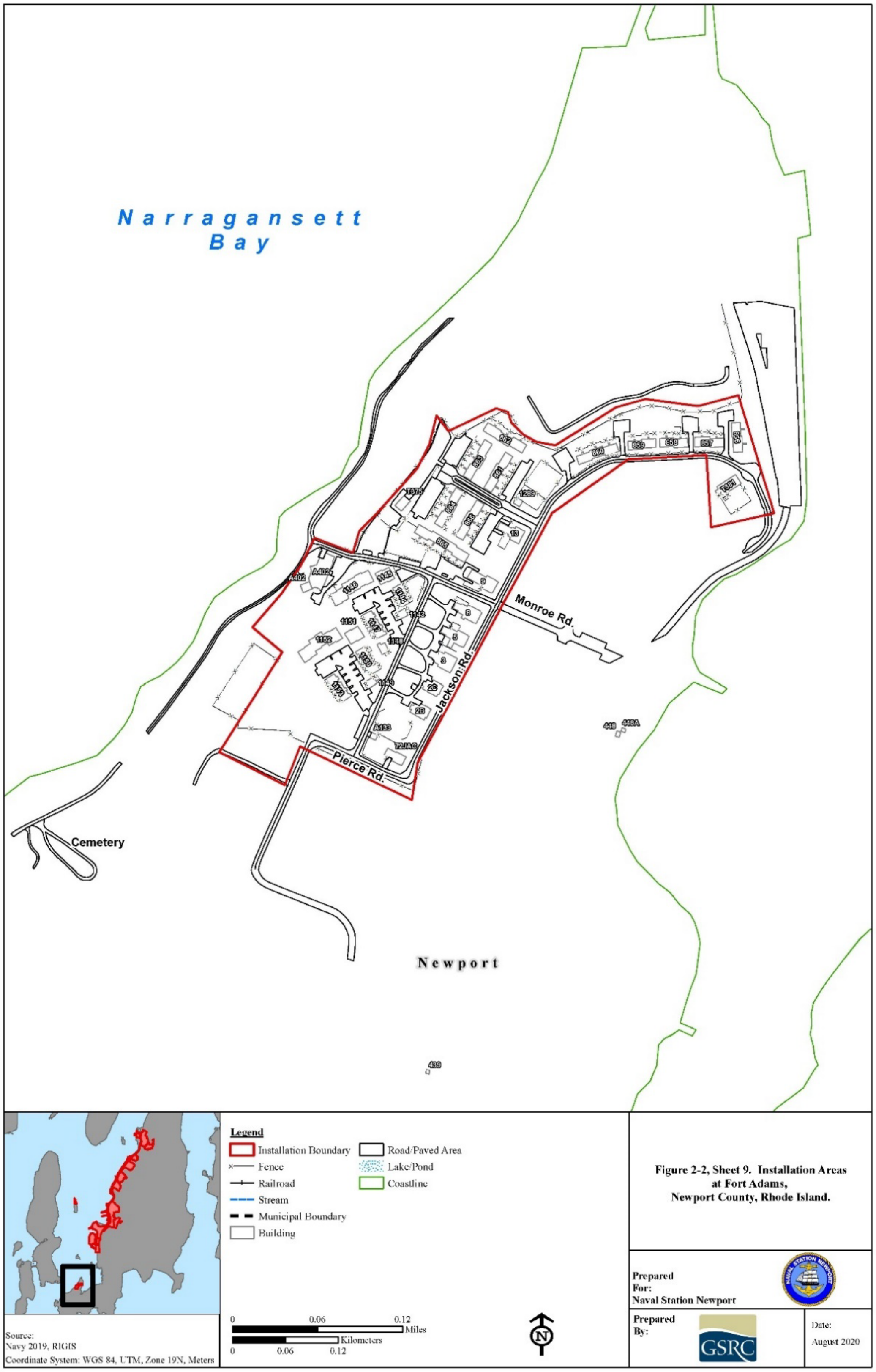

Figure 2-2, Sheet 9. Installation Areas at Fort Adams, Newport County, Rhode Island.

The northern portion of NAVSTA Newport primarily consists of abandoned tank farms and family housing areas. An area referred to as Midway consists of the inactive McAllister Landfill, Tank Farm 5, and the Greene Land Housing area. Tank Farms 3 and 4, as well as the Carr Point Recreation Area, are located farther north along the Defense Highway in an area known as Melville South. The Carr Point Recreation Area includes 29 acres of waterfront recreational facilities on Narragansett Bay. It is an important MWR asset for the Navy.

Melville North is approximately five miles north of the main installation and consists of another landfill site, Tank Farms 1 and 2, the Melville Housing Area, and Melville Backyard. Melville Backyard was originally developed as a fueling station for the Navy's oil-fired ships, but is no longer serving an active mission to NAVSTA Newport. Underground tanks were installed in the areas south of Melville Backyard (Tank Farms 1–5) to increase fuel storage at the installation. Melville Backyard is eligible for listing as a historic district on the National Register of Historic Places. Some of Melville Backyard has already been transferred to private ownership, and the remainder is planned to be disposed to the State of Rhode Island.

Fort Adams is located to the south of the main installation on a peninsula at the southern end of Aquidneck Island. The Navy's property on this site consists of the Fort Adams family housing area, which is bounded on the north, east, and south by the Fort Adams State Park and Narragansett Bay on the west.

Of the 50-acre Gould Island, the Navy currently controls 13 acres at the northern tip of the island. Gould Island is located in Narragansett Bay, approximately one mile offshore of Aquidneck Island and the main installation. The area of the island that is not controlled by the Navy is managed as a bird sanctuary by the State of Rhode Island. This site is currently used by NUWC to operate an undersea range facility. All access, water, and fuel to the island can only be obtained by boat.

The NAVSTA Newport Vision 2035 Master Plan (2008b) notes that the following outlying parcels on the installation have been flagged for disposal:

- Melville Backyard – 35 acres
- Tank Farm 1 – 49 acres
- Tank Farm 2 – 96 acres
- Tank Farm 3 – 41 acres
- Tank Farm 4 – 83 acres
- Defense Highway north of NUWC – 67 acres
- Former Navy Lodge – 3 acres
- Former Navy Hospital – 10 acres (three of which are underwater)

NAVSTA Newport plans to retain several additional outlying parcels:

- Tank Farm 5 and Firefighter Training Area – 72 acres
- Carr Point Recreation Area – 29 acres
- McAllister Landfill – 11 acres
- Gould Island – 13 acres
- Family Housing Areas – 301 acres

In 2005, an Aquidneck Island West Side Master Plan was developed by Newport, Middletown, and Portsmouth in anticipation of land disposal by the Navy around NAVSTA Newport. Due to the attractive waterfront, a high level of interest exists within the communities regarding the future of the "West Side" corridor along Defense Highway and the use of underutilized land parcels controlled by the Navy.

2.1.2 Regional Land Use

NAVSTA Newport occupies Aquidneck Island alongside the towns of Newport, Middletown, and Portsmouth, all located east of the main installation. The land area adjacent to NAVSTA Newport consists of densely developed municipal, commercial, and recreational land use to the south in Newport, with lower-density residential and agricultural land uses to the north and east in Middletown and Portsmouth. Figure 2-3 shows the regional land use and land cover near NAVSTA Newport.

In the City of Newport, mixed commercial and high-density residential land uses lie adjacent to Coddington Point and Coddington Cove areas (including the Naval Hospital institutional area). These areas are zoned as commercial industrial and residential. The Fort Adams Housing Area is considered residential, and Fort Adams State Park, which surrounds the housing area, is zoned open space/recreation (City of Newport 2017).

In Middletown, the land that abuts the installation is a mixture of residential use (predominantly single and one to five family residences, but also some apartment/condominium units are present), commercial, and farm-forest-open space land (Town of Middletown 2020). A Watershed Protection District runs just east of the installation along West Main Road, which also regulates land use to protect, preserve, and maintain current water quality standards, and prevent land uses that are detrimental to the quality and quantity of water in the town.

In Portsmouth, land adjacent to NAVSTA Newport is mostly residential, open space, and waterfront recreational. Land that is zoned industrial is located nearby as well.

As previously stated, Gould Island is shared with a state-run bird sanctuary, and the Fort Adams property is surrounded by state parkland.

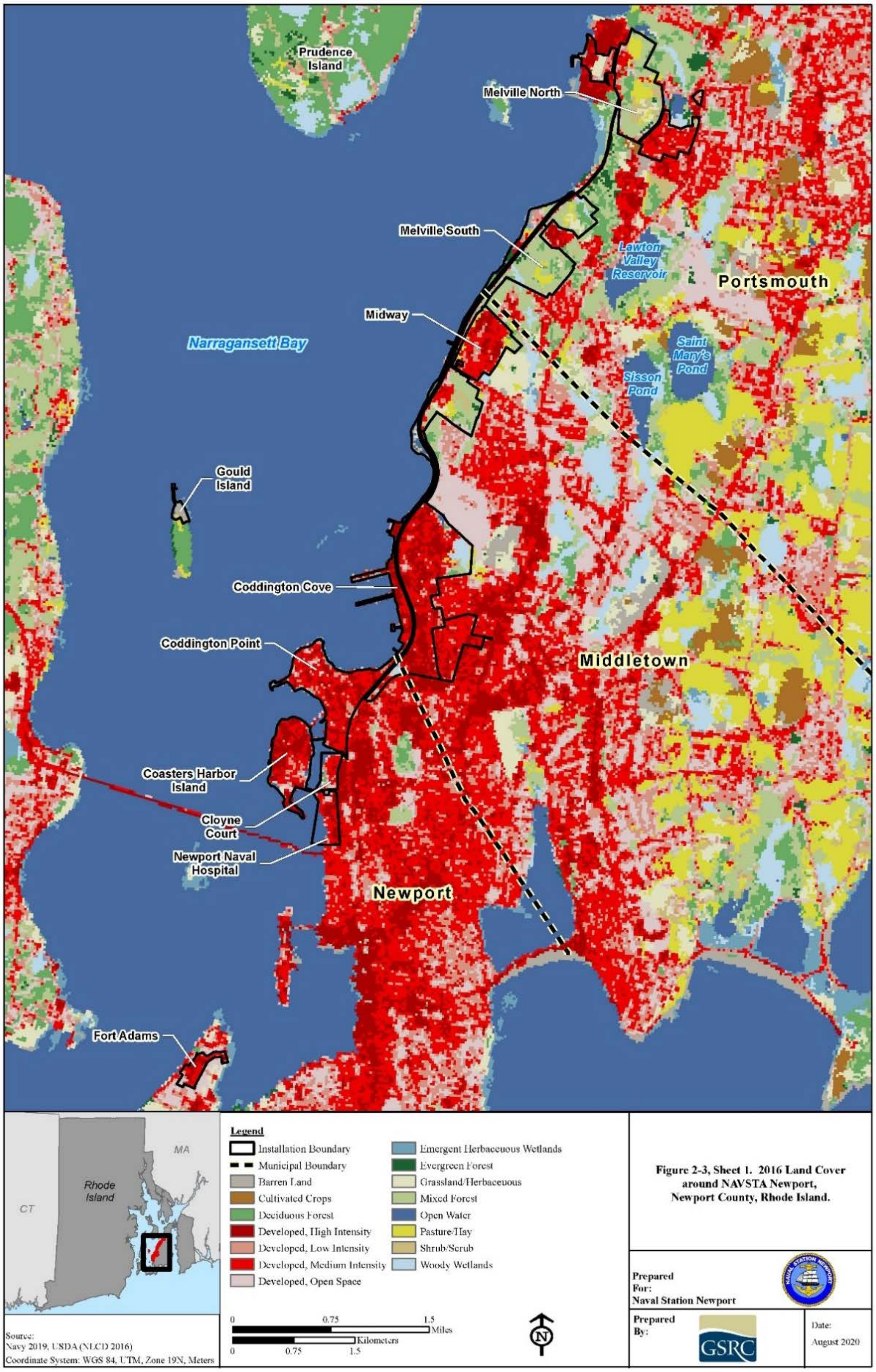

Figure 2-3. Land Cover around NAVSTA Newport, Newport County, Rhode Island.

2.1.3 Historic and Pre-Military Land Use

Even in the Colonial Era, Newport was considered an important harbor, commercial hub, and eventually a strategic naval position in the American colonies. Trade flourished in the harbor, and goods were shipped between Newport, the West Indies, and Africa. The English considered establishing a navy yard in Newport due to the success of the harbor, but eventually did not take action on construction. British fleets used Narragansett Bay during the Revolutionary War, and their abandonment of Rhode Island and the Bay has been credited as an important moment leading to the British defeat and the end of the war. However, the Revolutionary War caused Newport's commercial activity to suffer, and it never restored its pre-war levels (NAVSTA Newport 2013).

During the Civil War, the U.S. Naval Academy at Annapolis, Maryland was temporarily moved to Newport, but the Navy's presence was not permanently established until 1869. The Navy has a long history at the NAVSTA Newport site, which began as a manufacturing installation and evolved into one of the Navy's main educational, training, and research and development installations on the East Coast. A summary of the naval history of the site follows (NAVSTA Newport 2008b):

1869:

- Naval presence established with an experimental torpedo station at Goat Island. The station manufactured torpedoes and conducted other ordnance testing until the early 1950s.

1884:

- The Naval War College (NWC) was established as the Navy's premier educational institution for commissioned officers. The NWC has offered courses to officers in all four Services and the U.S. Coast Guard, as well as international naval officers.

World War II:

- NAVSTA Newport became a main training installation in the northeast U.S. for new Navy recruits. The sites used for training include Coddington Point and Coddington Cove (newly acquired).
- RDT&E of underwater weapons systems was established.
- During World War II, the experimental torpedo station was the main torpedo-manufacturing site in the U.S.

Post-World War II:

- Recruit training activities were reduced while research and development activities increased.

1950s:

- Piers were built, and NAVSTA Newport served as a homeport for ships serving the Atlantic Fleet for almost 25 years.

1970s:

- RDT&E of underwater weapons systems activity became the Naval Underwater Systems Center (NUSC); this eventually merged with other commands to become the NUWC.
- Training activities were consolidated under the Naval Education and Training Center (later evolved to become the Naval Education and Training Command [NETC]), which oversees the undergraduate-level training programs offered for enlisted and officer personnel.
- The Navy's Shore Establishment Realignment (SER) program discontinued homeporting ships at NAVSTA Newport. Fleet units were relocated and the installation's population was reduced by more than 14,000 personnel.

1990:

- BRAC legislation officially closed the Navy's mission at NAVSTA Newport, except to support berthing activities for visiting ships, inactive ships, and Coast Guard vessels, and NUWC RDT&E functions.

2005:

- BRAC legislation realigned several tenants to and from NAVSTA Newport.

2.1.4 Military Mission

Currently, the primary mission of NAVSTA Newport is to "fulfill the diverse requirements of its tenant commands by providing the facilities and infrastructure that are essential to their optimum performance." NAVSTA holds a significant presence in Rhode Island, with more than 50 Naval and DOD commands and activities, primarily focusing on education, training, and RDT&E, including the Naval War College, the Naval Undersea Warfare Center, and the Naval Health Clinic New England. Together, these commands and activities employ approximately 5,800 military and civilian personnel while the training and educational centers have approximately 17,000 students passing through its schools and classes annually (NAVSTA Newport 2019). NAVSTA Newport is the Navy's premier site for training officers, officer candidates, senior enlisted personnel, and midshipmen candidates. It is also a premier site for testing and evaluating advanced undersea warfare and development systems.

The NAVSTA Newport complex manages two piers for ship porting: Pier 1 and Pier 2. One inactive aircraft carrier is ported at Pier 1, the *USS Saratoga* (CV-60). The ship is planned to be scrapped (off-site), but nesting by peregrine falcons (*Falco peregrinus*) and osprey (*Pandion haliaetus*) occurs on the vessel, so moving and scrapping the ship will be done outside of nesting season and after consulting with the USFWS. Pier 2 is capable of berthing up to 10 ships; the U.S. Coast Guard has two ships homeported there, and NOAA has a research vessel ported at Pier 2.

2.1.5 Natural Resources Necessary to Support NAVSTA Newport's Mission

The core mission at NAVSTA Newport is to support its tenant commands, namely education and RDT&E. Natural resources within the installation complex, such as land areas, soils, hydrology, and vegetation, support the mission in practical ways (i.e., soil stabilization, decreasing stormwater runoff, and providing sites suitable for facilities). Some portions of NAVSTA Newport are used to support MWR opportunities, particularly along the waterfront, which supports marinas, boat ramps, swimming, and other recreational uses.

2.1.6 Operations and Activities that may Affect Natural Resources

Because the main mission objectives of the NAVSTA Newport tenants are education and RDT&E, the installation has no more effect on the surrounding natural resources than similar civilian activities within Aquidneck Island communities. The installation's proximity to the valuable Narragansett Bay also necessitates special vigilance so that NAVSTA Newport operations and activities do not negatively affect the Bay.

Impacts on natural resource assets from installation activities would be those associated with:

- large areas of impervious surfaces (increased surface runoff, degradation of storm water runoff quality);
- landscaping (introduction of non-native plant species, degraded wildlife habitat, use of pesticides and fertilizers);
- construction (erosion, increased permanent impervious surface area); and
- handling and storage of hazardous materials and oils.

Construction planned on NAVSTA Newport, as identified in the 2035 Master Plan, will present environmental challenges such as minimizing impacts on surface waters, preventing erosion along coastal areas, and reducing impacts of traffic on-base (and associated air quality) (NAVSTA Newport 2008a).

2.2 PHYSICAL ENVIRONMENT

2.2.1 Geology and Topography

Aquidneck Island and most of eastern Rhode Island are located within Narragansett Basin geologic formation, which is composed of sedimentary rock, predominantly sandstone, greywacke, shale, and conglomerate. The Basin is a topographic depression consisting of Pennsylvanian Sedimentary Facies underlain and surrounded by pre-Pennsylvanian, igneous, and metamorphic rocks. Overlaying the Pennsylvanian sediments are glacial deposits, which are the parent material for the area soils. Many of the Basin's features were formed during repeated glacial formation and withdrawal, resulting in gently rolling terrain and rich soil suited for agriculture. The underlying bedrock is known as the Rhode Island Formation, and consists of meta-sandstone, meta-conglomerate, schist, carbonaceous schist, and graphite, deposited during the Pennsylvanian era (Hermes et al. 1994).

Elevation at NAVSTA Newport ranges from sea level to 175 ft (53 m) above sea level. The existing topography consists of gentle-to-moderate sloping terrain from the shoreline of Narragansett Bay up toward the middle of Aquidneck Island. Drainage from the watershed area flows to the Bay through streams and drainage courses that run through culverts under Defense Highway. A north-south ridge along Route 138 defines the drainage basins of Aquidneck Island; drainage west of

Route 138, including NAVSTA Newport, discharges to the East Passage of Narragansett Bay, and drainage east of Route 138 discharges to the Sakonnet River.

2.2.2 Soils

NAVSTA Newport is located in the Narragansett Till Plains. Glacial deposits of till and outwash formed the soils in the area, most of which are subject to a high seasonal water table (as is generally true of all of Narragansett Bay island communities). This presents certain problems for community development because the land is generally rocky and covered by a relatively thin layer of soil.

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) in Rhode Island completed a soil survey in the state in 2012 as part of the National Cooperative Soil Survey (RIGIS 2013).

Figure 2-4, Sheet 1 depicts the soils found on NAVSTA Newport, with greater detail shown for the seven sub-areas on Figure 2-4, Sheets 2–8. The soil survey identified 15 distinct soil series on NAVSTA Newport. Descriptions and locations of these soils follow, in alphabetical order (USDA 1981).

Beaches (Be), Undifferentiated

Beaches (Be) consist of level and gently sloping areas along the shore of estuarine systems, such as Narragansett Bay. Beaches include dunes and areas exposed during low tide. The texture of this series consists of beach units with a mixture of sand, cobblestones, boulders, bedrock, and buried tidal marsh soils. Beaches are unprotected from the ocean and prone to erosion, particularly during severe storms.

- Beaches are mapped on NAVSTA Newport along Narragansett Bay coastline from the vicinity of the Normans Brook north to Melville.

Canton-Urban Land Complex (CC), Very Rocky

The Canton-Urban Land Complex (CC) consists of well-drained Canton soils and areas of urban land. This complex is composed of approximately 40 percent Canton soils, 30 percent urban land, and 30 percent rock outcrops and other soils. Typically, the Canton series texture is a fine sandy loam.

The CC is usually on side slopes or crests of glacial hills. Slopes are chiefly about six percent, but range from zero to 15 percent. The permeability is moderately rapid and available water capacity is moderate. Runoff is medium, and limitations to community development are the associated rock outcrops and slope.

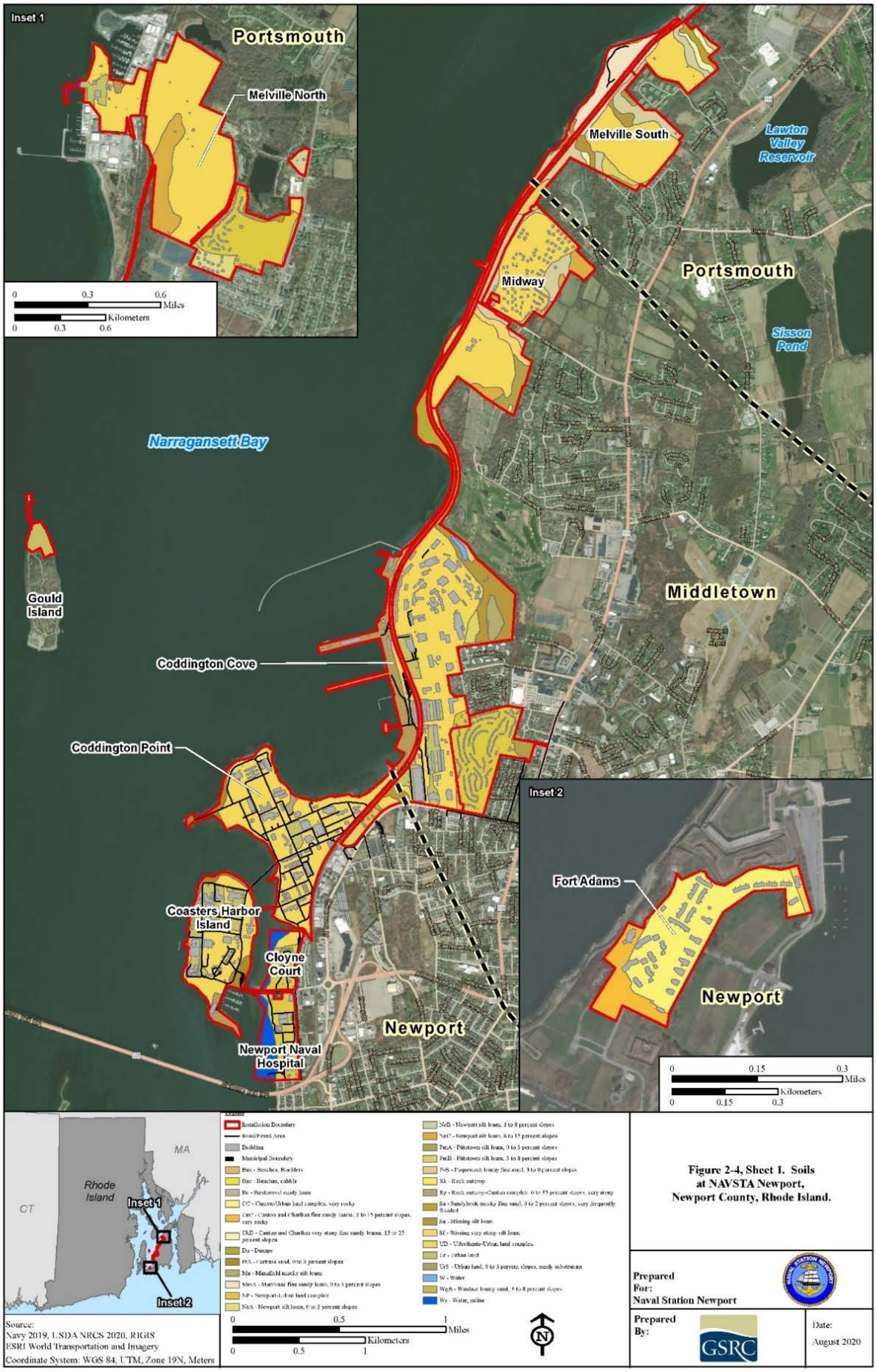

Figure 2-4, Sheet 1. Soils at NAVSTA Newport, Newport County, Rhode Island.

Figure 2-4, Sheet 2. Soils at Coasters Harbor Island, Newport County, Rhode Island.

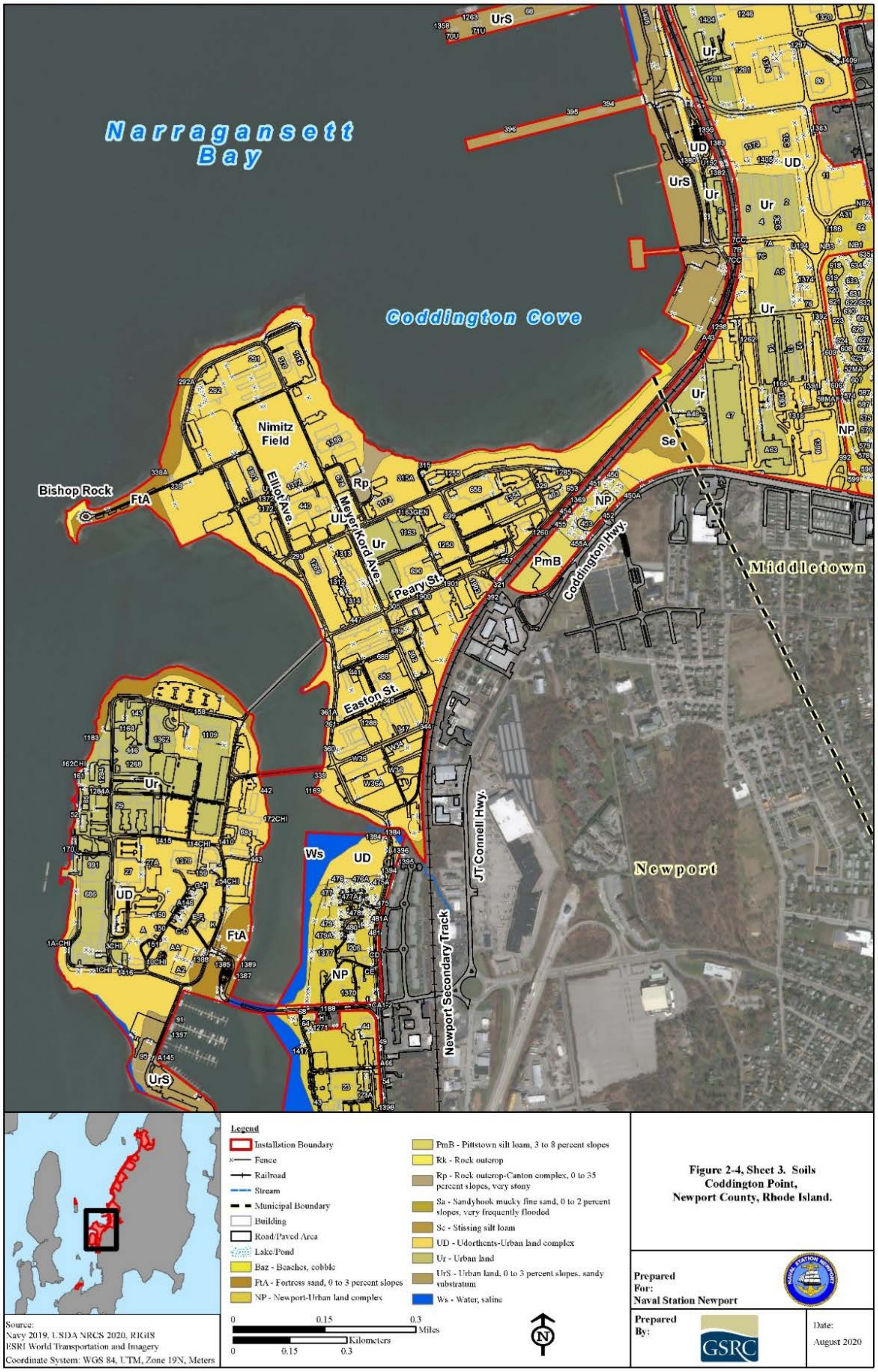

Figure 2-4, Sheet 3. Soils at Coddington Point, Newport County, Rhode Island.

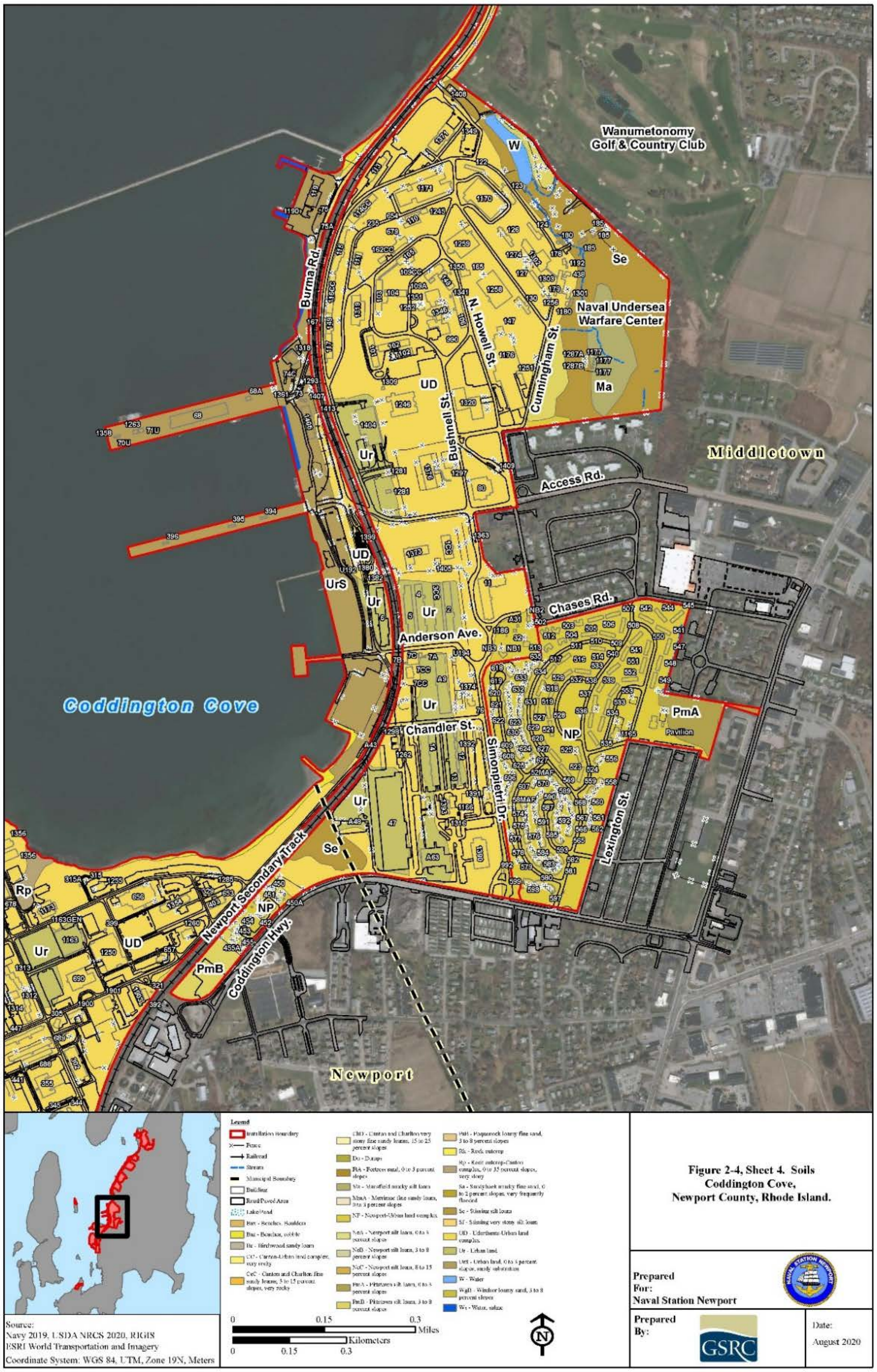

Figure 2-4, Sheet 4. Soils at Coddington Cove, Newport County, Rhode Island.

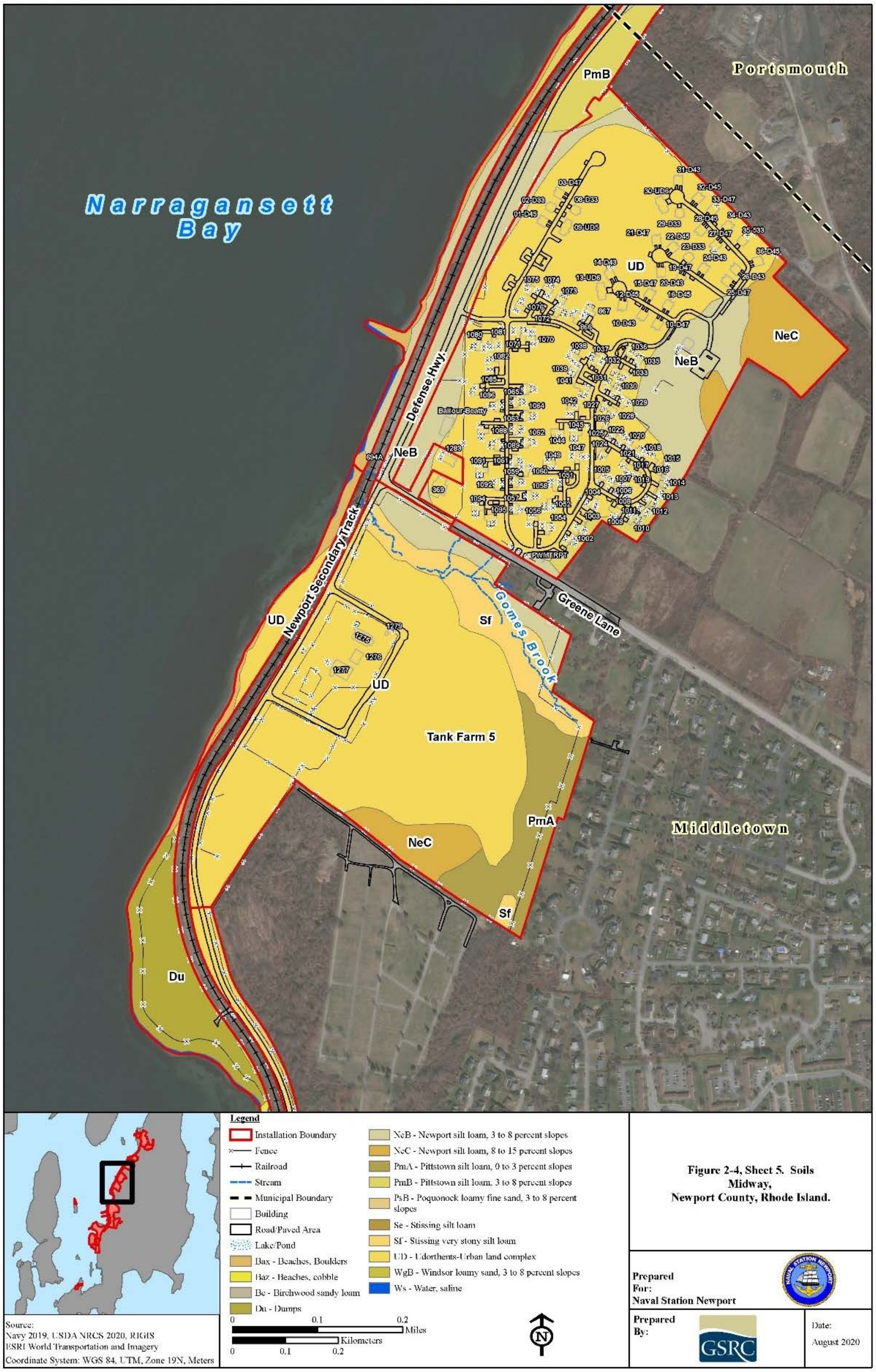

Figure 2-4, Sheet 5. Soils at Midway, Newport County, Rhode Island.

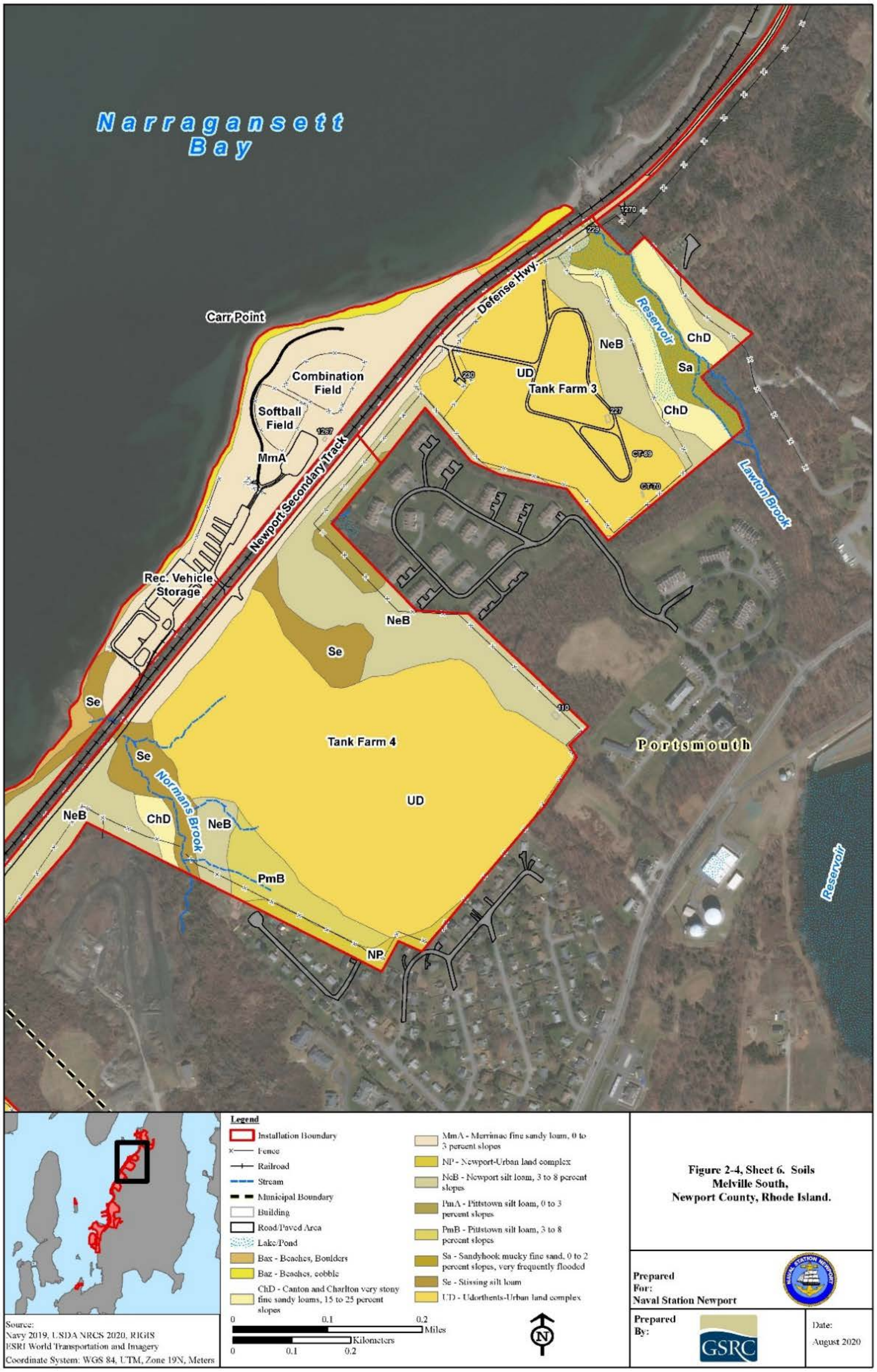

Figure 2-4, Sheet 6. Soils at Melville South, Newport County, Rhode Island.

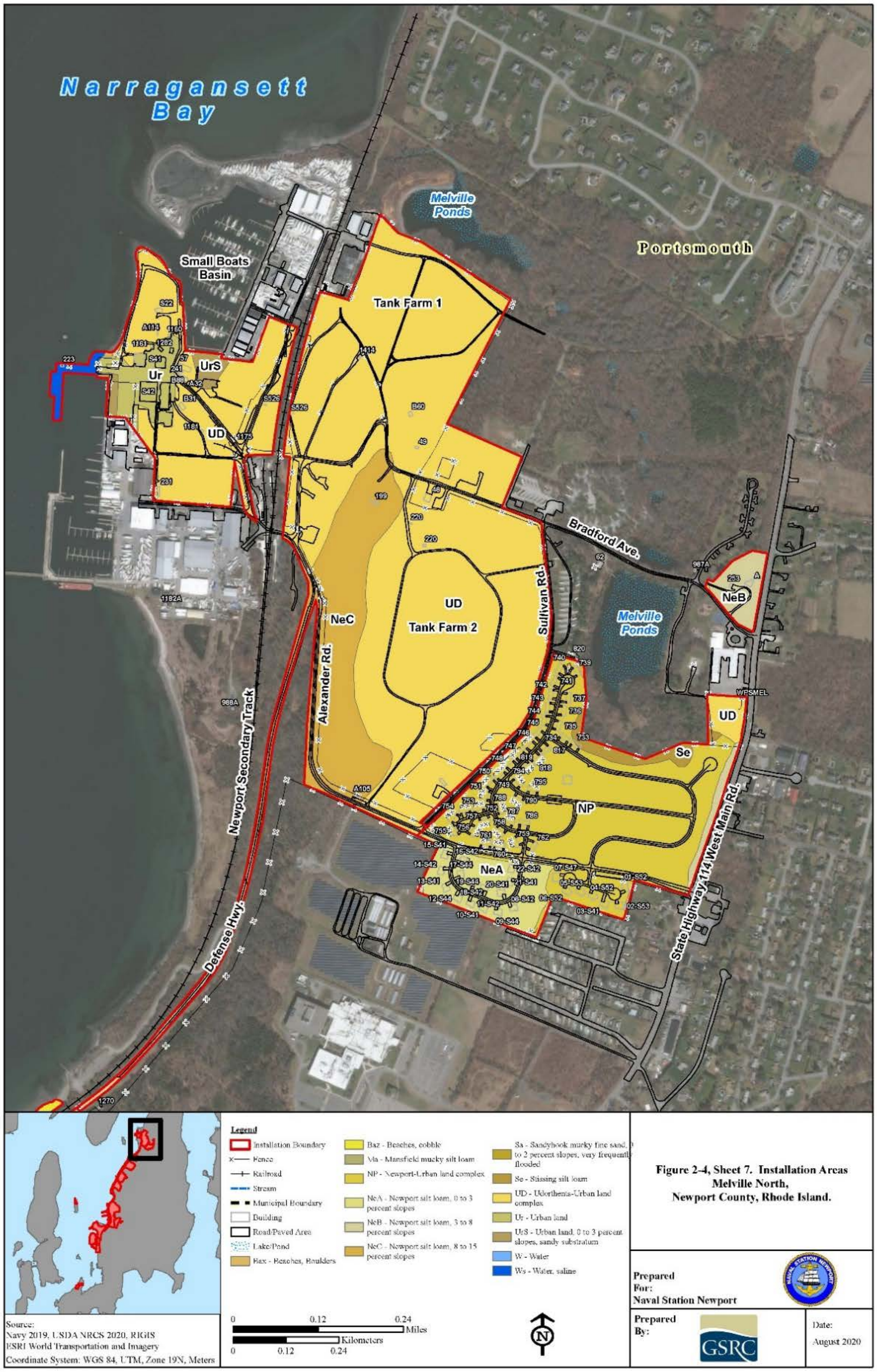

Figure 2-4, Sheet 7. Soils at Melville North, Newport County, Rhode Island.

Figure 2-4, Sheet 8. Soils at Fort Adams, Newport County, Rhode Island.

The majority of NAVSTA Newport property at Fort Adams is mapped CC.

Canton and Charlton Fine Sandy Loams (CeC)

The Canton and Charlton Fine Sandy Loams (CeC) are gently sloping to sloping (slopes range from three to 15 percent), well-drained, and mainly located on side slopes and crests of glacial upland hills and ridges. Stones and boulders may cover two to 10 percent of the surface, with some rock outcrops. This complex is approximately 50 percent Canton soils, 30 percent Charlton soils, and 20 percent other soils. Canton soils range from strongly acidic through extremely acidic, and Charlton soils are medium acidic through very strongly acidic.

- Land on the southern portion of Fort Adams is classified as CeC.

Mansfield Mucky Silt Loam (Ma)

Mansfield Mucky Silt Loam (Ma) is a nearly level (slopes range from zero to three percent), very poorly drained soil. The surface layer is typically a black mucky silt loam approximately eight inches thick, with a seven-inch thick dark grey silt loam subsoil. The soil is medium acidic through extremely acidic, and the high water table makes the soil poorly suited for community development, cultivated crops, and most wildlife habitat (except wetland habitat). During wet seasons, many Ma areas may have water ponding on the surface without suitable drainage outlets.

- On NAVSTA Newport property, Ma soil is found along the eastern side of the NUWC Campus area (labeled Anchorage on the map).

Merrimac Sandy Loam (MmA), 0–3 percent slope

Merrimac Sandy Loam (MmA) is somewhat excessively drained, and slopes associated with this soil are typically less than three percent. Permeability of this soil is moderately rapid, runoff slow, and available water capacity moderate. Soil is well-suited to trees, crops, and wildlife habitat. MmA soil is medium acidic through extremely acidic.

- On NAVSTA Newport property, MmA is found in the higher ground east of the beach at the Carr Point Recreation Area.

Newport Silt Loam (NeA, NeB, NeC)

Newport Silt Loam NeA is found on the crests of drumlins and glacial till plains with slopes of zero to three percent. NeB and NeC are found on the sideslopes of drumlins and glacial till plains, with slopes of three to eight percent and eight to 15 percent, respectively. The Newport silt loam series is well-drained and permeability is moderate or moderately rapid in the surface layer and subsoil, and slow or very slow in the substratum. Runoff is medium, and the available water capacity is moderate. This soil series is suitable for community development but limited by the slow or very slow permeability of the substratum. Roads and streets need careful design to prevent frost heaving. The hazard of erosion is moderate for NeB and severe for NeC.

- Newport silt loams soils are found in the Midway and Melville areas of NAVSTA Newport as indicated below:

- the Melville housing area, south of Stringham Road (NeA);
- the Melville campground recreation area (NeB);
- the upland area between Gomes Brook and Normans Brook, along Defense Highway (mapped NeB);
- the Lawton Brook area north of abandoned Tank Farm 3 (NeB); and
- steep slopes between Tank Farm 2 and Defense Highway in Melville (NeC).

Newport-Urban Land Complex

Newport-Urban Land Complex (NP*)* consists of well-drained Newport soils and urban land areas covered by streets, parking lots, buildings, and other urban structures. Slopes are mainly six percent but range from one to 15 percent. The soil texture consists of silt loam and permeability is moderate or moderately rapid in the surface layer and subsoil, and slow or very slow in the substratum. Available water capacity is moderate, and runoff is medium to rapid. Areas of this complex are used mainly for industrial and other urban purposes, but limitations to community development exist due to the slow or very slow permeability in the substratum. Roads and streets require careful design to prevent frost heaving.

- NP soils are found in the vicinity of the Naval Hospital, Cloyne Court housing area, Hart Field housing area, Coddington Cove housing area, and Melville housing area.

Pittstown Silt Loam (PmA and PmB)

Pittstown Silt Loam (PmA), with slopes of zero to three percent, is found on the crest of glacial upland hills and drumlins. PmB, with slopes between three and eight percent, is found on side slopes of these hills. Although formerly described as having moderate drainage, the USDA NRCS lists PmA and PmB among hydric soils (USDA NRCS 2012). Permeability is moderate in the surface layer and subsoil and slow in the substratum. Available water capacity is moderate, and runoff is slow. This soil series has a high seasonal water table from late fall through mid-spring. This soil is suitable for community development but is limited by the high water table and slow permeability of the substratum. Roads and streets require careful design to prevent frost heaving. Poorly drained Stissing (Se) soils may be found in association with Pittstown silt loam.

- Areas mapped PmA on NAVSTA Newport include the area incorporating Gomes Brook north and east of abandoned Tank Farm 5 and south of Greene Lane.
- Areas mapped PmB include a small area of poorly drained soil on the Portsmouth-Middletown line north of the Greene Lane Housing area, an isolated wetland north of abandoned Tank Farm 4 and adjacent to Carr Point, and extensive areas between the Newport Secondary rail line and Connell Highway, in the Coddington Cove area.

Stissing Silt Loam

Stissing Silt Loam (Se) soils are nearly level, poorly drained (hydric), and slopes range from zero to three percent. Permeability is moderate in the surface layer and subsoil, and slow in the subsurface. Available water capacity is moderate, and runoff is slow. This soil has a high seasonal water table near the surface from late fall through spring. The seasonal high water table and the slow permeability in the substratum make this soil poorly suited for community development. Se soils are hydric soils associated with wetlands, which are protected from disturbance under state and federal laws.

- Se soils are located within the wetland adjacent to Defense Highway, southwest of Building 47 along Coddington Cove and along Normans Brook, south of abandoned Tank Farm 4. The wetland located between the upper Melville Pond and the Melville housing area (outside of NAVSTA Newport property) is also mapped Se.

Rock Outcrop

Rock Outcrop (Rk) consists of level to very steep areas of exposed bedrock typically found along the shore of Narragansett Bay and Block Island Sound, in Rhode Island. Slope may range from zero to 50 percent. Areas of Rk are unprotected from the ocean and are subject to strong wave action during storms.

- One small area in the Fort Adams housing area near the coastline of Narragansett Bay is mapped Rk.

Udorthents-Urban Land and Urban Land

Udorthents-Urban Land (UD) soil series consists of moderately well-drained to excessively drained soils that have been disturbed by excavating or filling for construction, and areas that are covered by buildings and pavement. The permeability and stability of the UD soil series are variable. UD land complexes are approximately 70 percent Udorthents, 20 percent Urban Land, and 10 percent other soils.

Urban Land (Ur) soils consist primarily of sites for buildings, paved roads, and parking lots. Extensive areas of NAVSTA Newport are mapped UD or Ur, as indicated below:

- the majority of Coasters Harbor Island (UD, Ur);
- land east of Piers 1 and 2 at Coddington Cove (Ur);
- the entire peninsula of Coddington Point (UD);
- north and east of Defense Highway, in the Coddington Cove area (UD);
- in the area developed for Greene Lane Housing, Tank Farms 1 and 2, abandoned Tank Farms 3, 4, and 5, and the Defense Fuel Support Point (DFSP) in Melville (UD); and
- the NAVSTA Newport property on Gould Island (Ur).

Windsor Loamy Sand, 3–8 percent slope

Windsor Loamy Sand (WgB) is a gently sloping, excessively drained soil found on terraces, outwash plains, kames, and eskers. The permeability of this soil is rapid; available water capacity is low and runoff is medium. WgB is very strongly acidic through medium acidic in the surface layer and subsoil, and very strongly acidic through slightly acidic in the substratum.

This soil is suited for community development, trees, cultivated crops, woodland wildlife, and openland wildlife.

- Areas mapped WgB on NAVSTA Newport include the former McAllister Point landfill area along Narragansett Bay shoreline and into Tank Farm 5.

2.2.3 Hydrology

NAVSTA Newport hydrology is dominated by freshwater flow from upland areas into Narragansett Bay. Surface runoff is directed to one of the three freshwater stream tributaries that discharges into Narragansett Bay, or is directly discharged via overland runoff to drainage area outfalls directly released to the Bay.

The three major streams on NAVSTA Newport are Gomes Brook, Normans Brook, and Lawton Brook. In addition, two smaller, unnamed streams (between Normans and Lawton brooks) and a number of other small streams and/or drainage courses are subject to stormwater discharge.

Figure 2-5 shows the surface waters on NAVSTA Newport.

100-Year Floodplain

The 100-year floodplain around NAVSTA Newport includes areas that are subject to flooding during a storm with a likelihood of occurrence once within a 100-year period (Figure 2-6, Sheets 1–8). With more than 10 miles of frontage on the western shore of Aquidneck Island, low-lying natural resources at NAVSTA Newport are especially vulnerable to flood damage from waves with velocity (FEMA 2020). Velocity refers to wave action—flooding in coastal areas can be increased if there is wave velocity pushing water onshore.

A 100-year flood event may be expected to inundate extensive areas between the Newport-Pell Bridge and upland areas on Coddington Point, including the industrial and storage area north of Gate 2 adjacent to the Coasters Harbor estuary. Much of Coasters Harbor Island also would be inundated.

Along Coddington Cove and northward, 100-year floods may inundate land west of Defense Highway. Areas south of the breakwater would be subject to coastal flooding with wave action hazard. Piers 1 and 2 would be subject to coastal flooding with wave action hazard.

Midway’s Defense Highway would be slightly inundated during a 100-year flood event, and coastal flooding with wave action hazard would be expected along Narragansett Bay coastline. The Melville-Backyard area would receive 100-year flooding to an elevation of 13 feet.

The shoreline around the Fort Adams Housing Area is exposed to potential 100-year flooding action, but the upland areas would not experience flooding due to the steep topography surrounding the housing area. In addition, all of Gould Island falls within the 100-year floodplain.

Figure 2-5. Surface Waters at NAVSTA Newport, Newport County, Rhode Island.

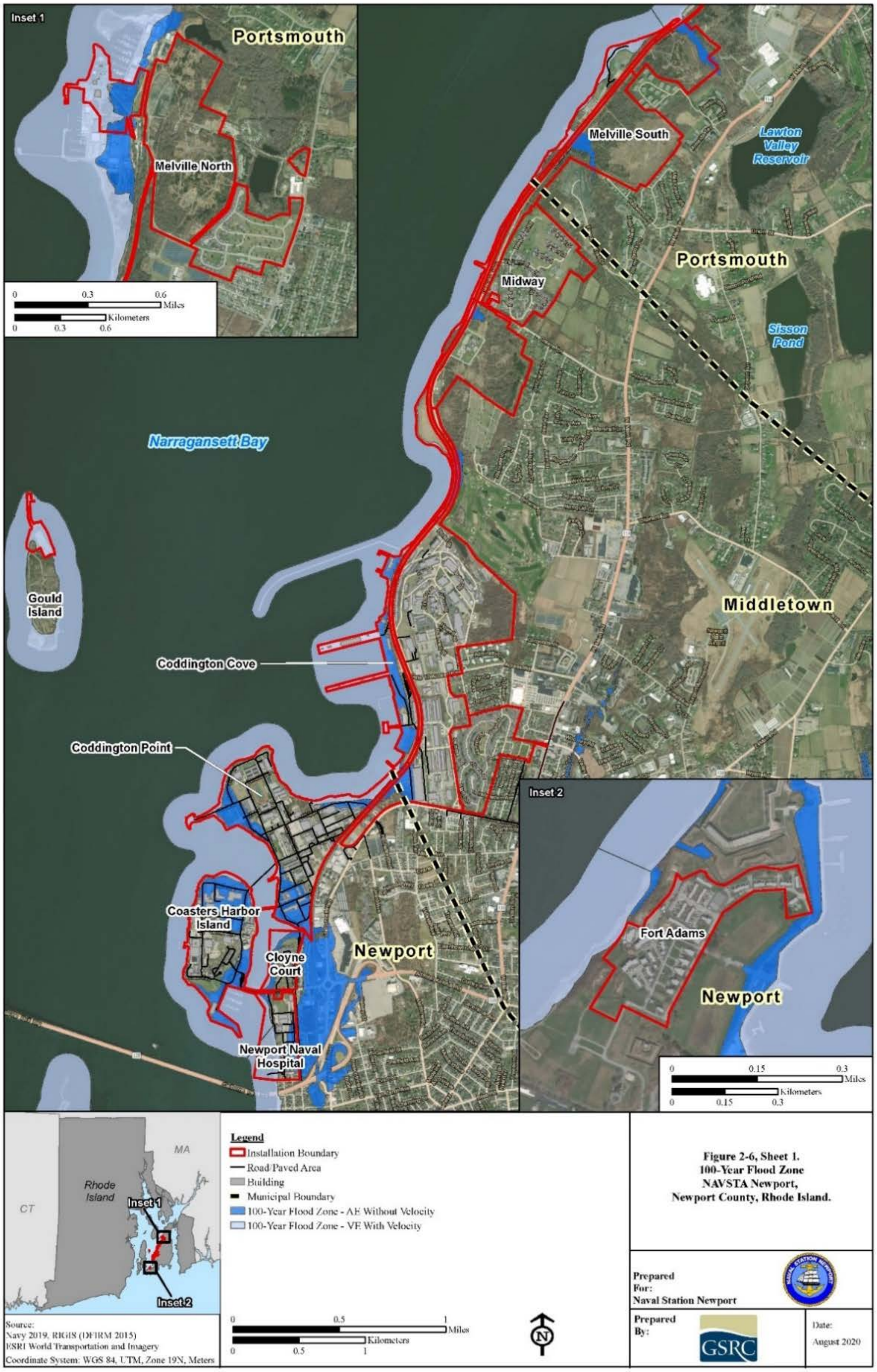

Figure 2-6, Sheet 1. 100-Year Flood Zone, NAVSTA Newport, Newport County, Rhode Island.

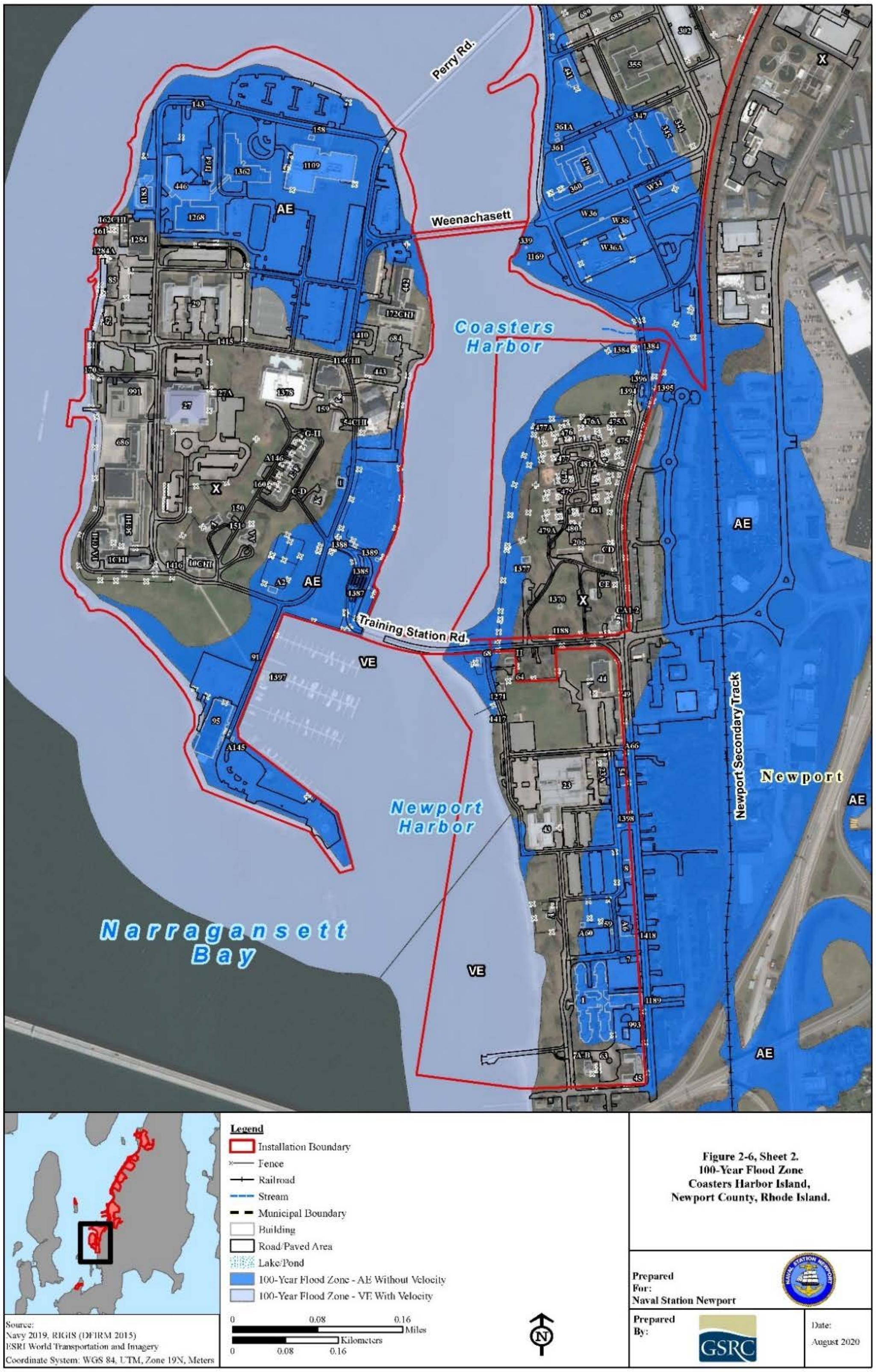

Figure 2-6, Sheet 2. 100-Year Flood Zone, Coastals Harbor Island, Newport County, Rhode Island.

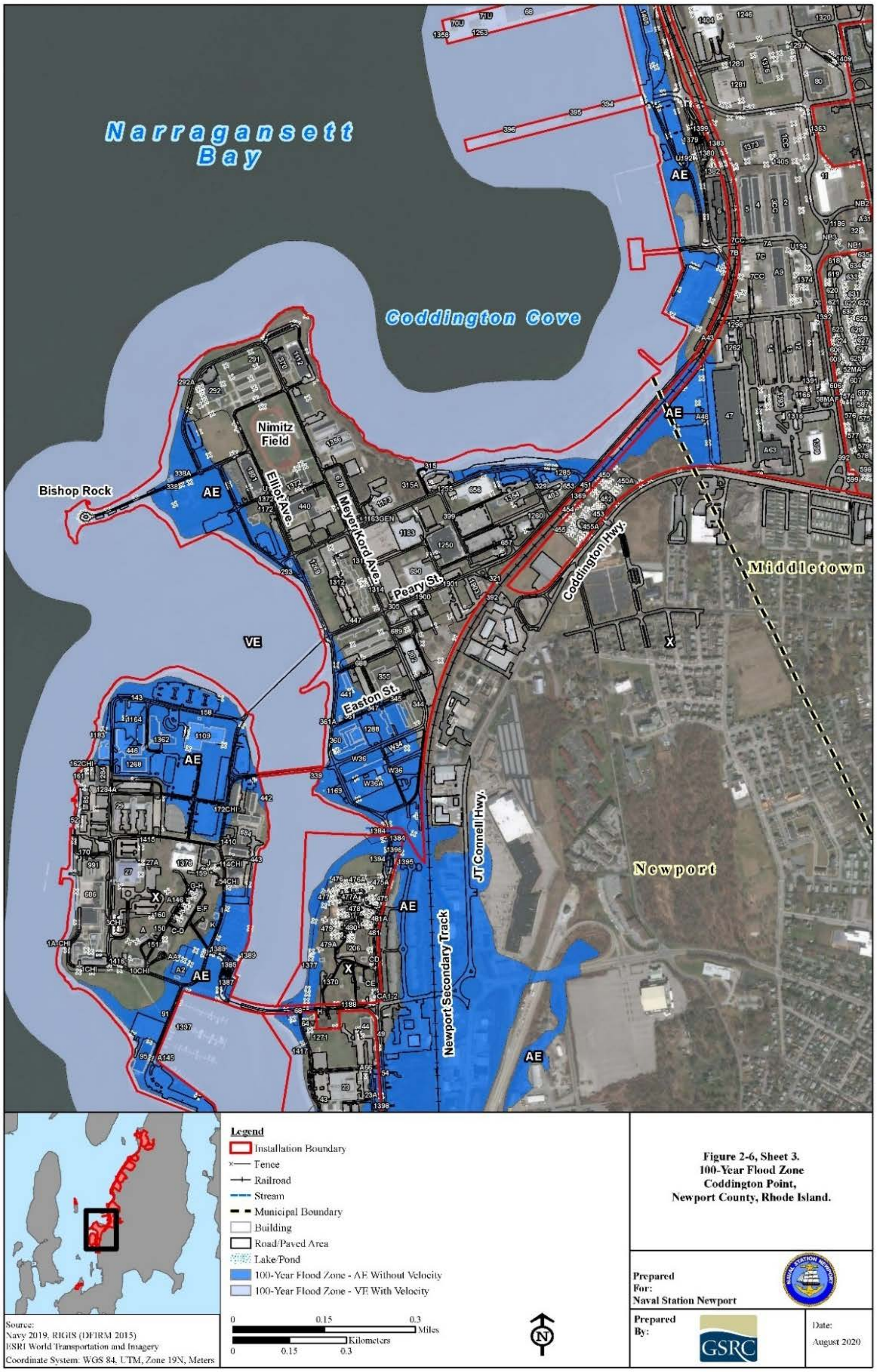

Figure 2-6, Sheet 3. 100-Year Flood Zone, Coddington Point, Newport County, Rhode Island.

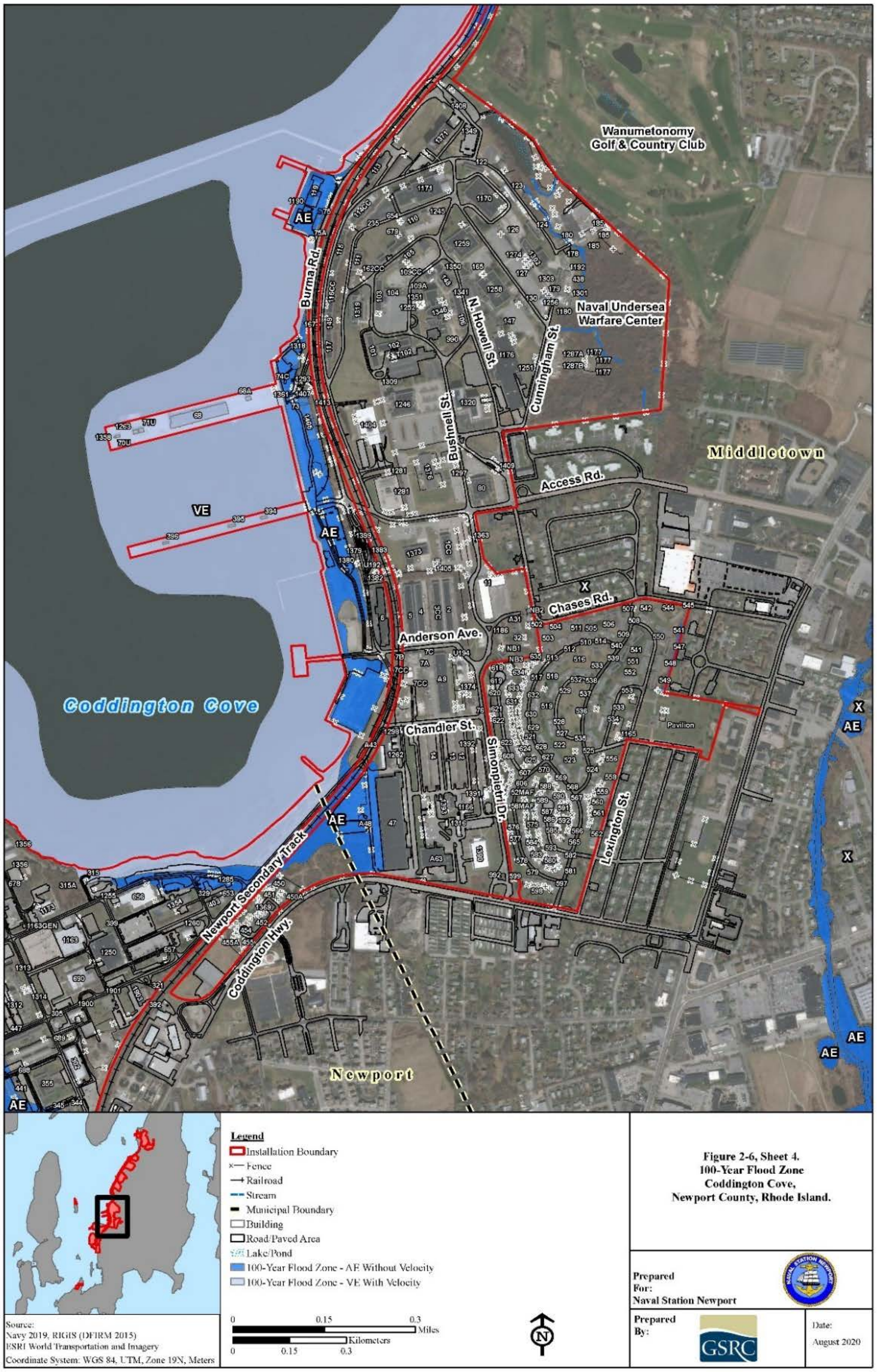

Figure 2-6, Sheet 4. 100-Year Flood Zone, Coddington Cove, Newport County, Rhode Island.

Figure 2-6, Sheet 5. 100-Year Flood Zone, Midway, Newport County, Rhode Island.

Figure 2-6, Sheet 6. 100-Year Flood Zone, Melville South, Newport County, Rhode Island.

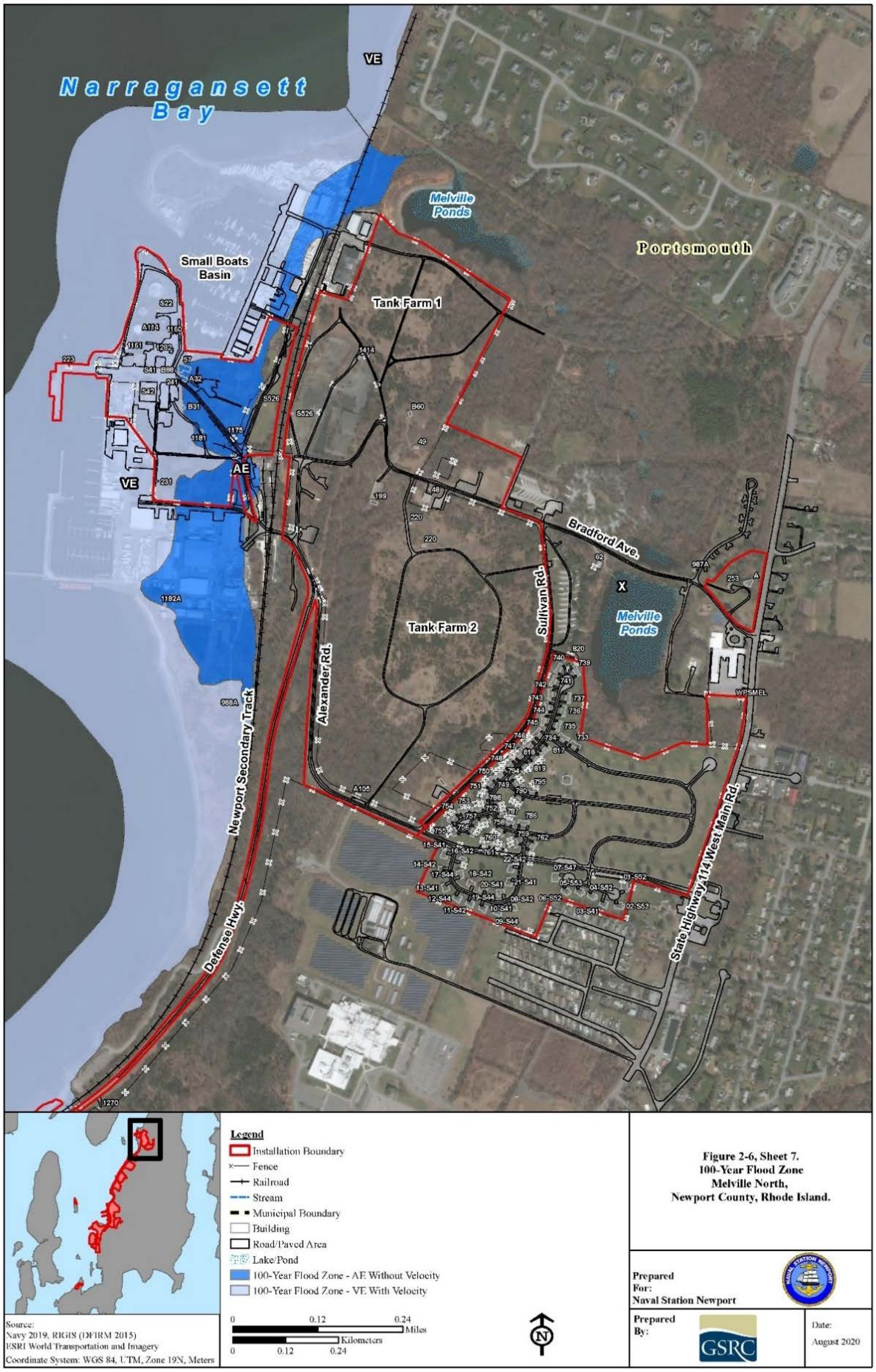

Figure 2-6, Sheet 7. 100-Year Flood Zone, Melville North, Newport County, Rhode Island.

Figure 2-6, Sheet 8. 100-Year Flood Zone, Fort Adams, Newport County, Rhode Island.

2.2.4 Climate

NAVSTA Newport falls within the humid continental climate region characterized by large seasonal temperature differences—warm summers and cold winters. Further, the installation's location along the Atlantic Ocean produces climate affected by the ocean's thermal qualities; warm gulf currents provide winters that are milder than inland areas. Average annual precipitation is 47.2 inches (NOAA 2010). Based upon data collected by the National Climactic Data Center (NCDC) for the most current Climate Normal (1981-2010) at T.F. Green Airport, average temperatures range from 31.8 degrees Fahrenheit (ºF) in the winter to 71.3ºF in the summer. Table 2-1 shows the annual and seasonal precipitation data and average, minimum, and maximum temperatures in the region.

Table 2-1. Average Annual and Seasonal Precipitation and Temperature, T.F. Green State Airport, Rhode Island.

	Precipitation (in.)	Minimum Temperature (ºF)	Average Temperature (ºF)	Maximum Temperature (ºF)
Annual	47.2	42.6	51.6	60.7
Winter (Dec, Jan, Feb)	11.37	23.6	31.8	40.0
Spring (Mar, Apr, May)	12.92	39.4	48.8	58.2
Summer (Jun, Jul, Aug)	10.53	62.0	71.3	80.6
Fall (Sept, Oct, Nov)	12.36	45.0	54.3	63.6

Source: NOAA 2010

The coast of Rhode Island is also susceptible to extreme storm events such as tropical storms, hurricanes (most recently, the devastating Hurricane Sandy in 2012), and nor'easters. Tropical storms and hurricanes form over warm, tropical ocean waters and travel in a counter-clockwise motion in the northern hemisphere. Hurricane season in the Atlantic begins 01 June and ends 30 November. Nor'easters are winter storms that form between November and April. Like a hurricane, nor'easter winds travel in a counter-clockwise motion around a low pressure system. Nor'easters generate high waves, cause large storm surges, and tend to move slowly so shorelines are affected for long periods of time. Nor'easter winds rarely reach hurricane intensity, but their slow movement can cause damage to large areas on the coast. Tropical storms, hurricanes, and nor'easters in the vicinity of NAVSTA Newport may bring torrential rain, flooding, and high storm surges, and cause erosion.

Predominant summer winds are from the southwest while predominant winter winds are from the northwest. Fort Adams is exposed to southwest winds from Rhode Island Bay. Coasters Harbor Island, Coddington Point, and Coddington Cove are protected from west winds by the landmass of Conanicut Island, and from winter storms from the north-northeast (i.e., nor'easters) by the land mass of Aquidneck Island.

2.3 BIOTIC ENVIRONMENT

2.3.1 Ecoregion (Northeastern Coastal Zone Ecoregion)

NAVSTA Newport falls within EPA's Northeastern Coastal Zone Ecoregion, specifically Narragansett/Bristol Lowland subsection of that ecoregion. An ecoregion is an area of general likeness in ecosystems and the type, quality, and quantity of environmental resources. This geographic identifier serves as a framework for research, management, and monitoring of ecosystems, and is critical for structuring ecosystem management strategies across federal and state agencies and nongovernmental organizations (EPA 2012a).

The Northeastern Coastal Zone comprises much of southern New England and the coast of New Hampshire and southern Maine, excluding Cape Cod. It is mainly characterized by irregular plains and plains with low to high hills. Predominant natural vegetation is Appalachian oak forests and northeastern oak-pine forests, with mostly mesic Inceptisol soils (EPA 2012a). Current land use in the ecoregion is largely forests, woodlands, and urban and suburban development, as well as minor areas of pasture and cropland.

The NAVSTA Newport sub-ecoregion, Narragansett/Bristol Lowland, is 1,207 acres that stretch from Providence, Rhode Island, and Aquidneck Island, Rhode Island, over to Cape Cod, Massachusetts. This region is characterized by flat and gently rolling irregular plains with elevation mostly below 200 feet, and coastal areas with bays, peninsulas, and islands. Low gradient streams, wetlands, ponds, and lakes are also present. The wetlands in this ecoregion provide important recharge to the region's aquifers. Cranberry bogs are abundant. Vegetation is varied; land cover is mostly deciduous and mixed forest, woody wetlands, and minor crop and pasture land.

A distinct type of Pennsylvanian-age sedimentary rock (sandstone, greywacke, shale, and conglomerate) defines Narragansett Basin, which is distinct from the igneous and metamorphic rocks found in surrounding ecoregions.

2.3.2 Narragansett Bay Watershed

Although Narragansett Bay is in Rhode Island, some of its watershed area is located in Massachusetts. The watershed covers 1,650 square miles and has three major rivers that provide the majority of the fresh water that flows into the bay—the Blackstone, the Taunton, and the Pawtuxet rivers (see Figure 2-7).

Narragansett Bay was one of the first estuaries to be included in the NEP. A Comprehensive Conservation and Management Plan (CCMP) for Narragansett Bay region was completed in 1993, and the most recent update of the plan was completed in 2012. The CCMP, collaboratively developed by both governmental and non-governmental organizations in Rhode Island and Massachusetts, puts forth a strategy for realizing a sustainable future for the entire Narragansett Bay Watershed Region (NBEP 2012).

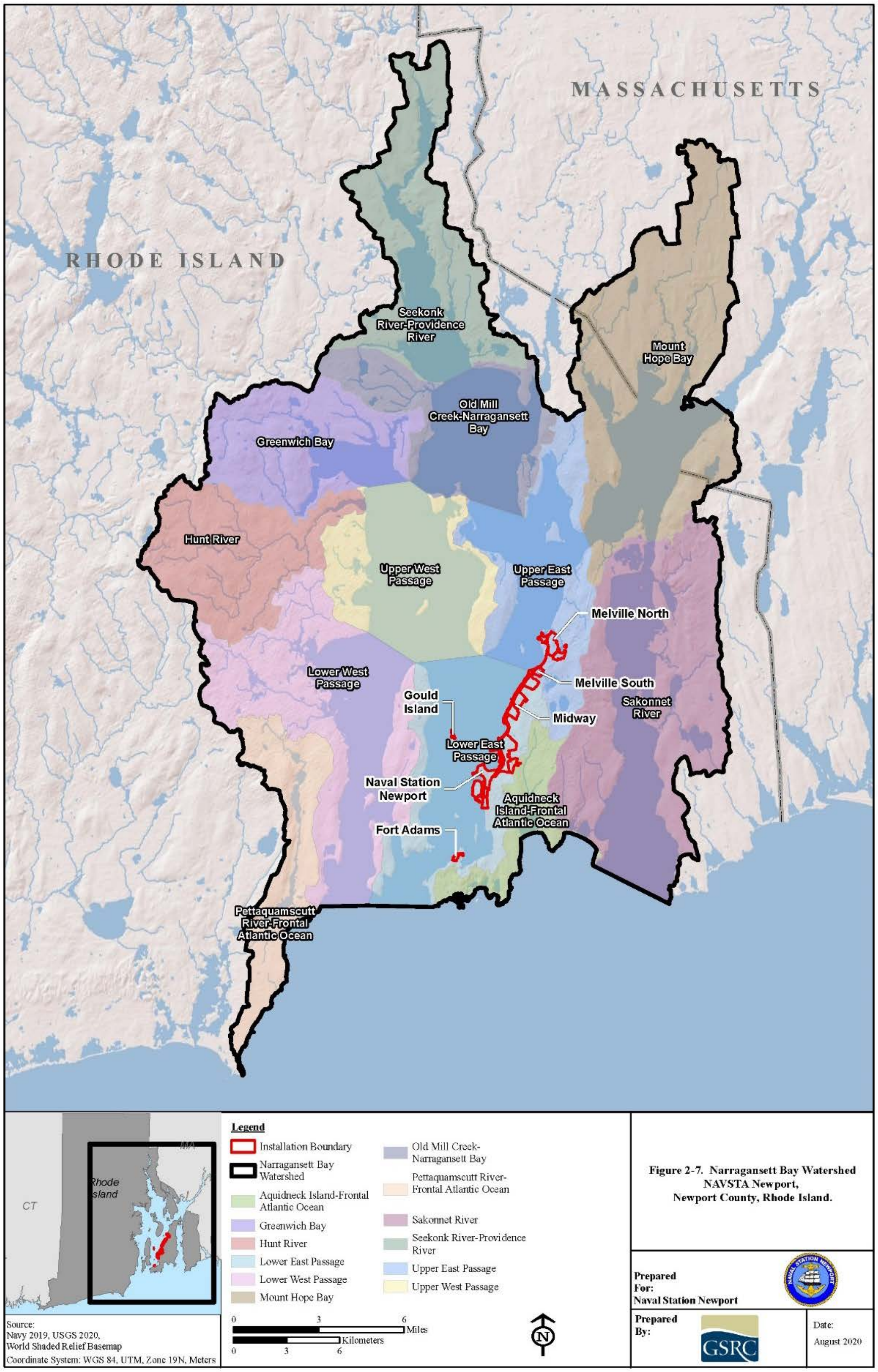

Figure 2-7. Narragansett Bay Watershed.

The CCMP recognizes the following ecosystem services[1] that Narragansett Bay watershed provides:

- filtering and cleaning waters;
- decreasing greenhouse gas emissions;
- enhancing property values;
- providing recreational opportunities and quality of life benefits; and
- supporting food production and natural resource industries.

The watershed faces problems new and old including pollution, climate change, and invasive species. Some of the priority issues within Narragansett Bay watershed region that the CCMP seeks to address include (NBEP 2012):

- non-point source pollution/stormwater;
- polluted stormwater runoff, septic systems, fertilizers, atmospheric deposition, and so forth;
- nutrient impacts on waterbodies;
- excessive nutrient levels due to non-point source pollution, which cause depletion of oxygen in the watershed and render habitats unsuitable for fish, shellfish, and other aquatic organisms;
- loss and degradation of habitat;
- construction-driven fragmentation of natural habitat and wildlife corridors, which has reduced ecosystem resilience to invasive species and climate change impacts;
- impacts of climate change;
- potential change across all aspects of the watershed ecosystem including the food web, processes such as nutrient cycling, plant and wildlife species, non-native species, precipitation levels, flooding, and sea-level rise.;
- science, monitoring, and funding needs;
- the need for better data on current conditions and funding for additional research and programs in order to effectively manage the watershed and estuary;
- addressing challenges through an ecosystem-based approach; and
- the need for environmental management to be applied at the ecosystem or watershed level to be most effective, which requires collaborative planning, involvement across all stakeholders, data and resource sharing, and regional-level planning and implementation.

[1] Ecosystem services are the direct and indirect benefits derived from natural resources and processes that occur in ecosystems (e.g., wetlands' role in water purification and flood control). Ecosystem services often provide quantifiable economic value).

The 2017 *State of Narragansett Bay and Its Watershed* report highlights the following key points (NBEP 2017):

- The water in the bay is getting cleaner;
- scientists are tracking changes in the ecosystem after recent reductions in pollution from wastewater treatment facilities;
- conditions vary greatly among places in the bay and watershed, generally improving with distance from urban areas, but urbanized areas are expanding;
- climate change is affecting air and water temperatures, precipitation, sea level, and fish in Narragansett Bay region; and
- more research and monitoring are needed to understand the major changes occurring in the bay and watershed in order to enable well informed adaptation and mitigation.

A 2007 report by the EPA's National Estuary Program notes that the chief environmental concerns in the Bay are eutrophication, nutrient loading, and pathogens. The watershed has experienced an increasing range of symptoms associated with eutrophication including low dissolved oxygen levels, fish kills, loss of eelgrass, macroalgae blooms, benthic community changes, and a shift in dominant fish communities within the Bay (from bottom-dwelling species such as winter flounder and tautog to water-column-dwelling species such as striped bass and scup). For these reasons, NBEP has focused on nutrient loading in the Bay, particularly nitrogen levels. The nitrogen levels have generally been associated with sewage, typically from wastewater treatment plants or older and failing septic systems within the watershed. Actual or suspected contamination from sewage-derived bacteria and pathogens can be detrimental to shellfish harvesting in the Bay (EPA 2007).

Habitat quality within Narragansett Bay Watershed region is also a concern, particularly for eelgrass beds, which have declined since the 1950s due to pollution, nitrogen loads, new development, dredging, and other factors.

2.3.3 Water Resources

Water resources comprise surface and ground water resources. Surface water features include streams, lakes, rivers, reservoirs, wetlands, and estuaries. Ground water includes subsurface hydrogeologic resources such as aquifers. Since surface and ground water are linked, effective land and water management requires clear understanding of both water resource types and how they are linked in any setting. For example, pollution of surface water can cause degradation of ground water quality, and vice versa.

2.3.3.1 Surface Water

All surface waters of the state of Rhode Island are categorized according to water use classifications by RIDEM based on considerations of public health; recreation; propagation and protection of fish, shellfish, and wildlife; and economic and social benefit. Each class of water use is identified by the most sensitive water uses to be achieved and protected; although surface waters are regulated to enhance and protect uses designated by the CWA, they may be suitable for additional beneficial uses.

RIDEM's *Water Quality Regulations*, published in 2006 and amended in 2009, classifies the surface waters of Rhode Island in Appendix A of the document (RIDEM OWR 2009). RIDEM-designated classifications for freshwater surface water uses, as presented in Rule 8.B.1 include:

- **Class AA:** Designated as a source of public drinking water supply or as tributary waters within a public drinking water supply watershed; for primary and secondary contact recreational activities; and for fish and wildlife habitat. These waters shall have excellent aesthetic value.
- **Class A:** Designated for primary and secondary contact recreational activities and for fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have excellent aesthetic value.
- **Class B:** Designated for fish and wildlife habitat, and primary and secondary contact recreational activities. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value.[2]
- **Class B1:** Designated for primary and secondary contact recreational activities, and for fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value. Primary contact recreational activities may be affected due to pathogens from approved wastewater discharges. (All Class B criteria must be met.)
- **Class CB:** Designated for secondary contact recreational activities and fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value.

Figure 2-8 depicts the water quality of surface waters on NAVSTA Newport. Lawton Brook in Melville South is classified as a Class A waterbody. Lawton Brook is downstream of the Lawton Valley Reservoir, which is a Class AA drinking water supply in Portsmouth.

All fresh waters not listed in Appendix A of the 2009 *Water Quality Regulations* shall be considered Class A (Rule 8.C.4). Normans Brook in Melville South, Gomes Brook in Midway, and other unnamed streams on NAVSTA Newport property are not listed in the appendix and are, therefore, classified as Class A waterbodies. These brooks and streams discharge into waters south of Carr Point, Coasters Harbor, and Coddington Cove (class SA waters).

[2] Some Class B and B1 waterbody segments may have partial use designated to them under Rule 8.C.3, outlining specific restrictions on use that may affect the application of criteria. One example is where waters are affected by activities such as combined sewage overflows and concentrations of vessels.

Figure 2-8. Rhode Island Water Quality Standard Classifications at NAVSTA Newport, Newport County, Rhode Island.

As with surface waters, RIDEM-designated uses for seawater surface waters as presented in Rule 8.B.2 of *Water Quality Regulations* (RIDEM OWR 2009) include the following:

- **Class SA:** Designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation, and industrial cooling. These waters shall have good aesthetic value. All seawaters not listed in Appendix A are classified as Class SA (Rule 8.C.5).
- **Class SB:** Designated for primary and secondary contact recreational activities, shellfish harvesting for controlled relay and depuration, and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation, and industrial cooling. These waters shall have good aesthetic value.
- **Class SB1:** Designated for primary and secondary contact recreational activities, and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation, and industrial cooling. These waters shall have good aesthetic value. Primary contact recreational activities may be affected due to pathogens from approved wastewater discharge (all Class SB criteria must be met).
- **Class SC**: Designated for secondary contact recreational activities, and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation, and industrial cooling. These waters shall have good aesthetic value.

With the exception of Class SB1 waters within 500 feet of the Newport Wastewater Treatment Facility outfall in the vicinity of Bishop Rock, all marine surface waters from the Newport-Pell Bridge north to the breakwater at Coddington Cove are classified as SB waters. Marine surface waters from the Coddington Cove breakwater north to Carr Point are classified SA. Between Carr Point and Coggeshall Point, north of Melville-North, marine surface waters are classified as SB1. Surface waters west of Fort Adams are classified as SA, with the exception of waters within 500 feet of the Navy sewer outfall, which are mapped SB and SB1 (RIDEM OWR 2009).

2.3.3.2 Ground Water

Aquifers in till and bedrock provide the ground water on Aquidneck Island and the eastern Narragansett Bay; water that is trapped between bedrock is captured in deep artesian wells and replenished where the aquifer is near or at surface level. The average depth of ground water on the island is approximately five to 12 feet, and all ground water and surface waters flow into Narragansett Bay. Due to its proximity to sea level, the ground water within NAVSTA Newport property is relatively shallow and susceptible to saltwater intrusion. No wells, shallow or artesian, exist at NAVSTA Newport for water consumption, and the City of Newport supplies water to the installation through the city's water system.

Ground water in the vicinity of NAVSTA Newport around Coasters Harbor Island, Coddington Point, Coddington Cove, and Melville North is classified by RIDEM as GB (ground water resources known, or presumed to be, unsuitable for drinking water use without treatment). Ground water around the Fort Adams housing area, Midway, Melville South, and Gould Island is classified as GA (ground water resources known, or presumed to be, of drinking water quality but not assigned the highest level of ground water quality classification) (RIDEM n.d.[a]).

2.3.4 Aquatic Habitats

2.3.4.1 Wetlands

Wetlands are defined under the CWA as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA 2013a). The EPA categorizes four main types of wetlands (with several sub-types) (EPA 2004):

- marshes – characterized by non-woody vegetation
    - tidal coastal marshes
    - non-tidal inland marshes
- swamps – dominated by woody vegetation
    - forested
    - shrub
    - mangrove
- bogs – freshwater wetlands, characterized by spongy peat deposits, evergreen trees, and shrubs, and sphagnum moss (rainwater is the only water source)
- fens – freshwater, peat-forming, covered largely by grasses, sedges, reeds, and wildflowers (ground water-fed)

Both bogs and fens tend to occur in the glaciated areas of the northern U.S.

Wetlands provide habitat for thousands of aquatic and terrestrial plants and animals, as well as being important stops for migrating birds. They function as a means for flood control and storm damage reduction, protect and improve water quality naturally, and provide recreational and aesthetic value.

Relevant to NAVSTA Newport, the entire installation falls within the Northeastern Coastal Zone Ecoregion and is under the regulations of the RICRMC. The CRMC *Rules & Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast* (CRMC n.d.) defines freshwater wetlands as:

A. A bog, floodplain, pond, marsh, riverbank, swamp, river, area of land within fifty feet (50'), area(s) subject to flooding, area(s) subject to storm flowage, floodway, flowing body of water, stream, intermittent stream, perimeter wetland, submergent and emergent plant communities, special aquatic sites, shrub and forested wetland or any combination thereof;
B. Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions; or
C. Any or all wetlands created as part of, or the result of, any activity permitted or directed by RIDEM after 16 July 1971 or the CRMC after 18 August 1999 including, but not limited to: restored wetlands; value replacement wetlands created to compensate for wetland loss such as flood plain excavations; and any wetlands created, altered or modified after 16 July 1971.

Existing data on wetlands at NAVSTA Newport are available from several sources including wetland delineations conducted at the NUSC Disposal Area (Tetra Tech 2008), Carr Point and Tank Farms 1–5 (NAVSTA Newport 2003), and a wetland functional assessment conducted at the Coddington Cove Rubble Fill Area (CC RFA) (Memorandum, Thomas Campbell to Sarah Watts, 4 November 2011). In addition to ground-truthing the existing mapped wetlands and identifying potential wetlands and waterbodies that are not currently mapped, wetlands ground-truthing field surveys were conducted in October 2013. The field effort was focused on the tank farms and wetlands on the NUWC property that had not previously been delineated. The combined results summarizing the existing wetlands data and ground-truthing surveys are described below. Figure 2-9, Sheets 1–5 depict the wetlands found at NAVSTA Newport, distinguishing between areas and boundaries mapped by different data sources and delineations.

IRP Site 04, CC RFA, was surveyed in October 2011 for a Wetland Functions and Values Assessment, and as part of a pre-design stage for the site and associated remedial action (Memorandum, Thomas Campbell to Sarah Watts, 04 November 2011). The CC RFA comprises a vegetated upland that historically was a disposal site for inert rubble materials (disposal area in the central portion of CC RFA), an intermittent stream, and an abutting wetland area between the fill area and the Penn Central Railroad right-of-way (ROW). The palustrine emergent wetland area comprises approximately three acres of the eight-acre site and is dominated by common reed (*Phragmites australis*), an invasive species. The wetland's principal functions are floodflow alteration and sediment/toxicant retention. Secondary functions include recharging/discharging of ground water, removing nutrients from surface water runoff, exporting production (such as organic plant material), stabilizing sediments and shorelines against erosion, and providing wildlife habitat. However, the wetland does not provide any endangered species, or any fish or shellfish habitat, nor does it provide any recreation, education/scientific value, uniqueness/heritage, or visual quality/aesthetics to NAVSTA Newport.

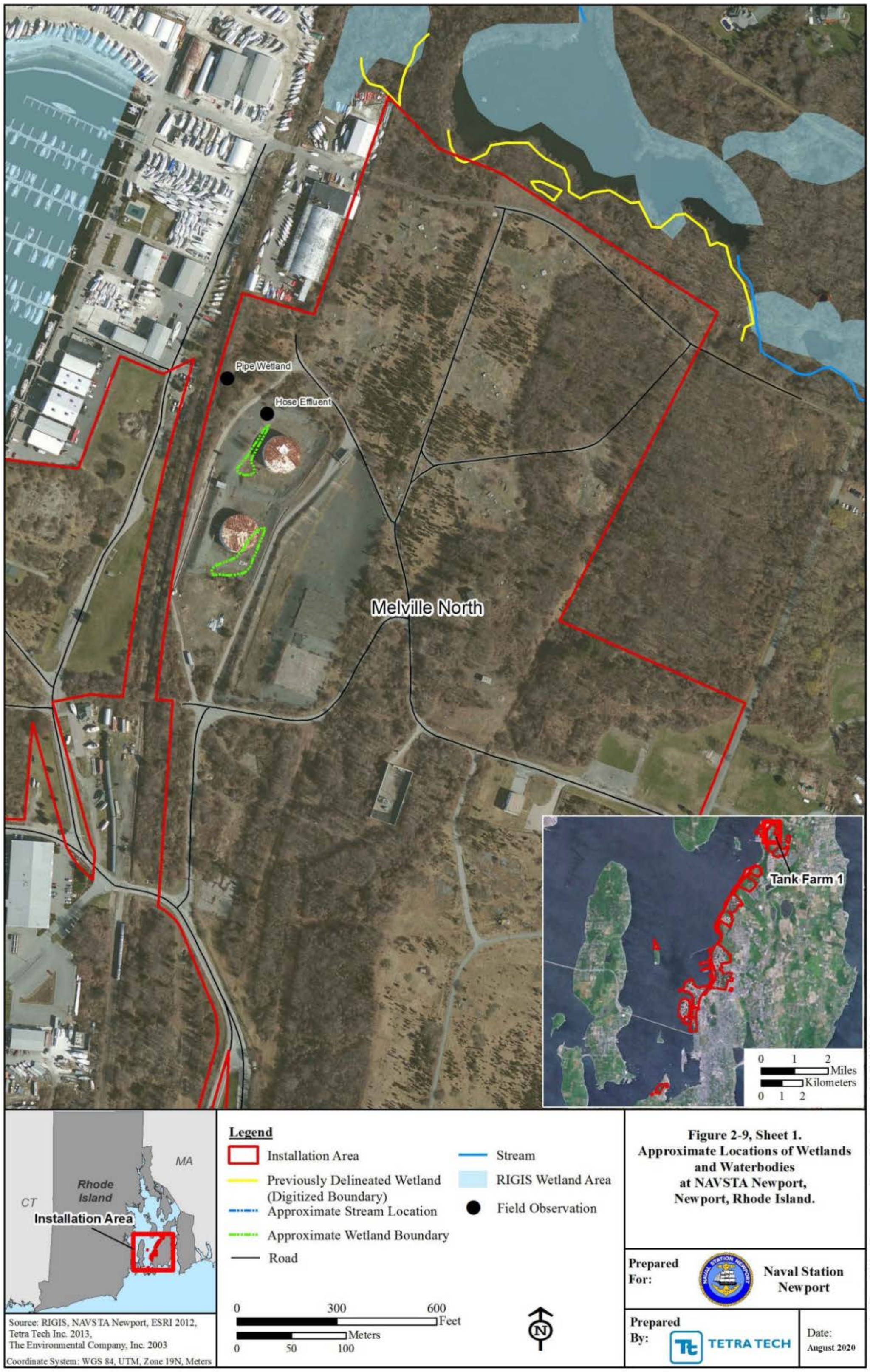

Figure 2-9, Sheet 1. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport County, Rhode Island.

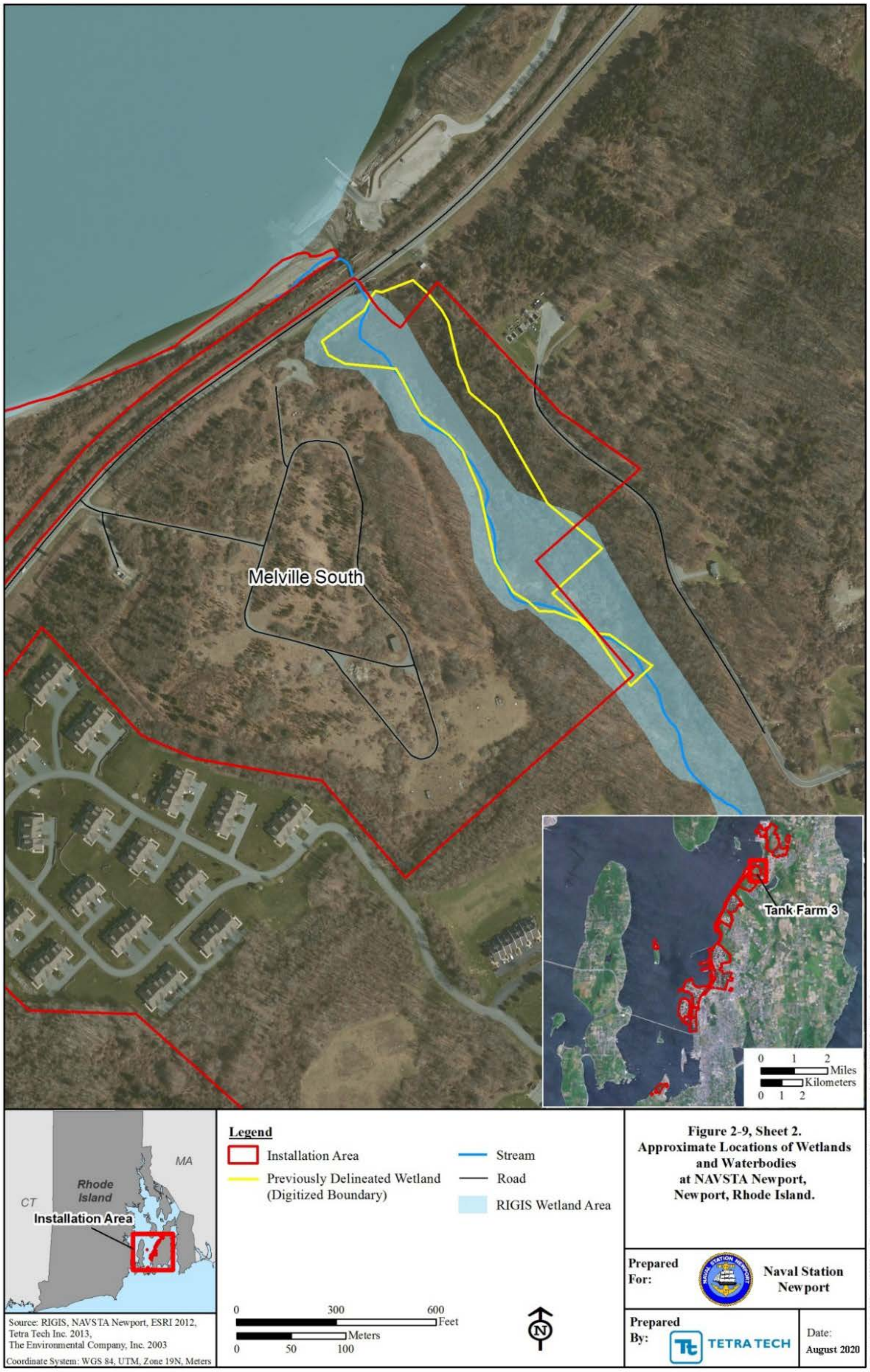

Figure 2-9, Sheet 2. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport County, Rhode Island.

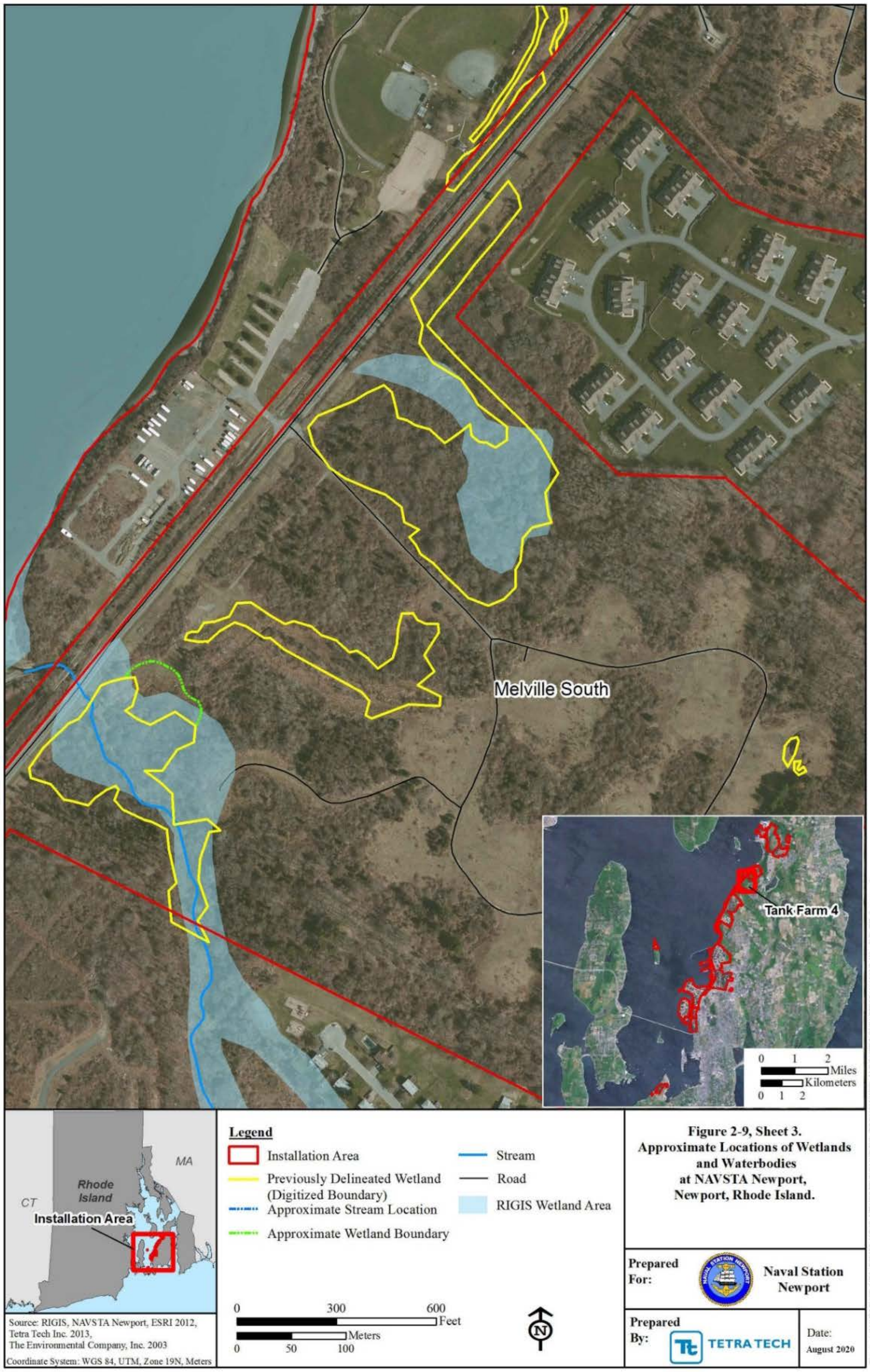

Figure 2-9, Sheet 3. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport County, Rhode Island.

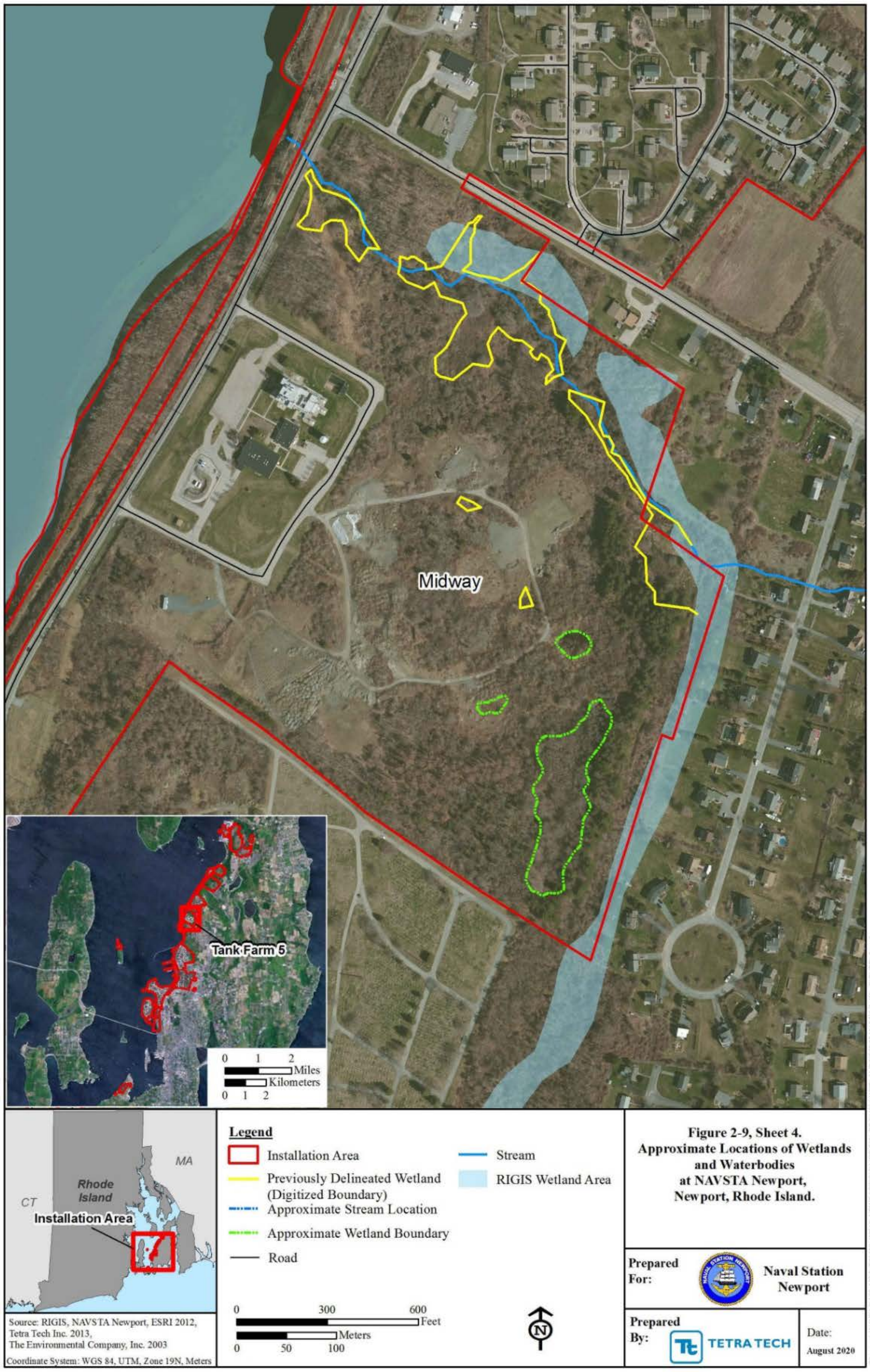

Figure 2-9, Sheet 4. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport County, Rhode Island.

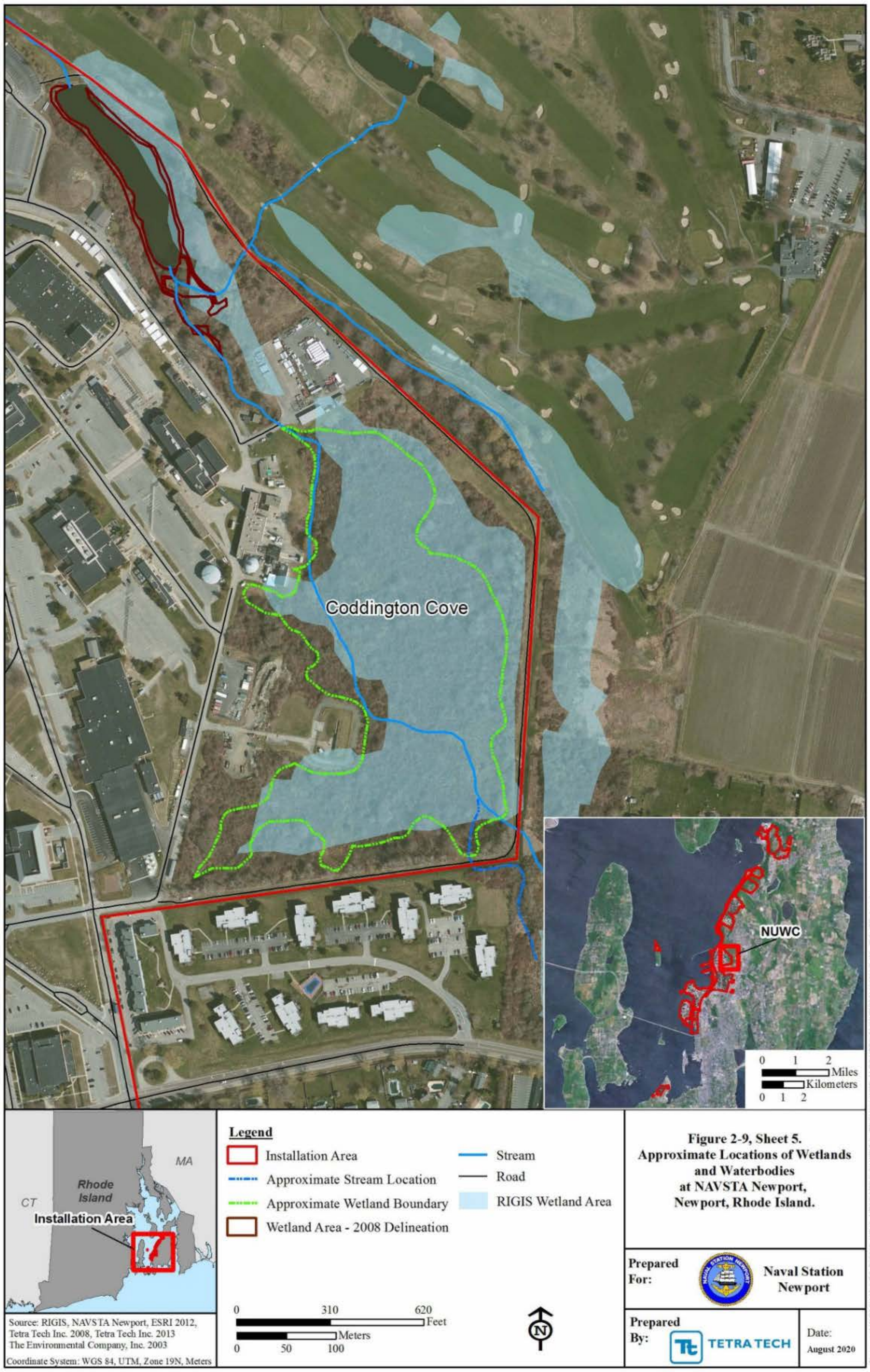

Figure 2-9, Sheet 5. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport County, Rhode Island.

There are two primary wetlands areas within NUWC: (1) in the vicinity of NUSC Disposal Area and NUWC Pond, known as IRP Site 08, and (2) in the Deerfield Area and the floodplains surrounding Deerfield Creek. The wetlands in the NUSC Disposal Area and around NUWC Pond were delineated in 2008 as part of environmental monitoring associated with the Disposal Area to determine the presence and extent of areas that meet the criteria for federal wetlands designation according to the U.S. Army Corps of Engineers (USCAE) (Tetra Tech 2008). The investigation found one area, totaling 0.8 acre within the site boundary, which met the criteria for designation as a wetland; the wetland community types were identified as palustrine emergent and palustrine scrub-shrub/emergent. In addition to the wetland, the NUSC Disposal Area also contains two intermittent streams (Deerfield Creek and an unnamed channel) and one pond (NUWC Pond). The wetlands are hydrologically connected to the pond through the two streams.

The wetlands in the Deerfield Area are extensive and include a combination of native and invasive species. A substantial amount of fill material has been deposited along the northeastern edge in order to create the bunker on the west side of the Deerfield Area. It appears that discarded concrete, asphalt, and debris historically were placed in the wetland, and the soils beneath this fill are hydric. Species composition in the Deerfield Area is similar to that described below for the Old Field, Shrub Swamp, and Emergent Marsh communities in Section 2.3.6.1 *Vegetative Communities*. Other species present include common rush (*Juncus effusus*), beggarticks (*Bidens* spp.), goldenrod (*Solidago* spp.), willow (*Salix* spp.), and red maple (*Acer rubrum*). Vegetation in the surrounding uplands is consistent with that found in former disturbed sites and includes a prevalence of invasive shrubs and vines, and thorny species (e.g., *Rubus*, *Smilax*, and *Rosa* spp.). Invasive species, common along edge habitat, include common reed, multiflora rose (*Rosa multiflora*), honeysuckle (*Lonicera* spp.), and tree-of-heaven (*Ailanthus altissima*). The wetlands should be delineated to more completely understand the extent of wetlands in this area. Approximate wetland boundaries and stream locations are shown on Figure 2-9, Sheets 1-5.

The location where the Deerfield Creek stream channel enters the Deerfield Area of NUWC has shifted compared to existing stream data. The creek now approaches the southeast corner of the Deerfield area and runs parallel to the southern fence line for approximately 150 feet before turning north and crossing under the fence and perimeter road via a culvert. The creek channel continues in a northeasterly direction until it reconnects with the original channel. The stream appears to have high nutrient inputs as evidenced by substantial algal growth. Some killifish (*Fundulus* spp.) are present, which have a high tolerance for environmental stressors and pollution.

In 2003, Tank Farms 1–5 and the Carr Point Recreation Area were investigated and delineated to determine the presence and extent of wetlands as designated by the USACE (NAVSTA Newport 2003). No wetlands or any waters of the U.S. were identified in Tank Farms 1 and 2 during this delineation. Three small potential wetland areas were identified in Tank Farm 1 during the 2013 wetland ground-truthing surveys. Two of these areas are in the former tank bed area (Figure 2-9, Sheet 1) and most likely are caused by impounding water above the impermeable layer that underlies the tank beds. Vegetation communities in these wetlands are similar in composition to the Wet Meadow communities described in Section 2.3.6.1 *Vegetative Communities*, with sedges (*Carex* spp.), rushes (*Juncus* spp.), goldenrods, and including spikerush (*Eleocharis* spp.), smartweeds (*Persicaria* spp.), beggarticks, cattail (*Typha latifolia*), and willow. Soils are shallow and vegetation appears stressed or stunted. A third, small (approximately 16-foot by 20-foot) wetland was observed adjacent to where an approximately 12-inch diameter pipe transitions from 6-feet above ground to underground. Wetland vegetation includes sedges, rush, and flatsedge (*Cyperus* spp.). Wetland ground-truthing surveys confirmed that there are no potential wetland areas in Tank Farm 2.

Tank Farm 3 has approximately 5.2 acres of wetlands located along the northern edge of the parcel and associated with Lawton Brook. The wetland comprises emergent marsh and gradually shifts to a scrub-shrub wetland community moving upgradient and upstream. Vegetation species composition is similar to those described for the Emergent Marsh and Shrub Swamp communities described in Section 2.3.6.1 *Vegetative Communities*, with the exception that the emergent community is dominated by common reed. The scrub-shrub sections of the wetland include a prevalence of red maple in addition to the species described in the Shrub Swamp community. The downstream end of Lawton Brook is restricted by a series of human-made dams or steps prior to crossing under Defense Highway via three culverts, which may have resulted in wetter conditions than historically would have occurred in this area.

Three wetland areas within Tank Farm 4 total approximately 12.8 acres. Norman's Brook is a perennial stream that runs through the southwest corner of Tank Farm 4, and it has an associated wetland. Wetlands also exist at the north end of Tank Farm 4, and there is a linear section of wetland between these two areas. All of the wetlands in this area are predominantly scrub-shrub wetlands. Vegetation in these wetlands includes a combination of Shrub Swamp and Wet Meadow communities. A small potential wetland area associated with the Norman's Brook wetland is not currently mapped correctly (Figure 2-9, Sheet 3). The linear wetland in between the other wetlands has hydrophytic vegetation and evidence of wetland hydrology; the soils are very compact, with a thin (6–8 inch) layer exhibiting reduced soil conditions (i.e., redox concentrations) overlying a non-hydric soil. This area may primarily be subject to storm flow, serving as a conduit to move water away from the historic tanks located on higher ground.

Tank Farm 5 has several areas of wetlands associated with Gomes Brook, which runs through from southeast to northwest along the edge of the site. Approximately 3.7 acres of wetlands had previously been mapped at Tank Farm 5. In addition, there are three other areas of wetland that were observed during the wetland ground-truthing surveys but are not currently mapped (Figure 2-9, Sheet 4). Two of these areas are small depressional areas that likely are in the location of former tanks and are most similar to the Wet Meadow community described in Section 2.3.6.1 *Vegetative Communities*. The third area is a large forested wetland area that is most similar to the Red Maple Swamp community and also contains gray birch (*Betula populifolia*) in the overstory.

Carr Point contains several small wetlands (totaling approximately 0.6 acre). One wetland is an emergent wetland along a power line corridor, another is associated with the vegetated drainage swale at the base of the slope at the edge of the power line corridor, and the last one is a scrub-shrub wetland associated with a vegetated drainage in between the power line and the second wetland described here. Vegetation in these areas is most similar to the Wet Meadow community described in Section 2.3.6.1 *Vegetative Communities*. Additional species observed include arrowleaf tearthumb (*Persicaria sagittatum*), jewelweed (*Impatiens capensis*), aster (*Aster* spp.), and swamp verbena (*Verbena hastata*).

2.3.4.2 Nearshore

NAVSTA Newport's nearshore areas include all submerged lands titled to the Navy and all other submerged lands that are adjacent to the installation that extend from the average high water level, offshore to the boundary of any secure areas controlled by the Navy. The NAVSTA Newport piers are located within the nearshore habitat of Narragansett Bay.

The nearshore area provides a unique habitat for a variety of plants and animals, including submerged aquatic vegetation (SAV) and other aquatic plants, fish, and shellfish. Nearshore habitat is ideal for eelgrass, the primary SAV species in Narragansett Bay. Nearshore waters comprise habitat for 80 percent of the saltwater fish species in the U.S. (EPA 2012b). Nearshore waters are also largely used for recreational purposes including boating, diving, swimming, surfing, and fishing activities.

In 2015, the Navy initiated nearshore surveys at the nearshore areas of Aquidneck and Gould Islands in NAVSTA Newport. Surveys were conducted to collect baseline data on the nearshore environment to assist the Navy in planning and provide data to be used during consultations with agencies. The objective of the survey was to record and analyze data for:

- benthic habitat, species, and sediment characteristics;
- nearshore water quality conditions;
- fish and invertebrate community assessment, including federally and state listed threatened and endangered species;
- SAV;
- intertidal flora and fauna; and
- marine mammals and sea turtles.

Data were collected during four seasonal surveys from spring 2016 to winter 2017: spring (April – June), summer (July – September), fall (October – December), and winter (January – March). Field surveys included benthic and water sample grabs, bottom trawls, beach seines, ichthyoplankton tows, marine mammal transects, and point samples for SAV (Navy 2017).

Overall results from the surveys concluded that the nearshore conditions at NAVSTA Newport are comparable to conditions in the grater Narragansett Bay. Benthic sediments, faunal communities, and water quality showed seasonal variability. Extremely low dissolved oxygen and high levels of nitrogen were recorded at some sampling stations. The survey also identified high abundance and diversity of fish and invertebrate communities and identified 40 species of fish and invertebrates. No rare, threatened, or endangered species were encountered. Abundant and diverse communities of benthic macroalgae and seagrass were also identified at 28% of the sample points. Invasive green algae, (dead man's fingers [*Codium fragile*]) was the most abundant algae and was documented at all but one sample site. The survey had limited detections of marine mammals and sea turtles; however the authors note that this was likely due to the limited time spent on the survey (Navy 2017, see Appendix N).

2.3.4.3 Deepwater Habitats

Deepwater habitats are classified as "permanently flooded lands lying below the deepwater boundary of wetlands" (Cowardin, et al. 1979). Deepwater habitats include marine, estuarine, riverine, and lacustrine systems. In marine and estuarine systems, deepwater habitat begins at the extreme spring tide low water line; in riverine and lacustrine systems, deepwater habitat begins at water depths greater than 2 meters (m) (6.6 ft.) below mean low water, or deeper if vegetation is present beyond this depth. In deepwater habitats, the surface water is permanent and often deep, and water (not air) is the primary area where organisms live. The deepwater habitat is classified separately from wetlands because wetlands do not traditionally include deep, permanent water.

No deepwater habitats have been identified at NAVSTA Newport.

2.3.4.4 Aquidneck Island Special Area Management Plan (SAMP) Areas of Particular Concern (APCs)

In 2009, the RICRMC adopted an *Aquidneck Island Special Area Management Plan for Portsmouth, Middletown, and Newport*. A Special Area Management Plan (SAMP) is authorized under the federal Coastal Zone Management Act of 1972 (16 U.S.C. 1452 [Section 303]) to address specific regional issues. The Aquidneck Island SAMP was developed to facilitate the regulatory process of new coastal development along the west side of the island while preserving the natural and recreational corridors in the region (CRMC 2009). The SAMP also identified Areas of Particular Concern (APCs), which are significant, ecologically important habitat areas, or areas that provide publicly owned access, open space, and recreational areas.

2.3.4.5 Rhode Island CRMC Type Waters

The CRMC has a *Coastal Resources Management Program* that outlines how the CRMC will manage the state's coastal resources. The first five chapters of the published program are referred to as the "Redbook," which was last revised on 14 May 2020. The CRMC and the Redbook are designed to help protect Narragansett Bay, and the program has designated stretches of water and coastline for conservation and low-intensity use. The CRMC has identified six categories of water ("Types") that are directly linked to the characteristics of the shoreline and are thus used to determine acceptable and unacceptable use of the coastline (CRMC 2020). Figure 2-10 depicts the CRMC Type Waters in Newport, Middletown, and Portsmouth, along the western shoreline of Aquidneck Island.

Type 1

Type 1 waters are considered Conservation Areas, and fall "within or adjacent to the boundaries of designated wildlife refuges and conservation areas, have retained natural habitat or maintain scenic values of unique or unusual significance, and/or are particularly unsuitable for structures due to their exposure to severe wave action, flooding, and erosion."

The CRMC protects Type 1 waters from any activities and uses that could degrade scenic, wildlife, and plant habitat values, which may adversely affect water quality or natural shoreline types. The CRMC considers unsuitable any alterations including construction of docks or dredging.

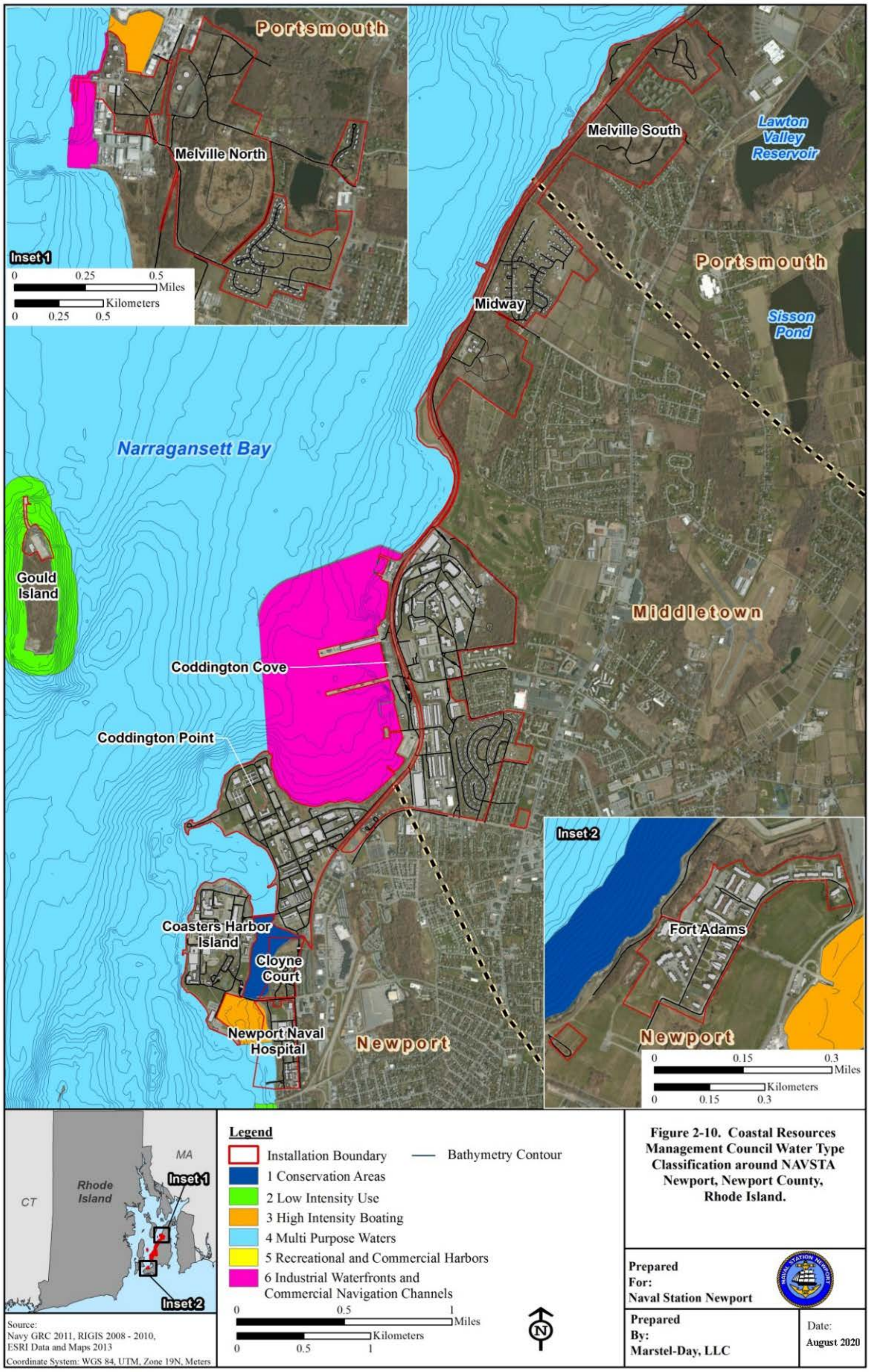

Figure 2-10. Coastal Resources Management Council Water Type Classifications around NAVSTA Newport, Newport County, Rhode Island.

Type 1 waters are adjacent to NAVSTA Newport at two locations:

- along the gravel beach and coastal wetland shoreline of Coasters Harbor between the two bridges to Coasters Harbor Island; and
- along the western shoreline of Fort Adams.

Type 2

Type 2 waters are considered Low-Intensity Use. This category includes waters adjacent to predominantly residential areas that have low-intensity recreational uses, high scenic value, good water quality, and maintenance of fish and wildlife habitat. Docks are acceptable, but more intense forms of development (such as new marinas and [non-maintenance] dredging projects) are prohibited if they would result in more intensive uses of the waters, change the area's character, or alter the established balance among uses.

Type 2 waters surround Gould Island.

Approximately 70 percent of the waters along Rhode Island's 420 miles of shoreline have been assigned as either Type 1 or Type 2. These areas are expected to retain high scenic values and low-intensity use.

Type 3

Type 3 waters are categorized as High-Intensity Boating areas. Recreational boating activities are the major use, and adjacent shorelines are dominated by commercial facilities to support the boating activities—marinas, boatyards, and associated businesses predominate. Dredging and shoreline alterations are permitted as long as they do not significantly interfere with recreational boating activities or values.

Type 3 waters are adjacent to NAVSTA Newport at three locations:

- along the human-made shorelines of the marina on Coasters Harbor Island;
- at the small boat basin located immediately north of the DFSP in Melville; and
- on the eastern shoreline of Fort Adams.

Type 4

Type 4 waters are regarded as Multipurpose Waters and include the open waters of the Bay and the sounds. These waters support a variety of commercial and recreational activities, as well as good fish and wildlife habitat. Water quality and a healthy ecosystem are primary concerns for the CRMC related to this type of water.

Adjacent to NAVSTA Newport (and for all of Narragansett Bay), all waters not designated 1,2,3,5, or 6 are considered Multipurpose Waters. They are depicted in light blue in Figure 2-10. The specific areas include:

- between the Newport-Pell Bridge and the southernmost bridge to Coasters Harbor Island;
- surrounding Coasters Harbor Island, along the human-made shoreline and gravel beach on the north, west, and south shores;
- between the northernmost bridge to Coasters Harbor Island and the north end of Coddington Point;
- in the region of Gate 32, along Defense Highway, around McAllister Point, and along the coastline until Melville Backyard; and
- along the tank farm north of the North Fueling Pier at Melville.

Type 5

Type 5 waters, Commercial and Recreational Harbors, are waters adjacent to waterfront areas that support tourist, recreational, and commercial activities. Commercial fishing vessels, recreational boats, and ferries all compete for limited water space, and businesses compete for waterfront position. Protection of the scenic characteristics of these areas, which make them valuable for tourism, is a high priority for the CRMC.

There are no Type 5 waters adjacent to NAVSTA Newport.

Type 6

Type 6 waters are categorized as Industrial Waterfronts and Commercial Navigation Channels, and have been extensively altered to accommodate water-dependent industrial and commercial activities. Periodic dredging is required to maintain adequate depths in channels, turning basins, and berths. Coddington Cove is considered a Type 6 water.

Type 6 waters are adjacent to NAVSTA Newport at two locations:

- within Coddington Cove, including Piers 1 and 2, a stone breakwater, and
- the YP Pier adjacent to the north fueling Pier in Melville.

Type 5 and Type 6 categorizations are assigned to areas adjacent to ports and industrial waterfronts. In these waters, maintenance of adequate water depths is essential, high water quality is seldom achievable, and some filling may be needed.

2.3.5 Threatened and Endangered Species and Species of Concern

Federally Listed Threatened or Endangered Species

Only one Federally listed species—the northern long-eared bat (*Myotis septentrionalis*)—has been observed on NAVSTA Newport; however, 2018 acoustic surveys did not identify northern long-eared bat at NAVSTA Newport (Tetra Tech 2019a). All of the state and federally listed threatened and endangered species that occur in Newport County, Rhode Island, and in Narragansett Bay, and which thus could be observed in the future on the installation or in adjacent offshore waters are listed in Table 2-2.

Table 2-2. State and Federally Listed Threatened and Endangered Species Occurring in Newport County, Rhode Island, and Narragansett Bay.

Common Name	Scientific Name	Status
Mammals		
Whale, Finback	*Balaenoptera physalus*	FE*
Whale, Humpback	*Megaptera novaeangliae*	MMPA
Whale, North Atlantic Right	*Eubalaena glacialis*	FE*
Whale, Sei	*Physeter catodon*	FE*
Whale, Sperm	*Balaenoptera borealis*	FE*
Whale, Blue (rare)	*Balaenoptera musculus*	FE*
Little brown bat	*Myotis lucifugus*	UR
Tricolored bat	*Perimyotis subflavus*	UR
Northern long-eared bat	*Myotis septentrionalis*	FT-4DR
New England cottontail rabbit	*Sylvilagus transitionalis*	SC
Birds		
American oystercatcher	*Haematopus palliates*	SC
Cooper's hawk	*Accipiter cooperii*	SC
Glossy ibis	*Plegadis falcinellus*	SC
Great blue heron	*Ardea herodias*	SC
Northern harrier	*Cirus cyaneus*	SE
Peregrine falcon	*Falco peregrinus*	SE
Piping plover (Atlantic Coast DPS)	*Charadrius melodus*	FT
Red knot	*Calidris canutus rufa*	FT
Roseate tern	*Sterna dougallii dougallii*	FE, SC
Sharp-shinned hawk	*Accipiter striatus*	SH
White-throated sparrow	*Zonotrichia albicollis*	SC
Reptiles and Amphibians		
Sea turtle, Hawksbill[1]	*Eretmochelys imbricata*	FE*
Sea turtle, Kemp's Ridley	*Lepidochelys kempii*	FE*
Sea turtle, Leatherback	*Dermochelys coriacea*	FE*
Sea turtle, Loggerhead (Northwest Atlantic Ocean DPS)	*Caretta caretta*	FT*
Sea turtle, Green*	*Chelonia mydas*	FT*
Fish		
Sturgeon, Atlantic (New York Bight, Chesapeake Bay, South Atlantic, and Carolina DPS)	*Acipenser oxyrinchus oxyrinchus*	FE*, SC
Sturgeon, Atlantic (Gulf of Maine DPS)	*Acipenser oxyrinchus oxyrinchus*	FT*, SC
Sturgeon, Shortnose	*Acipenser brevirostrum*	FE*, SH
Insects		
Lyre-tipped spreadwing	*Lestes unguiculatus*	SC*
Plants		
Gerardia, Sandplain	*Agalinis acuta*	FE*

[1]Species presence is not noted by the CRMC or NOAA, but is considered extremely rare in Rhode Island by USFWS and the Rhode Island Natural History Survey (RINHS).

Sources: USFWS 2014, USFWS 2020, CRMC 2010, RINHS 2006, RINHS 2007, NMFS 2014

*Indicates protected species no longer found within Newport County (USFWS 2020)

MMPA = Protected under the Marine Mammal Protection Act (MMPA) of 1972

FE = Federally Endangered SE = State Endangered SH = State Historical
FT = Federally Threatened ST = State Threatened SC = State Species of Concern
FT-4DR = Federally Threatened with 4(d) ** = Considered for state listing
UR = Federally Under Review

Several listed species of whales may occur in areas of Narragansett Bay; however, due to the depth and temperature of the bay, the presence of these species in the marine waters near NAVSTA Newport would be rare or unexpected (NOAA 2013; Appendix I). Several species of threatened and endangered sea turtles occur seasonally in New England waters (NOAA 2013; Appendix I). The sea turtles in northeastern nearshore waters are typically small juveniles with the most abundant being the federally threatened Northwest Atlantic Distinct Population Segment (DPS) of loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's ridley (*Lepidochelys kempii*). Loggerhead turtles have been found to be relatively abundant off the Northeast coast of the Northwest Atlantic DPS (from near Nova Scotia, Canada, to Cape Hatteras, North Carolina). Loggerheads and Kemp's ridleys have been documented in waters as cold as 11 degrees Celsius (°C), but generally migrate northward when water temperatures exceed 16°C. Federally endangered leatherback sea turtles (*Dermochelys coriacea*) are a commonly sighted species in New England waters during the warmer months as well. While leatherbacks are predominantly pelagic, they may occur close to shore, especially when pursuing their preferred jellyfish prey. These species are typically present in New England waters from 01 June to 01 November. Green sea turtles (*Chelonia mydas*) may also occur sporadically in New England waters, but those instances would be rare. Hawksbill turtles (*Eretmochelys imbricata*) can be found in rocky areas, coral reefs, and shallow coastal areas feeding on sponges; however they are considered extremely rare in Rhode Island (USFWS 2014).

Atlantic sturgeons (*Acipenser oxyrinchus oxyrinchus*) occur in marine and estuarine waters along the Atlantic coast from Labrador, Canada, all the way to Cape Canaveral, Florida. According to NMFS, individual Atlantic sturgeon from several DPS, including the New York Bight, Chesapeake Bay, South Atlantic, Carolina, and Gulf of Maine DPS, could all potentially occur in Narragansett Bay (letter from NMFS, 28 June 2013; Appendix I). The New York Bight DPS includes all Atlantic sturgeon that are spawned in the watersheds that drain into coastal waters from Chatham, Massachusetts and south to the Delaware-Maryland border (50 CFR 223-224 [CFR 2012]). All of the DPSs are federally endangered except for the Gulf of Maine DPS, which is threatened (CFR 2012). The main threat to the continued existence of Atlantic sturgeon is bycatch from fisheries and loss of spawning habitat (NOAA Fisheries n.d.). NMFS drafted a recommendation for critical habitat for the New York Bight DPS, which is discussed in Section 4.7.4, *Critical Habitat*, and critical habitat was designated in a Final Rule effective 18 September 2017 (50 CFR 226 [CFR 2017]); however, no areas near NAVSTA Newport were designated as critical habitat.

The piping plover (*Charadrius melodus*), which is listed as federally threatened throughout the Atlantic Coast population, has been reported in areas near the installation. A piping plover nest was discovered in 2013 on Second Beach in Middletown (S. Lang, email, 20 June 2013). The red knot (*Calidris canutus rufa*) was federally listed a threatened in 2015 in the Northeast Region. The Roseate tern (*Sterna dougallii dougallii*) was federally listed as endangered 1987 in the Northeast Region, and threatened in the Southeast Region. Two fish species, alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), had been proposed for listing, but in August 2013 NMFS published a determination that these species did not warrant listing under the ESA at the time.

In 2013, the USFWS released a proposed rule and 12-month findings on a petition to list the eastern small-footed bat and northern long-eared bat. The USFWS determined that the northern long-eared bat be listed as a threatened species throughout its range under the ESA in 2015 (USFWS 2015a). The USFWS also determined that the eastern small-footed bat does not merit listing. The USFWS is also conducting a range-wide candidate status assessment for the little brown bat; however the species is currently not listed. All three bat species have been documented on the installation (NAVSTA Newport 2011a, Tetra Tech 2014).

In July 2011, the USFWS was petitioned to list northern long-eared bat on the federal Endangered Species List as endangered or threatened, and to designate critical habitat under the ESA (USFWS 2011). On 02 October 2013, USFWS released the results of their 12-Month Finding on the 2011 petition, which concluded that listing for the northern long-eared bat was warranted (USFWS 2013). On 04 May 2015, the USFWS determined that northern long-eared bat warranted listing as Threatened (50 CFR 27; USFWS 2015a). On 27 April 2016, the USFWS published their determination of critical habitat for the species and determined that critical habitat was not prudent (USFWS 2016).

The New England cottontail rabbit (*Sylvilagus transitionalis*) is no longer a candidate species for federal listing (50 CFR 17 [CFR 2013b]) as of September 2015 (USFWS 2015b). This species prefers early successional forests (often less than 25 years old) with thick and tangled vegetation. The primary threat to this species is habitat loss through succession. The RINHS lists the New England cottontail as a species of concern. Although the New England cottontail was not confirmed to be present on NAVSTA Newport property during the 2006 RINHS inventory, a 2003–2004 survey of Aquidneck Island and other Narragansett Bay islands found evidence of at least two New England cottontails in Portsmouth and Middletown. The New England cottontail is almost identical in appearance to the Eastern cottontail (which has been confirmed present on NAVSTA Newport), and can typically only be distinguished by studying the skull or collecting DNA (RINHS 2006). During the 2013 fauna surveys, biologists reported that they observed Eastern cottontails at NAVSTA; however, they were not able to study the specimens closely enough to definitively rule out the New England cottontail's presence.

The cusk (*Brosme brosme*) is no longer a candidate species for federal listing (72 FR 10710) This species occurs in deep waters with rocky, hard bottom areas and water temperatures of 30-50ºF (NMFS 2019). Cusk occur primarily in deeper waters in the Gulf of Maine, but have been known to occur in the northwest Atlantic Ocean from New Jersey to Newfoundland. The decline of cusk is primarily attributed to commercial fishing; they are often taken as bycatch (NMFS 2019).

Rhode Island Natural Heritage Program

The Rhode Island RINHS maintains a comprehensive, statewide inventory of the following categories of species: state endangered, state threatened, species of concern, and state historical, as described below.

State endangered species are native species that are in imminent danger of extirpation from the state. These species meet one or more of the following criteria:

- formerly considered by the USFWS for listing as federal endangered or threatened
- a species with one or two known, or estimated, total populations in the state
- apparently globally rare or threatened, and estimated to occur at approximately 100 or fewer populations range-wide

State threatened species are native species that are likely to become state endangered in the future if current trends in habitat loss or other detrimental factors remain unchanged. These criteria meet one or more of the following criteria:

- a species with three to five known or estimated populations in the state
- a species that is especially vulnerable to habitat loss

Species of concern are native species that do not fall under the above categories but are also listed by the NHP due to various factors of rarity and/or vulnerability. Species in this category may warrant threatened or endangered designation, but presently status information is not well known

State historical species have been documented as occurring in the state during the last 100 years (animal species) or 150 years (plant species), but current occurrences are unknown. If an occurrence is located for a state historical species, that species would automatically be listed in the state endangered category.

A RINHS survey (2006) did not identify any rare plants or animals, or ecologically significant natural communities, on NAVSTA Newport.

The American oystercatcher is a state-protected species that has been observed on NAVSTA Newport. It occupies beaches and salt marshes, and feeds on invertebrates such as mussels, snails, and barnacles. Although adults have been seen on NAVSTA Newport, nests have never been found. Osprey (a state species of concern) and peregrine falcon (a state endangered species) are also present on NAVSTA Newport, nesting on the *USS Saratoga* at Pier 1. Other state species of concern that have been observed at NAVSTA Newport include glossy ibis, great blue heron, black-crowned night heron, snowy egret, horned lark (*Eremophila alpestris*), winter wren (*Troglodytes hiemalis*), golden-winged warbler (*Vermivora chrysoptera*), and white-throated sparrow (*Zonotrichia albicollis*).

2.3.5.1 Habitats of Special Concern

The CWA recognizes special aquatic sites as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values" (EPA n.d.[d]). These sites are also "generally recognized as significantly influencing or positively contributing to the overall environmental health or vitality of the entire ecosystem of a region." The CWA identifies six categories of special aquatic sites: sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes (CWA Part 230, Section 404(b)(1) Subpart E). Eelgrass beds, which can be found at

NAVSTA Newport (Navy 2017), are protected under the *vegetated shallows* category. Both mudflats and eelgrass beds are located offshore at NAVSTA Newport property at Coasters Harbor Island, Coddington Point, and Fort Adams.

Eelgrass beds provide valuable habitat for many species of fish in Narragansett Bay, serving as a source of both food and cover. These important habitats have been greatly reduced since the 1950s due to pollution and uncontrolled development and use of the subtidal areas in the Bay. The State of Rhode Island, with support from federal agencies, nonprofits and other sources, has engaged in an eelgrass restoration initiative. Marine intertidal mudflats, often found along saltmarshes, also serve as important habitat for species such as softshell clams and blue mussels, and serve as an important feeding area for shorebirds (including some migratory birds).

Habitat within the Coasters Harbor saltmarsh near Gate 2 has been affected in the past by filling along the north and south edges, creating a smaller footprint (likely prior to the enactment of the CWA in 1972). This habitat includes mudflats exposed at low tide, fringing saltmarsh, and freshwater inflow from upland areas outside of NAVSTA Newport. A wetland near the Connell Highway rotary is connected by a stream to the NAVSTA Newport saltmarsh. This wetland likely receives highway runoff from local roads and from the approach to the Newport-Pell Bridge; headwaters of this wetland and stream are located in a residential area southeast of the Jai-Lai stadium and may include parking lot runoff and storm drain discharge from the residential area as well. Additional adjacent, off-site land uses include commercial uses along the west side of Connell Highway, the Newport Secondary rail line, and a Newport Electric substation. On NAVSTA Newport property, adjacent land uses include a low-lying area to the south where debris has been observed, and fenced storage and stockpile areas along the north. This is not an IRP site.

2.3.6 Flora

The RINHS *Natural Resources Inventory and Assessment of Naval Station Newport* was completed in 2006. The inventory of ecological resources at NAVSTA Newport, conducted in 2005, is a comprehensive follow-up to a 1989 survey conducted by the Rhode Island Natural Heritage Program, which identified potential habitat for species listed as rare, threatened, or endangered in the state (RINHS 2006). The 2006 RINHS created, to the extent possible, a baseline inventory of flora and fauna and surveyed and assessed ecologically significant habitat on NAVSTA Newport land. The RINHS identified a total of 282 plant species on NAVSTA Newport, including 135 native plants and 147 non-native plants. A list of the flora that occurs at NAVSTA Newport is presented in Appendix D.

A survey conducted in the summer of 2013 confirmed many of the native species that had been previously identified on NAVSTA Newport by the RINHS (2006) while it also added species not previously noted for different areas of the installation. This survey included identifying 11 species considered invasive or undesirable (see Section 2.3.6.2 *Invasive Species* for more information). Common flora (both native and invasive species) identified on the installation, by site, are presented in a table in Appendix D.

2.3.6.1 Vegetative Communities

Although vegetation occurs throughout the installation, the majority of the land area at NAVSTA Newport is developed. The most extensive vegetated areas occur within the five defunct tank farms that occur in the northern half of the installation. A separate, large tract of undeveloped land occurs on the east side of NUWC.

An ecological community type map of NAVSTA Newport was developed following the 2013 field effort (Figure 2-11, Sheets 1 and 2). A total of 12 vegetation communities were mapped, including seven upland communities and five wetland communities (Table 2-3). The ecological community categories generally follow those put forth in the Rhode Island Ecological Communities Classification (Enser et al. 2011) and are based on multiple field surveys including the 2005 Natural Heritage surveys, in addition to the 2013 effort.

Table 2-3. Ecological Community Types, NAVSTA Newport, Rhode Island.

Community Type	Size (acres)[1]
Upland Communities	
Developed Land	896.8
Maritime Shrubland	31.1
Mixed Deciduous/Coniferous Forest[2]	5.5
Northern Hardwood Forest	14.1
Old Field	261.7
Ruderal Forest	98.1
Tree Plantation	3.9
Wetland Communities	
Emergent Marsh	5.7
Emergent Marsh w/ Shrub Swamp	3.3
Impoundment	1.7
Red Maple Swamp	0.2
Salt Marsh	1.5
Shrub Swamp	28.5
Shrub Swamp w/ Emergent Marsh	5.9
Wet Meadow	9.1
Total	**1,367.1**

[1] Acreages determined based on GIS data portrayed in Figure 2-11 (Tetra Tech 2013).

[2] Represented by the Mixed Oak/White Pine Forest in Figure 2-11.

Overall, a majority of the vegetated areas at NAVSTA Newport are dominated by early successional communities characterized by shade intolerant, disturbance-tolerant species. In addition, the communities contain a high percentage of introduced, invasive species. Both of these characteristics are indicative of the high degree of anthropomorphic disturbance and degraded condition of the habitat.

Figure 2-11, Sheet 1. Ecological Communities at NAVSTA Newport, Newport County, Rhode Island.

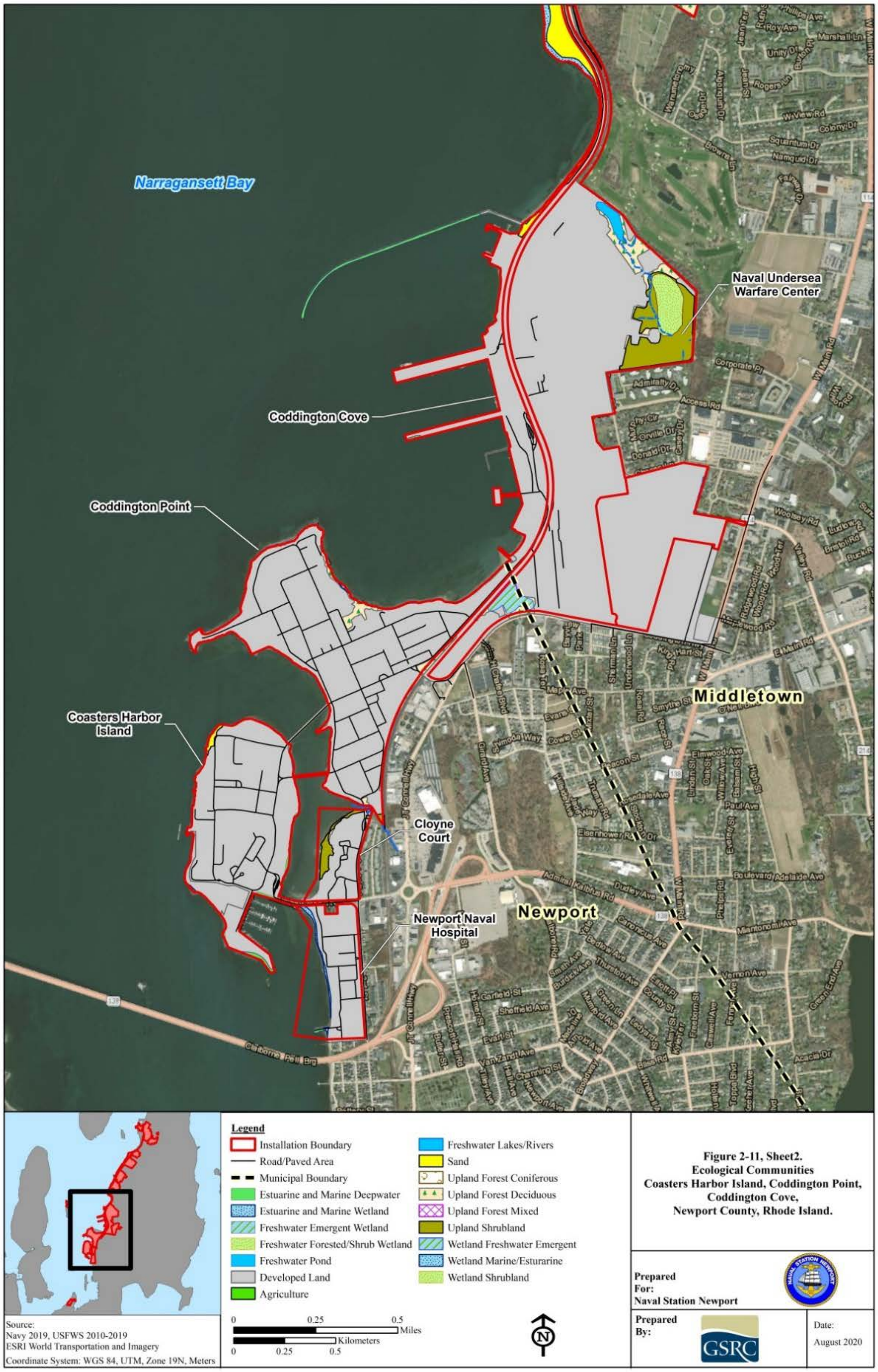

Figure 2-11, Sheet 2. Ecological Communities at NAVSTA Newport, Newport County, Rhode Island.

The following sections provide brief descriptions of each of the 12 communities included in the ecological community type map. Where possible, vegetation communities were classified to the community "type" using a best-fit approach. However, the RINHS classification is based on natural communities, which they describe as having a lack of naturalized, non-native species. Due to the high degree of past disturbance to the natural habitats at NAVSTA Newport, some of these communities did not match closely with the description provided by Enser et al. (2011). In such cases, communities were classified to the lowest level feasible (e.g., Northern Hardwood Forest).

Upland Communities

The Old Field community was the most ubiquitous community within the five tank farms, covering 261.7 acres (Table 2-3). The community was represented by various stages of succession after disturbance. More recently disturbed/mowed sites contained a greater number of herbaceous and graminoid species, with fewer shrubs or small trees, to older communities that possess a higher percentage of woody species. Younger versions of this community were common at Tank Farms 1, 2, and 4, and dominant species were sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), pathrush (*Juncus tenuis*), goldenrods, clover (*Trifolium* spp.), butter 'n' eggs (*Linaria vulgaris*), knapweed (*Centaurea biebersteinii*), and pokeweed (*Phytolacca americana*).

Vines and woody species were present at varying densities and include Japanese honeysuckle (*Lonicera japonica*), Allegheny blackberry (*Rubus allegheniensis*), eastern red cedar (*Juniperus virginiana*), apple, hawthorn (*Crataegus* spp.), and an abundance of autumn olive (*Elaeagnus umbellata*). The more successionally advanced Old Field communities were common at Tank Farms 3, 4, and 5, and contained similar species composition but had substantially higher density of woody species. Numerous non-natives were common within these shrub-dominated communities, including autumn olive, multiflora rose, Asiatic bittersweet (*Celastrus orbiculatus*), and Japanese honeysuckle. Stages of this community occur in proximity to other stages and often grade into one another.

Ruderal Forest communities occur throughout the installation, covering 98.1 acres (Table 2-3). These communities are described as "undifferentiated" upland forests that have developed following removal of native woody cover for agriculture or logging. Although the cause of removal of woody cover is neither agriculture nor logging, the resulting forests still lack diversity of native species and contain an abundance of exotic species. These forests are characterized by a combination of early-successional trees that cannot be identified as a natural ecological system. These forests at NAVSTA Newport contain substantial amounts of red maple, white pine (*Pinus strobus*), eastern red cedar, European larch (*Larix decidua*), and gray birch (*Betula populifolia*), with associated black locust (*Robinia pseudoacacia*), apple, black cherry (*Prunus serotina*), and walnut (*Juglans nigra*).

The Mixed Deciduous/Coniferous Forest class was observed at the southeastern corner of Tank Farm 2 and covers 5.5 acres. This forest possessed mesic soils, with 40–50 percent white pine in the overstory as well as a variety of deciduous associated species including several oak species, American beech (*Fagus grandifolia*), black cherry, and lesser amounts of eastern red cedar and black locust. The understory is notably sparse due to the closed canopy, and included highbush blueberry (*Vaccinium corymbosum*), arrowwood (*Viburnum dentatum*), and black cherry saplings.

The herbaceous layer was essentially absent. This forest did not fit any of the three communities described under the Mixed Deciduous/Coniferous Forest class, though it may most closely resemble Mixed Oak/White Pine Forests. The latter, however, occur on drier soils.

The Northern Hardwood Forest is a unique community on the installation and was observed in the northern section of Tank Farm 3 and a small northern section of Tank Farm 4. This mature, second-growth forest was dominated by a variety of hardwoods, including red and black oak (*Quercus rubra* and *Q. velutina*), American beech, red maple, and big-tooth aspen (*Populus grandidentata*), with paper birch (*Betula papyrifera*), black gum (*Nyssa sylvatica*), and highbush blueberry in the understory. Other characteristics included a few large-diameter American beech, numerous medium-sized trees, a relatively open understory, and a notable lack of non-native species. A linear section of this forest occurs north of the paved access road and is severed from the remaining parcel by a narrow band of Old Field community, which may have been a former access road or utility corridor. The Northern Hardwood Forest, located to the north, is similar in species composition but occurs on the north and south aspect slopes that lead into substantial Shrub Swamp wetland associated with the northwest flowing Lawton Brook.

Maritime Shrublands occur along much of the shoreline at NAVSTA Newport (Figure 2-11, Sheets 1-2). These mostly linear features include species of shrub that are able to tolerate moderate exposure to salt spray, and include mostly non-native autumn olive and multiflora rose. Other species observed include the non-native sand rose (*Rosa rugosa*) and Asiatic bittersweet.

Tree Plantation communities that occur on the eastern side of Tank Farm 5 are the result of past silvicultural activities. These conifer-dominant stands are even-aged and have a low species composition including white pine and/or Norway spruce (*Picea abies*) trees that occur in remnant rows. These stands are older, and volunteer species have become established within the community including species such as red maple, black cherry, and northern arrowwood (*Viburnum recognitum*), and several species of vines including Japanese honeysuckle, poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*).

The areas mapped as Developed Land include two main anthropogenic categories: Suburban Built (residential and commercial development) and Urban/Recreation Grasses (primarily lawns and parks). These areas occur throughout the installation but are most common in the southern half of the installation (Figure 2-11, Sheets 1-2 and Table 2-3).

Wetland Communities

A relatively small Red Maple Swamp community (0.2 acre) occurs within the wetland complex associated with Norman’s Brook in the southwest corner of Tank Farm 4 (Figure 2-11). The canopy of this community was almost completely composed of red maple, with an understory of black gum, and highbush blueberry; while northern arrowwood, jewelweed, and New York fern (*Thelypteris noveboracensis*) were common herbaceous species.

Shrub Swamp may be one of the most abundant wetland communities (28.5 acres) and are common along the drainages located within the tank farms as well as on the east side of the NUWC parcel (Figure 2-11 and Table 2-3). Common species observed within these communities include shrubs such as speckled alder (*Alnus incana*), spicebush (*Lindera benzoin*), willow, and arrowwood, and herbaceous species such as sensitive fern (*Onoclea sensibilis*), spotted jewelweed, false nettle (*Boehmeria cylindrica*), skunk cabbage (*Symplocarpus foetidus*), and jack-in-the-pulpit (*Arisaema triphyllum*). Invasive species often found within these communities include common reed, multiflora rose, and glossy buckthorn (*Frangula alnus*).

Emergent Marsh communities, including both semi-permanently (deep) and seasonally flooded (shallow) types, occur in isolated depressions such as those in the footprint of an imploded fuel tank in Tank Farm 5 as well as in wetland complexes associated with the installation's streams (Figure 2-11, Sheets 1-2). Common plant species in these communities include broadleaf cattail (*Typha latifola*), woolgrass (*Scirpus cyperinus*), poison ivy, and the invasive species purple loosestrife (*Lythrum salicaria*). Some shrub species such as arrowwood and willow occur at low densities within these mostly herbaceous communities.

Wet Meadow communities occur as scattered patches throughout the Old Field communities at Tank Farm 5. These areas contain saturated soils but rarely standing water, and common species include sedges, rushes, goldenrods, joe-pye weed (*Eutrochium dubium*), woolgrass, bluejoint (*Calamogrostis canadensis*), and non-native purple loosestrife.

Salt Marsh was the only estuarine marsh observed at NAVSTA Newport. Although a majority of the coastline within the installation is hardened by concrete bulkheads and other structures, a section of shoreline at the southern end of Cloyne Court contains a narrow band of Salt Marsh wetland. Additional salt marsh is present northeast of Gate 2, east of where a tidal creek crosses under the road, and these areas total 1.5 acres. Both of these communities are dominated by salt-grass (*Spartina alterniflora*). Additional species include native wetland plants including Atlantic white cedar (*Chamaecyparis thyoides*), groundsel tree *(Baccharis halimifolia*), bushy knotweed (*Polygonum ramosissimum*), woolgrass, and bulrush (*Schoenoplectus* species). Non-native plants include common reed and Japanese knotweed (*Polygonum cuspidatum*). Common reed is an invasive species that predominates in areas influenced by freshwater runoff. Additional details on invasive species are included in Section 2.3.6.2 *Invasive Species*.

2.3.6.2 Invasive Species

In the 2006 RINHS, more non-native plant species were identified on NAVSTA Newport than were native plants. Through the Invasive Plant Atlas of New England (IPANE) project, the State of Rhode Island discovered that Newport County has the highest number of invasive plant records per square mile (Gould 2005). Seven of these non-native invasive plant species were of particular concern in the 2006 RINHS for NAVSTA Newport: common reed, purple loosestrife, Norway maple (*Acer platanoides*), Japanese honeysuckle, Morrow's honeysuckle (*Lonicera morrowii*), European turkey oak (*Quercus cerris*), and black locust.

Of the 18 problematic plant species that are categorized as 'Widespread and Invasive' or 'Restricted and Invasive' by the Rhode Island Invasive Species Council (RIISC), 11 were observed at NAVSTA Newport during the 2013 flora surveys conducted in preparation of this INRMP: Asiatic (or ornamental) bittersweet, autumn olive, Japanese honeysuckle, purple loosestrife, Japanese knotweed, common buckthorn (*Rhamnus cathartica*), multiflora rose, tree-of-heaven, garlic mustard (*Alliaria petiolata*), porcelain-berry (*Ampelopsis brevipedunculata*), and wineberry (*Rubus phoenicolasius*).

Furthermore, four species that are considered 'Invasive' by RIISC, but for which more information is needed on their spread in Rhode Island, were also documented at the installation: Norway maple, Japanese barberry (*Berberis thunbergii*), burning bush (*Euonymus alatus*), and Morrow's honeysuckle.

The species and locations of the non-native invasive flora identified in the surveys are detailed in Table 2-4.

Table 2-4. Invasive Flora at NAVSTA Newport.

Common Name	Latin Name	Growth Form	Location Observed
Asiatic bittersweet*	*Celastrus orbiculatus*	Vine	All
Autumn olive*	*Elaeagnus umbellata*	Woody plant	All
Birdsfoot-trefoil	*Lotus corniculatus*	Herbaceous plant	Tank Farm 3, Coastline
Black locust	*Robinia pseudoacacia*	Woody plant	Tank Farms 1,2,3,4,5, Railroad ROW
Common buckthorn	*Rhamnus cathartica*	Woody plant	Tank Farms 1 and 3
Common reed	*Phragmites australis*	Grasslike plant	Tank Farms 3,4, 5, and near Gate 2
Crown vetch	*Coronilla varia*	Herbaceous plant	Tank Farm 4, Coastline
European turkey oak	*Quercus cerris*	Woody plant	Tank Farm 4, Railroad ROW
Garlic mustard*	*Alliaria petiolata*	Herbaceous plant	Tank Farm 5, Coastline
Glossy buckthorn	*Frangula alnus*	Woody plant	Tank Farm 2
Japanese honeysuckle*	*Lonicera japonica*	Woody plant	Tank Farms 1,3,4,5, Railroad ROW
Japanese knotweed*	*Polygonum cuspidatum*	Herbaceous plant	Tank Farm 5, Coastline, Railroad ROW
Morrow's honeysuckle	*Lonicera morrowii*	Woody plant	All
Multiflora rose*	*Rosa multiflora*	Woody plant	All
Norway maple	*Acer platanoides*	Woody plant	Tank Farm 4, Coastline, Railroad ROW
Porcelain-berry*	*Ampelopsis brevipedunculata*	Woody vine	Railroad ROW
Purple loosestrife*	*Lythrum salicaria*	Herbaceous plant	Tank Farms 4,5, Railroad ROW
Rugosa rose	*Rosa rugosa*	Woody plant	Coastline, Railroad ROW
Sycamore maple	*Acer pseudoplatanus*	Woody plant	Tank Farms 1,4,5
Tree-of-heaven*	*Ailanthus altissima*	Woody plant	Railroad ROW
Wineberry	*Rubus phoenicolasius*	Woody plant	Tank Farm 2
Winged burning bush	*Euonymous alatus*	Woody plant	Tank Farm 2

Source: RINHS 2006, Tetra Tech 2013

* Indicates non-native species

Descriptions of the exotic/invasive species of greatest concern according to the RINHS and the RIISC are presented in the following paragraphs.

Asiatic (or oriental) bittersweet (*Celastrus orbiculatus*) is an invasive vine that is often collected for its attractive berries and use for wreaths and floral arrangements. This plant is identified by its round leaves with axillary flower, and yellow and red capsule fruit clusters. Asiatic bittersweet can be distinguished from the declining native American bittersweet, whose flowers and fruit grow in singular, terminal panicles that are about as long as the leaves. Species confirmation should be sought prior to commencing any removal methods because the non-native species may be confused with American bittersweet, which is in decline. Asiatic bittersweet is ubiquitous at the installation and is common along perimeter and interior fences, within shrub and early successional forest thickets at all of the tank farms, and along the railroad corridor, Defense Highway corridor, and coastlines.

Autumn olive (*Elaeagnus umbellata*) is a nitrogen-fixing shrub that was introduced from East Asia for ornamental purposes but is now widely considered invasive. Autumn olive has red, berry-like drupes, leaves that are distinctly silver underneath, and can grow to 12 feet in height. Its nitrogen-fixing abilities allow it to thrive in poor soils. Autumn olive is a common shrub along the access roads in all of the tank farms and along the railroad corridors and coastlines.

Black locust (*Robinia pseudoacacia*) is a fast-growing tree that can reach 40–100 feet. Its shade reduces competition for other plants and creates areas with little ground vegetation. Its primary means of spreading is by both rudimentary and adventitious root suckers, though the tree does produce a high number of seeds annually or biannually. Black locust has been observed on NAVSTA Newport at Tank Farms 1–5 and the Railroad ROW.

Common buckthorn (*Rhamnus cathatica*) is a shrub or small tree that grows up to 22 feet in height. It can form dense thickets that crowd and shade native shrubs. It produces small black fruits that contain seeds; these fruits create a dense understory of seedlings. Seeds are also distributed through birds and mice that eat the fruit. A poorly established root structure makes common buckthorn vulnerable to fire, which is a typical means of management of the species. Common buckthorn was observed along the northern edge of Tank Farm 1 and in Tank Farm 3 where the common reed transitions to a scrub-shrub community.

Common reed (*Phragmites australis*) is a tall, perennial wetland grass that grows to 13 feet in height and spreads primarily by rhizome sprouts, allowing it to form pure, dense stands. It can also spread to new areas by seed or rhizome fragments. Common reed quickly displaces other desirable plant species, limiting diversity in the wetland community and providing little food or shelter for wildlife. Once established, common reed is very difficult to eradicate. Common reed is common in a variety of wet habitats such as drainage ditches, freshwater wetlands, and marshes. Common reed was found in Tank Farm 4.

European turkey oak (*Quercus cerris*) is a deciduous oak that typically grows to 40 to 60 feet but can reach up to 100 feet. European turkey oak is uncommon in Rhode Island but is invasive and naturalized in Massachusetts. It was found to have successfully reproduced along the NAVSTA Newport Railroad ROW during the 2006 RINHS, which is thought to be the first documented case of naturalization of European turkey oak in Rhode Island (RINHS 2006). Several mature turkey oaks and dozens of seedlings, saplings, and sprouts were found along the Railroad ROW at NAVSTA Newport, and one mature tree was found at Tank Farm 4.

Garlic mustard (*Allaria petiolata*) is an herbaceous plant that was introduced in the mid-1800s as a cooking herb. This plant grows to 2 to 4 feet tall and has white flowers and alternative, triangular leaves that are coarsely-toothed and give off a garlic odor when crushed. Garlic mustard is shade-tolerant, which allows it to spread into the forest understory where it forms dense carpets that outcompete or displace native wildflowers, as well as regenerating trees and shrubs. This species is present in Tank Farm 5 and in areas along the coastline.

Japanese barberry (*Berberis thunbergii*) is a shrub that grows to two to six feet in height and has numerous short thorns and arching stems. This dense shrub can be identified by small bright red berries that hang from the leaf stalks and persist through winter. Japanese barberry was introduced and has become invasive since escaping from cultivation. It is a common invasive of natural habitats including canopy forests and open woodlands. Japanese barberry occurs in the forest understory and along many of the fire roads.

Japanese honeysuckle (*Lonicera japonica*) is a perennial vine that twists its stems around vertical structures including shrubs and small trees. Its vines can kill shrubs, young trees, and other vegetation by cutting off flow of water through the plants and blocking sunlight. Underground rhizomes help establish and spread the plant locally. Japanese honeysuckle can quickly spread via tiny fruit seeds along woodland edges, which may be dispersed in this area by birds that consume the fruits. This species is common throughout the installation, with specific occurrences described at Tank Farms 1, 3–5, and at the Railroad ROW.

Japanese knotweed (*Polygonum cuspidatum*), also known as Mexican or Japanese bamboo, is an herbaceous perennial in the buckwheat family that can grow between three and 9.5 feet in height. The stout, round, hollow stems and formations of dense clumps resemble that of bamboo. It has extensive rhizomes that reach 45–60 feet in length and readily give rise to new plants. Japanese knotweed is commonly found in moist, open habitats along riverbanks, islands, wetlands, and drainage ditches along roadways, hillsides, and disturbed areas. An expansive stand of Japanese knotweed was observed along the fire road that runs along the western boundary of Tank Farm 3 and along the forest edge in multiple locations of Tank Farm 5.

Morrow's honeysuckle (*Lonicera morrowii*) is a multi-stemmed deciduous shrub that grows to 7 feet in height, with simple leaves that have white hairs on the underside, cream-colored flowers, and bright red berries. This weedy shrub spreads quickly and forms dense, shrubby, understory colonies that eliminate many native woody and herbaceous plants. It spreads by seed, typically through birds and mammals that consume its fruits and defecate the seeds. Morrow's honeysuckle has been observed on NAVSTA Newport at Tank Farms 1–5, the Railroad ROW, and along the coastline.

Multiflora rose (*Rosa multiflora*) is a perennial shrub with thorny, long, arching stems. It has alternate, compound leaves with seven or nine leaflets, and forms large clusters of fragrant white or pink flowers. It can reproduce from seed or by rooting at the tip of its arching canes or stems (The Pennsylvania State University 2013). Multiflora rose is an aggressive invader of open land and is particularly successful on forest edges and hedgerows. The shrub will often create impenetrable thickets that crowd out other vegetation and can become dominant in a forest understory. Multiflora rose has become naturalized throughout much of the U.S. and continues to be spread with the help of birds.

Norway maple (*Acer platanoides*) is a deciduous tree that commonly grows to heights of 40–50 feet. It has dark green leaves that turn pale yellow or reddish purple in fall. It can be distinguished from other maples by a milky white liquid that can be seen at the base of the petiole when a leave is removed from a twig. Norway maple is native to Europe from Norway southward, and is a popular ornamental tree in the U.S. that has escaped yard environments and become naturalized. This species produces large quantities of seeds that are easily dispersed into forest and forest edges. It casts extremely dense shade and has a shallow root system, so it can suppress grasses, other undergrowth, and biodiversity. It can displace other dominant trees, particularly sugar maples in the northeast. Norway maples were found on NAVSTA Newport at Tank Farm 4, along the coastline, and at the Railroad ROW.

Porcelain-berry (*Ampelopsis brevipedunculata)* is an invasive, woody vine that is native to northeast Asia and eastern Russia. Porcelain-berry superficially resembles native grape species (*Vitis* spp.) with non-adhesive tendrils that occur opposite leaves and berry-like fruit that appear in late summer–early fall and turn from pale lilac to bright blue. Porcelain-berry is common along the perimeter fences along the Railroad ROW.

Purple loosestrife (*Lythrum salicaria*) is a common invader of emergent wetland communities and will rapidly take over disturbed areas. This attractive forb has a square, woody stem and produces magenta flowers in late summer. Purple loosestrife is able to quickly establish under favorable conditions and replace native vegetation with a dense, homogeneous stand, limiting biodiversity and providing little value to native wildlife. The *Gallerucella* beetle, often referred to as purple loosestrife beetle, is a natural predator of this plant in its native range, and can be a form of biocontrol. Purple loosestrife is documented from wet meadows in Tank Farm 4, a round, emergent wetland in Tank Farm 5, along the Railroad ROW, and in wet swales along various installation roads.

Tree-of-heaven (*Ailanthus altissima*) is an invasive tree with smooth, gray bark and large compound leaves, which are entire (i.e., un-toothed) aside from a few glandular teeth on the lower margins. Tree-of-heaven is a prolific seeder that can invade rapidly, and it grows to heights of 80 feet or more. This species is also allelopathic, which means that individuals of this species release inhibitory chemicals that affect the development of neighboring plants.

Wineberry (*Rubus phoenicolasius*) is a vigorous shrub that was introduced in the late-1800s and is still used today by berry breeders. The shrub can grow to 9 feet tall, and the entire plant is covered in reddish hairs. The leaves are compound, green on top and white below, and the white flowers develop into a raspberry-like fruit. This prolific plant prefers moist, open areas like fields, roadsides, and forest edges. However, it will invade woodlands following a disturbance that creates a gap in a forest canopy, and can persist in shade after the canopy closes. Wineberry will outcompete and shade out native flora, and is also host to several viruses that can affect raspberries, such as raspberry yellow spot. This species was observed in the forests of Tank Farm 2.

Winged burning bush (*Euonymus alatus*) is a deciduous shrub with simple, elliptical leaves that turn a bright red in fall. This shrub was brought to the U.S. in the 1800s as a popular ornamental shrub and has since escaped cultivation. The shrub forms a dense canopy, and this, along with a dense root system immediately below the soil surface, prevents the establishment of other species. Burning bush was found in Tank Farm 2 during the 2005 field surveys.

Fifteen additional noxious plant species that are considered either 'Potentially Invasive' or 'Weedy,' or are being monitored by RIISC, were also documented on the installation during the 2005 and/or 2013 field surveys (RINHS 2006). These species are identified in the comprehensive plant species list for NAVSTA Newport provided in Appendix D.

In addition to flora, two invasive fauna species have been observed at NAVSTA Newport. An aquatic invasive tunicate species, *Styela clava,* has been found attached to the submerged portions of piers at NAVSTA Newport. Evidence of invasive Japanese shorecrabs (*Hemigrapsus sanguineus*) were also found during surveys. The U.S. Geological Survey (USGS) maintains the Nonindigenous Aquatic Species database, which maintains data populations and distributions on nonindigenous aquatic species.

2.3.7 Fauna

The 2006 RINHS identified numerous fauna on NAVSTA Newport. The survey included mammals, birds, reptiles and amphibians, and invertebrates.[3]

Due to its location on an island and use as a military installation for more than 140 years, NAVSTA Newport is a relatively isolated habitat. A comprehensive list of the fauna that occur at NAVSTA Newport is presented in Appendix D. Information on the protected species that occur at NAVSTA Newport is presented in Section 2.3.5, *Threatened and Endangered Species and Species of Concern*.

2.3.7.1 Mammals

Common mammals observed at NAVSTA Newport during the 2006 RINHS inventory include coyote (*Canis latrans*), eastern cottontail (*Sylvilagus floridanus*), white-tailed deer, and common raccoon (*Procyon lotor*). Additional species observed on the installation include feral cat (*Felis catus*), fox species (*Vulpes/Urocyon* sp.), eastern gray squirrel (*Sciurus carolinensis*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), northern short-tailed shrew (*Blarina brevicauda*), and white-footed mouse (*Peromyscus leucopus*).

White-tailed deer, eastern gray squirrel, eastern cottontail, and eastern chipmunk (*Tamias striatus*) were all directly observed during wetland and vegetative community surveys conducted in 2013 as part of this INRMP. Coyote scat was also observed during these surveys.

Bats

Depending on the species, bats typically utilize different structures for roosting, such as rock formations, caves, human-made structures, and dead and dying trees with cavities and loose bark (Harvey et al. 2011). Many bat species use riparian corridors, ponds, and wetlands as feeding

[3] *Note: The RINHS did not include surveys of fish.*

habitats due to the higher nocturnal insect densities within these areas (Hill and Smith 1984). Linkages between roosting and foraging habitats represent pathways of continual or regular bat activity throughout much of the year.

Bat surveys were not part of the 2006 RINHS; however, the authors noted that numerous small storage areas and buildings around the installation could potentially support bats. Eight species of bat are known or believed to occur in Rhode Island (RIDEM DFW n.d.[c]). Bat acoustic monitoring surveys were undertaken as part of the permitting process for a proposed project in 2009 and occurred seasonally until the fall of 2011. During these surveys seven bat species were recorded, including two species of the genus *Myotis*: little brown bat (*Myotis lucifugus*) and northern long-eared bat. Both species were documented at a coastal location near Bishop Rock and in the early successional scrub shrub fields of Tank Farm 4 (Tetra Tech 2014); however only little brown bat was documented during 2018 acoustic surveys (Tetra Tech Inc. 2018).

According to the USFWS, the little brown bat and the northern long-eared bat have both declined in the Northeast, most likely due to white-nose syndrome (WNS), a fungal disease caused by *Pseudogymnoascus destructans* (letter from Thomas R. Chapman, supervisor of the USFWS New England Field Office to David D. Dorocz, Environmental Division Director for NAVSTA Newport, 31 October 2012). WNS has been spreading through the northeast and into the central U.S. and Canada since 2007, killing millions of bats (USGS n.d.). The disease gets its name from the visible white fungal growth on the bat's muzzle and wings that sometimes appears in infected individuals. This disease has no known cure or vaccine. WNS has decimated large numbers of cave hibernating bats throughout the Northeast and appears to have reduced populations of *Myotis* bats to unsustainable levels. Because of the impacts of WNS on *Myotis* species, the USFWS was petitioned to list two species (eastern small-footed bat [*Myotis leibii*], and northern long-eared bat) under the ESA. Refer to Section 2.3.5 *Threatened and Endangered Species* for more information on the listing.

During a consultation call between the USFWS' New England Field Office, the NAVSTA Newport's natural resource management staff, and Tetra Tech biologists on 21 August 2012, the USFWS recommended that NAVSTA Newport consider additional bat surveys as part of their wildlife assessment and monitoring plan. The goal of these additional surveys was to more fully assess the occurrence of *Myotis* bats at NAVSTA Newport during the spring, summer, and fall periods. Surveys also targeted the occurrence of any summer roost sites at NAVSTA Newport. Three sets of surveys were conducted in 2013 to document *Myotis* species at the installation: 1) passive bat acoustic monitoring, 2) active bat acoustic monitoring, and 3) mist net surveys.

Bat acoustic surveys conducted from 09 April to 09 October 2013 detected more than 5,000 call sequences from seven bat species, including 50 for little brown bat and 17 northern long-eared bat at NAVSTA Newport (Table 2-5). Mist netting surveys in 2013 did not capture any *Myotis* species but captured two eastern red bats (*Lasiurus borealis),* neither of which had WNS. Five species were documented during seven nights of active transect surveys during June, July, and August of 2013 at NAVSTA Newport, including one little brown bat (TetraTech Inc. 2014, see Appendix L).

Table 2-5. Bat Species List and Likelihood of Occurrence at NAVSTA Newport, Rhode Island.

Common Name	Scientific Name	Likelihood of Occurrence[1]	Reason for Likelihood	Protection Status	Habitat Association	Species Identified during Acoustic Monitoring[2]
Big brown bat	*Eptesicus fuscus*	High	Suitable habitat, species range overlaps within project area, and known occurrences in adjacent counties to project area.	–	Habitat generalist found in a variety of habitats, including agricultural croplands; associated with human habitation structures.	Definitive
Eastern red bat	*Lasiurus borealis*	High	Suitable habitat within project area, species range overlaps with project area, and known occurrences in adjacent counties to project area.	–	Found in hardwood deciduous forests; Generally found in close association with riparian areas.	Definitive
Hoary bat	*Lasiurus cinereus*	High	Suitable habitat within project area, species range overlaps with project area, and known occurrences near project area.	–	Forested upland habitats, including mixed northern hardwoods.	Definitive
Silver-haired bat	*Lasionycteris noctivagans*	High	Suitable habitat within the project area and species range overlaps with project area.	–	Closely associated with conifer and mixed hardwood forests; Generally found in association with riparian areas.	Definitive

Common Name	Scientific Name	Likelihood of Occurrence[1]	Reason for Likelihood	Protection Status	Habitat Association	Species Identified during Acoustic Monitoring[2]
Eastern small-footed bat	*Myotis leibii*	High	Suitable habitat within the project area and species range overlaps with project area.	–	Closely associated with conifer and mixed hardwood forests; Generally found in association with riparian areas, and rocky outcroppings or talus slopes.	Moderate
Little brown bat	*Myotis lucifugus*	High	Suitable habitat within the project area and species range overlaps with project area.	USFWS Under Review	Found in close proximity to a water source for foraging and in close proximity to manmade structures.	Definitive
Northern long-eared bat	*Myotis septentrionalis*	High	Suitable habitat within the project area and species range overlaps with project area.	USFWS Threatened	Found in dense forest areas and forages in a variety of habitats. Closely associated with cave structures.	Moderate
Tricolored bat [formerly eastern pipistrelle]	*Perimyotis subflavus [formerly Pipistrellus subflavus]*	High	Suitable habitat within the project area and species range overlaps with project area.	USFWS Under Review	Found along edge habitats between agricultural croplands and native grassland.	Moderate

[1] **High** = Suitable habitat, species range overlaps with project area and known occurrences within and/or near project area.
Moderate = Species known to occur in habitat similar to project area, species' range overlaps with project area, and known occurrences near the project area.
Low = Marginally suitable habitat in project area, species' range does not overlap with project area, and no known occurrences within and/or near project area.

[2] **Definitive** = Calls classified by Bat Call Identification (BCID) and confirmed with qualitative vetting, numerous call sequences used to make determination of occurrence.
Probable = Calls classified by BCID and confirmed with qualitative vetting, however, few call sequences were recorded to make a definitive determination.
Possible = Calls classified by BCID, but not confirmed with qualitative vetting.

Bat acoustic surveys were conducted between 16 July and 25 July 2018 using five bat detectors, each equipped with SMM-U2 microphones, and following USFWS survey guidelines (Tetra Tech 2019a). Sampling sites were selected based on representative habitats within the installation, and on potential high bat activity, potential forest clearing, and accessability.

The goal was to perform a low-level short term acoustic survey at NAVSTA Newport during bat maternity period (15 May to 15August) to determine the presence or absence of northern long-eared bat following protocols established by the USFWS. Tetra Tech biologists sampled 50 detector-nights over 10 nights; a total of 19,523 bat passes were detected acoustically. Five species of bat and three groups were identified. Bat pass analysis software auto-classified northern long-eared bat several times; however definitive characteristics were not identified, and those passes were identified as *Myotis* sp. Big brown bat (*Eptesicus fuscus*) was the most commonly recorded species and eastern red bat, a migratory tree bat, was the second most commonly recorded species. Other species identified were hoary bat (*Lasiurus cinereus*), silver- haired bat (*Lasionycteris noctivagans*), and little brown bat (Tetra Tech 2019a, see Appendix L). Testing for WNS was not performed during this survey.

Baseline bat acoustic surveys were also performed on NAVSTA Newport in 2018. The objective was to perform a baseline survey to determine species composition and bat activity levels in resident and migratory bat species using acoustic methods. A total of 877 detector-nights were sampled over the course of 215 calendar nights between May and December. A total of 40,169 bat passes were recorded and identified to the species level or frequency group, resulting in an overall activity rate of 47.4 bat passes/detector-night. Six of the eight species of bats known to occur in Rhode Island were detected (big brown bat, eastern red bat, hoary bat, silver-haired bat, little brown bat, and tri-colored bat). Northern long-eared bat was not detected. The most dominant species were big brown bat, eastern red bat, and unidentified high frequency species, which combined accounted for 88 percent of all recorded bat activity. Presence of northern long-eared bat was not ruled out as a possibility due to unidentified high frequency detections. The detectors recorded bat activity for nearly the entire survey period, with the highest activity rates detected during late August, with no major pulses in activity observed in September and October. Bat activity varied among stations with the highest rates recorded at stations within or adjacent to a closed canopy (Tetra Tech 2019b, see Appendix L).

Marine Mammals

The predominant marine mammal occupying NAVSTA Newport lands is the harbor seal (*Phoca vitulina concolor*); the only marine mammal that is a year-round resident of Narragansett Bay (NAVSTA Newport 2011a). Harbor seals are most commonly sighted offshore of the installation, hauling out near Coddington Point and Bishop's Rock. Other marine mammals known to occur in Narragansett Bay include short-beaked common dolphin (*Delphinus delphus*), harbor porpoise (*Phocoena phocoena*), gray seal (*Halichoerus grypus*), harp seal (*Pagophilus groenlandicus*), and hooded seal (*Cystophora cristata*) (NAVSTA Newport 2011a). Harbor seals are frequently found at Coddington Cove and could potentially visit other areas of the installation (NAVSTA Newport 2011a).

Haul-out counts and identification of seals were performed during a 2010-2011 season, and again during a 2014-2015 and a 2015-2016 season at a rocky outcropping known as "The Sisters" located near Coddington Point on NAVSTA Newport (Moll et al. 2016, Appendix M). The project's goal was to gain an understanding of seal movement and behavior to assist the Navy in determining potential impacts from Navy training and testing. Moll et al. (2016) counted seals following NOAA seal watching guidelines; counts of maximum numbers of observed seals were performed weekly during peak low tide. Photographs of seals were taken with custom camera settings, and weather and environmental conditions at the time of observation were recorded. In addition, potential disturbances and seals' response to disturbance were documented.

Moll et al. (2016) found that populations of the two species of seals at The Sisters, harbor seals and gray seals, seem to be increasing over time (256 total individuals in the 2010-2011 season, and 624 total individuals in the 2015-2016 season). Average counts per observation increased from seven in the 2010-2011 season to 22 in the 2015-2016 season. Frequency of non-zero observations steadily increased from 51% in the 2010-2011 season to 90% in the 2015-2016 season. Time of first observation has steadily moved earlier between 2010 and 2016. Behavioral responses to various types of disturbance (container ships, boats, pedestrian and vehicle traffic, and drills) were minimal; only one disturbance-related full flush was observed in the 2015-2016 season due to pedestrian traffic.

2.3.7.2 Birds

More than 100 bird species have been observed at NAVSTA Newport. The Installation's location along the coast makes it a potential stopover or feeding habitat for birds that migrate along the Atlantic flyway.

Three state species of special concern raptors are found on NAVSTA Newport: the peregrine falcon osprey, and northern harrier (*Circus hudsonius*). In past years, peregrine falcons and ospreys have nested on an aircraft carrier ported at Pier 1; however this carrier is no longer homeported at Naval Station Newport. Northern harrier was detected during fall migration surveys as part of the Avian Risk Assessment conducted in 2010 (Tetra Tech 2012). Other raptors found to be on NAVSTA Newport include sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), northern goshawk (*Accipiter gentilis*), and turkey vulture (*Cathartes aura*). Barn owl (*Tyto alba*) and great horned owl (*Bubo virginianus*) have also been confirmed to be present on NAVSTA Newport (S. Kam personal communication, January 2014). Canada goose (*Barnta canadensis*) is the most numerous waterfowl species on NAVSTA Newport. Several species of sea ducks are found in Narragansett Bay but very few were observed on NAVSTA Newport land (Tetra Tech 2012). Mallards (*Anas platyrhynchos*) and red-breasted mergansers (*Mergus serrator*) use sheltered bays and coves along Narragansett Bay coastline and have been observed along the NAVSTA Newport shoreline.

Common wading birds at NAVSTA Newport include great-blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), and glossy ibis (*Plegadis falcinellus*). Snowy egret and glossy ibis are all state species of special concern.

Given the proximity to Narragansett Bay, a high number of seabirds are found at NAVSTA Newport. The herring gull (*Larus argentatus*) population is especially high, and double-crested cormorant (*Phalacrocorax auritus*) and common tern (*Sterna hirundo*) are also abundant on the installation. Shorebirds observed on NAVSTA Newport include killdeer (*Charadrius vociferous*), American oystercatcher (*Haematopus palliatus*), semipalmated plover (*Charadrius semipalmatus*), solitary sandpiper (*Tringa solitaria*), black-bellied plover (*Pluvialis squatarola*), and spotted sandpiper (*Actitis macularia*). The American oystercatcher is a state species of special concern. The federally listed piping plover (*Charadrius melodus*) uses the Bay as habitat (USFWS 2009) and is considered as Threatened in the state of Rhode Island. The red knot is federally listed as threatened in Rhode Island and is a migratory species in Rhode Island. The roseate tern is federally listed as endangered and historically bred in Rhode Island.

Passerines are adaptable to developed land such as that found on NAVSTA Newport; they use landscaping trees and flora, buildings, bridges, and other human-made structures for nesting, foraging, and breeding. Common songbird species found at the installation include American goldfinch (*Spinus tristis*), song sparrow (*Melospiza melodia*), barn swallow (*Hirundo rustica*), tree swallow (*Tachycineta bicolor*), and American robin (*Turdus migratorius*). Areas on NAVSTA Newport with shrubland habitat, such as along the coast and within tank farm areas, exhibit the greatest abundance of songbirds. Other common passerines observed on the installation include American crow (*Corvus brachyrhynchos*), black-capped chickadee (*Poecile atricapillus*), blue jay (*Cyanocitta cristata*), brown-headed cowbird (*Molothrus ater*), Carolina wren (*Thryothorus ludovicianus*), cedar waxwing (*Bombycilla cedrorum*), eastern kingbird (*Tyrannus tyrannus*), eastern towhee (*Pipilo erythrophthalmus*), gray catbird (*Dumetella carolinensis*), house wren (*Troglodytes aedon*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), red-winged blackbird (*Agelaius phoeniceus*), and yellow warbler (*Setophaga petechia*) (RINHS 2006).

Two introduced bird species, rock pigeon (*Columba livia*) and European starling (*Sturnus vulgaris*), both occur in high abundance at NAVSTA Newport. Other introduced species present on the installation include house sparrow (*Passer domesticus*) and house finch (*Haemorhous mexicanus*), which was introduced from the Western U.S.

Several species of birds were observed during wetland surveys in 2013 that were not included in the 2006 RINHS or 2012 Avian Risk Assessment inventories. These include hairy woodpecker (*Picoides villosus*) and red-breasted nuthatch (*Sitta canadensis*). Also note that the 2006 RINHS was designed to detect the presence of rare species and was not explicit enough with respect to birds. Even though some listed bird species have been observed on NAVSTA Newport, these species occur only as transients during migration (e.g., northern harrier and sharp-shinned hawk). These species are not rare or vulnerable during that season (J. Osenkowski, RIDEM, email dated 29 April 2014).

Migratory Birds

A number of species covered by the MBTA have been observed on or in the vicinity of NAVSTA Newport (Table 2-6). The piping plover is listed as federally threatened, and the American oystercatcher is considered a species of greatest conservation need by the State of Rhode Island. However, many other species, such as the Canada goose, occur at NAVSTA Newport and are not otherwise listed as threatened or endangered but do fall under the MBTA.

Table 2-6. Migratory Birds Found at NAVSTA Newport, Newport County, Rhode Island.

Common Name	Scientific Name	Common Name	Scientific Name
Alder flycatcher	*Empidonax alnorum*	Great crested flycatcher	*Myiarchus crinitus*
American crow	*Corvus brachyrhynchos*	Hairy woodpecker	*Picoides villosus*
American goldfinch	*Spinus tristis*	Herring gull	*Larus argentatus*
American kestrel	*Falco sparverius*	Horned grebe	*Podiceps auritus*
American oystercatcher	*Haematopus palliatus*	Horned lark	*Eremophila alpestris*
American redstart	*Setophaga ruticilla*	House wren	*Troglodytes aedon*
American robin	*Turdus migratorius*	Indigo bunting	*Passerina cyanea*
American tree sparrow	*Spizelloides arborea*	Killdeer	*Charadrius vociferous*
Brant	*Branta bernicla*	Northern cardinal	*Cardinalis cardinalis*
Baltimore oriole	*Icterus galbula*	Northern goshawk	*Accipiter gentilis*
Barn owl	*Tyto alba*	Northern harrier	*Circus cyaneus*
Barn swallow	*Hirundo rustica*	Northern mockingbird	*Mimus polyglottos*
Black-and-white warbler	*Mniotilta varia*	Olive-sided flycatcher	*Contopus cooperi*
Black-bellied plover	*Pluvialis squatarola*	Osprey	*Pandion haliaetus*
Black-capped chickadee	*Poecile atricapillus*	Peregrine falcon	*Falco peregrinus*
Black-crowned night-heron	*Nycticorax nycticorax*	Piping plover	*Charadrius melodus*
Blue jay	*Cyanocitta cristata*	Prairie warbler	*Setophaga discolor*
Blue-winged warbler	*Vermivora cyanoptera*	Purple finch	*Haemorhous purpureus*
Brown-headed cowbird	*Thryothorus ludovicianus*	Red-breasted merganser	*Mergus serrator*
Bufflehead	*Bucephala albeola*	Red-breasted nuthatch	*Sitta canadensis*
Canada goose	*Branta canadensis*	Red-eyed vireo	*Vireo olivaceus*
Carolina wren	*Thryothorus ludovicianus*	Red-tailed hawk	*Buteo jamaicensis*
Cedar waxwing	*Bombycilla cedrorum*	Red-winged blackbird	*Agelaius phoeniceus*
Chestnut-sided warbler	*Setophaga pensylvanica*	Ring-billed gull	*Larus delawarensis*
Chimney swift	*Chaetura pelagica*	Rose-breasted grosbeak	*Pheucticus ludovicianus*
Chipping sparrow	*Spizella passerina*	Ruby-crowned kinglet	*Regulus calendula*
Common loon	*Gavia immer*	Ruby-throated hummingbird	*Archilochus colubris*
Common tern	*Sterna hirundo*	Savannah sparrow	*Passerculus sandwichensis*
Common yellowthroat	*Geothlypis trichas*	Semipalmated plover	*Charadrius semipalmatus*
Cooper’s hawk	*Accipiter cooperii*	Sharp-shinned hawk	*Accipiter striatus*

Common Name	Scientific Name	Common Name	Scientific Name
Double-crested cormorant	*Phalacrocorax auritus*	Snow bunting	*Plectrophenax nivalis*
Eastern kingbird	*Tyrannus tyrannus*	Snowy egret	*Egretta thula*
Eastern towhee	*Pipilo erythrophthalmus*	Solitary sandpiper	*Tringa solitaria*
Eastern wood-pewee	*Contopus virens*	Song sparrow	*Melospiza melodia*
Gadwall	*Mareca strepera*	Spotted sandpiper	*Actitis macularius*
Glossy ibis	*Plegadis falcinellus*	Tree swallow	*Tachycineta bicolor*
Golden-winged warbler	*Vermivora chrysoptera*	Turkey vulture	*Cathartes aura*
Gray catbird	*Dumetella carolinensis*	Warbling vireo	*Vireo gilvus*
Great blue heron	*Ardea herodias*	White-throated sparrow	*Zonotrichia albicollis*
Great egret	*Ardea alba*	Willow flycatcher	*Empidonax traillii*
Great horned owl	*Bubo virginianus*	Winter wren	*Troglodytes hiemalis*
Green heron	*Butorides virescens*	Wood thrush	*Hylocichla mustelina*
Mallard	*Anas platyrhynchos*	Yellow warbler	*Setophaga petechia*

2.3.7.3 Reptiles and Amphibians

There are 12 species of snakes that are native to Rhode Island, none of which are venomous (RIDEM DFW n.d.[a]). According to RIDEM, Rhode Island snakes are generally afraid of people and do not pose a threat to life or property; moreover, indiscriminately injuring or killing snakes is illegal in Rhode Island (RIDEM DFW n.d.[a]). The eastern garter snake (*Thamnophis sirtalis*) was observed at NAVSTA Newport during the 2006 RINHS (RINHS 2006). This species is the most common and widespread of New England snakes and can inhabit a wide variety of habitats where it eats earthworms, amphibians, tadpoles, and other small animals (RIDEM DFW n.d.[a]).

Rhode Island also hosts seven species of non-marine turtles as well as five potential species of marine turtles. The common snapping turtle (*Chelydra serpentina*) has been observed at NAVSTA Newport (RINHS 2006). This animal is large and distinctive, weighing up to 35 pounds, and is primarily found in well-vegetated and soft-bottomed freshwater wetlands where it eats fish, small vertebrates and invertebrates, carrion, and plant material (RIDEM DFW n.d.[b]). According to NMFS, several species of sea turtles occur in the waters off Rhode Island, including Narragansett Bay; these turtles are typically juveniles and are most often seen between 01 June and 01 November (letter from NMFS to NAVSTA Newport, 28 June 2013; see Appendix I). The most common species seen in New England is the loggerhead turtle, followed by the Kemp's ridley and leatherback. The green sea turtle may also be observed, but instances in New England are quite rare (NOAA 2013; Appendix I). Hawksbill sea turtle is considered a hypothetical species; it has the remote potential to occur off the New England coast (Kenney and Vigness-Raposa 2010).

Eighteen species of amphibians are known to occur in Rhode Island (University of Rhode Island 2001) but only one, the green frog (*Lithobates clamitans*), has been observed at NAVSTA Newport. The main threat to amphibians in Rhode Island is loss of breeding habitat, especially vernal pools, which are seasonally inundated areas that many larval amphibians require for growth and development (RIDEM DFW 2015). Evidence of green frog breeding was observed at Tank Farm 5 (RINHS 2006).

The RINHS inventories were conducted in May, so it is likely that some species of herpetofauna that breed in early spring (e.g., mole salamanders and some frogs) were missed (RINHS 2006).

2.3.7.4 Fish

NAVSTA Newport borders Narragansett Bay, and its two piers lie within the Bay. Narragansett Bay is designated as an essential fish habitat (EFH) by NOAA Fisheries for one or more life stages of 14 federally managed fish species. EFH is designated to protect and conserve the waters and substrate necessary to fish, mollusks, and crustaceans for spawning, breeding, feeding, or growth to maturity. The New England Fishery Management Council identifies and defines the EFH for their managed species. The list of these fish species with applicable life stages within the Bay is shown in Table 2-7.

Table 2-7. Essential Fish Habitat (EFH) Designations at NAVSTA Newport, Newport County, Rhode Island.

Species Common Name (*Scientific Name*)	Eggs	Larvae	Juveniles	Adults	Spawning Adults
American plaice *(Hippoglossoides platessoides)*		S	M,S	M,S	
Atlantic mackerel *(Scomber scombrus)*	S	S	S	S	
Atlantic sea herring *(Clupea harengus)*		S	M,S	M,S	
Black sea bass *(Centropristis striata)*			S	S	
Bluefish *(Pomatomus saltatrix)*			M,S	M,S	
Cobia *(Rachycentron canadum)*	X	X	X	X	
Haddock *(Melanogrammus aeglefinus)*		S			
King mackerel *(Scomberomorus cavalla)*	X	X	X	X	
Red hake *(Urophycis chuss)*		S	S	S	S
Scup *(Stenotomus chrysops)*	S	S	M,S	M,S	
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X	
Summer flounder *(Paralichthys dentatus)*		F,M,S	M,S	S	
Windowpane flounder *(Scophthalmus aquosus)*	M,S	M,S	M,S	M,S	M,S
Winter flounder *(Pseudopleuronectes americanus)*	M,S	M,S	M,S	M,S	M,S

Source: NOAA 2020.

F = The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0 < salinity < 0.5%).

M = The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary. (0.5 < salinity < 25.0%).

S = The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0%).

X = The EFH designation for this species occurs throughout this bay or estuary.

2.3.7.5 Invertebrates

The 2006 RINHS identified 18 species of dragonflies and damselflies (odonate), at least 5 species of moths, 22 species of butterflies, 1 species of tiger beetle, and 3 other invertebrates. A listing of these species is presented in Appendix D. All but one of the odonate species found at NAVSTA Newport are either widespread or ubiquitous in distribution, and common or abundant in number in Rhode Island; however, one restricted/rare (state concern) species of damselfly, the lyre-tipped spreadwing (*Lestes unguiculatus*),was observed at Tank Farm 5 during the RINHS inventory. Restricted distribution means that it is found in six or fewer townships in Rhode Island, and rare abundance means that fewer than 10 specimens have been identified in the state. At NAVSTA Newport, a single adult male was found flying among emergent vegetation at Tank Farm 5 in 2005 (RINHS 2006).

The 2006 RINHS inventory found multiple dead Japanese shore crabs, a non-native invasive marine invertebrate. The survey could not find evidence of breeding populations of the crab, which competes with other species for habitat resources and is considered a threat to native and commercially valuable species where it becomes established.

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3.0 NATURAL RESOURCES MANAGEMENT AND MISSION SUSTAINABILITY

3.1 SUSTAINING MILTARY MISSION AND NATURAL ENVIRONMENT

3.1.1 Integrating Military Mission and Sustainable Use

The DOD's land management responsibilities include acting as a steward for hundreds of the nation's rarest species and most characteristic habitats without compromising the preparedness of the Armed Forces (Stein 2008). To this end, the Navy takes a proactive approach toward integrating the military mission with concepts of sustainable land use. Efficient and effective land use planning and natural resources management supports military readiness and sustainability while also protecting and enhancing natural resources. Using natural resources in a sustainable way that preserves ecosystem integrity is vital to ensuring that military mission activities can continue to be conducted on these lands over the long term.

The Navy understands the role INRMPs play in identifying potential conflicts between an installation's mission and natural resources, and identifying actions necessary to maintain the availability of mission-essential properties and acreage. An INRMP outlines goals and objectives for use by the installation Natural Resources Manager in order to balance the management of natural resources unique to an installation with military mission requirements and other land use activities affecting those resources (DOD and USFWS 2004). The NAVSTA Newport NRM is responsible for ensuring the accomplishment of the military mission in a way that sustains and enhances the natural resources on the installation (Stein 2008). The NAVSTA Newport NRM accomplishes this requirement by using an ecosystem management approach for the stewardship of the natural resources, and by working in close cooperation with military operators to ensure mutual support and understanding.

Although a large portion of NAVSTA Newport's acreage is developed for mission activities and support functions (e.g., residential housing), its remaining natural resources provide practical ecosystem services. These natural resources include wetlands, riparian buffers, nearshore habitats such as SAV, and other coastal habitats (e.g., maritime shrubland) that provide critical ecosystem services. Key ecosystem services of these natural resources are stormwater management, pollutant removal, and storm-surge buffering (refer to Section 3.2 *Ecosystem Services* for further discussion). The installation's natural resources also provide opportunities for outdoor recreation and aesthetic benefits; this contributes to the installation's MWR Program, which aims to enhance the quality of life for military personnel, their family members, and civilian personnel.

3.1.1.1 Sustainability Challenges

Certain issues are, or can potentially pose, significant challenges to the sustainability of the natural resources of NAVSTA Newport and the surrounding region.

Impervious surfaces – Hardened surfaces from developed areas such as buildings, parking lots and sidewalks do not allow rain from storm events (i.e., stormwater) to naturally penetrate into the ground. If not managed, this stormwater will quickly run across the land and erode soils, pick up pollutants and contaminants, and ultimately end up in receiving waterbodies as polluted runoff. For NAVSTA Newport, polluted runoff from two outfalls (7-95A and A) contribute to the degradation of the water quality of Narragansett Bay (see Section 4.1.1.2 *Stormwater Management* for more details). At NAVSTA Newport, LID practices are now being used, such as rain gardens, bioswales, and vegetative buffers, to manage stormwater in a way that mimics pre-development hydrology and filters out pollutants before allowing the runoff to be discharged into receiving waterbodies. Ideally these types of practices, often cost-effective, not only should be integrated into new development (e.g., new construction outlined in the NAVSTA Newport 2035 Master Plan), but also considered during redevelopment and as retrofits.

Invasive species – As described in Section 2.3.6.2 *Invasive Species* (and 4.8.2), NAVSTA Newport is challenged by numerous invasive species. Certain invasive species not only are negatively affecting native ecological resources, but also may present challenges to military operations. A primary example is the tunicate, an aquatic invasive species. The tunicate has been observed attached to the submerged portions of piers at NAVSTA Newport and thus may be attaching to the hulls of ships and other nautical equipment. In addition, dense invasive vegetation at the tank farms provides fuel load in the event of a wildfire.

Sea-level rise – As described in Section 3.3 *Climate Change*, sea level is predicted to rise over the next century. Coastal lands, including storm-surge buffering natural defenses such as wetlands, are vulnerable to habitat loss. Military infrastructure on these coastal lands also will be threatened by sea-level rise and super-imposed storm surges. Sea level has risen by nine inches at Newport from 1930 to 2015, and sea levels are projected to rise by eleven feet at Newport by 2100 (NBEP 2017).

3.1.2 Define Impact on Military Mission

To protect and maintain natural resources while ensuring the continuation of the military mission, NAVSTA Newport has implemented an ecosystem management approach for environmental stewardship of the installation's natural resources. The management strategy maximizes the use of suitable lands for the military mission while minimizing impacts on natural resources.

The types of natural resources constraints that may affect NAVSTA Newport's mission are different from those of installations with combat training missions. The NAVSTA Newport mission is to provide facilities and infrastructure to fulfill the requirements of its tenant commands—a mission that is not especially disturbing to the current condition of its natural resources. Currently, natural resources management at NAVSTA Newport does not significantly affect military mission. As is discussed further under Section 6.2, the installation is achieving *no net loss* in the capability of military lands to support the mission of the installation through the implementation of the INRMP.

3.1.2.1 Encroachment and Training Constraints

The Navy defines encroachment primarily as any non-Navy action, planned or executed, that inhibits, curtails, or possesses the potential to impede performance of Navy activities (Navy 2007). As noted above, natural resources and natural factors are not currently encroaching upon the military mission (NAVSTA Newport 2008b). However, some constraints to military mission and operations caused by natural resources and natural factors do exist. Figure 3-1 shows the natural resources constraints on NAVSTA Newport. Environmental constraints primarily consist of regulatory compliance requirements concerning protection of wetlands and submerged aquatic vegetation, the management of any threatened and endangered species present on the installation, and IRP sites (Figure 3-1).

Additional constraints could exist beyond what is shown in Figure 3-1. For example, NAVSTA Newport must provide a federal consistency determination for proposed actions that have a foreseeable impact to coastal uses or resources of the coastal zone. The State of Rhode Island has total maximum daily loads (TMDL) scheduled for Narragansett Bay in 2022 for nitrogen, 2022 for oxygen, and 2025 for fecal coliform (RIDEM OWR 2018). In addition, an extensive portion of NAVSTA Newport is located within the flood zone, and thus developing this land is challenging. The NAVSTA Newport Master Plan encourages sustainable development principles and identifies areas for development that are not in the flood zone. Refer to Section 4 *Natural Resources Program Overview* for more information on these regulatory-related topics.

A future environmental constraint for NAVSTA Newport may be climate change. As mentioned above in Section 3.1.1.1 *Sustainability Challenges*, sea-level rise driven by climate change has the potential to cause inundation of coastal lands along NAVSTA Newport. Military infrastructure could be in vulnerable locations to sea-level rise and associated storm surges. For example, Coasters Harbor Island and Coddington Point, where principal training and support facilities are located, are currently prone to storm surges and are likely vulnerable to future sea-level-rise impacts (NAVFAC MIDLANT 2008). Refer to Section 3.3 *Climate Change* for more information concerning sea-level rise and storm surges.

Areas within the installation that are not designated as constraints on Figure 3-1 are considered opportunities, which represent areas where natural resources do not restrict the Navy’s ability conduct its military mission. In addition, undeveloped areas outside of the installation boundary represent opportunities for potential encroachment partnering, as is described in the next section.

3.1.3 Encroachment Partnering

On Figure 3-1, a few parcels of state lands abut NAVSTA Newport, and may offer opportunities for encroachment partnering. For example, on Gould Island, the state owns a wildlife sanctuary, and thus RIDEM may be interested in working with NAVSTA Newport to protect and restore the submerged aquatic vegetation beds bordering the western shore of Gould Island. Note that Fort Adams is essentially embedded within Fort Adams State Park, thus buffering Fort Adams from traditional encroachment challenges such as urban development. Similarly, the Greene Land Housing Area above Tank Farm 5 is also buffered from urban encroachment to the east by state lands.

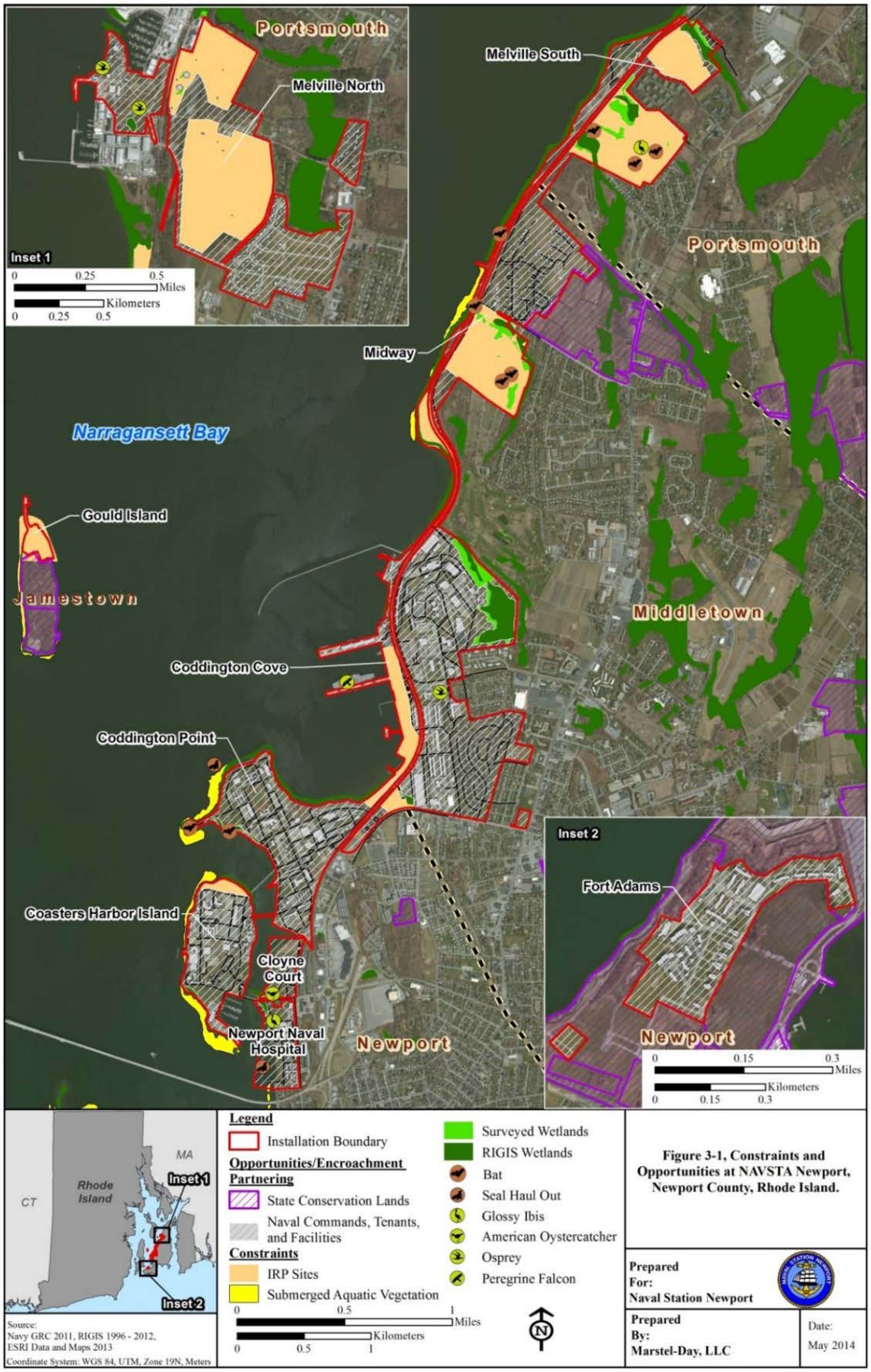

Figure 3-1. Constraints and Opportunities at NAVSTA Newport, Newport County, Rhode Island.

As discussed in Section 4.1.1.2 *Stormwater Management*, sediment-laden discharge from Outfall 7-95A and Outfall A are partially sourced from developed lands off of NAVSTA Newport, and from NUWC in the case of Outfall A. This polluted runoff discharges into Narragansett Bay and is a priority issue for stormwater management. It will be necessary for NAVSTA Newport to partner with NUWC, Middletown, and Portsmouth to develop a drainage-basin-wide stormwater management improvement strategy to reduce the amount of polluted runoff that goes into the Bay from Outfalls 7-95A and A. This encroachment partnering strategy will demonstrate Navy leadership in resolving complex issues such as stormwater management, particularly with the future possibility of TMDL's being established for the Bay.

3.1.4 Relationship to Other Operational Management Plans

This INRMP is not intended to replace existing installation policy, operations protocols, or military management plans. Rather, this INRMP is meant to facilitate the integration and coordination of natural resources management actions with other plans and programs at the installation and, moreover, with NAVSTA Newport missions (refer to Section 1.7 *Coordination and Development* for further discussion). Currently, NAVSTA Newport does not have any range management plans in place that would need to be coordinated with natural resources management at the installation.

3.2 ECOSYSTEM SERVICES

An ecosystem is an ecological unit of living organisms, abiotic factors, and their interactions which are found in a similar environment and influenced by similar processes like fire or flooding (NatureServe 2013). Ecosystem services are the collective direct and indirect benefits that humans derive from ecological processes and the resultant resources occurring in ecosystems. These include "provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life (DODI NRCP 2011)." For example, wetlands play a major role in water purification and flood control; forests and coastal wetlands play a major role in carbon sequestration; and bees, butterflies, and moths pollinate many plants to enable their reproduction, including agricultural crops. Ecosystem services also provide potential economic value and thus present an opportunity to reduce installation costs in gray (or built) infrastructure for things such as stormwater management, drinking water filtration, and storm-surge buffering.

In recognition of the importance of ecosystem services, DODI 4715.03 (DOD 2018) requires that all DOD natural resources conservation program activities include consideration of ecosystem services to foster their long-term ecological integrity and sustainability. Stewardship of ecological resources (e.g., wetlands, forests, and aquatic resources) on DOD lands through an ecosystem-based management approach protects the ecosystem services associated with these resources.

Conserving, enhancing, and further incorporating ecosystem services into the planning vision of NAVSTA Newport and the surrounding region will provide lasting benefits, including support of NAVSTA Newport's current and future sustainability and the ability to prevent, or at least minimize, the impacts of encroachment. Furthermore, leveraging ecosystem credits or assets such as wetlands, carbon sequestration, or biodiversity, can provide the flexibility to meet new and changing mission requirements as well as create natural buffers against development and other encroachment. NAVSTA Newport's ecosystems services are summarized in Table 3-1.

This INRMP describes several projects in Chapter 5, Project Descriptions, that directly support the sustainability and restoration of ecosystem services at NAVSTA Newport.

3.3 CLIMATE CHANGE

According to the U.S. Global Change Research Program (USGCRP), warming of the climate is both "unequivocal" in its occurrence and primarily human-induced (Melillo et al. 2014). Climate change is already affecting people in the U.S. in a multitude of ways; temperatures are rising, extreme weather events are more frequent and/or intense, sea levels are rising, glaciers are losing mass, and growing seasons are lengthening. Across the U.S. there is clear scientific evidence that sea level is rising, Atlantic Coast hurricane intensities are increasing, average temperatures are rising, and precipitation is occurring more frequently during heavy, single-day events (EPA 2016a). These primary effects of climate change (i.e., sea-level rise, extreme weather events, and temperature and precipitation changes) are causing impacts on natural resources such as shifts in species' ranges and distributions, changes in phenology, and variations in ecological processes such as drought, fire, and flood (DOD Natural Resources Program 2016).

DODI 4715.03 (DOD 2018) requires climate change to be addressed in INRMPs to help mitigate potential impacts of climate change to the natural resources on installations. Additionally, Executive Order 11988 established the Federal Flood Risk Management Standard and requires federal agencies to adopt stricter construction standards for projected climate change scenarios. The 2017 Climate Change Installation Adaptation and Resilience Handbook, in accordance with Unified Facilities Criteria 2-100-01, the Installation Master Planning, and other DoD guidance, directs Navy Master Development Planners "to consider" climate change in the development of Master Plans and other projects. The handbook provides the framework helping planners understand how to consider climate change in their plans and projects, and is used during the analysis phase of the Navy Installation Development Plan process (Leidos and Berger 2017). Climate change information for NAVSTA Newport and Rhode Island is summarized below; a project for a climate change vulnerability assessment and adaptation strategy is described in Section 5.1 Project Descriptions.

3.3.1 Historical and Current Climate Trends

A multitude of climate-driven impacts have been documented in Rhode Island over the last century (RICRMC 2011, NBEP 2017).

> *Air temperature is increasing* – Average annual temperatures rose by 1.14°C between 1960 and 2005; notably this represented the highest increase in New England (Smith et al. 2010; Heffner et al. 2012). In addition, the number of extremely hot days in the Northeast is increasing (URI Climate Change Collaborative 2011). Average air temperature is projected to increase approximately 2-6°C by 2100 (NBEP 2017).

Table 3-1. Key Ecosystem Services Provided by the Ecological Resources of NAVSTA Newport.

Ecological Resources	Ecosystem Services	Military Benefits	Regional Benefits
Nearshore and coastal habitats: SAV, beaches, and maritime shrublands	• Storm protection • Erosion control • Biodiversity (e.g., fish and shellfish nursery grounds in SAV; habitat for marine mammals and migratory birds) • Habitat corridor • Recreation	• Buffers installation from storm surges and flooding, thus reducing risk to infrastructure • Reduces costs for hardened shoreline protection infrastructure • Waterfront recreational opportunities for personnel quality of life	• Supports regional biodiversity by protecting habitats for wildlife, pollinators, marine mammals, fish, and shellfish • Supports Narragansett Bay fish and shellfish industries • Provides open space in an otherwise developed landscape
Wetlands and riparian habitats: emergent marshes, shrub swamp	• Storm protection • Flood control • Water retention and purification • Absorbs and cleans pollution from stormwater • Erosion control • Maintains hydrologic cycle • Carbon sequestration • Biodiversity • Habitat corridor • Climate regulation	• Buffers installation from storm surges and flooding, thus reducing risk to infrastructure • Reduces costs for hardened shoreline protection infrastructure • Reduces stormwater management and flood control costs • Reduces water treatment costs • Reduces pollution prevention costs	• Supports regional biodiversity by protecting habitats for wildlife, pollinators, fish, and shellfish • Supports Narragansett Bay fish and shellfish industries • Provides open space in an otherwise developed landscape
Upland habitats: old fields, northern hardwood forests, mixed oak/white pine forests	• Absorbs and cleans pollution from stormwater • Carbon sequestration • Oxygen production • Biodiversity • Habitat corridor • Climate regulation • Recreation	• Reduces stormwater management costs • Reduces water treatment costs • Reduces pollution prevention costs	• Supports regional biodiversity by protecting habitats for wildlife and pollinators • Provides open space in an otherwise developed landscape

Water temperature is increasing – Annually Narragansett Bay is nearly 1.67°C warmer, with winter sea-surface temperatures 2.22°C warmer, since the 1960s (Heffner et al. 2012). In addition, estuarine water at Narragansett Bay increases between 0.028- 0.031°C per year (NBEP 2017).

Sea level is rising at an accelerated rate – Sea levels in the Northeast have risen three to four times faster than the global average rate (Rhode Island Sea Grant 2013a). Sea level has risen by nine inches at Newport from 1930 to 2015, and sea levels are projected to rise by a total of eleven feet at Newport by 2100 (NBEP 2017).

Storminess is increasing – Although tropical cyclones in the North Atlantic seem to have increased in intensity (URI Climate Change Collaborative 2011), records of tropical cyclones impacting the U.S. are too short to assess long-term trends (Executive Climate Change Council Science and Technical Advisory Board 2016).

Precipitation and weather patterns are changing – Average annual precipitation in Rhode Island has increased by 12 inches since 1905, with less snowfall but more intense rain storms (URI Climate Change Collaborative 2011). Current projections for the region predict an increased volume of annual precipitation, greater frequency and intensity of precipitation events, changes in seasonalities, limited summer precipitation, and prompting drought conditions (NBEP 2017).

Ocean acidification is occurring – The oceans continue to absorb atmospheric carbon dioxide, which has resulted in the lowering of global sea water pH levels by 0.1 units (RICRMC 2011). It is predicted that sea water pH levels will decrease an additional 0.2-0.3 units by the end of the century if current carbon emission trends continue (Hoegh-Guldberg and Cai 2014).

3.3.2 Future Climate Change Trends

In Rhode Island, the current climate trends are expected to continue, with warmer temperatures, increased intensity of extreme storms, less snow and more rain, accelerated sea-level rise, and a more acidic ocean (Heffner et al. 2012, NBEP 2017). Average air temperature is projected to increase approximately 2-6°C by 2100 (NBEP 2017). Even though annual precipitation is expected to increase by 7–14 percent in the Northeast, rain will fall in fewer events resulting in a higher risk of flooding. This phenomenon (of more rain in fewer events), combined with warmer temperatures, is also projected to cause more droughts (Rhode Island Sea Grant 2013a). By the end of this century, sea level is projected to increase by 3–5 feet above 1990 levels, with a 1-foot increase expected by 2050 (Figure 3-2, Sheets 1–8) (Rhode Island Sea Grant 2013a). Storm surges associated with more intense hurricanes is expected to be 2 to 4 feet above sea level (Rhode Island Sea Grant 2013a). Ocean acidification is expected to continue to be problematic as pH may decline by 0.3–0.4 units (RICRMC 2011).

3.3.3 Ecological Impacts of Climate Change

Numerous impacts on species, habitats, ecosystems, and ecological processes are projected for Rhode Island.

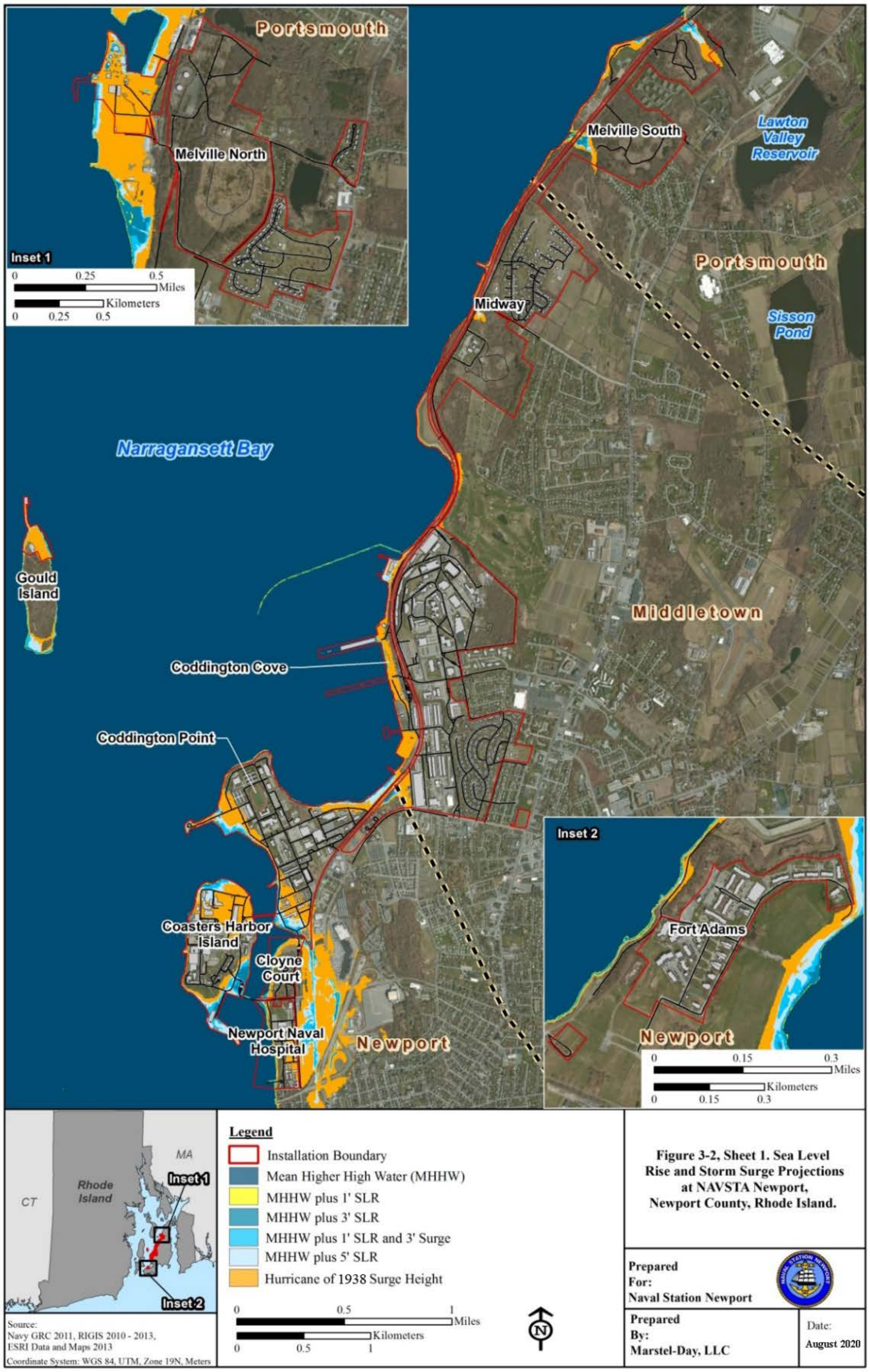

Figure 3-2, Sheet 1. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

Figure 3-2, Sheet 2. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

Figure 3-2, Sheet 3. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

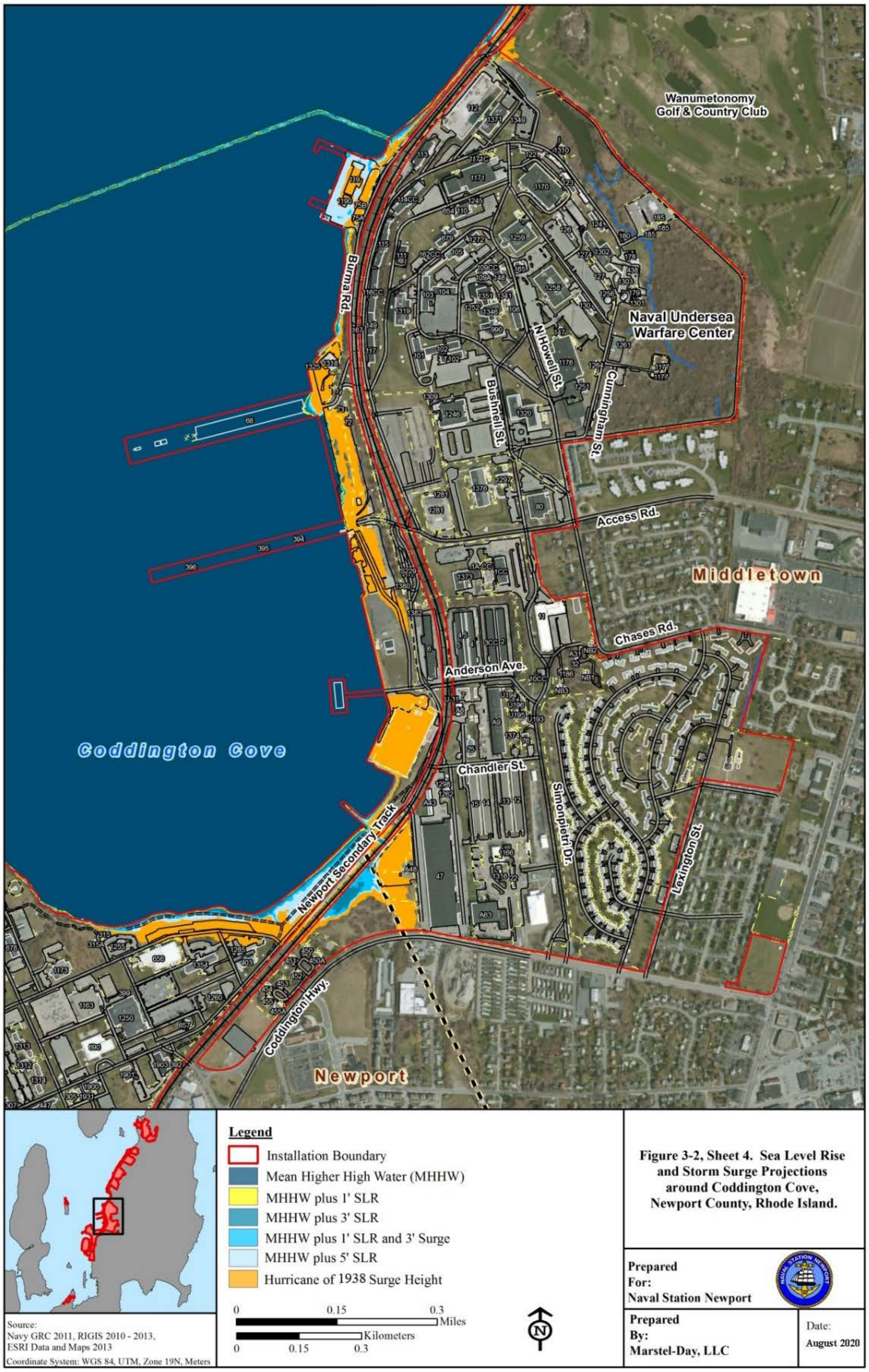

Figure 3-2, Sheet 4. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

Figure 3-2, Sheet 5. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

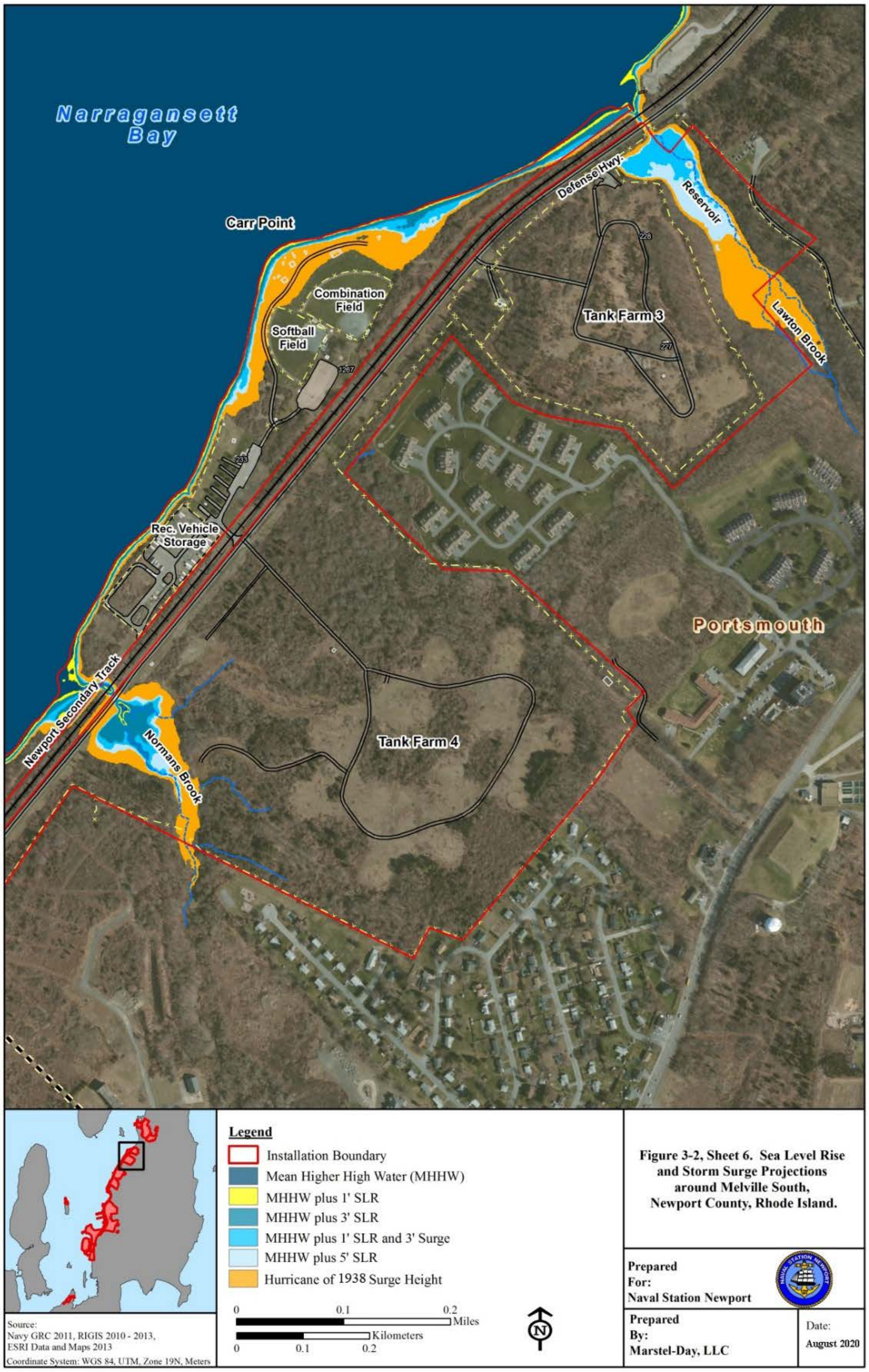

Figure 3-2, Sheet 6. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

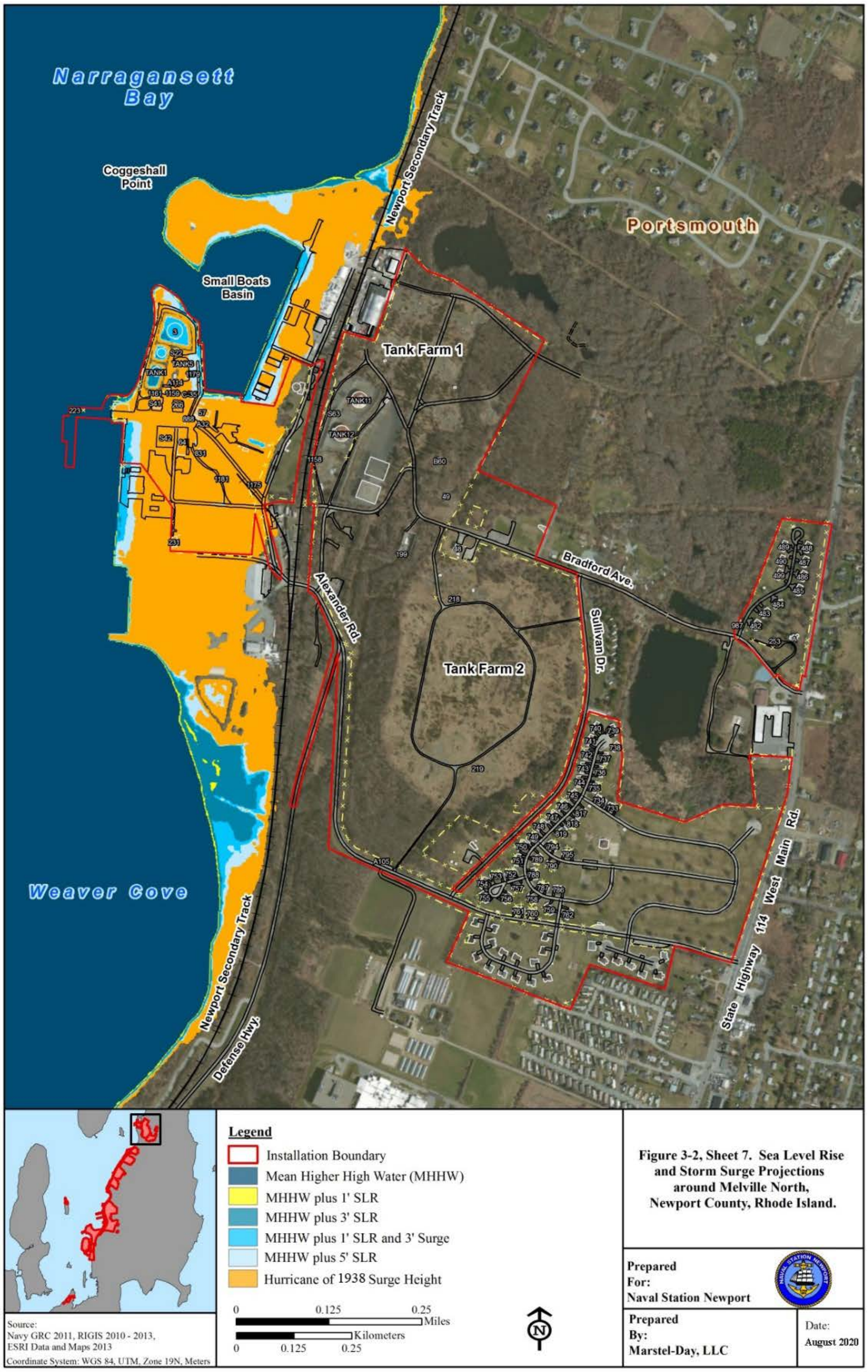

Figure 3-2, Sheet 7. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

Figure 3-2, Sheet 8. Sea Level Rise and Storm Surge Projection at NAVSTA Newport, Newport County, Rhode Island.

Narragansett Bay Ecosystem – Ecological changes in the food web have been documented and are expected to continue to change along with piscine community shifts correlated with warming temperatures. Freshwater inputs are expected to increase, carrying higher pollutant loads into the Bay and contributing to water quality degradation. Hypoxia (low dissolved oxygen) and harmful algae blooms are more likely to occur with warmer waters, stressing aquatic life (RICRMC 2011, Heffner et al. 2012, NBEP 2017).

Nearshore, Coastal Zone, and Wetland Habitats – SAV populations are projected to decline, in part due to increased polluted runoff (primarily sediment). Sea-level rise will narrow the zones for intertidal habitats and beaches, with beaches also being more vulnerable to erosion during more severe storms. If tidal marsh growth cannot keep up with sea-level rise, or if it is impeded from landward migration by development or hardened shorelines, significant coastal wetland acreage may be lost by the end of this century (URI Climate Change Collaborative 2011, Heffner et al. 2012, Rhode Island Sea Grant 2013a, Rhode Island Sea Grant 2013b).

Fisheries – Regionally it has been predicted that with increased warming the distribution of American shad (*Alosa sapidissima*), alewife, Atlantic mackerel (*Scomber scombrus*), American plaice (*Hippoglossoides platessoides*), American lobster (*Homarus americanus*), and winter flounder (*Pseudopleuronectes americanus*) will shift north. Blue crab (*Callinectes sapidus*), Atlantic menhaden (*Brevoortia tyrannus*), and striped bass (*Morone saxatilis*), typically more southern along the Atlantic Coast in their distribution, may increase in the Northeast. If sea-level rise results in less acreage of saltwater marshes, productivity of fish and shellfish species will decline due to reduced nursery and foraging habitats. With increasing ocean acidification, less dissolved carbon may be available for shellfish to utilize in shell production, but the impacts of acidification may be dissimilar among species (RICRMC 2011, Heffner et al. 2012).

Marine Mammals and Sea Turtles – Cold-water marine mammals are expected to shift more northward with increasing water temperatures. Sea-level rise will affect sea turtle nesting areas and feeding grounds on beaches by decreasing habitat areas available (NBEP 2017).

Wildlife Species – Loss of beaches, mudflats, and saltmarshes to sea-level rise could cause seabirds and shorebirds to lose breeding, foraging, and migratory stopover habitats, and thus result in declining populations. In particular, at-risk species such as the piping plover, glossy ibis, and the American oystercatcher may lose critical habitat. For bats, climate change research is in its early stages, but changing climates may cause species to shift northward (e.g., models for the little brown bat point to this distribution shift) (Strickland 2011). Birds, bats, and pollinators all may experience asynchronous phenology with their prey and forage-base species (e.g., spring arrival for some migratory bird species may occur earlier than the emergence of their prey insects) (RICRMC 2011; Heffner et al. 2012).

Invasive Species – Temperature and precipitation changes are projected to stress native species, leaving them vulnerable to competition from invasive species. In Narragansett Bay, jellyfish are becoming more abundant. Southern invasive aquatic and plant species will also expand northward (URI Climate Change Collaborative 2011; Heffner et al. 2012; Rhode Island Sea Grant 2013c).

Diseases – Vector-borne diseases, such as those carried by ticks and mosquitoes, may increase and diseases common to fish, shellfish and marine plants in southern waters will move northward. In Narragansett Bay, the American oyster (*Crassostrea virginica*) already has been affected by Dermo, a disease caused by the parasite *Perkinsus marinus* that has moved northward with warming waters (Heffner et al. 2012). WNS, originally thought to be limited to more southern climes, has started to affect bats in Rhode Island (see Section 4.6.1.3 *Bats* for more information concerning bats).

3.3.4 Implications for Natural Resource Management

Given the extensive shorelines along NAVSTA Newport, sea-level rise and increased storm surges may be significant issues for sustaining beach and tidal wetland habitats, and thus habitat for migratory birds (e.g., piping plovers) and marine mammals (e.g., harbor seals). SAV may be detrimentally affected by the projected increase in sediment pollution from higher stormwater volume flows. Warming temperatures may result in more southern invasive species expanding northward, likely causing invasive species management to be a continuing problem for the installation.

Adaptation strategies for NAVSTA Newport can focus on promoting climate change resiliency to enable natural resources sustainability. Adaptation strategies can include the following types, as examples:

Decrease Stressors – Decrease other stressors that negatively affect at-risk species, priority habitats, and Narragansett Bay, such as the stressors of invasive species, disease vectors, polluted runoff, and future development of remaining natural areas and open space.

Sustain Coastal Habitats – To minimize loss of coastal beaches and marshes, conserve adjacent upland areas to allow coastal lands to naturally migrate inland as the sea rises. Additionally, beach replenishment with sediment, although costly, may be an option.

Restore Habitat – Continue to restore priority habitats and ecosystems including habitat for at-risk species. Undertake restoration, creation, and enhancement of wetlands and other natural habitats that are most threatened by climate change. Stabilize stream banks and restore riparian forest habitats to decrease sediment and nutrient loads into Narragansett Bay.

Education and Outreach – Educate NAVSTA Newport personnel and surrounding communities on the threat climate change poses to natural resources and resulting impacts on property, structures, and infrastructure.

A climate change vulnerability assessment project, as described in Chapter 5, for NAVSTA Newport will provide a detailed analysis of installation natural resources that are at-risk from climate change. This vulnerability assessment can then be used to devise installation-specific climate adaptation strategies.

3.4 NATURAL RESOURCES CONSULTATION REQUIREMENTS

Section 7 of the ESA requires federal agencies to formally consult with the USFWS (inland fish and wildlife species) or NOAA NMFS (marine species) when any proposed activity authorized, carried out, or conducted by that agency may significantly affect a listed species or designated critical habitat. As a result of consultation, the USFWS or NOAA NMFS will issue a biological opinion including actions that the federal agency must complete in order to conduct the proposed activity. If critical habitat is located on federal property and adequate protection and management of the critical habitat has been included in the installation INRMP, the ESA allows the USFWS to preclude this habitat from the biological opinion. However, in order for the critical habitat to be excluded, the qualifying INRMP must address the maintenance and improvement of the primary constituent elements important to the species, and must manage for the long-term conservation of the species. For minor or less-than-significant impacts on ESA-listed species or designated critical habitat, informal consultation with the USFWS and NOAA NMFS may be appropriate. Section 7 consultation (formal or informal) is not expected to be required for any of the natural resources management projects recommended in this INRMP.

Only one Federally listed species—the northern long-eared bat—has been observed on NAVSTA Newport; however, the species was not identified in acoustic surveys performed in 2018 (Tetra Tech 2019a). Bats are increasingly becoming species of concern; the USFWS is conducting a candidate assessment for the little brown bat and the tricolored bat, which have also been observed on the installation, but are not currently listed. In addition, migratory species do use the natural habitats and open space for transient use (e.g., migratory shorebirds and songbirds, marine mammals, and sea turtles). Atlantic sturgeon has been listed on the federal endangered species list, but NMFS has confirmed that no critical habitat for the species exists on or in the immediate vicinity of NAVSTA Newport (see Section 4.7.4).

Any authorization, funding, or undertake of an action that may adversely affect essential fish habitat (EFH) by a federal agency requires consultation with NOAA Fisheries. Adverse effects on EFH are any direct or indirect effects that reduce the quality and/or quantity of the habitat. These effects can range in spatial scales from large ocean uses to small projects along the coast. NOAA Fisheries provides advice and recommendations to the federal agency to avoid, reduce, or offset these adverse effects. As part of the EFH consultation, federal agencies must submit an EFH assessment to NOAA Fisheries, which must include:

- A description of the action,
- an analysis of the potential adverse effects of the action on EFH, and the managed species,
- the federal agency's conclusions regarding the effects of the action on EFH, and
- proposed mitigation (if applicable).

Additional information such as an analysis of alternatives, the results of on-site inspections, literature reviews, or the views of recognized experts, may also be necessary depending upon the scale and nature of the adverse effects to EFH (NOAA Fisheries 2019).

3.5 NEPA COMPLIANCE

Prior to the passage of Sikes Act legislation, the extent of natural resources management on military lands was largely discretionary. Although installations with applicable natural resources were required to prepare natural resources plans, it was not a legal requirement. The only legal natural resources requirements for installations were related to compliance with the ESA, CWA, and other statutory requirements or DOD directives. Passage of the SAIA brought into effect the requirement for "the Secretary of each military department to prepare and implement an integrated natural resources management plan for each military installation in the U.S. under the jurisdiction of the Secretary" (Navy 2006a). The Council on Environmental Quality (CEQ) defines an INRMP as a major federal action requiring NEPA analysis, and as a result the Navy Office of General Counsel (Installations and Environment) has established that implementation of an INRMP, per SAIA requirements, necessitates the preparation of NEPA documentation prior to approval of the INRMP. The preparation of an EA is usually sufficient to satisfy the NEPA review requirement for most installation INRMPs; however, in cases where implementation of the INRMP would have a significant impact on the environment, the preparation of an Environmental Impact Statement (EIS) is required. Annual updates and revisions may be covered by the original NEPA documentation unless a major change in the installation mission or natural resources management objectives occurs.

Decisions that affect future land or resource use that are associated with an INRMP require NEPA analysis. The NRM should refer to Secretary of the Navy Instruction (SECNAVINST) 5090.6A and Chapter 10 of OPNAV M-5090.1 (Navy 2019a) for basic guidance on the preparation of NEPA documents. CEQ's "Regulations for Implementing NEPA" (available at: http://www.thecre.com/fedlaw/legal14/toc_ceq.htm) and "NEPA's Forty Most Asked Questions" (available at: https://www.energy.gov/sites/prod/files/G-CEQ-40Questions.pdf) provide further information. The INRMP and associated NEPA documentation should be prepared as individual documents to ensure that the viability, integrity, and intent of each are maintained. The intent of the INRMP is to outline projects that would fulfill Navy compliance and stewardship obligations, while the intent of the NEPA documentation is to analyze the impacts of the natural resources management actions outlined in the INRMP. While each of these are prepared as separate documents, they should be prepared simultaneously, as it is important for installation NRMs to coordinate preparation of the two documents at the earliest possible stage to ensure that decisions reflect current environmental values and avoid potential conflicts.

Preparation of the NEPA documentation should be completed early to accommodate Navy decision-makers. If a comment period or public notice is required for the NEPA process, these should be coordinated and integrated with the INRMP. A FONSI must be achieved before the INRMP can be implemented. If a FONSI is not achievable, the NEPA process must proceed to an EIS. One of the first steps in the NEPA process is to define the proposed action and explain its purpose and need. The proposed action is to develop and implement an INRMP that integrates natural resources management with the installation's military use in a manner that ensures military readiness and provides for sustainable multipurpose uses and conservation of natural resources (Navy 2006a). The purpose and need for the INRMP is to meet statutory requirements imposed by the SAIA as well as the requirements of various DOD and Navy Instructions. The Purpose and

Need section can be further clarified with a brief discussion of the required plan elements (as outlined in the SAIA) applicable to the installation.

The majority of the NEPA document should focus on the discussion of relevant environmental issues and reasonable alternatives. Alternatives that are not feasible because they are inconsistent with the installation mission, unreasonably expensive, or too technically or logistically complex should not be included in the analysis. In addition, any alternatives that are associated with significant environmental impacts cannot be analyzed in an EA and would require preparation of an EIS. The CEQ defines reasonable alternatives as those that are economically and technically feasible and utilize common sense. Feasibility is a measure of whether the alternative makes sense and is achievable. The analysis should focus on the alternatives and methodologies proposed for implementing the natural resources management program. The 2006 Navy INRMP guidance document recommends that the NEPA analysis for INRMP documents adopt a "programmatic" approach that provides opportunities for the installation to accommodate unforeseen projects that meet pre-established criteria for significance evaluation, as well as changes to the projects, as long as impacts are covered within the overall scope and analysis for the selected alternative (Navy 2006a). Analysis in the NEPA document would focus on evaluation and comparison of alternative plans in association with the natural resources management objectives established for NAVSTA Newport by the INRMP. Analysis should not focus on the individual projects or practices except in the cases of controversial projects or projects considered outside the scope of, or a major deviation from, a previously existing INRMP (Navy 2006a). The projects and recommendations outlined in an INRMP should provide a framework for reviewing ongoing activities, and should also assist in reviewing changes for unforeseen projects or modifications in the future. It is important to distinguish that the NEPA analysis for evaluating this INRMP is different from the project level of analysis used for project specific actions.

The No Action/Status Quo alternative should always be included as an alternative to implementation of the INRMP. The No Action/Status Quo alternative describes impacts that would occur if the installation did not implement the INRMP and continued to operate without a plan, or impacts that would occur if the installation continued to implement the current INRMP that is in place. The No Action/Status Quo alternative serves as a baseline to which all other alternatives are compared. Each alternative should describe the general geographical extent applicable to each of the natural resources management objectives. Each of the reasonable alternatives may only represent variable intensities of one or more of the natural resources management objectives; however, differences in funding levels for each alternative would not constitute a valid range of alternatives. For example, it is not acceptable for all required compliance projects to represent an alternative. A brief summary of all alternatives considered for the INRMP should be included to provide the review agencies and the local community with the range of management scenarios that were analyzed.

Although specific projects are not required to be analyzed in the NEPA document, a complete list of projects, including description, cost estimate, funding priority designations, and implementation schedule, must be included to provide the basis of the proposed action. If agency stakeholders and the Navy determine that potential projects are controversial, sufficient project details must be provided in the INRMP so that a decision can be made regarding significance as part of the NEPA analysis. In addition, controversial projects or projects outside the scope may require a tiered or amended NEPA document for that specific project. All projects must be consistent with the methodologies analyzed in the NEPA document, and the installation should ensure that the NEPA documentation for the INRMP is prepared such that it would accommodate for unforeseen projects and changes to original projects. Appendix F of the Navy INRMP guidance document (Navy 2006a) includes more information on preparing NEPA documents for INRMPs.

The final EA prepared for this INRMP, which was prepared upon completion of an environmental review and public comment process, is available in Appendix J.

3.6 PARTNERSHIPS AND COLLABORATION

Effective communication among personnel from different offices is vital for ensuring that site activities are implemented as planned under the INRMP. An ecosystem approach to natural resources management also requires managers to look beyond site boundaries to non-DOD partners. There are many agencies, organizations, and other institutions that can assist in implementing an INRMP; thus local and regional partnerships should be encouraged. Both DOD and Navy policy call for installations to form partnerships to facilitate the implementation of many of the natural resources initiatives presented in this plan. Installations can enter into cooperative agreements with federal agencies, states, local governments, NGOs, and individuals for a variety of reasons such as biological inventories, monitoring, research, minor construction and maintenance, public outreach and education, INRMP support, or conservation law enforcement. Navy installations are encouraged to use partnerships and volunteers to complete projects under the direction and supervision of Navy natural resources managers. The use of volunteers must be in accordance with DODI 1100.21, *Voluntary Services in the Department of Defense* (DOD 2020).

The following sections discuss potential agencies and organizations that could provide support with INRMP implementation. These partnerships can be very beneficial because they make it easier and more cost effective for installations to fund natural resources research and improvement projects.

3.6.1 Partnerships and Collaborations

3.6.1.1 Other DOD and Navy Organizations and Programs

- Chief of Naval Operations Energy and Environmental Readiness Division (CNO [N45])

  The CNO (N45) is the Navy’s principal leader and overall program manager for Natural Resources matters. As such, the CNO (N45) works to ensure that there are sufficient resources to establish an INRMP consistent with legislative requirements and DOD policy and provides policy needed to establish a sufficient INRMP. The CNO (N45) also coordinates Navy INRMPs with relevant federal agencies, military services, and environmental organizations. For more information about CNO (N45) responsibilities, see OPNAV M-5090.1, *Environmental Readiness Program Manual* (Navy 2019a).

- Commander, Navy Region Mid-Atlantic (CNRMA)

  MIDLANT serves as the Regional Command for all Navy installations and facilities along the eastern seaboard from Maine to North Carolina, except for installations in the Washington, D.C. area. According to OPNAVINST 5090.1E (Navy 2019b), the Regional Commander should promote and coordinate INRMP implementation with the appropriate Budget Services Office and Engineering Field Division. The CNRMA works to educate Navy employees about how to reduce environmental impacts and helps foster communication throughout the various levels of Navy organization about environmental commitments and performance. NAVSTA Newport can also reach out to MIDLANT for guidance on how to comply with new and existing environmental legislation, regulations and guidelines (OPNAV M-5090.1 [Navy 2019a]).

- Commander, Naval Facilities Engineering Command Mid-Atlantic (COMNAVFACENGCOM MIDLANT)

  The COMNAVFACENGCOM serves as the Navy Natural Resources Technical Program Manager. As such, he or she must ensure proper stewardship of Navy natural resources and compliance with corresponding laws and regulations. The COMNAVFACENGCOM provides a variety of resources that may assist NAVSTA Newport in implementing this INRMP such as planning a Navy-wide Natural Resources Conference each year; evaluating new methods, policies, technologies, and procedures for natural resources management; and providing technical guidance for developing cooperative agreements to implement natural resource plans. For a complete list of COMNAVFACENGCOM responsibilities, see OPNAV M-5090.1 (Navy 2019a).

- U.S. Coast Guard (USCG)

  The USCG is committed to protecting the public, the environment, and U.S. economic interests in the nation’s ports and waterways, along the coast, on international waters, or in any maritime region, as required, to support national security. The Marine Environmental Protection Program may be of particular interest to NAVSTA Newport, as it works to prevent the introduction of invasive species into the marine environment, stop ocean dumping, and prevent oil and chemical spills. The USCG also acts as the “Federal On-Scene Coordinator” for oil and hazardous substance incidents in coastal areas.

- DOD Legacy Resource Management Program

  The DOD Legacy Resources Management Program was created by Congress to fund natural and cultural resources management projects that may otherwise go unfunded. The Legacy Program seeks projects that further conservation goals while also supporting military mission sustainment. Legacy funds may be requested annually in accordance with instructions provided by the Office of the Deputy Under Secretary of Defense for Installations and Environment and the Office of the Deputy Assistant Secretary of Navy (Environment).

- Strategic Environmental Research and Development Program (SERDP)

  SERDP is an environmental research program that is planned and executed through a partnership between DOD, the Department of Energy, and EPA. SERDP funds research that pursues solutions to DOD's environmental challenges. One of the SERDP focus areas is Resource Conservation and Climate Change, which has a particular interest in understanding ecological systems on DOD lands, assessing the impact of training on protected species, and understanding ecological impacts from climate change. Research funded by the SERDP program may be of interest to NAVSTA Newport. In addition, NAVSTA Newport could potentially serve as a host for SERDP-funded investigations.

- DOD Partners in Flight (PIF)

  It is DOD policy to promote and support the PIF initiative that protects and conserves neotropical migratory birds and their habitat. The DOD and its services support PIF by protecting vital habitat, enhancing biodiversity, and maintaining healthy and productive natural systems on their lands, consistent with military missions. PIF includes national working groups to deal with local and regional problems. NAVSTA Newport can coordinate with and seek assistance from the PIF Northeast Working Group to manage for particular migratory birds species on the installation.

- DOD Partners in Amphibian and Reptile Conservation (PARC)

  DOD PARC provides a network through which the DOD can work to avoid future mission restrictions while providing stewardship for threatened and endangered herpetofauna. DOD PARC focuses on habitat and species management; inventory, research, and monitoring; and education, outreach, and training. It provides a framework for the effective management of amphibians and reptiles by the military services and their installations. DOD PARC's primary responsibility is to ensure that the DOD has the operational and logistical flexibility necessary for testing and training exercises.

3.6.1.2 Other Federal Agencies and Programs

- U.S. Fish and Wildlife Service (USFWS)

  The mission of the USFWS is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The USFWS implements key conservation statutes, including the ESA, MBTA, and the Sikes Act. Naval installations must consult with the USFWS when preparing INRMPs. The USFWS office with responsibility for NAVSTA Newport is the New England Field Office located in Concord, New Hampshire. The USFWS also operates 21 coastal programs throughout the U.S. including the Southern New England–New York Bight Coastal Program, which is located in Charlestown, Rhode Island. These USFWS offices will be able to provide technical expertise and assistance in implementing this INRMP, and can help advise NAVSTA Newport on how to maximize conservation without compromising its military mission.

- National Oceanic and Atmospheric Administration (NOAA)

  Part of the Department of Commerce, NOAA is tasked with managing and researching marine ecosystems of the U.S. There are several offices within NOAA that could advise NAVSTA Newport on marine and coastal stewardship, such as NMFS, Coastal Services Center, and Narragansett Bay National Estuarine Research Reserve. NMFS is responsible for stewardship of living marine resources, such as fish and marine mammals, as well as their habitat; it oversees the MMPA and the ESA (for marine species and anadromous fish). The Coastal Services Center, which has a Northeast division, works to protect coastal resources by providing data, tools, training, and technical assistance. Narragansett Bay National Estuarine Research Reserve conducts research and provides training in order to protect and restore coastal and estuarine ecosystems in Narragansett Bay.

- U.S. Environmental Protection Agency (EPA)

  The EPA leads the nation's environmental science, research, education, and assessment efforts. Its activities include developing and enforcing environmental regulations; providing financial assistance to state environmental programs, non-profits and educational institutions; performing environmental research at laboratories located nationwide; sponsoring voluntary partnerships and programs; and providing environmental education. The EPA also protects human health and the environment through a variety of activities such as regulating water and air pollution and overseeing clean-up of contaminant spills. Of particular interest to NAVSTA Newport is the Atlantic Ecology Division Lab, located in Narragansett, Rhode Island. This lab conducts research on water of the Atlantic seaboard, including Narragansett Bay, to understand how human activities on land and water affect water quality.

- U.S. Army Corps of Engineers (USACE)

  The mission of USACE is to deliver public and military engineering services, partner in peace and war to maintain U.S. security, energize the economy, and reduce risks from disasters. The New England District of USACE is responsible for work in the six New England states east of the Lake Champlain drainage basin, including Massachusetts. The USACE, New England District conducts environmental remediation, flood damage control, natural resource management, streambank and shoreline protection, and navigation maintenance and improvements including dredging and disaster assistance. USACE can provide engineering and construction support to NAVSTA Newport and can also serve as a technical advisor for environmental restoration and other projects. In addition, NAVSTA Newport has the option to access USACE organizations, such as the Waterways Experiment Station and the Construction Engineering Research Laboratory, for technical assistance and support for natural resources projects.

- Natural Resources Conservation Service (NRCS)

  NRCS assists in the protection and conservation of soil resources throughout the U.S. and could help NAVSTA Newport manage and conserve its soils.

- U.S. Geological Survey (USGS)

  USGS is a multi-disciplinary organization that provides scientific information on biology, geography, geology, geospatial information, and water to minimize damage from natural disasters and manage the nation's water, biological, energy, and mineral resources. USGS could assist NAVSTA Newport by helping design biological, water quality, and hydrologic surveys, and facilitating the integration of NAVSTA Newport data into national or regional databases. For example, USGS has an invasive species program that provides methodologies and information to manage and prevent species invasions. USGS also houses the National Climate Change and Wildlife Science Center, whose mission is to provide NRMs with the scientific tools and information they need to address the impacts of climate change on fish, wildlife, and their habitats. As part of this mission, the Center offers a series of webinars geared toward NRMs related to climate and wildlife.

- U.S. Department of Agriculture (USDA)

  The USDA Agricultural Research Service Foreign Plant Disease and Weed Science Research Unit could provide technical assistance to NAVSTA Newport with invasive species management and eradication.

3.6.1.3 State Agencies

- Rhode Island Department of Environmental Management (RIDEM)

  RIDEM works to preserve the quality of Rhode Island's environment, maintain the health and safety of Rhode Island residents, and protect the natural systems upon which life depends. The Sikes Act requires that installations consult with the state fish and wildlife agency when preparing an INRMP. For NAVSTA Newport, the appropriate state agency is RIDEM. There are several RIDEM programs that may be of interest to NAVSTA Newport, such as the Division of Fish and Wildlife (DFW), Narragansett Bay Estuary Program, and the Sustainable Watersheds Program.

- Rhode Island Coastal Resources Management Council (RICRMC)

  The RICRMC was created in 1971 to protect and manage Rhode Island's coastal resources. The RICRMC develops coastal resource management plans, regulates activities that could affect the coast, assists other state agencies in factoring coastal resources into their decision-making processes, and sponsors coastal zone research.

- Rhode Island Bays, Rivers, and Watersheds Coordination Team (BRWCT)

  The Rhode Island BRWCT is a state interagency team that conducts planning, fosters partnerships across state agencies, and funds research. Their mission is to protect, manage, restore, and sustainably develop Rhode Island's watersheds.

3.6.1.4 Regional and Local Agencies

- New England Interstate Water Pollution Control Commission

  The mission of the New England Interstate Water Pollution Control Commission is to provide coordination, public outreach, research, training, and leadership in water management for New England and New York State. This agency could serve as a valuable resource for identifying BMPs for monitoring and managing waterbodies on and around NAVSTA Newport. They also offer training for wastewater management.

3.6.1.5 Colleges and Universities

- University of Rhode Island (URI), University of Massachusetts, and Brown University

  URI, including the URI Narragansett Campus, as well as the University of Massachusetts and Brown University, are all located in proximity to NAVSTA Newport. Each of these universities hosts robust environmental and engineering research programs and could potentially offer technical assistance in natural resources management activities. The Rhode Island Sea Grant, part of the National Sea Grant College Program within NOAA, is housed within the URI School of Oceanography; it supports research and education related to coastal ecosystems. URI is also the host for the North Atlantic Cooperative Ecosystem Studies Unit (NACESU), which is a partnership among federal agencies (including DOD) and Northeastern universities that provide research, technical assistance, and education with respect to the North Atlantic Coast.

  There may be opportunities for university researchers to conduct investigations on or near NAVSTA Newport, which could help shed light on the condition of the installation's natural resources. This could potentially be funded through the DOD's Strategic Environmental Research and Development Program, which funds research to solve DOD's environmental challenges.

3.6.1.6 Non-governmental Organizations

There are many NGOs operating in the vicinity of NAVSTA Newport that are dedicated to conserving natural resources in Rhode Island. These organizations can potentially provide technical expertise, as well as funding and volunteers to carry out management and restoration activities. Some organizations to consider include:

- Aquidneck Island Land Trust
- Association of National Estuary Programs
- Clean the Bay
- Environment Rhode Island
- Estuarine Research Foundation
- Restore America's Estuaries

- Rhode Island Chapter of The Nature Conservancy
- Save the Bay

3.6.1.7 Interagency Programs

- Coastal America

  Coastal America is a partnership of federal agencies, state and local governments, and private organizations that work together to protect and restore coastal ecosystems. It seeks to improve coastal management by sharing information, pooling resources, and combining management and technical expertise. Coastal America has a Civil-Military program that seeks to align coastal restoration projects with the military's need to provide high-quality, real-world training. These projects, called "innovative readiness training," could offer a way for NAVSTA Newport to improve environmental stewardship on the installation while also providing training opportunities.

- Narragansett Bay Estuary Program (NBEP)

  As part of the National Estuary Program, the NBEP is charged with protecting and restoring Narragansett Bay by engaging state and federal agencies, NGOs, and local communities in planning management actions for the Bay. As part of its duties, the NBEP created a Comprehensive Conservation and Management Plan, which was most recently updated in 2012. The Plan outlines goals, objectives, and actions related to Narragansett Bay and provides guidance for how to protect and restore the Bay.

- The North Atlantic Landscape Conservation Cooperative (NALCC)

  Landscape Conservation Cooperatives are public-private partnerships that share and provide information to ensure the sustainability of natural and cultural resources. The NALCC, which includes all of Rhode Island, is one of 22 LCCs across the country. The NALCC includes the states of Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, and Maine. It also includes tribes, federal agencies, NGOs, and other species-specific partnerships like migratory bird joint ventures and fish habitat partnerships. The North Atlantic LCC funds research and also provides resources such as data, scientific publications, videos, and webinars related to conservation topics relevant to the Northeast. NAVSTA Newport could take advantage of some of these resources for training purposes and could potentially participate as a study site for NALCC-funded research projects.

3.6.2 Public Access and Outreach

3.6.2.1 Public Access and Outdoor Recreation

Although provision of public access is addressed in the SAIA, security concerns in the aftermath of 11 September 2001 ("September 11th") have greatly restricted public access on DOD facilities. Access to NAVSTA Newport outdoor recreation facilities is restricted to authorized personnel, which include active duty military personnel and their dependents, DOD civilian employees at NAVSTA and their dependents, active duty reservists at NAVSTA and their dependents, DOD contract support employees at NAVSTA, and retired military. Outdoor recreation opportunities available include recreational fishing, camping at designated recreational areas, and access to the NAVSTA Newport sailing center and marina. Recreational opportunities are described in more detail in Section 4.11 *Outdoor Recreation*. Additionally, this INRMP includes projects to enhance and create additional recreational opportunities including trails, watchable wildlife areas, and interpretive signs throughout public areas on the installation. Refer to Chapter 5, *Project Descriptions*, for more details.

Access to the installation is granted through obtaining proper identification and documentation as accepted by NAVSTA Newport. Examples of proper identification include an Active Duty ID card, a DOD civilian Common Access Card (CAC), a retired DOD ID card, and a DOD civilian contractor card. Non-DOD personnel and contractors not carrying a civilian contractor card must check in and obtain a one-day pass from the security guards. To receive a one-day pass, the driver needs to show a valid driver's license and current vehicle registration. One-day passes will be issued for guests to the installation. Contractors (or anyone providing a paid service) must be sponsored by installation personnel and will need to come to the Security Office to obtain access to the installation.

Access requests for natural resources-related events taking place at a NAVSTA Newport facility should be submitted directly to the NAVSTA Newport NRM. The NRM will then forward the access request to the Security Office.

3.6.2.2 Public Outreach and Environmental Education

The Public Affairs Office is responsible for publicizing NAVSTA Newport stewardship activities within the NAVSTA Newport Community. Outreach vehicles include the NAVSTA Newport newsletter, NAVSTA Newport TV, and the NAVSTA Newport websites. Outreach to the public outside of the NAVSTA Newport community is accomplished via partnering on natural resources projects both inside and outside the installation (e.g., SAV monitoring) and making natural resources information available to interested agencies (i.e., USFWS and RIDEM). Outreach is also accomplished through demonstration projects involving volunteer groups, dissemination of information brochures about natural resources, and through placement of interpretive signs.

While public access is restricted due to national security reasons, the installation is receptive to and has participated in public outreach events.

This INRMP includes projects for additional public outreach events and activities, including continuing Earth Day and other volunteer-oriented events (e.g., National Public Lands Day) to support habitat enhancement and restoration projects such as

- controlling invasive species,
- restoring and monitoring SAV,
- conducting Bay clean-ups,
- planting native plants,

- planting flowers to create pollinator habitat,
- installing interpretive signs about the natural resources, and
- marking storm drains with "Drains to the Bay" stencils.

Many of the above proposed projects provide excellent environmental education opportunities. The installation will consider partnering with the installation tenants (e.g., Naval Academy Preparatory School, Naval War College), agencies and NGOs, Boy Scouts and Girl Scouts, and nearby schools to accomplish these projects. Refer to Chapter 5, *Project Descriptions* for more details.

3.7 STATE WILDLIFE ACTION PLANS

The State and Tribal Wildlife Grants program was created by Congress in 2000 to fund actions to conserve declining fish and wildlife species before they become threatened or endangered. It is the core federal program for preventing future endangered species listings (RIDEM 2013). A primary condition for states to be eligible for matching grants is to develop a State Wildlife Action Plan (SWAP) that provides an assessment of the health of wildlife and habitats, identifies the problems they face, and outlines conservation actions. In the August 2006 memorandum that provided DOD's official INRMP template, DOD identified the incorporation of SWAPs into INRMPs, and vice versa, as a critical element of the environmental management strategy and mission sustainability. In order to achieve the goals established by the Sikes Act via mutually agreed-upon fish and wildlife conservation objectives, NAVSTA Newport has consulted the Rhode Island SWAP and coordinated with the RIDEM DFW to develop complementary natural resources management strategies.

Rhode Island completed its first SWAP in 2005, and published the second revision in 2015 (RIDEM 2015). The SWAP outlines a series of actions and finer-scale tasks to address threats and effectively conserve the state's wildlife resources, particularly for the species of greatest conservation need (RIDEM DFW 2015). The following actions are directly relevant to NAVSTA Newport:

- conduct routine surveys/monitoring of species of greatest conservation need and habitats, including for migratory birds, bats, and marine mammals
- minimize the loss of riparian habitat
- control invasive species in coordination with state partners
- restore and manage priority habitats for wildlife including pollinators

These actions have been incorporated in the development of this INRMP and are supported by the natural resources management programs presented in Section 5. Furthermore, the GIS data that have been collected during surveys will be shared with the RIDEM DFW.

4.0 NATURAL RESOURCES PROGRAM OVERVIEW

This section provides detailed information on the primary natural resources management program elements identified for NAVSTA Newport. Specific projects and actions have been developed that will assist the installation in meeting the established goals and objectives. Actions are bulleted differently in the following sections depending on whether the project is dependent on funding, or if it is an action that will not require a specific funding mechanism to complete. All projects requiring funding are summarized in Chapter 5 and Appendix C.

- ☞ Specific project that requires a funding mechanism to complete. Funding-dependent projects may be associated with more than one management unit.
- ❖ Management action that can be carried out passively, without the need to seek out specific funding to complete.

No impacts on the mission are expected to occur from implementation of the natural resources management projects and actions described in this section; however, if special considerations are necessary, these are described where applicable.

4.1 WATER RESOURCES MANAGEMENT

Water resources are an important part of natural ecosystems due to the diverse biological and ecological functions they support and hydrologic functions they perform, such as improving water quality, ground water recharge, pollution treatment, nutrient cycling, provision of wildlife habitat and niches for unique flora and fauna, stormwater storage, and erosion protection (Benton et al. 2008). To protect these important resources, many federal and state laws and local ordinances have been enacted to regulate actions that affect them, including, but not limited to the following:

- EO 11988 (Floodplain Management)
- EO 11990 (Protection of Wetlands)
- NOAA Coastal Zone Management Program Development and Approval Regulations (15 CFR 923)
- Federal Consistency with Approved Coastal Management Programs (15 CFR 930)
- Clean Water Act (Section 404)
- Rivers and Harbors Act (Section 10 Regulatory Program) (33 CFR 320-330)
- Smart Development for a Cleaner Bay Act of 2007 (Rhode Island General Law Title 45, Chapter 45-61.2, 2007)
- Aquidneck Island Special Area Management Plan Coastal Development Regulations (RICRMC 2009)

The following sections describe water resources management in regard to surface waters, wetlands, and floodplains, and provide management actions that address the specific set of issues that occurs at NAVSTA Newport.

4.1.1 Surface Waters

The term "surface waters" encompasses the rivers, streams, lakes, estuaries, and oceans in a region. For NAVSTA Newport, approximately 1.16 miles of first and second order streams (i.e., Mother of Hope Brook, Lawton Brook, and four "no name" streams) course through the installation (see Figure 2-5). In addition, NAVSTA Newport's surface waters and lands provide runoff into Narragansett Bay, an ecologically important estuarine environment (for more information on the Bay, see Section 4.2, *Coastal and Marine Management*). Across the nation, surface waters, and their water quality and biological resources, are detrimentally affected by stormwater runoff carrying sediments, nutrients (primarily nitrogen and phosphorus), and toxic chemicals from the land uses within the watershed. This same phenomenon affects NAVSTA Newport. BMPs such as riparian forest buffer protection and restoration, low-impact development approaches to stormwater management, and the prevention of toxic spills are key to protecting NAVSTA Newport's surface waters and Narragansett Bay.

To restore, preserve, and enhance the water quality of Rhode Island's surface waters as well as to maintain their designated uses (e.g., drinking water, fish and wildlife habitat, recreation such as swimming and fishing, shellfish consumption, and aquatic life), RIDEM's Office of Water Resources (OWR) implements the state's Water Quality Standards Program to protect surface waters from pollutants (RIDEM OWR 2019). Established water quality standards are the following physical, chemical, and biological criteria, which have parameters defining minimum water quality that will support the designated uses:

- dissolved oxygen
- sludge deposits, solid refuse, floating solids, oil, grease, or scum
- color and turbidity
- fecal coliform bacteria
- enterococci
- taste and odor
- pH
- temperature
- chemical constituents
- nutrients

Rhode Island's Water Monitoring Strategy is the program responsible for gathering water quality data to assess the state's surface waters (RIDEM OWR 2005). The surface water quality standards serve as the regulatory basis for the establishment of treatment controls and strategies, and also for determining when a waterbody becomes impaired (i.e., Category 5 waters that are placed on the EPA 303[d] List of Impaired Waters). If impaired, a state TMDL of the pollutant may need to be defined. Within, or adjacent to, NAVSTA Newport, six waterbodies have been classified as impaired (Table 4-1; Figure 4-1) (EPA n.d.[a]; EPA n.d.[b]; RIDEM OWR 2018).

Table 4-1. Impaired Waters, 303(d), within or adjacent to NAVSTA Newport.

Site Name	Waterbody ID	Designated Use Impairment	Cause of Impairment	State TMDL Status
Coddington Cove	RI0007030E-01A	Fish and wildlife habitat	Hazardous waste	TMDL scheduled for 2028
Newport Harbor	RI0007030E-01D	Fish and wildlife habitat	Sediment pollution	TMDL scheduled for 2028
East Passage (at McAllister Point)	RI0007029E-01C	Fish and wildlife habitat	Sediment pollution	TMDL scheduled for 2028
Lawton's Brook	RI0007035R-04	Fish and wildlife habitat	Benthic-macroinvertebrate bioassessments	TMDL scheduled for 2026
Melville Ponds	RI0007029L-01	Fish and wildlife habitat	Total phosphorus	TMDL scheduled for 2023
Upper Narragansett Bay	RI0007024E-01	Fish and wildlife habitat	Total nitrogen, dissolved oxygen, and fecal coliform	TMDL scheduled for 2022

NAVSTA Newport implements erosion and sediment control, stormwater management, and hazardous waste/spill prevention programs, described in the sections below, to protect its surface waters, as well as its wetlands and the estuarine environment of Narragansett Bay, from pollutants.

Projects to protect surface waters within the scope of the INRMP at NAVSTA Newport include the following:

- ☞ Conduct a stream and riparian habitat condition assessment to identify areas in need of restoration.
- ☞ Restore priority stream reaches and riparian areas.
- ☞ Develop an Installation Conservation Design Plan that contributes to stormwater pollution reduction.

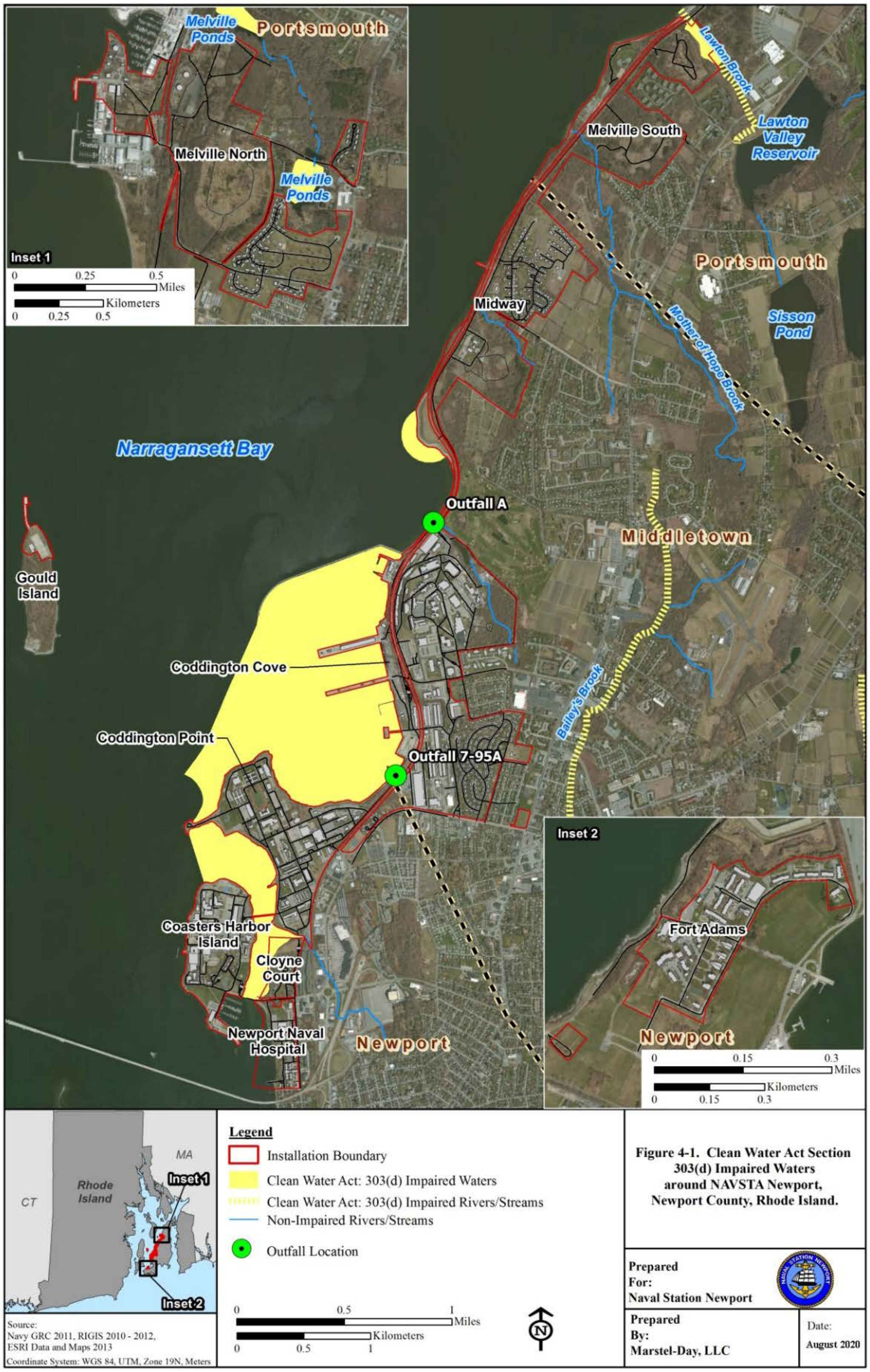

Figure 4-1. Clean Water Act Section 303(d) Impaired Waters around NAVSTA Newport, Newport County, Rhode Island.

4.1.1.1 Erosion and Sediment Control

Land use practices such as agriculture, forestry, land conversion (e.g., site construction), and existing developed lands contribute nonpoint source (NPS) pollution (i.e., polluted runoff) into waterbodies. During storm events, stormwater picks up these pollutants as it moves across the land. Common NPS pollutants are excessive nutrients, sediments, pesticides, oils, and toxic chemicals. Ground-disturbing activities typically remove or reduce the vegetation from an area, exposing the soil and making it susceptible to erosion. In addition, developed lands lead to higher volumes of stormwater runoff, also leading to increased erosion of stream banks receiving these stormwater flows. These eroded soils, both from across a landscape and from stream banks, lead to excessive sedimentation in receiving waterways. Not only can excessive sedimentation cause detrimental effects on aquatic species and habitats (e.g., smother oyster and mussel beds and increase turbidity, thus reducing light reaching SAV), but the sediments can also be contaminated with other pollutants (e.g., pesticides and toxic chemicals).

To reduce NPS pollution, erosion and sediment control (ESC) practices are used for ground-disturbing activities at NAVSTA Newport. For construction projects that include land disturbances greater than one acre, the installation executes ESCs specified within the *Rhode Island Soil Erosion and Sediment Control Handbook* (RIDEM 1989). This handbook describes the site planning process and provides technical guidance, specifications, and designs for ESC BMPs for construction activities. Typical ESC practices are temporary or permanent vegetative cover, tree protection, silt fences, storm drain protection, sediment basin, and riprap.

4.1.1.2 Stormwater Management (Point Sources and Non-Point Sources)

As stated above, NPS pollution is transported to waterways largely through stormwater runoff. Much of NAVSTA Newport's stormwater flows westerly into Narragansett Bay through the installation's stormwater conveyance system. In Rhode Island, the *Smart Development for a Cleaner Bay Act* was passed in 2007 to prevent the continued degradation of the state's waters. The law states that "stormwater, when not properly controlled and treated, causes pollution of the waters of the state..." and "development often results in increased stormwater runoff by increasing the size and number of paved and other impervious surfaces..." (Rhode Island General Law 2007). Implementation required RIDEM and CRMC, in conjunction, to amend the RI Stormwater Design and Installation Standards manual to include the following:

- Maintain pre-development groundwater recharge and infiltration on site to the maximum extent practicable (MEP);
- Demonstrate that post-construction stormwater runoff is controlled, and that post-development peak discharge rates do not exceed pre-development peak discharge rates; and
- Use low impact-design techniques as the primary method of stormwater control to the MEP.

To reduce the volume of polluted runoff from NAVSTA Newport into the Bay, stormwater is managed on the installation under a Phase II MS4 (i.e., small municipal separate storm sewer systems) permit and the Multi-Sector General Permit for industrial stormwater; both issued from the state of Rhode Island. The 2019 MSGP Industrial Stormwater Management Plan (SWMP) *Stormwater Management Prevention Program Plan* (SMPPP) and permit, includes three sites that fall under this permit and are inspected quarterly: Building W-34 (MWR Boat Maintenance Facility), Building 47 (Shipping and Receiving Warehouse) and Building W-36 (Reserves Vehicle and Boat Maintenance Storage Facility). The industrial SMPPP is updated every five years, and the Phase II SWMP must be updated when the state revises its Phase II MS4 program (last updated in 2004). It is expected that the State of Rhode Island will begin updating the Phase II MS4 permit in 2020.

The 2017 MS4 BMP Operation and Maintenance Plan identifies each BMP and its location. Stormwater BMPs installed at NAVSTA Newport include 50 BMPs such as retention/detention basins, dry swells and ponds, infiltration trenches and permeable pavement. In addition, there are 37 underground units such as grit separators, Vortechnic units, underground detention, and Stormcepto units. NAVSTA Newport also has more than 2400 catch basins which collect sand and debris and are inspected annually. The State of Rhode Island requires that LID site planning and design strategies are used to the maximum extent practicable (MEP) in order to reduce the generation of water runoff volume for both new and redevelopment projects.

Approved LID methods and/or procedures must be explored at the site and need to supply a specific rationale in the event LID strategies are rejected as infeasible. The site planning process must be documented and include how the proposed project will meet the following measures and/or methods to:

1. Protect as much undisturbed open space as possible to maintain pre-development hydrology and allow precipitation to naturally infiltrate into the ground;
2. Maximize the protection of natural drainage areas, streams, surface waters, wetlands, and other regulated areas;
3. Minimize land disturbance, including clearing and grading, and avoid areas susceptible to erosion and sediment loss;
4. Minimize soil compaction and restore soils compacted as a result of construction activities or prior development;
5. Provide low-maintenance, native vegetation that encourages retention and minimizes the use of lawns, fertilizers, and pesticides;
6. Minimize impervious surfaces;
7. Minimize the decrease in the "time of concentration" from pre-construction to post construction, where "time of concentration" means the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;
8. Infiltrate precipitation as close as possible to the point it reaches the ground using vegetated conveyance and treatment systems;

9. Break up or disconnect the flow of runoff over impervious surfaces; and
10. Provide source controls to prevent or minimize the use or exposure of pollutants into stormwater runoff at the site in order to prevent or minimize the release of those pollutants into stormwater runoff.

As of 2013, LID treatment systems exist at the following locations on the installation:

- 1390 CC (Army Reserve Center)
- 1393 CC (HAZMAT)
- 1406 CC (US Coast Guard)
- 95 CHI (Officers Club)
- 1109 CHI (Gym)
- NGIS
- 302 CP (NAPS Drill Hall)
- 678 CP (BEQ)
- 112 CP (Marine Drill Hall)
- 1356 CP
- 1372 CP (NAPS Barracks)
- Midway Housing
- 23 NH (Clinic)
- 80 NUWC (Pass and ID)
- 1176 NUWC
- 1320 NUWC
- 1404 NUWC

These LID practices include such things as pervious hardscapes for walkways, bioswales, rain gardens, bioretention units, and gravel beds around parking lots. Typical annual maintenance for these treatment systems includes:

- maintaining grass to not exceed six inches;
- correcting erosion gullies, and stabilizing eroded side slopes and channel bottoms;
- maintaining healthy stands of vegetation, and pruning or replacing woody vegetation;
- removing sediment build-up from the bottom of channels;
- removing silt and sediment from filter beds;
- replacing the filter media if ponding occurs; and

- removing weeds from mulched/stone areas.

In the near future, LID will be utilized at these additional locations:

- Parking areas at NUWC buildings 101, 679, and 1351
- Building 1310 Hazardous Waste Storage Facility
- Building 1264 Demo & New Isopar Facility
- Gate 13 NUWC Fence Extension
- Site 19-Onshore Derecktor Shipyard

As noted above, polluted runoff is causing the deterioration of the ecological health of Narragansett Bay. At NAVSTA Newport, Outfall 7-95A and Outfall A (Figure 4-1) are discharging sediment and polluted runoff from the installation into Narragansett Bay; this has rapidly become a priority issue for stormwater management. During storm events, sediment-laden plumes running into the Bay are particularly noticeable from Outfall A. This outfall discharges runoff from a stormwater pond for NUWC. The stormwater volume from Outfall A also results in the loss of sand from the beach into the Bay. Furthermore, the NUWC stormwater pond is an IRP site; a funded Record of Decision (ROD) exists for two to three feet of contaminated sediments to be removed. For Outfall 7-95A (approximately midway along the shore of Coddington Cove near Building 47), beach erosion is occurring due to the outfall, and has caused an eroded depth of four to five feet to be lost at the outfall. The stormwater discharge for this outfall is sourced from a wetland that catches runoff from the developed lands along West Main Road. Thus, this stormwater issue is a joint problem between both Middletown and NAVSTA Newport. For both outfalls, pipes need to be extended farther out into the Bay (D. Moore, personal communication, September 2013) to prevent the outfalls' flows from causing shoreline erosion. In addition, a strategy can be developed for improving stormwater management within each outfall's drainage basin.

- Extend Outfall 7-95A and Outfall A pipes further into Narragansett Bay.
- Develop a stormwater management improvement strategy with Middletown and Portsmouth for the drainage basins for Outfall 7-95A and Outfall A.

4.1.2 Wetlands

As directed by the CWA, the military is responsible for identifying and locating jurisdictional waters of the U.S., including wetlands that have the potential to be affected by activities associated with the military mission. Development of roads, installation of new culverts, and grading or fill activities have the potential to affect wetlands and waters of the U.S., according to Section 404 of the CWA. Erosion and sedimentation from these types of activities into wetlands is a concern at NAVSTA Newport. However, certain actions that have a minimal adverse impact on wetlands and other water resources may qualify for a Nationwide Permit (NWP). The NWP program was designed to streamline the Section 404 permitting process, and includes 'maintenance activities' such as repairing, rehabilitating, or replacing existing structures as well as removing accumulated fill or debris from within, or around, existing structures. Activities associated with aquatic habitat restoration, establishment, or enhancement may also qualify under an NWP.

Information contained in this document that describes wetlands, including wetland inventory maps for NAVSTA Newport (see Figure 2-9), is provided only for planning purposes. If ground-disturbing activities are proposed that may affect waters of the U.S., including wetlands at the installation, consultation with the state of Rhode Island will either occur as:

- a federal consistency review with the RICRMC for coastal and freshwater wetlands within the vicinity of the coast, to ensure consistency with the Coastal Management Zone regulations (RICRMC n.d.; RICRMP 2018); or
- a permit application to RIDEM OWR Wetlands Program for freshwater wetlands not covered by RICRMC (RIDEM OWR 2007). RIDEM has a programmatic general permit that can jointly serve as the state wetlands permit and the CWA Section 404 permit with the USACE (RIDEM OWR 2008a).

For regulatory purposes, the state's rules and regulations for freshwater wetlands also apply to the following jurisdictional resource areas (RIDEM OWR 2007):

- *Perimeter wetlands* – consisting of the area of land within 50 feet of the edge of any freshwater wetland consisting in part, or in whole, of a bog, marsh, swamp, or pond.
- *Riverbank wetlands* – area of land within 200 feet of the edge of any flowing body of water having a width of 10 feet or more, and that area of land within 100 feet of the edge of any flowing body of water having a width of less than 10 feet during normal flow.
- *Floodplain wetlands* – land area adjacent to a river or stream or other flowing body of water that is, on average, likely to be covered with flood waters resulting from a 100-year-frequency storm.

For NAVSTA Newport, it is rare that a wetlands permit will be required from RIDEM for proposed projects because most wetlands are within the coastal zone; thus, any actions potentially affecting these wetlands are addressed through a federal consistency review with RICRMC (C. Mueller, personal communication, October 2013; see Section 4.2 *Coastal and Marine Management* for more information).

To comply with the federal policy of no net loss of wetlands, OPNAV M-5090.1, instructs that impacts on wetlands, other surface waters, and riparian areas by planned future projects are to be avoided to the extent practicable (Navy 2019a). If wetland impacts are unavoidable and a permit is required to authorize the activity, appropriate impact minimization and mitigation will be required, and will be determined through consultation with the appropriate federal and state agencies (USACE, USFWS, RIDEM, and/or RICRMC). In addition, Section 404 of the CWA requires restoration of wetlands damaged by any project activities, with in-kind replacement of wetlands as the preferred mitigation strategy. The Navy also encourages wetlands creation or enhancement projects and use of wetland mitigation banks where compatible with the installation's mission (Navy 2019a).

The state of Rhode Island also requires all applicants for wetlands permits to avoid or, when not possible to avoid, minimize impacts on all wetlands including perimeter, riverbank, and floodplain wetlands. This includes staying out of the wetlands or doing everything possible to limit the extent of alteration to the wetlands (RIDEM OWR 2008b). RIDEM's *Wetland BMP Manual* provides detailed specifications for minimizing impacts on wetlands (RIDEM OWR 2010).

To minimize further wetland impacts, wetland inventory/planning maps prepared for the installation are used during the site selection process for new construction, and a wetland delineation is conducted prior to finalizing the site selection to ensure that wetlands and buffer areas are avoided to the maximum extent possible and practicable. For some maintenance projects where wetland impacts are unavoidable, the Navy utilizes BMPs to minimize wetland impacts.

Currently jurisdictional wetland delineations have been completed for site specific projects that may affect wetlands. Delineations have been conducted for:

- Tank Farm 5,
- Tank Farm 3 and 4, and
- Carr's Point.

In addition, a wetlands functions and values assessment occurred in 2011 at the Coddington Cove Rubble Fill Area as part of the pre-design stage for this site to inform decision making regarding the remedial action (Tetra Tech 2011).

It is recommended that a jurisdictional wetland delineation is conducted for the entire installation to gain efficiencies for evaluating impacts from future proposed projects. Recently, NAVSTA Newport Environmental Division submitted a project to conduct this installation-wide delineation (C. Mueller, personal communication, October 2013).

The EPA has issued guidance on siting hazardous waste management facilities in and adjacent to wetlands (NAVSTA Newport 2001), citing that wetlands are highly sensitive areas and are among the most productive ecosystems in the world. Construction, expansion, or operation of these facilities directly in and near wetlands can destroy fish and/or wildlife habitats. In addition, the high amount of unstable soils make them poor areas for land-based storage operations. Any hazardous wastes spilled can spread faster through ground water and surface water. Such contamination may harm commercial and recreational fisheries and shellfish harvesting. Hazardous waste releases into wetlands can also reduce the variety and reproduction of species living in wetlands. EPA guidance cites that one of the most serious consequences of a hazardous waste spill or leak in a wetland can occur in the process of restoring the wetland. Removing the contaminated sediments can be very costly and may even destroy the wetland.

The following is the management action planned for wetlands:

- Wetland and riparian areas will be avoided in future construction of structures and other facilities, including roads, to the maximum extent possible and practicable. New roads will be located outside riparian areas, whenever possible. Any stream crossings will be designed to minimize the area disturbed, and unimproved streams crossings are prohibited.

The projects to further wetlands protection, within the scope of the INRMP at NAVSTA Newport, include the following:

- Conduct an installation-wide wetlands delineation.
- Evaluate condition of wetlands and the shoreline, and prioritize areas in need of wetlands restoration and living shorelines restoration.
- Restore wetlands characterized as a high restoration priority.

4.1.3 Floodplain Management

A function of floodplains, especially wetland areas such as estuaries, is their ability to temporarily store floodwaters, trap erosion-generated sediment, and remove nutrients (such as nitrogen and phosphorous), and chemical and organic wastes. The ability of these areas to perform these functions is limited when the floodplain becomes developed. Floodplains receive protection through EO 11988, Floodplain Management, which directs federal agencies to reduce the risk of flood loss by not constructing in floodplains, and to restore and preserve the natural and beneficial values served by floodplains. The principal sources of flooding in the flood zone are from astronomical tides (e.g., lunar tides), storm surge, and seiches (i.e., a standing wave that can be caused by winds, seismic activities, or tsunamis).

Figure 2-6, Sheets 1-8 in Chapter 2 delineate the 100-year flood zone (i.e., Rhode Island special flood hazard areas) on NAVSTA Newport, as determined by the Federal Emergency Management Agency (FEMA). These are areas of NAVSTA Newport that are subject to inundation during a storm with a magnitude expected to occur once within a 100-year period. Significant portions of NAVSTA Newport property lie within the 100-year floodplain zones, particularly on Coasters Harbor Island and Coddington Point (and also Gould Island), where the potential for storm surge flooding is more prevalent (NAVSTA Newport 2008a). Although a consideration in siting future facilities, certain measures may be taken in the design and development of new construction to minimize impacts associated with coastal flooding, including elevated first floor heights. Significant areas of Coasters Harbor Island are within the flood zone, with much of this island highly developed. One undeveloped area along Coddington Cove serves an important floodwater buffering protection service (near the Newport/Middletown municipality boundary); thus, it is important to protect this area from future construction activities.

The Rhode Island Emergency Management Agency provides information on floodplain management and regulations, and an overview of the state permit process for proposed projects within floodplains. For construction projects within the flood zone, NAVSTA Newport must obtain permits from the USACE and RIDEM. Within the master plan for NAVSTA Newport, one of the sustainability guidelines for new construction is to avoid floodplains (NAVSTA Newport 2008a).

The EPA has prepared guidance for siting hazardous waste management facilities in environmentally sensitive areas such as floodplains and wetlands (NAVSTA Newport 2001). Section 264.18, Location Standards, of the Resource Conservation and Recovery Act (RCRA) (40 CFR 26418), specifies that a facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless the owner or operator can demonstrate to the EPA regional administrator's satisfaction that (1) procedures are in effect that will cause the waste to be removed safely, before flood waters can reach the facility, to a location where the wastes will not be vulnerable to flood waters; or (2) for existing waste piles, no adverse effects on human health or the environment will result if washout occurs. A washout means the movement of hazardous waste from the active portion of the facility as a result of the flooding.

Flood zones on the installation may change with climate change, in particular with sea-level rise and a superimposed storm surge from extreme storms. Section 3.3.3 (*Ecological Impacts of Climate Change*) provides more details on installation areas that are vulnerable to sea-level rise and storm surge (see Figure 3-2 in Chapter 3). In addition, Section 4.10.2 (*Hazardous Waste Management and Spill Prevention*) recommends a project for conducting a vulnerability assessment of facilities with hazardous waste and oil to sea-level rise and storm surge. Any storage facilities with hazardous waste and oil in the flood zone already pose an increased environmental risk to water resources; increased sea-level rise will shift the flood zone landward, and thus cause additional facilities with hazardous waste/oil to be in closer vicinity to water resources.

A management action and a project concerning floodplains follow.

- Any dredge or fill activities planned for areas located within the floodplain zone will require coordination with USACE and RIDEM to obtain the appropriate permits, and may be subject to NEPA review and documentation before any ground-disturbing activities are undertaken in floodplains. NAVSTA Newport will observe designated riparian zones when siting new construction.
- As part of the climate change vulnerability assessment and adaptation plan, analyze how the flood zone may shift with sea-level rise and assess whether this will affect additional hazardous waste and oil locations.

4.2 COASTAL AND MARINE MANAGEMENT

The coastal areas of NAVSTA Newport are subject to regulation under the federal Coastal Zone Management Act of 1972 (CZMA) and Rhode Island General Law §46-23 et Seq. The CZMA, administered by the NOAA, authorizes coastal states to identify coastal zone areas and develop coastal management plans subject to federal approval. According to the CZMA, states shall delineate a coastal zone area that encompasses all important coastal resources, such as transitional and intertidal areas, salt marshes, beaches, coastal waters, and adjacent shorelands.

As defined through the Rhode Island Coastal Resources Management Program (RICRMP), Rhode Island's coastal zone encompasses the whole state. However, the inland extent of the regulatory authority of the state's CZMA agency, the RICRMC, includes any area 200 feet inland from any coastal feature. The RICRMC also has authority over any activity that will affect watersheds, as well as certain activities that occur anywhere within the state, including the activities related to the siting and operations of power-generating plants, petroleum storage facilities, chemical or petroleum processing, minerals extraction, sewage treatment and disposal plants, solid waste disposal facilities, and desalination plants.

The CMZA expressly excludes federal lands from the state coastal zone; however, federal activities on these properties are still required to undergo "federal consistency review" if there is a reasonable expectation that such activities will affect the state coastal zone or natural resources therein. According to the RICRMP, the actions subject to federal consistency review include any activity within or outside the coastal zone that is:

- conducted by, or on behalf, of a federal agency; requires a federal permit or license; or receives federal financial assistance; and
- likely to affect any land or water use or natural resource of the coastal zone (RICRMC 2012).

Moreover, Section 307 of the CZMA requires federal actions to be consistent with that state's approved coastal management plan to the maximum extent practicable.

- Any activity that may affect land or water use or natural resources in the Rhode Island Coastal Zone should be subject to a federal consistency review, and include coordination with the RICRMC to ensure consistency with the CZMA.

The RICRMC has adopted a Shoreline Change SAMP (URI-CRC 2018). The SAMP provides:

- a synthesis of the current scientific understanding of sea level rise, storm surge, tidal flooding, and coastal erosion, as well as the impacts these hazards pose to infrastructure, other developed property such as municipal buildings and residential properties, and the social, environmental and cultural assets in Rhode Island;
- a description of the tools developed to model and map potential future impacts from these coastal hazards;
- a discussion of risk and risk management within the coastal zone;
- recommendations for best management practices and adaptation strategies or techniques to be employed at both the state and local level to minimize future risk; and
- all scientific literature and technical reports that support the new research conducted as part of the SAMP.

The following management activities are recommended for coastal and marine areas around NAVSTA Newport:

- Conduct a nearshore habitat assessment and species inventory.
- Continue monitoring the health and distribution of SAV.
- Contribute to the restoration of SAV beds.

The nearshore environment is an indefinite zone that extends seaward from the shoreline and is primarily influenced by wave action (EPA 2013a). Nearshore ecosystems support a variety of aquatic organisms, including many commercially important fish and shellfish. It is estimated that 80 percent of commercially important fish species depend on the nearshore environment at some point in their lifecycles (EPA 2013a). Part of what makes the nearshore environment unique and biologically productive is SAV, which is defined as any rooted, vascular plant that lives and grows below the water's surface (except for some flowering structures), in coastal or estuarine waters (RICRMC 2013). Eelgrass (*Zostera marina*) is the dominant SAV in Rhode Island, but widgeon grass (*Ruppia maritima*) also occurs in the state. These plants tend to form underwater "meadows" that provide food and shelter to numerous aquatic organisms, including scallops, crabs, geese, ducks, and numerous fish species. SAV also plays an important role in nutrient cycling and sediment stabilization.

Once widespread in Narragansett Bay, eelgrass populations have declined dramatically during the last century. Decreased water quality, most notably due to increased amounts of nitrogen pollution, can cause eelgrass to die off; however, sedimentation and shading can also cause beds to decline by depriving eelgrass of sunlight (RICRMC 2012). In a 2012 study, SAV was estimated to have increased by 23.6 percent in Narragansett Bay from 2006 to 2012; although the researchers state this result should not yet be interpreted as a definitive upward trend for SAV until additional years of data are collected (Bradley et al. 2012). In a follow-up study published in 2016, SAV (91% eelgrass) acreage declined by as much as 52% between 2012 and 2016 (Bradley et al. 2017). Because it is such a critical component of the coastal ecosystem, SAV is protected under Section 300.18 of the RICRMP, *Submerged Aquatic Vegetation and Aquatic Habitats of Particular Concern*. Section 300.18 establishes that "all impacts to SAV and SAV habitat shall be avoided where possible and minimized to the extent practical," and outlines several policies for protecting SAV beds (RICRMC 2012).

Known locations of SAV beds near NAVSTA Newport are shown in Figure 4-2, along with other coastal resource information.

In order to better manage coastal and marine environments, NAVSTA Newport has established a baseline condition of the installation's nearshore environment through a variety of surveys including: marine fish surveys, benthic surveys, SAV mapping, and a marine mammal survey (Navy 2017). A repeat survey of nearshore conditions, or surveys targeting more specialized areas and/or species within the nearshore environment, is expected to occur every 10 years. For both pelagic fish (those species that feed primarily from the water column) and demersal fish (species that are primarily bottom-dwelling), surveys should encompass at least one annual cycle to assess the presence of migratory species throughout the year. Implementation of this project will ensure compliance with the requirement for the installation to collect baseline flora/fauna inventories that are to be included in the INRMP. In addition, the information collected will be used to fill in important informational gaps in understanding the roles of the various species and habitats occurring within the nearshore environments of the installation. Collected data will inform management actions for federally managed fish species, known and proposed threatened and endangered species (e.g., Atlantic sturgeon which is federally threatened and state endangered), various migratory birds, and cetaceans.

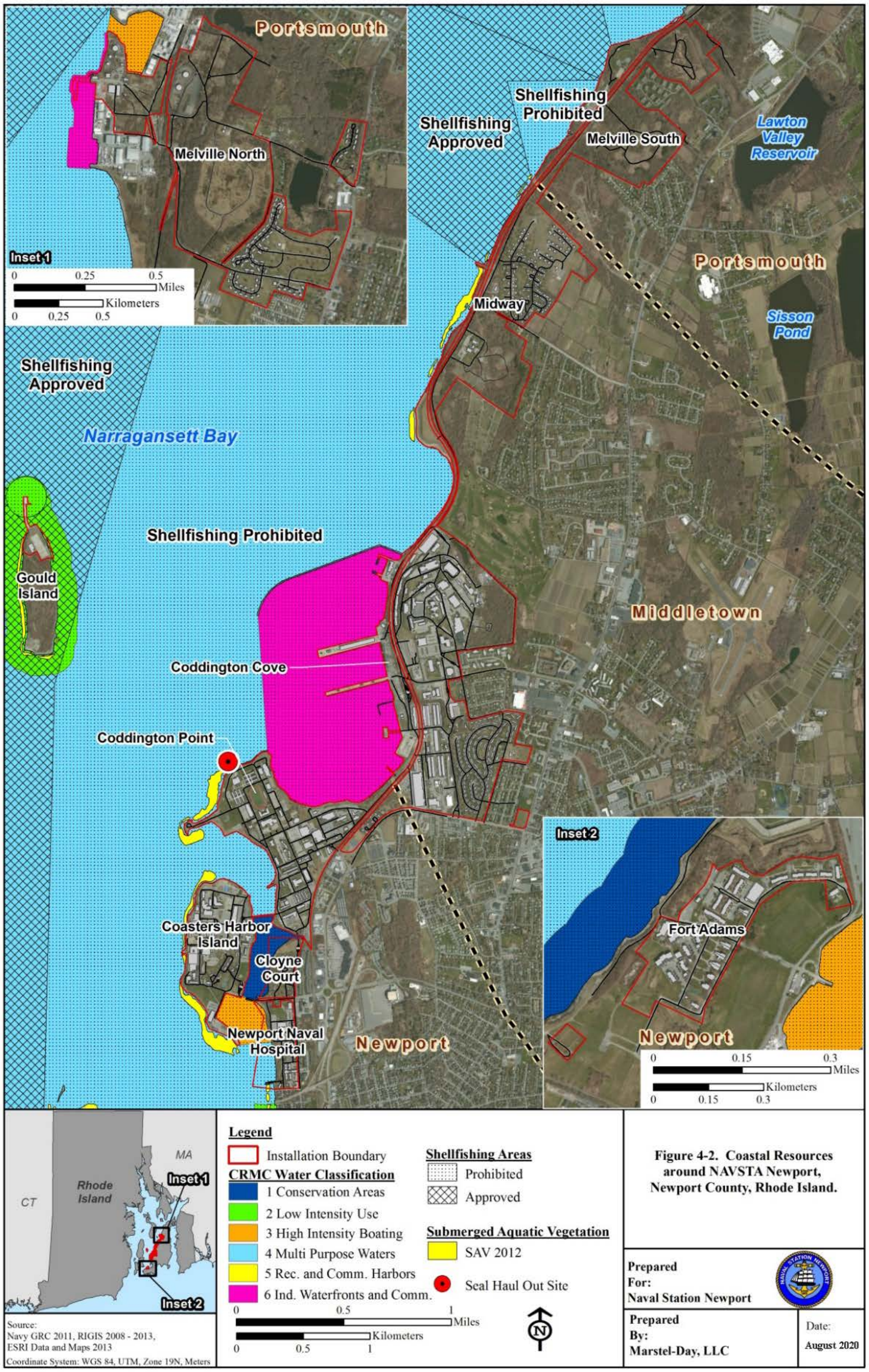

Figure 4-2. Coastal Resources around NAVSTA Newport, Newport County, Rhode Island.

SAV is critical to sustaining nearshore ecosystems; NAVSTA Newport should monitor SAV beds regularly. The RICRMC recommends that SAV surveys be carried out when SAV beds are at their peak biomass, which likely occurs between 01 July and 15 September (RICRMC 2012). Further guidance on conducting SAV restoration can be found in *SAV Handbook: A Guide for Restoring SAV on DOD Installations* (DOD and USACE 2005). In addition, NAVSTA Newport should conduct a shoreline restoration assessment to assess the feasibility of structures such as living shorelines or oyster reefs, that could then be constructed as a separate project.

4.3 VEGETATION MANAGEMENT

Vegetation management is an important component of natural resources management at NAVSTA Newport. The installation includes many areas that must have routine vegetation maintenance and removal for safety reasons. Developed areas including activity buildings, residential areas, and recreational areas require landscaping to maintain a neat appearance and reduce safety issues arising from overgrown vegetation.

4.3.1 Landscaping and Grounds Maintenance

In addition to benefiting safety and enhancing the visual appeal of the installation, the installation's grounds maintenance program can be integrated with the INRMP objectives to benefit natural resources, primarily by implementing beneficial landscaping concepts (see 4.3.2 below) and providing wildlife habitat. This integrated vegetation management approach can encourage the establishment of certain vegetation communities that are also beneficial to migratory birds and pollinators (e.g., bees and butterflies). Beneficial landscaping, such as planting native species to reduce water and nutrient demands, and increased use of shade trees and protective vegetation are encouraged. NAVSTA Newport recognizes these benefits and has done landscaping around the buildings and parking lots in an effort to minimize the high maintenance costs of mowing, increase shade (to reduce utility costs), and improve the aesthetics throughout the working environment.

Guidance for grounds maintenance practices on Navy properties is provided in DODI 4715.03 (DOD 2018), the 1994 President's Executive Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds (60 Federal Register 40837), EO 13148, and Greening the Government through Leadership in Environmental Management (21 April 2000). DODI 4715.03 states that each installation shall, to the extent practicable, use regionally native plants for landscaping and other beneficial techniques (DOD 2018).

NAVSTA Newport maintains its grounds through mechanical and chemical means. Mechanical means include trimming, mowing, and pulling plants; chemical means include the use of herbicides (including Roundup Pro®, 4-Speed XT®, and Drive®, among others) and fertilizers. Vegetation maintenance takes place routinely along sidewalks, roads, fencelines, and fire hydrants, in order to preserve visibility and access. Most of these areas are maintained by the public works department, whereas most other vegetation maintenance on the installation is carried out by contracted staff. Turf areas, ornamental plant beds, and LID treatment systems are also maintained regularly, generally by contractors.

Ample opportunities exist to provide natural resource benefits, or minimize detrimental impacts, through landscaping and grounds maintenance activities. To fully address how to integrate natural resource objectives into these activities, an Installation Conservation Design Plan can be developed to outline BMPs and also to pinpoint where habitat enhancement for wildlife and pollinators can occur on the installation (e.g., the tank farms can be enhanced to benefit regional biodiversity).

The following is a recommended project:

- Develop an Installation Conservation Design Plan. This plan will address:
  - ➢ beneficial landscaping in grounds maintenance areas (see Section 4.3.2 below);
  - ➢ stormwater management practices (including low-impact development) (see Section 4.1.1.2);
  - ➢ no-mow areas (see Section 4.3.3 below);
  - ➢ urban forestry (see Section 4.3.4 below);
  - ➢ enhancement of landscaped grounds for wildlife and pollinators; and
  - ➢ restoration/management of natural areas for wildlife and pollinators (see Section 4.3.5 and 4.3.6 below).

4.3.1.1 Beneficial Landscaping

The concept of beneficial landscaping emphasizes

- using regionally native plants;
- using construction practices that minimize adverse effects on the natural habitat;
- preventing pollution by reducing fertilizers and pesticides, using IPM techniques, recycling green waste, and minimizing runoff; and
- practicing soil and water conservation (EPA 2016b).

The use of regionally native plant species, rather than non-native species, is generally better suited for local site conditions because it reduces the need for intensive maintenance and the use of fertilizers and pesticides. Native plant species are also less likely to become invasive pests than non-native species, and serve as better sources of food and cover for native wildlife.

Given its location on Narragansett Bay, NAVSTA Newport must exercise caution when applying herbicides and fertilizers that may wash into the Bay. In using herbicides, maintenance crews are asked to use those with a lower rate of application, when possible, and/or use spit treatments to minimize the amount of herbicide being used. Maintenance contractors are liable for any non-target effects of the herbicides they use, which may result in cleanup, replanting, or reseeding. Planning around seasonal variations in weather can help to reduce chemical runoff from fertilizers. Fertilizing fields during the rainy spring season increases the likelihood that excess fertilizer will be washed into Narragansett Bay. For this reason, fall is a preferable time for this kind of maintenance.

The following are management actions for beneficial landscaping:

- Avoid use of fertilization in lawns and other grounds maintenance areas in the spring season (to prevent nutrient pollution into the Bay), except for new plantings, to help them become established; and
- use regionally native plant species and beneficial landscaping practices. Supplemental plantings of native trees and shrubs in maintained open areas and around buildings and recreational areas should be conducted, where consistent with current and planned land uses, to help enhance habitat diversity and meet wildlife management objectives.

4.3.1.2 No-Mow Areas

To protect resources, NAVSTA Newport limits maintenance in some areas of the installation (Figure 4-3). The reservoir in the Melville North area of the installation allows only for the trimming of trees, and several stretches of wetlands in the Melville South area are left undisturbed. Additional areas without grounds maintenance exist in the southern regions of the installation.

Reducing vegetation maintenance reduces pollution from fertilizers and pesticides, cuts emissions from gas-powered machinery, and allows for a greater abundance of plant life.

The management action for no-mow areas is:

- Evaluate whether any current no-mow areas can provide suitable wildlife and pollinator habitat. If so, add a project in the next annual update to enhance these areas through techniques such as native plantings, bird/bat box installation, and/or invasive plant control.

4.3.1.3 Urban Forestry

Urban forestry provides an opportunity to incorporate trees that provide valuable ecosystem services into urban and suburban fabrics. Urban forests can include parks, gardens, greenways, and landscaped streets and boulevards. These areas filter air and water, reduce stormwater runoff, and decrease heat-island effects (USDA-FS 2020). Many localities and military installations have adopted tree ordinances to preserve these ecosystem services and protect important tree species. Such policies often require approval from appropriate staff before trees are removed, and entail a replacement ratio higher than 1:1 for any trees that are removed.

In 2012, Fort Belvoir adopted a Tree Removal and Protection policy that could serve as an example for NAVSTA Newport. The policy requires review and written approval by the installation's director of public works before tree removals or construction projects that may affect tree survival. Unless a project is given special exemption, each tree removed as a result of maintenance or construction is to be replaced by two trees. This policy compensates for the removal of larger trees and for potential mortality of the newly planted trees. See Appendix P for the full text of Fort Belvoir Policy Memorandum #27, Tree Removal and Protection.

Figure 4-3. No Maintenance Areas at NAVSTA Newport Newport County, Rhode Island.

The management action is the following:

- Adopt a Tree Removal and Protection Policy that will require approval by the Natural Resources Manager prior to any tree removals during site construction, landscaping, and grounds maintenance activities, and include a replacement ratio for each tree removed.

4.3.2 Natural Areas

Natural areas, or undeveloped lands, exist primarily within the tank farms. However, patches of natural areas exist throughout the installation (see Figure 2-11 [Ecological Communities at NAVSTA Newport]). The vegetation communities of these natural areas include:

- salt marshes;
- maritime shrublands;
- emergent marshes;
- shrub swamps;
- old fields;
- northern hardwood forest;
- mixed oak/white pine forest; and
- ruderal forest (i.e., successional forests on disturbed lands).

These natural areas can be proactively managed to restore native habitats for regionally protected species, migratory birds, other wildlife, and pollinators. As part of the Installation Conservation Design Plan, NAVSTA Newport will incorporate management actions for how to restore and manage these natural areas to encourage native biodiversity and to control invasive species.

4.3.3 Pollinators

World-wide, pollinators affect 35 percent of all crop production, boosting outputs for 87 of the leading food crops (Food and Agriculture Organization of the United Nations 2013). Recently, the Navy has recognized the important ecological role played by pollinators and has encouraged installations to foster pollinator habitats. Pollinators include bees, butterflies, moths, beetles, flies, hummingbirds, and bats. As a group, pollinators are threatened worldwide by habitat loss and fragmentation, pesticides, disease, and parasites.

Rhode Island bee pollinators include honey bees, bumble bees, squash bees, Mason bees, sweat bees, carpenter bees, and mining bees. Additional pollinators in the state include pipevine swallowtail butterflies, drone flies, and ruby-throated hummingbirds (The Heinz Center 2013). Use of native plants is preferable because these are usually adapted to Rhode Island’s growing conditions, and native pollinators evolved with these plants (USDA-NRCS n.d.).

As part of the Installation Conservation Design Plan, NAVSTA Newport will develop and implement management actions in the following ways to establish pollinator habitat:

- identifying areas in landscaped grounds, grounds maintenance areas, and no-mow areas that can be enhanced with native plants to establish pollinator gardens (in landscaped and grounds maintenance areas) and habitats (in no-mow areas);
- identifying how natural areas can be managed to support pollinator populations; and
- developing BMPs for landscaped grounds, grounds maintenance areas, no-mow areas, and natural areas in regard to maintenance and management (e.g., use of pesticides).

NAVFAC has established pollinator friendly BMPs for the application of pesticides (NAVFAC 2014); these recommend using IPM approach by:

- monitoring and assessing pest populations to determine if levels warrant control; and
- selecting the best combination of pest control options that minimize risks to pollinators.

Pollinator friendly BMPs include:

- reading and following pesticide labels;
- being alert to blooms;
- timing pesticide applications correctly;
- avoiding residual toxicity;
- checking weather;
- using less hazardous pesticides;
- minimizing drift;
- communicating with beekeepers; and
- learning about local regulations/programs.

4.4 FOREST MANAGEMENT

There is no forest management on NAVSTA Newport.

4.5 WILDLAND FIRE MANAGEMENT

The historical wildfire regime, ignited naturally, in Rhode Island was characterized by a 35-200 year frequency, and wildfires were mostly low-intensity understory fires (USDA-FS 2011). Native Americans periodically burned the forest understory to maintain open forests that were conducive to certain tree species, game habitat, and agriculture, particularly around Narragansett Bay (URI Cooperative Extension n.d.). Currently, wildland fires can occur anytime of the year in Rhode Island; but springtime (March through May) is when the most destructive wildfires tend to occur because forest fuel loads are typically dry (and dry quickly after rain events) and the weather is characterized by low humidity (RIDEM n.d.[b]).

Wildland fires in Rhode Island are managed by the Department of Environmental Management's Division of Forest Environment ("Forestry"), and wildland fire control is challenged by a high degree of wildland urban interface. RIDEM Division of Forest Environment (RIDEM DFE) is responsible for the statewide forest fire protection plan, which is included in the *Rhode Island Forest Resource Management Plan* (RIDEM DFE 2005). Forestry provides forest fire protection on state lands and assists rural volunteer fire departments with brush fire suppression. Also, Forestry occasionally conducts prescribed burns in selected state management areas to control underbrush and enhance habitat. The USFWS also conducts prescribed burns on the properties it manages in Rhode Island.

Although prescribed burns are not conducted at NAVSTA Newport, emergency fires are handled by the NAVSTA Newport Fire Department. Wildland fire potential is low on the installation, but the installation's five imploded or remaining tank farms may pose a fire risk. Fuel residues left in the tanks or the soils surrounding them may increase the chances of fire. Several tanks are surrounded by dense invasive vegetation, which adds to potential fire fuel load and makes the Tank farms potentially more vulnerable to wildfires. The control of invasive plants adjacent to the Tank farms will help reduce the wildland fire risk.

4.6 FISH AND WILDLIFE MANAGEMENT

The purpose of fish and wildlife management on NAVSTA Newport is to protect, conserve, and manage fish and wildlife resources at a level that is compatible with the military mission and federal and state laws. Management guidelines should not necessarily optimize the installation for any one species, but should instead provide a diversity of habitats for a variety of species. The following laws and regulations apply to managing fish and wildlife at NAVSTA Newport:

- ESA of 1973 (P.L. 93-205) and amendments of 1988 (P.L. 100-478)
- Fish and Wildlife Coordination Act (Public Law [P.L.] 85-654)
- Fish and Wildlife Conservation Act (16 USC § 2901-2912)
- Lacey Act of 1900 (16 USC §§ 3371-3378) as amended by the Lacey Act of 1981
- Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006
- Marine Mammal Protection Act of 1972 (PL 92-522; 16 USC § 1361–1421; 86 Statute 1027) as amended through 1996
- MBTA (16 USC § 703–716)
- Rhode Island State Fish and Game Laws
- SAIA (16 USC § 670 a)

4.6.1 Wildlife Management

Wildlife population management is a critical component of the NAVSTA Newport INRMP. It is equally important to, if not more important than, habitat management because habitat management will prove futile if wildlife populations exceed their carrying capacity. Some wildlife populations need to be managed because species become too rare, while others need to be managed because species are overly-abundant. The Rhode Island Comprehensive Wildlife Strategy (RIDEM DFW 2015) lists some of the leading threats to Rhode Island's Fish and Wildlife:

- habitat loss and fragmentation from lack of conservation planning and coordination (i.e., resulting in land conversion)
- habitat loss from inadequate-sized reserves (including poor landscape context, loss of connectivity, and so forth)
- habitat fragmentation from lack of focal area approach to conservation
- lack of greatest conservation need species and key habitat data needed for incorporation into the Rhode Island comprehensive strategy
- lack of research to guide threat assessment and prioritization of conservation planning
- lack of strategy to implement landscape-level biodiversity and water quality/quantity monitoring to support planning and assessment
- lack of strategy to support priority research
- lack of advocacy for environmental review
- lack of authority from, and enforcement of, current regulations
- lack of advocacy for comprehensive wildlife conservation
- broad-scale temporal and spatial climate change

Not all species are threatened by increasing human influences. Some species, such as deer, raccoons, and pigeons, actually flourish in disturbed landscapes. When a wildlife species becomes overly abundant, it can lead to increased human-wildlife conflicts.

With respect to general wildlife management, the following management action and projects are planned for NAVSTA Newport:

- Utilize BMPs to reduce the risk of introducing or spreading invasive species (see Section 4.9).
  - ➢ Conduct annual acoustic monitoring for bats using full spectrum bat detectors.
  - ➢ Enhance wildlife habitats by installing bat and bluebird boxes.
  - ➢ Promote pollinator habitat.
  - ➢ Conduct a stream and riparian habitat condition assessment to identify areas in need of restoration.
  - ➢ Restore priority stream reaches and riparian areas.

Invasive species can degrade the quality of habitat on NAVSTA Newport. For example, the shrubs and grasses present at the tank farms are used for nesting and foraging by birds, amphibians, and small mammals. However, the value of this habitat may be degraded by overgrowth of invasive, non-native plant species. Thinning invasive plants, while also proactively restoring native plants, can help enhance the quality of the tank farms for wildlife, and utilizing BMPs as described in Section 4.9.

Conservation, or beneficial, landscaping includes planting native plant species, reducing the use of chemical fertilizers and pesticides, and minimizing bare soil (http://www.envirolandscaping.org/conservation.htm). Conservation landscaping can attract pollinators, increase food resources for wildlife, and provide habitat. Conservation landscaping at NAVSTA Newport could include building bird and bat boxes in appropriate places. For more information, see Section 4.3, *Vegetation Management*, of this INRMP.

Stream habitat restoration may include conducting a stream condition assessment to prioritize areas in greatest need of bank stabilization, riparian buffer restoration, and in-stream habitat restoration. Undertaking these activities will improve habitat quality for species that spend all or part of their life cycles in those streams, and would also improve the quality of water entering Narragansett Bay, benefitting bay-dwelling species as well.

4.6.1.1 Deer

Until recently white-tailed deer were relatively rare in Rhode Island but changes in the landscape, most notably a resurgence in the amount of secondary forest cover and a lack of natural predators, have led to dramatic increases in the deer population (RIDEM DFW n.d.[d]). According to the RIDEM DFW, there were only 662 white-tailed deer in the state in 1941; by 2004, there were an estimated 15,800 across the state (RIDEM DFW n.d.[d]). Deer are highly fecund and can achieve dense populations in a short amount of time, as evidenced by the fact that their population in Rhode Island increased by over 2200 percent in just 63 years. Deer can be voracious browsers and can pose a threat to native vegetation, and can cause ecological damage to forest habitats by over-browsing if their population becomes too large. When over-populated, deer herds can pose a public safety and health hazard through auto strikes, nuisance complaints, and tick borne diseases (Tefft 2018). In Rhode Island, hunting remains the most effective method of deer population management (RIDEM DFW n.d.[d]). In 2010, RIDEM revised its primary management goals for the state-wide deer populations:

- Provide a sustainable quality deer management program that maintains deer populations that are ecologically sound.

In addition, RIDEM has annually monitored the state deer herd for Chronic Wasting Disease (CWD) since 2002; no positive samples have ever been recorded, and Rhode Island is considered a CWD free state (RIDEM DFW n.d.[d]).

On NAVSTA Newport, the deer density is high, estimated at near 20 deer per square mile (Brian C. Tefft, Principal Wildlife Biologist, RIDEM; personal communication, 15 October, 2013). Currently, there are no deer management or hunting programs on NAVSTA Newport.

4.6.1.2 Coyotes

Coyotes are present on Aquidneck Island and have been observed on NAVSTA Newport (RINHS 2006). Although some view coyotes as a threat, others recognize coyotes as an important part of an ecosystem. Coyotes can offer wildlife viewing opportunities. Coyotes can provide beneficial regulation of small mammal populations (e.g., foxes, raccoons, skunks, woodchucks, squirrels, and mice). Generally, the sighting of a coyote is not a problem or threat to public safety (and no documented coyote attacks on humans have occurred in Rhode Island), but direct interactions with pets and humans do pose concerns. The state classifies coyotes as a protected furbearer under Rhode Island General Law (RIGL) section 20-16-1; pursuant to RIGL §20-1-12, RIDEM allows hunting and trapping to harvest coyotes for recreational, economical, and nuisance-related reasons (RIDEM DFW 2006).

The size of coyote populations is directly linked to resource availability. Oftentimes, when coyotes conflict with humans, it is because humans have been feeding coyotes, whether intentionally or not. Public education is critical to managing coyote-human conflicts at NAVSTA Newport. Narragansett Bay Coyote Study, a project of the Conservation Agency (The Conservation Agency 2014), prepared an educational pamphlet for NAVSTA Newport called the *Coyote Coexistence Guide* (see Appendix G). This guide advises people on several BMPs:

- never feed coyotes or leave food out that might attract them;
- never feed pets outside;
- guard any small pets, and keep them indoors at night;
- keep all pet cats indoors, and do not feed stray or feral cats;
- act big, mean, and loud to scare away any coyotes you see; and
- remember that feeding a coyote teaches it to approach people, which will likely result in the animal being euthanized (in other words, “A fed coyote is a dead coyote”).

NAVSTA Newport should continue to promote these BMPs and should make these informational pamphlets readily available. In addition, NAVSTA Newport should continue to manage the feral cat population, as described in Section 4.8.4, *Feral Cats*, because cats can both attract coyotes to human-occupied areas and bolster the coyote population by providing excess food. Finally, hunters should be reminded to remove all animal parts from the area because animal remains can attract coyotes.

In most cases, coyotes do not pose a threat to public safety or property; however, coyotes have the potential to become aggressive, or show signs of rabies or other diseases. NAVSTA Newport personnel should encourage the public to report any seemingly dangerous coyote to the NRM, and reports of dangerous coyotes should be shared with RIDEM immediately by calling (401) 789-0281 (DFW) or (401) 222-3070 (Law Enforcement). No hunting program exists on NAVSTA Newport for coyotes, but a coyote can be removed from the installation if it is deemed a nuisance. Further details about the RIDEM coyote policy can be found in Appendix G.

The following are recommended management actions regarding coyotes at NAVSTA Newport:

- educate the public in BMPs for minimizing human-coyote conflicts; and
- remove all feral cats from the installation.

4.6.1.3 Bats

Annual bat monitoring, along with regular acoustic surveys, could help natural resource managers better understand which species occur on the installation, when and where they occur, and how their population numbers are changing through time. As part of a proposed project, NAVSTA Newport has agreed to develop a comprehensive, post-construction avian and bat monitoring and protection plan. Installation staff can expand upon these efforts by monitoring bat populations at additional sites on the installation (i.e., sites not already being monitored as part of the proposed project).

To understand the bat population demographics at NAVSTA Newport, the recommended project and the management action are the following:

- develop a Bat and Bird Conservation Strategy;
- conduct acoustic monitoring for bats using full spectrum bat detectors every five years;
- conduct an annual installation-wide roost search during the summer for the presence of bats;
- conduct a mist-net survey for *Myotis* bat species in natural habitat areas; and
- ensure that the decontamination protocol recommended by White-Nose Syndrome.org is followed (White-Nose Syndrome.org n.d.).

4.6.1.4 Reptiles and Amphibians

Restoration of streams and wetlands, as described in Chapter 5 of this INRMP, will help improve breeding areas for amphibians at NAVSTA Newport. In addition, the following outreach project is recommended:

- Develop and print educational brochures or factsheets. A reptile and amphibian educational pamphlet will inform NAVSTA Newport residents, personnel, and visitors of the following:
  - ➢ no venomous snakes exist in Rhode Island. Snakes are a natural part of the ecosystem and should be left alone;
  - ➢ contact information for a professional who can safely remove snakes, in case people encounter a snake in a high-traffic area or near their dwelling;
  - ➢ under Rhode Island state law, it is illegal to possess most native turtle species, except for the common snapping turtle (RIDEM DFW n.d.[b]);
  - ➢ turtles should not be picked up, unless they are in immediate danger, and even so, they should be placed as close as possible to where they were found. Turtles are territorial and will attempt to return to their home range; in doing so they may encounter hazards, particularly roads (RIDEM DFW n.d.[b]);
  - ➢ sea turtles, if sighted, should not be disturbed or harassed in any way; and
  - ➢ contact information for personnel that the public can call if turtles are sighted on or near NAVSTA Newport.

RIDEM has a pamphlet that contains information about Rhode Island’s native snakes and advises the public on how to interact with snakes (see Appendix G).

4.6.2 Migratory Bird Management

The MBTA is the primary legislation in the U.S. established to conserve migratory birds. It implements the U.S. commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. The species of birds protected by the MBTA appears in Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13 [CFR 2000]). On 02 December 2003 the President signed the 2003 National Defense Authorization Act. The Act provides that the Secretary of the Interior shall exercise his/her authority under the MBTA to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense.

Congress defined military readiness activities as all training and operations of the Armed Forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Congress further provided that military readiness activities do not include:

- the routine operation of installation support functions, such as administrative offices; military exchanges; commissaries; water treatment facilities; storage facilities; schools; housing; motor pools; laundries; MWR activities; shops; and mess halls;
- operation of industrial activities; or
- construction or demolition facilities used for the purpose described in the above two bullets.

The final rule authorizing DOD to take migratory birds during military readiness activities was published in the Federal Register on February 28, 2007. The regulation can be found at 50 CFR Part 21. The regulation provides that the Armed Forces must confer and cooperate with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects of a military readiness activity if it determines that such activity may have a significant adverse effect on a population of a migratory bird species.

The requirement to confer with the USFWS is triggered by a determination that the military readiness activity in question will have a significant adverse effect on a population of migratory bird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, or to function effectively in its native ecosystem. A population is defined as, “a group of distinct, but coexisting individuals of the same species, whose breeding site fidelity, migration routes, and wintering areas are temporally and spatially stable, sufficiently distinct geographically (at some point of the year), and adequately described so that the population can be effectively monitored to discern changes in its status.” Assessment of impacts should take into account yearly variations and migratory movements of the affected species.

Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding (MOU) developed in accordance with Executive Order 13186, signed 10 January 2001, “Responsibilities of Federal Agencies to Protect Migratory Birds.” The

MOU between the DOD and the USFWS was signed on 21 July 2006. The MOU includes, but is not limited to, the following DOD responsibilities:

- obtaining permits for import and export, banding, scientific collection, taxidermy, special purposes, falconry, raptor propagation, and depredation activities;
- encouraging incorporation of comprehensive migratory bird management objectives in DOD planning documents;
- incorporating conservation measures addressed in regional or state bird conservation plans in INRMPs;
- managing military lands and activities other than military readiness in a manner that supports migratory bird conservation;
- avoiding or minimizing impacts on migratory birds, including incidental take and the pollution or detrimental alteration of the environments used by migratory birds; and
- developing, striving to implement, and periodically evaluating conservation measures for management actions to avoid or minimize incidental take of migratory birds, and if necessary, conferring with the USFWS on revisions to these conservation measures

4.6.2.1 Regional and State Bird Conservation Plans

The following regional and state bird conservation plans have been reviewed to ensure that this INRMP is consistent with conservation measures outlined in these plans:

Department of Defense Partners in Flight Strategic Plan (DOD PIF 2014): For migrant birds on DOD installations, this plan recommends the following types of management actions and projects on DOD installations:

- Inventory;
- on-the-ground management;
- education; and
- long-term monitoring to determine changes in migrant bird populations on DOD installations.

New England/Mid-Atlantic Coast Bird Conservation Region Implementation Plan (Atlantic Coast Joint Venture 2008): This plan identifies high-priority species and their habitats for residential and migratory birds for Bird Conservation Region 30 (of which Rhode Island is a part). The plan delineates important geographic areas, and describes priority monitoring and research needs.

Atlantic Coast Joint Venture Strategic Plan (Atlantic Coast Joint Venture 2009): The Atlantic Coast Joint Venture is a partnership focused on the conservation of habitat for native birds in the Atlantic Flyway and Atlantic Coast region. The plan provides a framework for collaboration between multiple state, federal, international, and NGO partners on how to conserve birds.

Northeast Regional Shorebird Plan (Clark and Niles 2013): Produced in partnership between the North Atlantic Shorebird Habitat Working Group and the New Jersey DFW, this plan establishes goals for managing habitats, conducting research, and educating the public about shorebirds in the North Atlantic region.

Mid-Atlantic/New England/Maritimes Waterbird Conservation Plan (Manem Waterbird Working Group 2006): Created by a partnership of over 200 organizations, including wildlife managers, scientists, policymakers, and educators, this plan provides information on species occurrence, conservation status, threats, and management measures needed for 74 species of waterbird in the region.

4.6.2.2 General Migratory Bird Management

Narragansett Bay is in the Atlantic flyway, which is a major bird migration route. The Atlantic flyway stretches over some of the most densely populated and developed areas of the U.S., which makes it critically important that natural areas and undeveloped lands be conserved and managed to support these species. Numerous bird species protected under the MBTA utilize the installation (see Section 2.3.7 *Fauna*); as a result, protection of existing habitat for many species of migrating landbirds and shorebirds is an important component of this INRMP. Although many of the lands within NAVSTA Newport are developed, habitats remain that are important to migratory birds for nesting, foraging, and providing migratory stopover habitat. These habitats include beaches, salt marshes, and maritime shrublands along the coast, wetlands such as emergent marshes and shrub swamps, successional fields and forests growing on disturbed lands, and small forest patches of northern hardwoods and mixed oak-white pine (see Figure 2-11).

The taking of migratory birds through hunting within the state is regulated by the RIDEM DFW (RIDEM DFW 2019). During annual INRMP reviews, the Navy must report any migratory bird conservation measures that have been implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds. NAVSTA Newport also coordinates with the USFWS for all impacts on migratory birds.

Migratory bird monitoring is ongoing at NAVSTA Newport. The DOD and USGS jointly developed a Coordinated Bird Monitoring Plan, which outlines procedures for bird monitoring, including study design, data collection methods, and data analysis. The plan also calls for data to be stored in a long-term repository, such as the Coordinated Bird Monitoring Database (CBMD). NAVSTA Newport staff should share their data with the CBMD; ideally, data should be checked for quality and then uploaded immediately following each field season.

The DOD PIF Program is another resource for advice on managing and sharing bird monitoring data. DOD PIF representatives assist installation NRMs in improving the monitoring and inventory, research and management, and education programs involving birds and their habitats (DOD PIF 2013).

In some instances, migratory birds may be injured on NAVSTA Newport (i.e. when birds become entangled in electrical wires). According to the USFWS, installation staff should contact a wildlife rehabilitator if an injured bird is discovered. However, it would be advisable for NAVSTA Newport to develop a more detailed standard operating procedure for reporting and handling injured birds. This will help ensure that appropriate staff are notified of the incident and that proper procedure is followed. Further, installation staff should receive training in the MBTA, including what constitutes a prohibited act, which migratory species are most likely to occur on the installation, and how to report an injured bird or a violation of the MBTA. In addition, DOD PIF provides guidance on how to reduce injuries and mortalities related to avian collisions with power lines through the creation of an Avian Protection Plan (Avian Power Line Interaction Committee 2012).

Thus, the following management actions and projects for managing migratory birds at NAVSTA Newport are planned:

- vegetation clearing should occur from November to March to the extent practicable;
- develop a standard operating procedure for handling injured birds;
- continue annual monitoring of birds (including migratory and rare, threatened, and endangered [RTE] species), and a point count survey every five years;
- add avian data to DOD Coordinated Bird Monitoring Database; and
- attend training on MBTA.

4.6.2.3 Neotropical Migratory Birds

For the breeding birds of North America, 341 species are neotropical migratory birds, identified as those species that breed in the U.S. and Canada but winter in Latin America and the Caribbean; populations of 127 of these species are in decline (American Bird Conservancy 2009). The primary threats to neotropical migratory birds include:

- fragmentation of their breeding, migratory staging/stopover, and wintering habitats due to development, land conversion, habitat degradation, and deforestation;
- collisions with buildings, communication towers, power lines, and wind turbines;
- poisoning by toxic chemicals such as pesticides;
- predation by introduced predators (e.g., feral/outdoor cats); and
- global climate change.

Creating a diversity of plant species in natural areas can improve the quality of NAVSTA Newport lands for neotropical migrants. Neotropical birds use plants for food, nesting materials, and cover from predators. Planting a variety of plant species can help ensure that sufficient resources are available to meet their needs. In addition, it is important to take neotropical migratory birds into account when conducting management activities. For example, pesticide use can remove the insect prey base of many songbirds, and the mechanical control (e.g., mowing) of invasive plants during the breeding season could remove nesting habitat for certain species. Finally, feral cats can pose a significant hazard to neotropical birds. Feral cats should be removed from the installation immediately. In addition, those possessing a pet cat should be required to keep it indoors and should have appropriate identification on their pet, in case it is lost. Moreover, installation staff should disseminate information about what people can do if they have an unwanted cat (i.e., to avoid the cat's being abandoned and left outdoors).

The following management actions will improve the quality of NAVSTA Newport installation lands for neotropical migratory bird species:

- take into account the presence, or suspected presence, of neotropical migrants during both breeding and migratory seasons when managing invasive plants, or conducting other disruptive activities in natural areas; and
- remove feral cats from the installation and educate the public about keeping cats indoors (see Section 4.8.4).

4.6.2.4 Migratory Waterfowl and Shorebirds

Migratory waterfowl and shorebirds may use beaches and wetlands of NAVSTA Newport, as well as the offshore areas that border the installation. Management action for the federal and state protected species of piping plover, American oystercatcher, and roseate tern are discussed under Section 4.7.

4.6.3 Marine Wildlife Management

Marine mammals include any ocean dwelling mammal, such as whales, sea otters, or dolphins, or any animal that primarily lives in the ocean, such as polar bears. Worldwide, populations of many marine mammals have declined over the past century. Some of the main threats to marine mammals include accidental capture in fishing gear, habitat destruction or degradation, illegal hunting, pollution, underwater noise, and ship strikes (NOAA 2019). Under the MMPA, it is unlawful to "take" a marine mammal without authorization; depending on the species, authorization can come from the NMFS or the USFWS. Under the MMPA, to "take" is to "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect" marine mammals. Any action that produces sound underwater in areas occupied by marine mammals could constitute harassment and, therefore, must be evaluated by the appropriate agency. According to OPNAVINST 5090.1E, *Environmental Readiness Program*, all Navy requests for take authorizations must be coordinated with the Chief of Naval Operations Environmental Readiness Division (Navy 2019b). Detailed information on the MMPA take authorization process can be found on the NMFS' Office of Protected Resources website at https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.

As described in Section 2.3.7, harbor seals are the predominant marine mammal at NAVSTA Newport, and the only year-round marine mammal resident in Narragansett Bay (NAVSTA Newport 2011a**).** To protect harbor seals and ensure compliance with the MMPA, NAVSTA Newport will continue to enforce the following rules:

- prohibit access to the breakwater.
- limit marine traffic near harbor seals by enforcing the Security Zone within Coddington Cove; and

- protect harbor seal habitat by implementing the SPCC plan to reduce risk of environmental pollution (see Section 4.1.1.3), and continue BMPs relating to stormwater management.

Operations at NAVSTA Newport are not known to negatively affect marine mammals; however, some activities, such as in-water construction, may require consultation with the NMFS or USFWS. Interim Environmental Policy No. 10-001 provides the following guidance for MMPA compliance for in-water construction:

> "Installation Environmental Program Managers (IEPMs), in consultation with their installation natural resources (NR) staff, should review planned construction projects that have an in-water component to them such as pile driving, removal, demolition, or dredging, and the potential for marine mammals to be present in the vicinity of the action area. If possible, IEPM's should look programmatically across their region to determine if there are multiple in-water construction projects in the same general vicinity and/or if there are projects that would occur sequentially over a number of years in the same general vicinity. If projects are identified and marine mammals are present, IEPMs shall coordinate with/contact their installation NR staff and/or Facility Engineering Command (FEC) environmental planning and conservation product line coordinator (PLC) to review the action for MMPA compliance. The installation NR staff/PLCs shall then make a recommendation to the IEPM if an MMPA authorization (i.e., Incidental Harassment Authorization [IHA] or Letter of Authorization [LOA]) is required for the action. NAVFAC Atlantic and Pacific marine resources experts are available to provide assistance in making this determination. The IEPM shall consider the lead time to obtain an MMPA permit. MMPA website notes that it takes 4–8 months for NMFS to issue an IHA and 8–18 months to issue an LOA. The time starts when NMFS issues an official "Notice of Receipt" of the request. Typical time lines, based on past Navy request, are 12 months for an IHA and 18–24 months for an LOA."

- MMPA compliance should be included in the planning requirements of an environmental checklist for in-water construction projects.

Stranding occurs when an animal is found alive or dead on a beach, or else found floating dead in open water. Given its location on Narragansett Bay, it is possible that some marine mammals may become stranded on coastal areas of NAVSTA Newport. The NMFS has established several marine mammal stranding centers to assist stranded or beached animals.

In the event that this occurs, NAVSTA Newport personnel should adhere to the protocol established by the CNO (N45) (Navy 2006b) Environmental Readiness Division. These management actions apply to any stranded marine mammal or sea turtle that appears to be injured, disoriented, or dead.

- The installation commander will immediately contact the NMFS regional stranding coordinator in the event of a live or dead marine mammal stranding at the installation, with notification to the CNO Environmental Readiness Division occurring immediately thereafter. The NMFS regional stranding coordinator for the Northeast region is Mendy Garron, who can be reached at (978) 282-8478.

- In addition to contacting the NMFS regional stranding coordinator and notifying the CNO Environmental Readiness Division, the Northeast Region Stranding Network Marine Mammal and Sea Turtle Stranding and Entanglement Hotline will be contacted at 866-755-6622. The members of this network are authorized by federal law to respond to marine mammal and sea turtle strandings. Mystic Aquarium in Mystic, Connecticut is the NOAA Fisheries' authorized responder to rescue stranded marine mammals and sea turtles in the vicinity of NAVSTA Newport. Mystic Aquarium can be reached at (860) 572-5955.
- Monitor the animal from a safe distance. Remain a minimum of 100 yards from the stranded animal. Crowding the animal is unsafe for the observer as well as the animal. Do not touch the animal, alive or dead, because wild animals can carry many diseases, parasites, and bacteria, some of which can be transmitted to humans. Do not attempt to push the animal back into the water, and if it goes back into the water on its own, do not attempt to follow after or swim with it.
- Carefully observe the animal. Observe the position of the alive or dead animal and monitor its breathing. Wait for responders from the NMFS and or the Northeast Stranding Network to arrive and direct them to the animal. Relay all observations to the responders so that they can provide the best possible care for the stranded mammal or sea turtle.

In 2006, NAVSTA Newport and NOAA signed a Memorandum of Agreement (MOA) to allow NOAA staff, contractors, and volunteers to utilize NAVSTA Newport facilities to conduct necropsies on whales found in the region. A copy of this MOA can be found in Appendix S.

4.6.4 Fisheries Management

4.6.4.1 Fishing

The Fish and Wildlife Conservation Act (Non-game or Forsythe-Chafee Act) of 1980 sets forth general management guidelines for fish and wildlife resources by encouraging all federal departments and agencies to utilize their statutory and administrative authority to conserve and promote conservation of non-game fish and wildlife, and their habitats. In addition, two other federal laws apply to the management of fish and wildlife resources: the Lacey Act of 1900, as amended by the Lacey Act of 1981, and the Magnuson-Stevens Fishery Conservation and Management Act, as amended in 1996, and as reauthorized under the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSA). It is DOD policy to allow fishing on military installations, provided that such activities are in accordance with DODI 4715.03 (DOD 2018), OPNAVINST 5090.1E (Navy 2019b), OPNAV M-5090.1 (Navy 2019a), and relevant state and federal regulations. For Rhode Island, those regulations include Rhode Island Marine Fisheries Statute and Regulations Part VII, the State of Rhode Island Fish and Wildlife Freshwater and Anadromous Fishing Regulations for the current season, and the current year's Rhode Island Freshwater Fishing Abstract.

NAVSTA Newport Instruction 5090.26B, *NAVSTA Newport Recreational Fishing Procedures* (Appendix O) describes roles and responsibilities with respect to recreational fishing at the installation (NAVSTA Newport 2014a). Fishing is prohibited at the IRP sites and on Toner Bridge (see Figure 4-7 in section 4.11 *Outdoor Recreation*). Refer to Section 4.11.2, *Fishing and Boating*, for more information on the fishing program.

4.6.4.2 Fish Habitat

In addition to regulating fish harvest, NAVSTA Newport is also tasked with protecting fish habitat. As part of the MSA, the NMFS, in cooperation with regional fisheries management councils, establishes criteria for EFH for managed species. EFH includes all types of aquatic habitat where fish spawn, breed, feed, or grow to maturity. The MSA protects EFH by requiring all federal agencies to consult with the NMFS on all actions or proposed actions that are either permitted, funded, or undertaken by the agency, and that may adversely affect EFH. An adverse effect means any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination, physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific, or habitat-wide impacts including individual, cumulative, or synergistic consequences of actions. As part of the consultation, the NMFS will provide recommendations for how the agency can avoid, minimize, or offset impacts on EFH. Importantly, the recommendations from the NMFS are only advisory—agencies are still authorized to act in contravention to the recommendations, though they must justify their actions in writing. The Navy Policy Regarding Essential Fish Habitat Assessments and Consultations (OPNAV M-5090.1 [Navy 2019a]) was updated in March 2011 to align with the compliance requirements of the Magnuson Stevens Act and contribute to consistency in EFH consultations across the Navy.

In order to conduct an EFH consultation with the NMFS, the federal agency must submit an EFH Assessment, which describes the proposed action; analyzes the effects of the action on EFH, the managed species, and associated species; and provides the agency's view regarding the effects of the action on EFH. The NMFS Greater Atlantic Regional Fisheries Office (GARFO) has developed a worksheet (Appendix H) to assist federal agencies in evaluating the impact of their actions on EFH and determining the magnitude of those impacts.

NAVSTA Newport will continue to implement the following projects to protect and improve fish habitat on the installation:

- restore priority stream reaches and riparian areas;
- continue monitoring the health and distribution of SAV; and
- continue restoration of SAV beds.

Restoring streams and riparian areas can benefit fish in two main ways. First, many fish species rely on streams as habitat for all or part of their life cycles. Species such as alewife, blueback herring, American shad, Atlantic salmon (*Salmo salar*), rainbow smelt (*Osmerus mordax*), and Atlantic sturgeon spawn in the rivers of Rhode Island. Second, restoring streams and riparian areas will improve the quality of water feeding into Narragansett Bay, and thus will benefit species living there.

The New England Fisheries Management Council, to which Rhode Island is a party, has designated EFH for a variety of species that occupy Narragansett Bay (see Table 2-6 in Section 2.3.7.4, *Fish*, for a species list). Of note is the fact that SAV has been designated as EFH for summer flounder (*Paralichthys dentatus*). Summer flounder is an important commercial species in Rhode Island, but populations have declined due to overfishing. Eelgrass is especially important for larval and juvenile flounder. The adults spawn along the Atlantic continental shelf, and the young migrate into coastal estuaries, including those found in Narragansett Bay (URI Environmental Data Center n.d.). Measures to protect SAV are identified in Section 4.2, *Coastal and Marine Management*.

4.6.4.3 Shellfish Management

Shellfish, including quahogs (*Mercenaria mercenaria*) and oysters, are important commercial species in Narragansett Bay. The state allows aquaculture operations for shellfish such as oysters, and a CRMC-permitted oyster farm is located near the installation. Rhode Island Sea Grant and the University of Rhode Island published a Rhode Island Shellfish Management Plan, which provides guidance on managing and protecting coastal areas for shellfish (Rhode Island Sea Grant 2014). Restoring streams and eelgrass beds at NAVSTA Newport will benefit shellfish by helping to improve water quality and increasing available habitat for these species.

4.7 THREATENED AND ENDANGERED SPECIES MANAGEMENT, CRITICAL HABITAT, AND SPECIES OF CONCERN

4.7.1 Endangered Species Act of 1973

The ESA of 1973 was enacted to provide a program of preservation for endangered and threatened species and to provide protection for ecosystems upon which these species depend for their survival. The ESA is administered by the USFWS (terrestrial and freshwater wildlife) and NOAA's NMFS (marine species). Section 7 of the ESA requires all federal agencies, in consultation with the USFWS or NMFS, to implement protection programs for designated species, to use their authorities to further the purposes of the act, and to ensure that their actions are not likely to jeopardize the continued existence of listed species as a result of destruction or adverse modification of critical habitat. Responsibility for the listing of an endangered or threatened species, and for the development of recovery plans, lies with the Secretary of the Interior and the Secretary of Commerce. The USFWS is responsible for implementing the ESA within the continental U.S.

An endangered species is in danger of extinction throughout all, or a significant portion of, its range. A threatened species is likely to become endangered within the foreseeable future throughout all, or a significant portion, of its range. Proposed species are those that have been formally submitted to Congress for official listing as endangered or threatened.

In addition, the USFWS identifies species that are candidates for possible addition to the List of Endangered and Threatened Wildlife and Plants under the ESA (50 CFR 17.11-17.12 2013a). The USFWS maintains a candidate list to:

- provide advance knowledge of potential listings that could affect land planning decisions;
- solicit input to identify candidates not requiring protection or additional species that may require protection under the act; and
- solicit information needed to prioritize the order in which species will be proposed for listing. Candidate species have no legal protection under the ESA.

When the USFWS initiated a court-ordered effort to designate critical habitat for all federally listed species, the DOD became concerned that the designation of critical habitat on military lands would add an excessive amount of burden (through administrative compliance and consultation requirements) on military installations, with limited benefit afforded to listed species (Benton et al. 2008). In defense, the DOD argued that it was currently providing extensive protection to listed species through the formal consultation process with the USFWS and via conservation measures specified in installation INRMPs. To address this, the Defense Authorization Act for fiscal year 2004 (108th Congress 2003) granted the USFWS specific authority to exempt DOD lands from the designation of critical habitat, provided that a comprehensive and approved INRMP was in effect, the INRMP specifically addressed the conservation of species under consideration, and the INRMP was implemented.

4.7.2 Federally Protected and Candidate Species

In accordance with the ESA, NAVSTA Newport must protect and help recover any federally listed threatened and endangered species that occur on installation lands or waters. Further, NAVSTA Newport must avoid "taking" any listed species. Under the ESA, "take" includes harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting any threatened and endangered species, or attempting to do so. Staff at NAVSTA Newport is required to consult with USFWS or NMFS staff in advance of any activity that may result in the taking of a listed species. In such cases, the agency will work with installation staff to prevent or reduce takings, and, if appropriate, will issue an incidental take permit. Discussions and listing status of federally listed threatened and endangered species is included in Section 2.3.5.

The defined projects for threatened, endangered, and candidate species include:

- continuing annual monitoring of birds (including migratory and RTE species), and a point county survey every five years.
  - ➢ Giving a special emphasis on detecting piping plovers, roseate terns, red knots, and American oystercatchers.
- Conducting a mist-net survey for *Myotis* bat species (i.e., little brown bat and northern long-eared bat) in natural habitat areas every 5 to 8 years to show trends; and
- developing and printing educational brochures or factsheets.
  - ➢ For fishers and other recreational users to prevent accidental take of state and federal threatened, endangered, and candidate species, or other species of concern.

Specific management actions for threatened, endangered, and candidate species include the following:

- Implement the following for piping plover:
  - ➢ prohibit off-road vehicles during the breeding season;
  - ➢ require that dogs be leashed along beaches, in wetlands, and other coastal habitats;
  - ➢ manage beach areas to promote growth of native vegetation; and
  - ➢ remove trash and other debris from beaches.

- Consider adopting BMPs (see below) for creating and/or restoring New England cottontail habitat.

USFWS Headquarters recommends that the following conservation measures to all Federal agencies whose actions may affect the northern long-eared bat:

1. Perform northern long-eared bat surveys according to the most recent Range-wide Indiana Bat/ northern long-eared bat Summer Survey Guidelines. Benefits from agencies voluntarily performing northern long-eared bat surveys include:
   a. Surveys will help federal agencies meet their responsibilities under Section 7 of the ESA. The Service and partners will use the survey data to better understand habitat use and distribution of northern long-eared bats, track the status of the species, evaluate threats and impacts, and develop effective conservation and recovery actions. Active participation of federal agencies in survey efforts will lead to a more effective conservation strategy for the northern long-eared bat.
   b. Should the USFWS reclassify the species as endangered in the future, an agency with a good understanding of how the species uses habitat based on surveys within its action areas could inform greater flexibility under the ESA. Such information could facilitate an expedited consultation and incidental take statement that may, for example, exempt taking associated with tree removal during the active season, but outside of the pup season, in known occupied habitat.

2. Apply additional voluntary conservation measures, where appropriate, to reduce the impacts of activities on northern long-eared bats. Conservation measures include:
   a. Conduct tree removal activities outside of the northern long-eared bat pup season (June 1 to July 31) and/or the active season (April 1 to October 31). This will minimize impacts to pups at roosts not yet identified.
   b. Avoid clearing suitable spring staging and fall swarming habitat within a 5-mile radius of known or assumed northern long-eared bat hibernacula during the staging and swarming seasons (April 1 to May 15 and August 15 to November 14, respectively).
   c. Manage forests to ensure a continual supply of snags and other suitable maternity roost trees.
   d. Conduct prescribed burns outside of the pup season (June 1 to July 31) and/or the active season (April 1 to October 31). Avoid high-intensity burns (causing tree scorch higher than northern long-eared bat roosting heights) during the summer maternity season to minimize direct impacts to northern long-eared bat.
   e. Perform any bridge repair, retrofit, maintenance, and/or rehabilitation work outside of the northern long-eared bat active season (April 1 to October 31) in areas where northern long-eared bats are known to roost on bridges or where such use is likely.
   f. Do not use military smoke and obscurants within forested suitable northern long-eared bat habitat during the pup season (June 1 to July 31) and/or the active season (April 1 to October 31).
   g. Minimize use of herbicides and pesticides. If necessary, spot treatment is preferred over aerial application.

h. Evaluate the use of outdoor lighting during the active season and seek to minimize light pollution by angling lights downward or via other light minimization measures.
i. Participate in actions to manage and reduce the impacts of white-nose syndrome on northern long-eared bat. Actions needed to investigate and manage white-nose syndrome are described in a national plan the Service developed in coordination with other state and federal agencies.

Additional Conservation Actions Recommended by the New England Field Office for the NLEB

1. Designate caves and mines that are occupied by bats as smoke-sensitive targets. Avoid smoke entering these caves and mines any time of the year when federally listed bats are present.
2. Within 0.25 miles of known, occupied NLEB hibernacula, design timber harvest to maintain, enhance, or restore swarming, staging, roosting, and foraging habitat. The desired habitat condition is that these areas will feature structurally complex, resilient forest communities with a continuous supply of snags, culls, cavities, and other quality roosts.
3. Plan herbicide and other pesticide application to avoid or minimize direct and indirect effects to known, occupied bat hibernacula and maternity roosts.
4. Survey old buildings, wells, cisterns, bridges, and other man-made structures for bats before the structures are modified or demolished. If roosting bats are found, modify or demolish these structures outside the active season (April 1 to October 31) and evaluate the need for alternative roosts.
5. Avoid cutting or destroying known, occupied maternity roost trees unless they are a safety hazard.
6. Where needed to provide drinking sources for bats, create small wetlands or water holes.

A survey for New England cottontail, as well as for associated habitat, will inform Natural Resources staff of where the species may occur and where management activities, such as restoring habitat or restricting access, should be carried out. The New England Cottontail Regional Executive Committee, which includes representatives from the USFWS, NRCS, Wildlife Management Institute, RIDEM, and wildlife agencies from Connecticut, Maine, Massachusetts, and New Hampshire, produced a guide called *Best Management Practices: How to Make and Manage Habitat for the New England Cottontail* (NEC Regional Technical Committee 2013). This guide can serve as a resource for managing NAVSTA Newport habitat for the benefit of New England cottontail. Importantly, according to the guide, habitat suitable for the New England cottontail is also beneficial for 137 other wildlife Species of Greatest Conservation Need in the New England region, so managing habitat for New England cottontail may also improve habitat quality for many other species at NAVSTA Newport.

As a general rule, educating recreational users about how to identify federal or state-listed threatened, endangered, or candidate species, or other species of concern, can help prevent accidental takes. Moreover, educational materials should also instruct people on how to report a sighting of one of these species.

4.7.3 State Protected Species

The Rhode Island State Endangered Species Act, under Title 20 of the General Laws of the State of Rhode Island, authorizes the director of RIDEM to designate species as Endangered, meaning that they are in imminent danger of extirpation from the state. State-listed species are afforded the following protection under § 20-37-3 of the State of Rhode Island General Laws (State of Rhode Island n.d.):

> "No person shall buy, sell, offer for sale, store, transport, import, export, or otherwise traffic in any animal or plant or any part of any animal or plant whether living, dead, processed, manufactured, preserved, or raw if the animal or plant has been declared to be an endangered species by either the United States secretaries of the interior or commerce or the director of the Rhode Island department of environmental management. The only exception to these prohibitions shall be for purposes of scientific research or educational display, either of which must be done by or under the formal supervision of a legitimate college or university and then only upon the issuance of a special permit for each individual excepted species. The permit may be issued by the director of environmental management. The permit will be denied by the director, if in his or her opinion issuance of the permit would not be entirely justified or entirely in the best interests of preservation and protection of the species involved. Under no circumstances will a permit be granted for exception if commercial considerations are involved in any way."

The Rhode Island Natural Heritage Program and the Rhode Island Endangered Species Program collect information about the distribution of species across the state and participate in annual reviews of the state endangered species list.

As discussed in Section 2.3.5, the American oystercatcher is a state protected species that has been observed on NAVSTA Newport, though no nests have been found. The following project will be considered if funding is available at NAVSTA Newport:

- Continue annual monitoring of birds (including migratory and RTE species), and conduct a point count survey every five years, placing special emphasis on detecting piping plovers, roseate terns, red knots, and American oystercatchers.

4.7.4 Critical Habitat

No critical habitat currently has been designated on NAVSTA Newport or in its surrounding waters. The ESA directs both the NMFS and USFWS to designate critical habitat for listed species. Critical habitat is defined as a specific geographic area that is essential for the conservation of a threatened or endangered species. The ESA requires that federal agencies consult with either the NMFS or USFWS if an agency action may adversely modify critical habitat. In 2004, Congress amended the ESA to specify that critical habitat should not be designated on land controlled by DOD if it is determined that the INRMP provides sufficient benefit to the species in question.

Atlantic sturgeon range from Labrador, Canada all the way to Cape Canaveral, Florida. They are a wide ranging fish and could potentially be found in any river or estuary on the East Coast. Thus, NAVSTA Newport works with NMFS to ensure that the installation is supporting adequate habitat for the species. NAVSTA Newport has consulted with NMFS and confirmed that areas on or in the immediate vicinity of NAVSTA Newport have not been considered for designation of critical habitat for Atlantic sturgeon.

Additionally, even if the installation or its surrounding waters are designated as critical habitat in the future, the Navy could qualify for exemption due to the fact that the management measures included in this INRMP will benefit protected species if implemented.

4.7.5 Species of Concern

Species of concern are native species that do not meet the criteria to be state endangered or threatened, but nevertheless are identified by the Rhode Island NHP due to their rarity or vulnerability. Observations of protected and rare species at NAVSTA Newport are shown in Figure 4-4.

4.7.6 Rare Ecosystems

Based on the RINHS (2006), NHP is not aware at the current time of any rare plants or animals or ecologically significant natural communities on NAVSTA Newport. The intense alteration and industrial-related land use patterns precludes classifying any habitats present in NAVSTA as “ecologically significant natural communities.” The nearshore area does have unique habitat for a variety of plants and animals, especially eelgrass, the primary SAV species in Narragansett Bay.

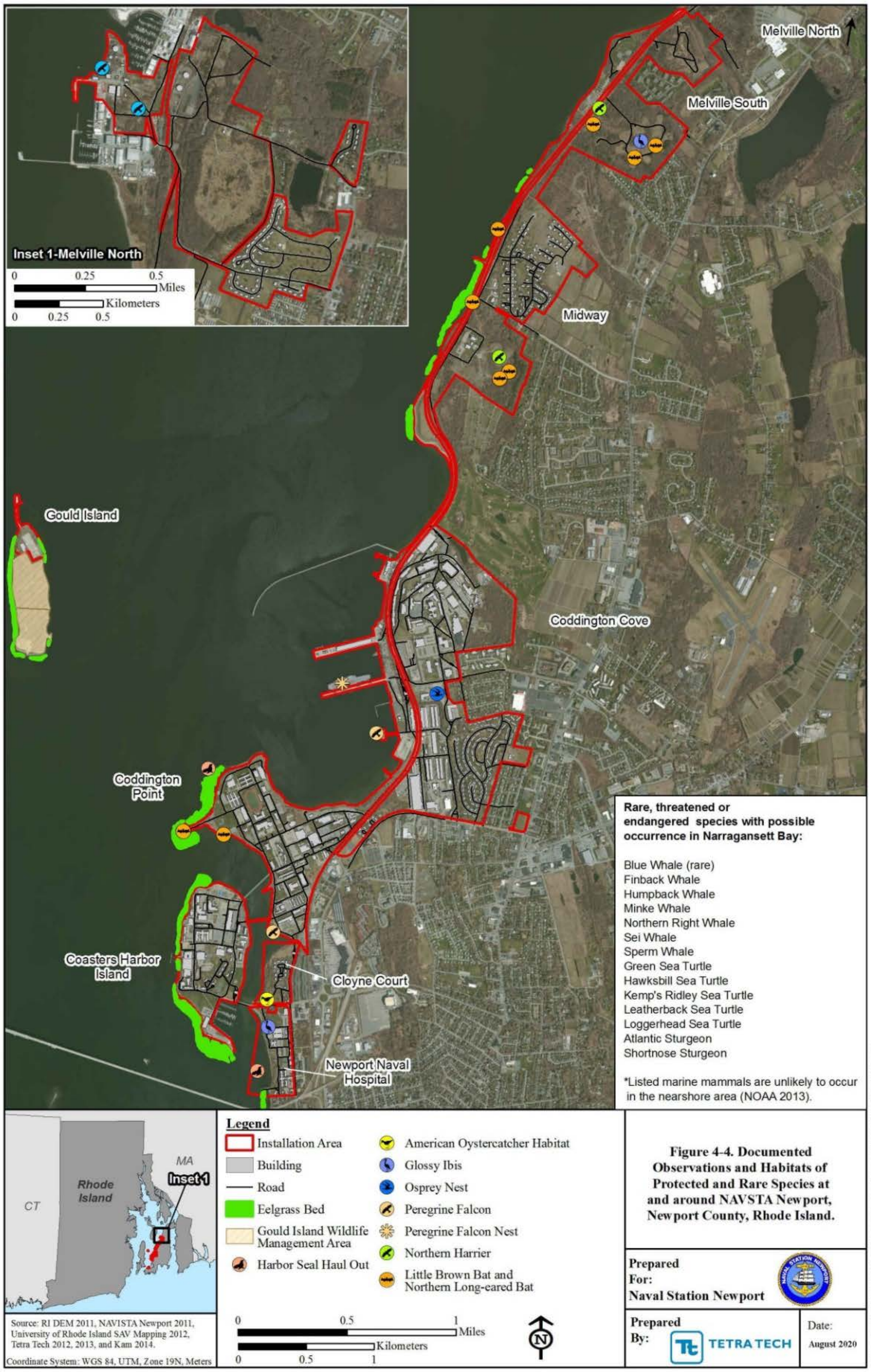

Figure 4-4. Documented Observations and Habitats of Protected and Rare Species at and around NAVSTA Newport, Newport County, Rhode Island.

4.8 PEST MANAGEMENT

The pest management program at NAVSTA Newport operates consistently with, and under the authority of, federal laws and military guidelines. These laws and regulations are implemented at NAVSTA Newport through the installations *Integrated Pest Management Plan* and are overseen by the installations pest management coordinator:

- Federal Insecticide, Fungicide, and Rodenticide Act;
- Federal Noxious Weed Act of 1974;
- EO 13112 (Invasive Species);
- Occupational Safety and Health Standards (29 CFR 1910);
- EPA Regulations for Pesticide Programs (40 CFR 150-186);
- DOD Pest Management Program (DOD DIR 4150.07);
- Environmental Readiness Program Manual (OPNAV M-5090.1);
- Navy Occupational Safety and Health Program Manual (OPNAVINST 5100.23D);
- Navy Pest Management Program (OPNAVINST 6250.4B);
- Navy Medical P-5010; and
- Design of Pest Management Facilities (Military Handbook 1028/8A).

A "pest" as defined by DODI 4150.07 with incorporated changes, *The DOD Pest Management Program*, includes arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds, and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable. IPM is an approach to managing pests that includes a planned program, incorporating continuous monitoring, education, record-keeping, and communication to prevent pests and disease vectors from causing unacceptable damage to operations, people, property, material, or the environment. IPM uses targeted, sustainable (effective, economical, and environmentally sound) methods including education, habitat modification, biological control, genetic control, cultural control, mechanical control, physical control, regulatory control, and where necessary, the judicious use of least-hazardous pesticides (DOD PMP 2018). It is DOD policy to use IPM to control pests whenever possible.

The pest management program at NAVSTA Newport is described in the installation's *Integrated Pest Management Plan* (NAVFAC Atlantic 2009). The goal of the IPMP is to prevent pests from interfering with tenant and fleet unit operations, curbing pest-related health and safety problems, protecting government property from damage, and preventing morale problems due to uncontrolled pest populations. As specified in the IPMP, pesticides should only be used when necessary and only in accordance to package directions. Measures should be taken to minimize pesticide "drift," whereby a pesticide leaves the targeted area and affects non-target organisms. Drift can be reduced by selecting low or nonvolatile pesticides, using larger spray nozzles (to increase droplet size), spraying only when wind velocity is less than 10 miles per hour, and employing other tactics outlined in the IPMP.

4.8.1 Vector-Borne Diseases

Some pests pose public health risks because they act as vectors for human disease.

4.8.1.1 Diseases Carried by Ticks

Ticks are external parasites in the arachnid group that are dependent on the blood or tissue fluids of their hosts. Five genera of ticks in the U.S. transmit the majority of human tick-borne diseases. Within Rhode Island, there is considerable concern regarding Lyme disease and growing concern over human monocytic ehrlichiosis (HME), or human granulocytic ehrlichiosis (HGE), and human babesiosis. The common deer tick (*Ixodes scapularis*) can transmit all of these diseases. In addition, the lone star tick (*Amblyomma americanum*) and western black-legged tick (*Ixodes pacificus*) can also transmit Lyme disease. The lone star tick is also a primary vector for HME.

Lyme disease is a vector-borne disease caused by the *Borrelia burgdorferi* bacteria, which is transmitted through the bite of an infected tick. The infection requires that a tick remain attached to the host for at least 12 hours. Based on data from the CDC, in 2017 Rhode Island had 595 confirmed cases of Lyme disease, and 537 probable cases (CDC 2017). Rhode Island is considered to have a high incidence of Lyme disease.

Lyme disease can mimic symptoms of other diseases, which creates difficulties in diagnosis. A 'bull's eye' rash, the primary hallmark of Lyme disease, can appear several days after infection; however, in some cases it does not occur. Flu-like symptoms are often commonly associated with Lyme disease (LymeNet 2020). A vaccine has been developed, but efficacy and lifetime vaccination schedules, at this point, are uncertain. Physicians may recommend that individuals in high-risk areas for Lyme disease consider the vaccination (a three-dose preliminary schedule) as a viable option.

A second tick-borne disease transmitted to humans is HGE. HGE is a term used to describe infections caused by the *Ehrlichia* genus of bacteria. The first known carrier of HGE-causing bacteria was the lone star tick; however, HGE-causing bacteria can also be carried by the common deer tick. According to the CDC, symptoms include high fever, severe headaches, muscle pain, chills, nausea, and vomiting, among others. HGE is a serious disease that can be fatal, even for people who were previously healthy (CDC 2010). HGE is most common in Oklahoma, Missouri, and Arkansas; 30 percent of cases nationwide occur in these three states. HGE is known to Rhode Island, though only at a rate of 0.3 to 1 case per 1 million people annually (CDC 2012a).

The third disease of concern is babesiosis. This malaria-like infection was first convincingly diagnosed on Nantucket Island, Massachusetts, in the 1970s (Reubush et al. 1977). The principal vector of the protozoan parasite *Babesia microti* is the common deer tick. The first reported cases of babesiosis in Rhode Island occurred in 1994 (Rodgers and Mather 2007). The infection requires an attachment between 36 to 48 hours of the tick to the host. Those infected with babesiosis are likely to remain asymptomatic, with minimal treatment necessary. However, no proven treatment exists for those with severe cases. Severe cases usually develop in persons with suppressed immune systems. Experimental drug combinations are often used based on patient response to specific treatments (CDC 2012a).

Measures should be taken to reduce habitat for ticks on NAVSTA Newport.

- Ticks tend to occupy areas that are somewhat shaded, with vegetation or leaf litter to which ticks can cling. Keeping grass in landscaped areas below six inches in height and removing excess brush and leaf litter can reduce available habitat for ticks and lessen the threat of Lyme disease and other tick-related diseases (CDC 2012b).
- Deer, rodents, feral cats, and other mammals can host ticks. Measures should be taken to manage populations of these animals if they become overly-abundant at NAVSTA Newport.

Hunting for deer is no longer permitted at NAVSTA Newport. As described in Section 4.8.4, *Feral Cats*, Navy policy requires immediate removal of all stray cats on Navy property. Removing feral cats can help reduce the threat of tick-related diseases by reducing the number of tick carriers on the installation. The NAVSTA Newport IPMP provides further guidance on managing nuisance mammals, such as raccoons and rats, which will further reduce the number of available tick hosts.

4.8.1.2 West Nile Virus

West Nile Virus (WNV) is most commonly transmitted to humans from infected mosquitoes. Though most people infected with the virus show no symptoms, in some cases WNV can cause life-threatening inflammation of the brain or spinal cord. First identified in New York City in 1999, experts believe WNV is established as a seasonal epidemic in North America that flares up in the summer and continues into the fall. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes can then spread WNV to humans and other animals when they bite. Most people who are exposed will not become seriously ill or show any symptoms at all. Preventing exposure to the virus is accomplished through mosquito prevention and control programs (CDC 2018).

Mosquito control programs should employ a full program consisting of several parts:

- Education;
- participation of station residents and personnel;
- monitoring of mosquito populations and habitats;
- habitat modification; and
- chemical control, when justified.

The first facet of a mosquito control program would consist of education for station personnel and tenants pertaining to the types of disease(s) involved, symptoms, mechanisms of transmission, and control methods. The second part of a mosquito control program is involvement of station residents and personnel (i.e., eliminate standing water around the home, stay inside during fogging efforts, etc.). The next two elements include monitoring of larvae and adults to determine where species of concern and populations are occurring, and if habitat modification is a possible option as a means of control. The final element of mosquito control consists of implementation of chemical control methods (i.e., truck-mounted foggers, water treatment, etc.). The biological larvae controls are implemented first as a means of reducing or avoiding the stronger adulticides altogether (NAVFAC Atlantic 2009).

The NAVSTA Newport IPMP recommends keeping mosquito populations under control as a means of reducing the risk of WNV. It establishes procedures for surveying mosquito populations and coordinating with medical staff at the University of Rhode Island to test mosquitoes for disease. Another key management action is to reduce standing water, when possible, because this will limit the areas available for mosquitoes to breed (NAVFAC Atlantic 2009).

It is important to note that healthy wetlands, though they may contain standing pools of water, are not ideal breeding grounds for mosquitoes. In fact, healthy wetlands contain a variety of organisms that feed on adult mosquitoes and their larvae. Polluted wetlands tend to harbor more mosquitoes because they lack mosquito predators and support algal blooms that feed larvae. Wetland restoration can, therefore, assist in reducing mosquito populations (EPA n.d.[c]).

4.8.1.3 Rabies

Rabies is caused by a virus that affects mammals, including humans. Some common carriers of rabies include raccoons, foxes, skunks, bats, woodchucks, cats, and dogs (RIDEM DFW 2016). The rabies virus accumulates in the saliva, and can spread through a bite or scratch from an infected animal. It can also spread without a bite occurring, such as through contact with a wound from an infected animal, or if saliva gets into the eyes or mouth of the handler. NAVSTA Newport will implement these management actions to prevent the transmission of rabies:

- ensure that all pets located on the installation are prevented from roaming freely, and are vaccinated for rabies, as mandated by Chief of Naval Operations letter N456M/1U595820, *Policy Letter Preventing Feral Cat and Dog Populations on Navy Property;*
- educate the public about feral cats and ensure that all residents, personnel, and visitors comply with all policies related to feral cats (see Section 4.8.4 of this INRMP);
- comply with the Vertebrate Management section of the NAVSTA Newport IPMP, including, but not limited to, these actions:
    - any wild/feral animals capable of transmitting rabies or behaving aggressively shall be managed; and
    - any animal (capable of carrying rabies) that has bitten or scratched someone shall be managed and analyzed for rabies.
- Mandate that all residents contact appropriate personnel if they suspect that an animal has rabies.

4.8.2 Gypsy Moth

European gypsy moths (*Lymantria dispar*) were introduced from Europe to the U.S. in 1869, near Boston, when a laboratory containing a silkworm-gypsy moth hybridization experiment was destroyed during a storm. The storm scattered the gypsy moths into the surrounding local forests. Since that time, the gypsy moth and its destructive habits have spread to 16 states, spanning from Maine to North Carolina. The gypsy moth is most destructive in the caterpillar stage, when it feeds on the foliage of more than 500 species of trees and shrubs. The USDA, along with the U.S. Forest Service (USFS) and the Animal and Plant Health Inspection Service (APHIS) have a collaborate effort to use several methods to control gypsy moth populations, including suppression, eradication, and slow-the-spread projects (USDA USFS APHIS 2012).

In addition, in 1991, a subspecies variant, the Asian gypsy moth (*Lymantria dispar* ssp.), was first discovered in Vancouver, British Columbia, near the U.S. border. Since that time, Asian gypsy moths have been caught in pheromone-baited traps in Washington, Oregon, and other areas of British Columbia. The suspected mode of importation is a ship that had been ported in eastern Russia. The second known introduction of this strain of gypsy moth was in 1993, near Wilmington, North Carolina. In addition, several egg masses were found in military cargoes in Charleston, South Carolina, and Baltimore, Maryland (NAVSTA Newport 2001). The USDA, in cooperation with state and local authorities, has treated areas that have known introductions of the moth with aerial applications of the virus *Bacillus thuringiensis*, which is known to kill the European strain of gypsy moth. In addition, cooperative agreements are also in place with foreign countries to help investigate any contaminated cargoes before the ships leave port. The USDA also inspects ships that are known to come from ports where the Asian strain is prevalent, before they enter U.S. ports.

Gypsy moth caterpillars feed on the leaves of hundreds of species of trees and shrubs. If they become dense enough, they can actually cause plants to die from defoliation (Hoover 2001). The gypsy moth was first observed in Rhode Island in 1901. Since then, periodic outbreaks have caused thousands of acres of forests to be defoliated. However, in 2001 gypsy moth caterpillars were heavily infected by a fungus, *Entomophaga maimaiga*, which wiped out nearly all of the caterpillars. This fungus may serve as a natural biological control of gypsy moth outbreaks (Butler and Wharton 2002). The Rhode Island Department of Environmental Management Division of Forest Environment is responsible for monitoring and recommending controls for gypsy moths and other forest pathogens.

The NAVSTA Newport IPMP recommends the following actions:

- surveying high value and ornamental plantings on a monthly basis for signs of Gypsy moths or Gypsy moth caterpillars;
- caring for trees (e.g., adequate space, water, and fertilization) to maintain robust health;
- planting stress-tolerant species and species that are known to be less palatable to Gypsy moth caterpillars;
- removing infested parts of trees, or entire trees, when necessary;

- using pheromone traps or other traps; and
- applying chemical controls only when needed, using the least toxic option available, and always following application instructions.

4.8.3 Geese and other Nuisance Birds

In the past, populations of Canada geese and several species of gulls, including herring, ring-billed, and great black-backed gulls, have caused challenges on NAVSTA Newport. Flocks of Canada geese are problematic within many areas of NAVSTA Newport property where large openland grass habitat areas provide preferable foraging and resting habitats for this species. Geese require openland habitat and will continue to increase in population as long as they are not threatened by human activity, and their habitat is not degraded.

Also, bird feces can damage buildings, rooftops, and sidewalks. In particular, problems related to gull species include nests on roofs that clog drainage pipes or air-handling units; droppings and feathers, which are drawn into air conditioning systems and cause destruction of polyurethane roofs; and competition with other sea and shorebird colonies.

A variety of methods are available to NAVSTA Newport personnel to keep bird populations at an acceptable level. According to the IPMP, the Navy War College occasionally applies goose repellent to fields before major events, such as graduation (NAVFAC Atlantic 2009). The installation also removes goose nests when they are found, and addles eggs. Goose nests have not often been found on the installation (one nest has been found between Gates 1 and 2 along the shoreline). USDA has conducted goose round-ups twice, but this does not appear to be an effective long-term strategy. The installation employs a dog and handler to visit sites that geese occupy in order to scare them away and, in certain areas, has reduced mowing frequency in order to allow grass to grow to a height that will deter geese. The use of the trained dog has been an effective deterrence technique.

Since geese and gulls are migratory species, and are therefore protected under the Migratory Bird Treaty Act (MBTA), NAVSTA Newport must obtain annual approval for these activities. According to the MBTA, it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg or any such bird, unless authorized under a permit. NAVSTA Newport obtains the necessary depredation permit through the USFWS Division of Migratory Bird Management.

- Continue goose control including the use of a trained dog;
- survey for nuisance species;
- continue to use physical barriers made of wire on buildings, where appropriate, and should remove nests and their contents as permitted by the USFWS;
- continue to allow vegetation to grow, where appropriate, in order to deter geese; and
- use grid wires suspended on rooftops, audio and visual frightening, and toxicants to harass gulls. Harassing gulls does not require a permit under the MBTA.

Allowing native vegetation to grow into a dense buffer between the water and upland grassy areas has been shown to be a deterrent to goose use. Incorporation of grounds maintenance practices to allow 25-foot-wide buffers of shrubs and dense herbaceous vegetation will not only deter geese in preferred shoreline landing areas, but can also help to protect water quality from surface runoff during storm events.

4.8.4 Feral Cats

Feral cats threaten public health through the spread of disease. In addition, feral cats can pose a risk to wildlife because they are both predators and prey; they are known to hunt birds and other small animals, but they are also attractive prey for coyotes. According to a recent scientific study, free-ranging domestic cats kill an estimated 1.4 to 3.7 billion birds and from 6.9 to 20.7 billion mammals annually (Loss et al. 2013).

As per Chief of Naval Operations letter N456M/1U595820, *Policy Letter Preventing Feral Cat and Dog Populations on Navy Property*, dated 10 January 2002 (Appendix Q), it is against Navy policy to allow stray cats to roam Navy property. For these reasons, feral cats should be removed from NAVSTA Newport and the public should be educated about how to prevent feral cats from inhabiting the installation.

The NAVSTA Newport IPMP provides specific protocols for managing feral cat populations at NAVSTA Newport. The NAVSTA Newport IPMP specifies the following:

- free-roaming cats shall not be allowed on Navy property;
- domestic cats must be registered and micro-chipped;
- non-lethal trapping methods will be used whenever possible;
- personnel must be informed not to feed stray animals; and
- cats trapped at NAVSTA Newport shall be taken to a local animal shelter.

Appendix G, *Don't Let Your Cat Go AWOL! Indoor Cats are Safe Cats*, shows an example of an educational brochure that could be distributed to personnel and residents of NAVSTA Newport. According to this brochure, implementing the following rules can help reduce the feral cat population on NAVSTA Newport:

- Residents should be encouraged to spay or neuter cats as soon as they come of age.
- Residents should be prohibited from feeding feral cats.
- Residents and personnel should notify authorities when they see cats on the installation; installation staff should assure the public that cats will be treated humanely and taken to a local animal shelter.
- Contact information for a local shelter should be freely available so that residents can turn unwanted pets over to the shelter, rather than abandoning them.

The Armed Forces Pest Management Board (AFPMB) Technical Guide 37, *Integrated Management of Stray Animals on Military Installations* (AFPMB 2012), provides detailed information about various trapping techniques. This guide can be found in Appendix Q.

4.9 INVASIVE SPECIES MANAGEMENT

Executive Order 13112, issued in February 1999, defines an invasive species as any species that is not native to an ecosystem, and whose introduction does, or is likely to cause, economic or environmental harm, or harm to human health. According to EO 13112, subject to the availability of appropriations and to the extent practicable and permitted by law, each federal agency should use relevant programs and authorities to:

- prevent the introduction of invasive species;
- detect and control such species in a cost-effective manner;
- monitor invasive species populations;
- provide for restoration of native habitats that have been invaded;
- conduct research on invasive species to prevent introduction, and for sound control; and
- promote public education on invasive species.

Three laws are important to invasive species management: the Noxious Weed Act of 1974, the Lacey Act of 1900 (as amended in 1998), and the Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990. The Noxious Weed Act of 1974 (as amended in 1975) provides for the control of noxious plants on lands under the control or jurisdiction of the federal government. The law allows poisonous plants and noxious weeds to be controlled or destroyed in an approved manner when the plants interfere with the safe and efficient use of the land, endanger the health and welfare of personnel, or infest adjacent property. The Lacey Act of 1900 identifies certain species as “injurious.”

Invasive species management encompasses control of insect pests, invasive plant species, and noxious weeds through treatment and prevention measures. Invasive species management can be implemented first by adopting an IPM strategy that will aid in control by changing routine practices, or making habitat and structural alterations. The integration of IPM strategies should reduce the use and need for application of chemical controls; however, chemical controls may be required if problems persist despite the use of IPM methods. If chemical controls are necessary, they should be applied carefully to kill only targeted pests, with minimum use of the least toxic product available. The application of herbicide to control invasive species must be done in accordance with state and federal regulations.

Invasive species are present on NAVSTA Newport. A 2006 survey (RINHS 2006) found that 52 percent of the plant species found on the installation were non-native, with several of these designated as invasive (see Section 2.3.6.2 for the list of non-native, invasive species found at NAVSTA Newport). In addition, the surveyors found evidence of invasive Japanese shorecrabs, including carcasses. An invasive tunicate species, *Styela clava*, has also been observed attached to the submerged portions of piers at NAVSTA Newport (S. Kam, personal communication, June 2013). If left unchecked, invasive species can degrade habitat quality for native plants and animals, and could potentially pose a safety hazard. For example, thick overgrowth of invasive plants around the NAVSTA Newport tank farms represents a significant fuel load and could pose a potential fire hazard. Invasive species projects to be implemented include the following:

- Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts.
- Develop and print educational brochures or factsheets.
  - Offer information to fishers and boaters for how to reduce the spread of invasive species such as milfoil and zebra mussels by cleaning equipment and avoiding contamination.
- Attend training on invasive species management.

The California Invasive Plant Council (Cal-IPC) provides the following detailed guidance on numerous BMPs for invasive species (Cal-IPC 2012):

- Plant native plant species whenever soil is disturbed or plant species are removed. This will help prevent non-native plant species from colonizing these areas.
- Be careful when removing non-native plant species not to spread seeds, fruits, or fragments that could possibly transfer plants from one area to another.
- Invasive species control is most effective at the early stages of an invasion. Once a non-native species establishes a viable, reproducing colony, it can be very difficult and expensive to control. Natural resources staff should therefore prioritize controlling incipient invasions and protecting high-quality areas from being invaded.
- The Center for Invasive Species and Ecosystem Health provides information about how to identify and manage 1,627 different non-native species, including common reed.
- The “Manager’s Tool Kit,” maintained by the National Invasive Species Information Center, provides links to numerous BMPs guides from a variety of agencies (USDA-NISIC n.d.).

Table 4-2 provides selected BMPs for minimizing the spread of invasive species at NAVSTA Newport as well as links to comprehensive guides for various user groups.

Table 4-2. BMPs for Slowing the Spread of Invasive Species at NAVSTA Newport.

Vector for Dispersing Invasive Species	Examples of BMPs
Construction and Landscaping Activities	• Construction contracts should include language about planting only native species. The Ladybird Johnson Wildflower Center at the University of Texas at Austin provides a list of species native to Rhode Island that are suitable for landscaping. A copy of the list is provided in Appendix R. • Avoid planting species known to be invasive in Rhode Island.
Visitors to Natural Areas	• All visitors should inspect and clean all vehicles, equipment, tools, and clothing—especially footwear. This should be done before moving from one area of the installation to another (e.g., moving from one Tank Farm to another). • Minimize disturbances to soil. • See "Non-Native Invasive Species BMPs: Guidance for the U.S. Forest Service Eastern Region," which has special guidance for recreation (USDA-FS 2012).
Boats	• After boating, inspect the hull, piping, and tanks for any organisms. Remove and dispose. • Do not dump bait or any other type of organism. • For more detailed guidance, see "Preventing the Spread of Aquatic Invasive Species: BMPs for Boaters," produced in partnership between the State of California and the USFWS (Matuk et al. 2009).
Natural Resource Field Personnel	• When removing non-native plant species, be careful not to spread seeds, fruits, or fragments that could possibly transfer plants from one area to another. • When visiting multiple sites, be careful to inspect and clean vehicles, equipment, tools, and clothing—especially footwear, before transitioning from one site to another. • For further guidance, see "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd ed.)," by the California Invasive Plant Council (Rhode Island Wild Plant Society n.d.).

According to the Rhode Island Wild Plant Society, the following plants are invasive in Rhode Island (Rhode Island Wild Plant Society n.d.). These species should not be planted at NAVSTA Newport:

- Norway maple (*Acer platanoides*)
- Tree-of-heaven (*Ailanthus altissima)*
- Japanese barberry (*Berberis thunbergii*)
- Common barberry (*Berberis vulgaris*)
- Asian bittersweet (*Celastrus orbiculatus*)

- Russian olive, Oleaster (*Elaeagnus angustifolia*)
- Goumi, cherry silverberry (*Elaeagnus multiflora*)
- Autumn Olive (*Elaeagnus umbellata*)
- Winged euonymus (*Euonymus alatus*)
- Burning bush (*Euonymus atropurpureaus*)
- Climbing euonymus (*Euonymus fortunei*)
- Yellow flag iris (*Iris pseudacorus*)
- Purple loosestrife (*Lythrum salicaria*)
- Japanese honeysuckle (*Lonicera japonica*)
- Tartarian honeysuckle (*Lonicera tatarica*)
- Common reed (*Phragmites australis*)
- Japanese knotweed (*Polygonum cuspidatum*)
- Giant knotweed (*Polygonum sachalinense*)
- Glossy buckthorn (*Rhamnus frangula*)
- Common buckthorn (*Rhamnus cathartica*)
- Multiflora rose (*Rosa multiflora*)
- Beach rose, Hedgerow rose (*Rosa rugosa*)

4.10 LAND MANAGEMENT

4.10.1 Installation Restoration Program (IRP)

The release of hazardous substances, pollutants, and contaminants may result in adverse impacts on natural resources. The Navy IRP is designed to identify and evaluate contaminated Navy facilities. It provides for compliance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). The IRP identifies hazardous releases, considers the risks, and assesses the impact on human health and the environment (to include impacts on threatened and endangered species, migratory birds, and biotic communities). When the impact may result in an unacceptable risk to human health and the environment, the IRP develops response actions to lessen the impact.

IRP sites and study areas on NAVSTA Newport are listed below, and shown on Figure 4-5.

- Building 32 Area, Gould Island
- Carr Point Firing Range
- Carr Point Storage Area
- Coddington Cove Rubble Fill Area
- Derecktor Shipyard
- McAllister Point Landfill
- Melville North Landfill
- Melville Water Tower
- NUSC Disposal Area
- Old Fire Fighting Training Area
- Tank Farm 1
- Tank Farm 2
- Tank Farm 3
- Tank Farm 4
- Tank Farm 5

NAVSTA Newport publishes a *Site Management Plan* (SMP) to manage all of its environmental investigative and remedial response activities conducted under the IRP (NAVFAC MIDLANT 2012). The SMP schedules the implementation of the IRP at NAVSTA Newport and is updated annually to review and revise site priorities and scheduled activities.

The NAVSTA Newport IRP manager is a member of the Environmental Division staff. When necessary, installation natural resources staff is able to assist in identifying potential impacts on natural resources caused by contaminant releases. Environmental Division staff is able to communicate natural resource issues to the IRP manager, attend Restoration Advisory Board (RAB) meetings, review and comment on IRP documents (e.g., the SMP, Remedial Investigations), and ensure that contaminant response actions minimize impacts on the natural resources on NAVSTA Newport, to the extent possible.

Figure 4-5. Installation Restoration Program Sites at NAVSTA Newport, Newport County, Rhode Island.

4.10.2 Hazardous Waste Management and Spill Prevention

NAVSTA Newport is registered as a large quantity generator (LQG) of hazardous wastes with the Rhode Island Department of Environmental Management. As such, the installation keeps a *Hazardous Waste Contingency Plan* to establish guidelines to ensure that installation hazardous waste (HW) storage facilities are properly designed and equipped to minimize the possibility of spill (NAVFAC 2011). In the event of a spill, the plan stipulates actions to minimize hazards to human health and the environment. The Contingency Plan contains procedures for emergency notification requirements, personnel evacuation, spill response actions, site cleanup, and personnel training requirements.

NAVSTA Newport generates HW through various facility operations, including a medical and histology lab, recycling center, automotive/vessel maintenance, and light bulb crushing. HW generated from these operations include: flammables; oxidizers; corrosives; acids; batteries (some reactive); bulbs; oil/gas filters; oil rags; used antifreeze; and paints/aerosols (NAVFAC 2011). All of these types of hazardous wastes can have detrimental effects on the environment, including on species, aquatic environments, and human health, if spills occur. One hazardous waste accumulation area (HWAA), two satellite accumulations areas (SAAs), and three universal waste accumulation acres (UWAAs) are located on NAVSTA Newport. Most HW is stored in 30- or 55-gallon drums; although some 5-gallon containers are used in the health clinic (NAVFAC 2011). The highest risk for HW spills is during the transportation and handling of HW at the 90-day storage facility. At the time of a spill, environmental office responders determine if the spill is reportable to regulatory agencies per federal and state regulations. The notification of agencies depends on the type of spill and conditions, and all are outlined in the HW Contingency Plan.

NAVSTA Newport also stores petroleum products and follows the federal protocol laid out in the current *Spill Prevention, Control, and Countermeasure Plan* (SPCC) for the handling and transporting of oils and fuels (NAVFAC 2012). NAVSTA Newport is considered a non-transportation-related onshore facility that stores oil and oil products in excess of SPCC enabling criteria values. Based on its location along Narragansett Bay, the installation has the potential to discharge oil in harmful quantities into or upon the navigable waters of the U.S., adjoining shorelines, or coastal wetlands. Spilled oil creates a complex web of potential and irreversible damages to organisms and habitats. The SPCC identifies types, properties, and locations of fuel stored at the base, as well as the training activities conducted prior to a spill and security precautions on base. For its oil sources, NAVSTA Newport has 74 above-ground oil storage areas (primarily oils for emergency generators, heating systems, water supply pumps, and for waste oil storage), 40 underground storage tanks (primarily for vehicle fuel, emergency generator fuel, and heating oil), 237 active dielectric fluid-filled transformers (NAVFAC 2012), and 36 hydraulically operated elevators. The SPCC Plan is prepared in conformance with the RIDEM Division of Groundwater and Freshwater Wetlands Oil Pollution Control Regulations.

In the event of an actual spill, NAVSTA Newport's *Facility Response Plan* (FRP) establishes oil and hazardous material response procedures. As part of this plan, the potential vulnerability of environmentally sensitive areas near facilities that could be affected by a spill was identified. The FRP also used Environmental Sensitivity Index (ESI) maps, field surveys, and shoreline prioritization standards to establish priorities of vulnerable areas on NAVSTA Newport. NOAA's Office of Response and Restoration determine the ESI maps, which are used to prioritize oil spill responses. A map of the ESI areas around NAVSTA Newport can be seen in Figure 4-6, Sheet 1 and Sheet 2.

The Navy On-Scene Coordinator (Commander Navy Region 1, New England) has the authority to assess and oversee oil-spill cleanup and damage assessment activities on Naval installations within the Mid-Atlantic Region. The Regional Environmental Coordinator has been designated as the Natural Resource Trustee, thereby assuming responsibility for spill clean-up procedures and damage assessments. Further guidance regarding roles and responsibilities can be found in OPNAVINST 5090.1E (Navy 2019b) and the current SPCC.

NAVSTA Newport has not had a major spill within the past decade. Between December 2002 and August 2011, the installation had 219 spills, only 50 of which required reporting to National Response Center and/or Rhode Island Department of Environmental Management. Well over half of the spills that occurred involved two gallons of spillage or less (NAVFAC 2012, Table 3-3 revised). Future climate change with associated sea-level rise may pose problems for preventing spills into Narragansett Bay and adjoining shorelines. Installation climate change adaptation strategies will need to address hazardous waste and oil locations that will be vulnerable to sea-level rise and storm surge.

- As part of the climate change vulnerability assessment and adaptation plan, evaluate the risk to hazardous waste and oil locations from sea-level rise, storm surge, and flood zone shifts.

4.10.3 Reclamation of Disturbed Sites

Proper land management is important not only for achieving appropriate vegetation ground cover, but also improving soil microbes and nutrients, the hydrological balance through infiltration and percolation, sustainable water quality, quality wildlife habitat, and reduction of runoff and soil erosion. Construction or other activities may potentially leave an area inhospitable for vegetative growth or better suited for noxious weeds to take over (due to changing the landscape, removing several feet of soil, and leaving a bare mineral soil exposed).

To return disturbed grounds to viable soils, NAVSTA Newport will implement these management actions:

- soil abatement (such as fertilization) to add vital nutrients to allow seeds to propagate
- soil stabilization to keep unstable soils and seeds from blowing, eroding, or washing away
- establishment of native or non-invasive plant communities through seeding with accepted seed mixes, irrigation, weed management, and pest management

Figure 4-6, Sheet 1. Environmental Sensitivity Index Map for Narragansett Bay, Rhode Island.

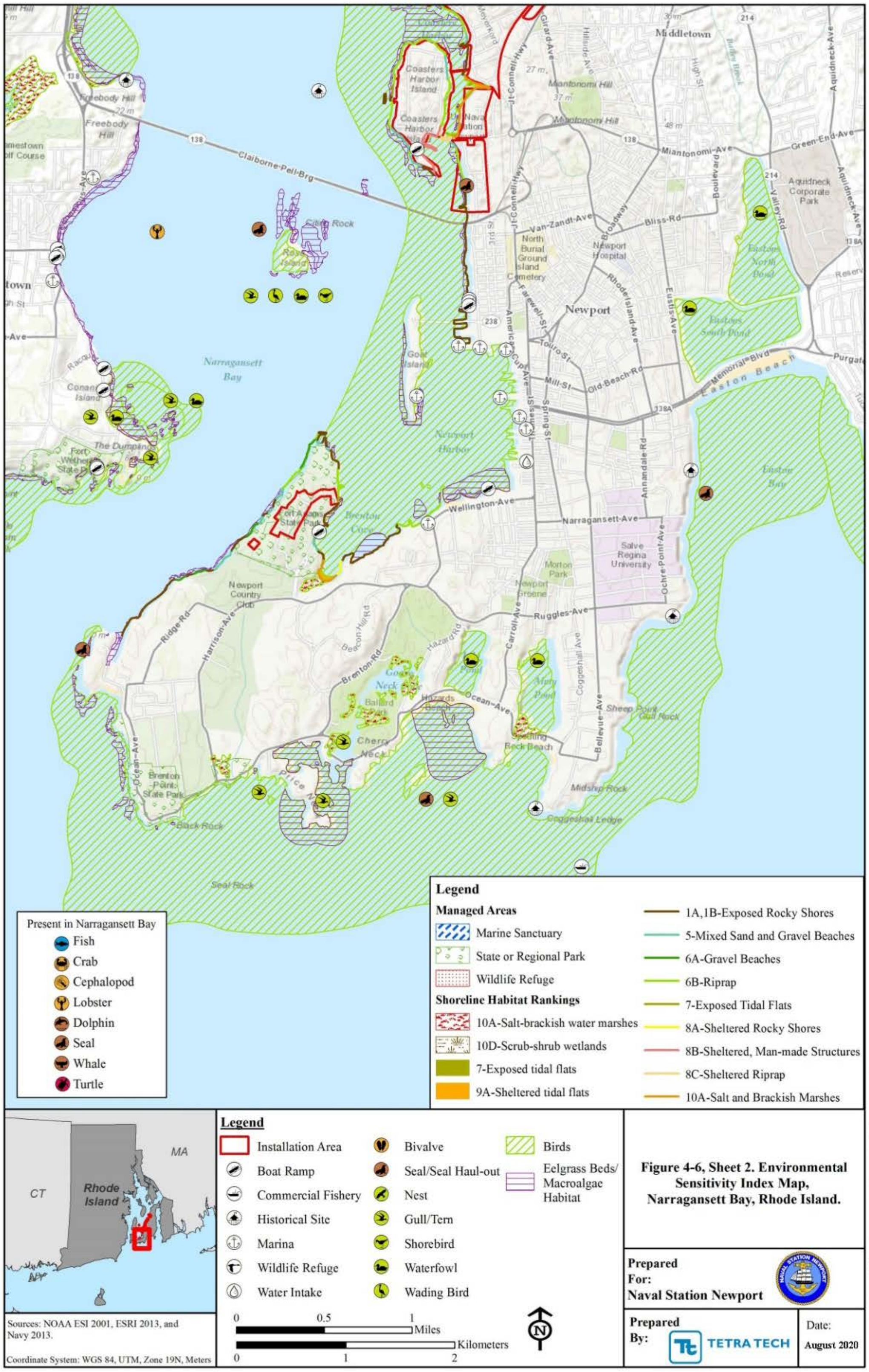

Figure 4-6, Sheet 2. Environmental Sensitivity Index Map for Narragansett Bay, Rhode Island.

NAVSTA Newport may also lay sod or establish xeriscaping on disturbed sites. Section 4.9 contains discussion on invasive species management on NAVSTA Newport, including listing of BMPs to slow the spread of invasive species on the base, and a list of species that should NOT be planted at NAVSTA Newport. These management actions should be taken into account as the installation reclaims disturbed sites.

Because many of the soils in the state of Rhode Island were developed from glacial till, they can be fairly acidic, which can create an environment in which it is difficult for vegetation to grow. Certain projects may require NAVSTA Newport to utilize imported soil for fill (or use soil brought in from other locations on the installation). When doing this, soil acidity should be taken into account, because it may affect the pH levels of topsoil necessary to promote vegetative growth. Further discussion of the soils on NAVSTA Newport can be found in Section 2.2.2.

As NAVSTA Newport has included more LID into construction and maintenance around the base, it has developed directives for the construction of landscaped areas and maintenance of sites. For example, LID was applied to the development of a new walkway at Building 1268, which specified which areas should be sodded, mulched, filled with loam, and ground-cover-planted. It also specified where native trees and other plants (red maple, winterberry, myrtle, and red osier dogwood should be planted) (Marstel-Day 2010). The LID notes for this project also specify temporary protection of the disturbed areas as the vegetation grows (limestone and fertilizers, seed, and hay mulch may be applied), and measures to control blowing dust and soil movement (surfaces moistened periodically, calcium chloride applied).

Such steps to reclaim disturbed lands at NAVSTA Newport maintain aesthetics on the base, provide habitat, reduce erosion, and reduces runoff.

4.11 OUTDOOR RECREATION

NAVSTA Newport offers military personnel and their families a variety of recreational opportunities. The installation offers a fitness/jogging trail, marina, fishing, ball fields, picnic tables, and camping areas (Figure 4-7). Located along Narragansett Bay, the installation also affords scenic vistas, birding opportunities, and contact with natural habitats. The NAVSTA Newport MWR department manages athletic and recreational facilities on the installation.

At 29-acres, Carr Point Recreation Area is the largest designated recreation area on the installation, and includes two softball fields, picnic pavilions, and RV campgrounds. Other recreational opportunities are found in parks and shorelines throughout the installation.

4.11.1 Fishing and Boating

Narragansett Bay provides for numerous aquatic recreational activities, including sailing, power boating, and fishing. Many of these services are offered through the Navy Sailing Center and Marina with additional services and launch ramps on Coasters' Harbor Island, just south of Gate 1. The marina includes 125 berthing slips, 34 mooring balls, a parking lot, and a boat launch ramp. No dry storage is available for private boats; only Navy-owned boats are stored.

Figure 4-7. Outdoor Recreation Opportunities at NAVSTA Newport, Newport County, Rhode Island.

It is DOD policy to allow recreational fishing at military installations in compliance with federal and state regulations and best wildlife management practices. Saltwater recreational fishing is one of the primary outdoor recreational activities conducted at NAVSTA Newport. Opportunities for saltwater fishing are found along the seawalls, and beaches along the installation's entire coastline with some exceptions (i.e., the IRP sites and on Toner Bridge). Shellfishing is permitted between the Midway pier and Carr Point.

NAVSTA Newport Instruction 5090.26B (2014) outlines the fishing program for the installation. Recreational fishing at NAVSTA Newport is controlled by the commanding officer (CO; NAVSTA Newport 2014b). Fishing licenses may be issued to active duty military personnel and their dependents, DOD civilian employees and their dependents, active duty reservists and their dependents, DOD contract support employees, and retirees. All anglers must carry both a NAVSTA fishing license and the applicable Rhode Island State license.

Fees are not charged for fishing licenses. The NAVSTA Environmental Program Manager oversees the fishing program as it relates to wildlife management, and must liaise with appropriate state and federal personnel to ensure that the NAVSTA program abides by all local, state, and federal fish and wildlife laws and regulations. For further details, see NAVSTA Newport Instruction 5090.26B (NAVSTA Newport 2014a).

The NAVSTA security director is tasked with enforcing applicable regulations. This includes enforcing the provision that fishing activities shall not result in the taking of any other wildlife species. If an angler sights a marine mammal or sea turtle, they must stop fishing and immediately report the sighting to installation security. Security must then report the sighting to the environmental program manager. The CO and natural resources manager also have enforcement authority, and, as with the security director, can suspend or revoke fishing privileges, as appropriate.

4.11.2 Other Outdoor Recreation Opportunities

4.11.2.1 Nature Trails

A fitness/jogging trail runs along the entire perimeter of Coddington Point and into the Coddington Cove area, allowing for both passive and active enjoyment of the coastline. The trail passes through beach, wetland, and developed areas. The 2008 NAVSTA Newport Facility Master Plan includes improvements to this trail by paving and widening sections, while improving the fitness stops along the trail (NAVSTA Newport 2008a). In addition, the plan aims to increase the sidewalk and trail network on the installation. Although some trails would parallel roadways, others would diverge to more directly reach destinations or provide scenic value (NAVSTA Newport 2008a).

4.11.2.2 Camping

Campsites are located on the installation at Carr Point and near the installation at a Town of Portsmouth nature preserve. The 2008 NAVSTA Newport Facility Master Plan includes plans for the construction of six cottages and 36 additional RV campsites at Carr Point (NAVSTA Newport 2008a).

4.11.2.3 Sailing

The Navy Sailing Center and Marina, located near NAVSTA Newport Gate One, offers classes on sailing and power boating to authorized patrons. The marina offers berthing and a boat launching ramp for towed boats. Sailboats, powerboats, and kayaks are also available for rent. The Sailing Center and Marina is open from May through October.

4.11.2.4 Bird Watching

NAVSTA Newport and the areas around it attract a variety of waterfowl and shorebirds. The 37 acres of Gould Island not owned by the Navy serves as a bird sanctuary run by the State of Rhode Island, providing an abundance of valuable bird habitat. Birds of interest that utilize the lands and waters surrounding NAVSTA Newport include the American oystercatcher, the piping plover, and the osprey.

- Install osprey nesting platforms.
  - ➢ If possible, locate the nesting platforms within sight of newly designated Watchable Wildlife Areas.

4.11.2.5 Watchable Wildlife Areas

The coastal areas of NAVSTA Newport provide opportunities for military personnel, residents, and civilian staff to enjoy watching wildlife, such as waterfowl and shorebirds, along the coast of the installation. By establishing Watchable Wildlife Areas, opportunities for wildlife viewing will be enhanced as an outdoor recreational activity for individuals who live and reside at NAVSTA Newport. Watchable Wildlife Areas are typically chosen for their biological value, wildlife visibility, and public accessibility. These areas can include infrastructure such as picnic tables and/or benches to enhance and promote usage, trails, and interpretative signs. At NAVSTA Newport, potential sites for Watchable Wildlife Areas include

- Dewey Field;
- the shoreline along the southern portion of Coddington Cove; and
- the southwestern corner of Coasters Harbor Island.

In addition, the NRM can determine whether it is possible to establish a Watchable Wildlife Area in sight of the newly constructed osprey nesting platforms, to provide public viewing opportunities of nesting ospreys and their young.

- Establish up to five Watchable Wildlife Areas.
  - ➢ These areas may include benches, trails, and interpretive signs. Potential topics for the interpretative signs are:
    - ❖ *Narragansett Bay Ecosystem*: Place interpretive signs about the Bay along the installation’s fitness trail. Address species of interest, habitat, and ecosystem interdependence.
    - ❖ *Wetlands*: Explain the ecosystem services provided by wetlands, including protection from storm surges, flood reduction, and water filtration.

- *Waterfowl and Shorebirds*: Along the fitness trail or at Watchable Wildlife Areas, discuss common shorebirds, including the piping plover, roseate tern, and American oystercatcher.
- *Invasive Species*: Place signs at docks and piers to inform fishers and boaters of how to reduce the spread of invasive species such as milfoil and zebra mussels by cleaning equipment and not dumping bait into coastal waters, and how boaters can avoid contaminating the Bay by not dumping trash, fuel, oil, or human waste.

4.12 CONSERVATION LAW ENFORCEMENT

Conservation law enforcement staff is not present on NAVSTA Newport. The NRM serves as a liaison to the installation security and RIDEM game wardens when any conservation law enforcement issues occur.

4.13 ENVIRONMENTAL AWARENESS, EDUCATION, AND OUTREACH

In order to successfully manage its natural resources, NAVSTA Newport must engage and educate community members on and off the installation. Increasing environmental awareness will increase involvement and support for the installation's conservation programs.

In addition to the Watchable Wildlife Areas described in 4.11.3.5, these management actions and projects will be implemented to increase environmental awareness both on and off the installation:

- Update the Environmental Program webpage to include environmental education and outreach materials such as brochures, factsheets, and a map of outdoor recreational opportunities (e.g., Watchable Wildlife Areas, fishing areas, birding areas, osprey platforms, camping sites and trails).
- Host volunteer and outreach events with military residents, personnel, and community partners. Partner with Clean Bays and Save the Bay to run volunteer events on the installation for Earth Day and National Public Lands Day. Invite military families, base personnel, and community groups to participate in volunteer events. Boy/Girl Scouts and school groups also may be interested in volunteer events. Consider the following projects for volunteer events:
    - trash clean-ups along the shore of the installation;
    - invasive plant removal;
    - native species plantings;
    - marking storm drains with "Drains to the Bay";
    - living shoreline and wetland restoration projects; and
    - installing bluebird and bat boxes.
- Develop and print educational brochures or factsheets. Consider the following brochures and factsheets:

- *Threatened and Endangered Species*: Develop informational materials (e.g., a brochure or fact sheet) for hunters, fishers, and other recreational users to prevent accidental take of federal or state-listed threatened, endangered, or candidate species, or other species of concern.
- *Species of interest*: Address charismatic species, nuisance species (e.g., raccoons), and other wildlife (e.g., fox). Include information on how there are no venomous snakes in Rhode Island.
- *Invasive Species*: Offer information to fishers and boaters on how to reduce the spread of invasive species such as milfoil and zebra mussels by cleaning equipment and avoiding contamination.
- *Feral Cats*: Educate the personnel and residents at NAVSTA Newport on how to reduce the installation's feral cat population. Strategies should emphasize getting pets spayed and neutered, not feeding stray cats, and reporting stray cats. *Don't Let Your Cat Go AWOL! Indoor Cats are Safe Cats* (Appendix G), serves as an example.
- *Coyotes*: Continue disseminating the installation's coyote brochure (see Appendix G).
- *Reptiles and Amphibians*: Develop a pamphlet to inform NAVSTA Newport residents, personnel, and visitors about snakes, turtles, and sea turtles. See Appendix G for a snake pamphlet produced by RIDEM.

4.14 TRAINING OF NATURAL RESOURCES PERSONNEL

The goals and requirements for training of NAVFAC natural resources personnel are outlined in M-5090.1 (Chapter 3 Environmental Readiness Training), as part of the Navy Environmental Readiness Training Program, which identifies specific training courses and sources of training to address these requirements. All environmental scientists and environmental protection specialists must participate in meaningful, continuous learning activities to stay current and proficient in technical/functional disciplines, policy initiatives, and leadership and management skills. Participation in periodic training courses and workshops will keep environmental staff up-to-date on natural resources management issues and laws, as they relate to natural resources management at military installations.

- To enhance the NRM's expertise and the implementation of this INRMP, the NAVSTA Newport NRM will attend the following training:
  - invasive species management;
  - MBTA;
  - coastal restoration techniques;
  - climate change/sea-level rise adaptation; and
  - GIS/Global Positioning Systems (GPS).

4.15 GIS MANAGEMENT, DATA INTEGRATION, ACCESS, AND REPORTING

GIS is a tool that is an integral part of natural resource and environmental protection and planning. It provides the installation and natural resource managers with databases that include information pertaining to the spatial facets of data. In these databases, data from aerial photographs, topographic surveys, monitoring efforts, and other natural resources information are each referenced to a geographic coordinate system. Being able to represent data spatially enhances the installation's ability to effectively coordinate management efforts and ensure that current and planned mission activities do not adversely affect natural resources, including watersheds, wetlands, floodplains, natural landscapes, soils, forests, and wildlife that must be protected, conserved, and managed using an ecosystem approach. In addition, GIS is a tool that supports efficient and effective land use planning and maintaining military readiness and sustainability, as well as protecting and enhancing the natural resources for multiple use, sustained yield, and biological integrity.

In accordance with the OPNAVINST 5090.1E, NRMs are encouraged to use GIS to develop and implement their INRMP (Navy 2019b). Navy GeoReadiness Centers provide overall coordination and acquisition of installation specific GIS data and resources, maintain the Common Installation Picture (CIP) data layers, and ensure that the quality control includes accuracy, currency, and compliance of all geospatial data holdings. At the GeoReadiness Center, one person manages the GIS support for all of the INRMPs for the installations in the Navy Region Mid-Atlantic Command (MIDLANT) region. The support from the GeoReadiness Center enables program managers to view, report, analyze, and update data. These GeoReadiness Services are provided via the Regional Shore Installation Management System (RSIMS).

Maintaining the GIS database to ensure that it contains up-to-date data for all pertinent natural resource data such as habitat and species surveys, natural resource management project areas, and mission impacts is essential for establishing a proactive natural resources management program that supports the NAVSTA Newport mission and ecosystem integrity. Training personnel to use GIS and GPS to accurately collect spatial data at the meter or sub-meter scale is essential for building and maintaining a comprehensive GIS database that meets the installations natural resources planning needs.

In accordance with guidance pertaining to the use of GIS for natural resource management, all GIS data layers associated with the NAVSTA Newport INRMP are provided to NAVFAC MIDLANT and NAVSTA Newport's Environmental Division. All GIS data created or modified for use in this INRMP follows the spatial data standards for facilities, infrastructure, and environment (SDSFIE). Likewise, all GIS deliverables associated with implementation of applicable INRMP projects should adhere to SDSFIE.

The map figures presented in this INRMP were developed using:

- existing digital data files provided by the Navy in fall 2012;
- photo interpretation and field reconnaissance of aerial photography;
- data collected during field surveys from 2009 to 2013 related to a proposed project and field surveys for this INRMP; and
- other GIS databases available to the public.

The base imagery used is a color-balanced image mosaic, one-meter ground sample distance (GSD), high-resolution digital orthophotographs produced from aerial photos collected over Rhode Island. The imagery is projected to Universal Transverse Mercator, Zone 19 North, World Geodetic System 1984. The data produced from this effort are provided in Universal Transverse Mercator, World Geographic System 1984, Zone 19N.

Additional data from public sources, such as Rhode Island GIS and NOAA, were used to identify the state of natural resources beyond the installation boundary and the natural resource-related efforts and interests of other stakeholders, which in turn illustrate the role NAVSTA Newport plays in current and future natural resource management at the local community and state levels.

- The NRM will attend training on GIS/GPS.

4.16 LEASES

Pursuant to the Sikes Act and DOD Policy, INRMPs address natural resource management on all lands for which the installation has real property accountability, including lands used via license, permit, or lease, and lands occupied by tenants or lessees.

NAVSTA Newport holds a host-tenant agreement with the U.S. Army to allow for a U.S. Army reserve center to be located on the installation. In addition, NAVSTA Newport holds a lease with National Grid (an energy company) for a parcel of land to use for a liquid natural gas (LNG) peaking facility. Peaking facilities are used for storing surplus natural gas to use during peak consumption (such as during the summer or winter months).

4.16.1 Installation Service Support Agreements (ISSAs)

NAVSTA Newport holds an ISSA with the USCG for the USCG to berth three buoy tender ships and one cutter and additional support facilities at the waterfront.

4.16.2 Enhanced Use Leasing (EULs) – N/A

This section is not applicable; there are no EULs at NAVSTA Newport.

4.16.3 Agricultural Outleases – N/A

This section is not applicable; there are currently no Agricultural Outleases at NAVSTA Newport.

4.17 ECOLOGICAL CONSERVATION AREAS – N/A

This section is not applicable; there are currently no Ecological Conservation Areas at NAVSTA Newport.

4.18 DEMOLITION SITE RESTORATION – N/A

This section is not applicable; there are currently no demolition site restoration areas at NAVSTA Newport.

4.19 CULTURAL RESOURCES

The NAVSTA Newport ICRMP was completed in 2010, and provides guidelines and procedures for management of the station’s cultural resources through 2018 (Navy 2015).

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5.0 PROJECT DESCRIPTIONS

This chapter provides the descriptions for projects introduced in Chapter 4 (and a couple of projects that are discussed in Chapter 3). The INRMP Project Summary Table, located in Appendix C, contains a listing of all the projects with their applicable project codes, implementation schedule, the legal driver, the Navy assessment level, funding priorities, cost estimates, funding sources, and the targeted dates for completion. The projects are intended to develop, enhance, and maintain natural resources management practices at NAVSTA Newport and have been prioritized for implementation. The DOD funding priority classifications are explained in Section 6.1.1 *Programming Hierarchy*.

5.1 PROJECT DESCRIPTIONS

The INRMP project descriptions below address relevant INRMP goals and objectives that each project supports, in addition to details such as anticipated location, potential collaborators, timeframe for implementation, and recurrence.

Project 1. Point count survey of all bird species present at NAVSTA Newport (including migratory and RTE species) every five years.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport.
Location	Installation-wide
Frequency	5 years
Last Completed	2020
Potential Collaborators	USFWS, RIDEM
Project Description	Perform a point count survey of all bird species present at NAVSTA Newport and the adjacent shoreline. This survey shall include a special emphasis on detecting RTE species including piping plovers, roseate terns, red knots, and American oystercatchers. Sampling shall occur during all four seasons. Monitoring procedures will follow the joint DOD and USGS Coordinated Bird Monitoring Plan, which outlines procedures for bird monitoring including study design, data collection methods, and data analysis. NAVSTA Newport staff will coordinate with the USFWS to report any sightings of the piping plover, roseate tern, and red knots, and with RIDEM if an American oystercatcher nest on NAVSTA Newport beaches is discovered. The DOD and USGS Coordinated Bird Monitoring Plan also calls for data to be stored in the Coordinated Bird

	Monitoring Database. Ideally, data should be checked for quality and then uploaded immediately following each field season.

Project 2. Develop a Bat and Bird Conservation Strategy.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments.
Location	Installation-wide
Frequency	n/a
Last Completed	Not yet completed
Potential Collaborators	USFWS, RIDEM
Project Description	This document will outline various conservation measures, mitigation techniques, and field surveys that address both birds and bats.

Project 3. Bat monitoring that includes biannual acoustic monitoring for bats using full spectrum bat detectors, as well as an installation-wide roost search during the summer.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments.
Location	Acoustic surveys at Tank farms, Bishop Rock Installation-wide roost search
Frequency	2 years
Last Completed	2018
Potential Collaborators	USFWS, RIDEM
Project Description	Two bat detector stations should be set up every 2 years, one in the tank farm area and one near Bishop Rock. Detectors (such as Wildlife Acoustics Song Meter SM4 Bat) should be operational from 15 April to 15 October with detector data downloaded once a month. Data will provide year-to-year trends in bat populations at NAVSTA Newport and will continue to build upon datasets collected since 2009. Data should be analyzed using similar techniques used during previous surveys. Acoustic surveys were completed in 2018 and will continue to occur biannually.

Project 4. Conduct a mist-net survey for *Myotis* bat species in natural habitat areas.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments.
Location	Natural habitats (e.g., tank farms)
Frequency	3 years
Last Completed	2018
Potential Collaborators	USFWS, RIDEM
Project Description	Conduct a mist-net survey for *Myotis* bat species in natural habitat areas at NAVSTA Newport every 5 years. Mist-netting should follow established USFWS protocols for trapping *Myotis* species. The netting protocols should adhere to established WNS decontamination guidelines. Mist-netting capture surveys should occur for a total of four nights in late July, consisting of two net sets per night at different locations each night, yielding a total of eight locations surveyed. Any *Myotis* species captured should be banded per USFWS guidelines. In conjunction with mist netting, a bat detector should be deployed at each net to acoustically document bat species. Target year for the next mist-net survey is 2021.

Project 5. Enhance wildlife habitats.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport.
Location	Tank farms
Frequency	n/a
Last Completed	Not yet completed
Potential Collaborators	USFWS, RIDEM
Project Description	In each of the tank farms, add two to four bluebird boxes per tank farm. In each tank farm, also install two bat boxes. After the first year, evaluate whether the boxes are being used by these species. A grate will also be installed over the cistern cover on Gould Island to protect bats that may be using the underground cistern from predators. Target year for completion of this project is 2023.

Project 6. Implement the invasive species management plan, once completed, with invasive species surveys, control, as well as habitat restoration efforts that include early successional habitat and control for invasive species.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport. Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species. Objective 3.6. Implement IPM controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.
Location	Installation-wide
Frequency	1 year
Last Completed	2020
Potential Collaborators	USFWS, RIDEM
Project Description	Implement an invasive species management plan based on installation-wide invasive species surveys. The plan will identify priority species and habitats for invasive species control. In areas where the objective is to restore native habitats, planting of native plant species may need to occur along with the control of invasive species. Early successional/scrub shrub natural areas of NAVSTA Newport provide good foraging habitat for bats (including the little brown and northern long-eared bat). Maintaining the tank farms and other areas in a natural habitat by restricting development will provide foraging, roosting, and transitory habitats for migratory and non-migratory bats. Project to be conducted annually or as funding allows.

Project 7. Survey for the presence of the New England cottontail rabbit.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments.
Location	Installation-wide
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	USFWS, RIDEM

Project Description	NAVSTA Newport will survey for the presence of the New England cottontail minimally within potential habitats within the installation (i.e., brush, shrubs, and densely stocked young forests). It is almost impossible to distinguish the New England cottontail from the non-native Eastern cottontail. Non-invasive techniques include winter track surveys on fresh snow (although conditions for track surveys are often not ideal) and winter pellet surveys (that incorporate genetic analysis of pellets to determine species). Live trapping may be an option also. In addition, any cottontail roadkill can be genetically tested. Target year for completion of this project is 2023.

Project 8. Conduct an installation-wide wetland delineation.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation. Objective 1.6. Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable.
Location	Installation-wide
Frequency	One-time
Last Completed	2018
Potential Collaborators	USACE, RIDEM
Project Description	Although field surveys have been conducted to identify wetland habitat types, a jurisdictional wetlands delineation across the installation is needed. This delineation will ensure that wetland boundaries are defined to gain efficiencies for evaluating impacts from future proposed development. Then impacts on wetlands can be avoided or minimized, and when not possible, mitigation measures can be determined. In 2013, the NAVSTA Newport Environmental Division submitted a project to conduct this installation-wide delineation.

Project 9. Evaluate condition of wetlands and the shoreline, and prioritize areas in need of wetlands restoration and living shorelines restoration.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation. Objective 1.4. Enhance the function(s) and value(s) of NAVSTA Newport's aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible. Objective 1.6. Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable.
Location	Installation-wide
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	USACE, RIDEM, CRMC
Project Description	The condition of wetlands and the installation shorelines will be evaluated to identify habitat areas in need of restoration. Condition of wetlands will be assessed based on criteria such as presence/density of invasive species, hydrologic function, human-made materials (e.g., culverts), pollution, and loss of acreage. Condition of shorelines will be assessed by factors such as the presence of natural vegetation (if appropriate for the shoreline habitat type), occurrence/severity of erosion, presence of human impacts (e.g., trash, debris, human-made structures) and any habitat loss. Target year for completion of this project is 2021.

Project 10. Restore wetlands characterized as a high restoration priority.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.4. Enhance the function(s) and value(s) of NAVSTA Newport's aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible.
Location	TBD
Frequency	One-time

Last Completed	Not yet completed
Potential Collaborators	USACE, RIDEM, CRMC
Project Description	Restoration of wetlands will provide a multitude of ecological benefits including water quality improvement, habitat for native flora and fauna, sequestration of carbon, and absorption of floodwaters. Wetlands in need of restoration will be identified by the findings of the jurisdictional wetlands delineation and the wetlands condition assessment. Tentatively, the NUWC wetlands and the wetlands near Gate 2 have been identified as potential priorities. The NUWC wetlands capture stormwater runoff from developed lands in Middletown (off of the installation); the stormwater volume appears to be in excess of what the wetland can absorb. The Gate 2 wetlands are bisected by the boundary for the installation; private residential lands are adjacent. The wetlands are capturing stormwater runoff from the residential land use, including parking lots. Target year for completion of this project is 2021.

Project 11. Restore eroded coastal areas identified as a high restoration priority.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.4. Enhance the function(s) and value(s) of NAVSTA Newport's aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible.
Location	TBD
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	RIDEM, CRMC, URI-CRC, Save the Bay, NOAA
Project Description	Ideally, soft or "living shoreline" techniques are one of the preferred methods for abating coastal erosion since hardened/structural shoreline methods can have detrimental impacts on natural resources. Living shorelines are the term used for restoring a natural shoreline (often of fringe salt marsh vegetation) to provide the benefit of storm-surge buffering and reduction of coastal erosion. Typically, a living shoreline project involves restoring an eroding coastal area by first grading the bank back to a gradual slope and then re-vegetating with natural wetland or beach vegetation. It also can include "soft engineering" (or bioengineering) techniques to abating coastal erosion such as installing coir logs, which are made from woven coconut fiber and can be used at the base of an eroding bank or salt marsh. Although helpful for some coastal erosion situations, a study by Save the Bay and CRMC has determined that living shoreline techniques may not be able to solve the most pressing problems of accelerating sea-level rise and inundation of

	coastal features and infrastructure along Narragansett Bay (Save the Bay 2013). Thus, additional coastal restoration techniques will need to be considered based on the characteristics (e.g., fetch, bathymetry, and shoreline topography) of any coastal erosion areas. Some of these other restoration techniques that may be applicable are vegetation enhancement, intertidal shellfish reefs, bioengineering, bank grading, and beach nourishment. For the shellfish reefs, this technique involves using natural materials (e.g., coir logs with shell bags) to recruit mussels or oysters to stabilize low marsh edges through the accumulation of sediment (Save the Bay 2013). URI-CRC and CRMC have recently published a Shoreline Change SAMP that addresses the impacts of storm surges, flooding, sea level rise, and erosion (URI-CRC 2018). Target year for completion of this project is 2021.

Project 12. Conduct a nearshore habitat assessment and species inventory.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation. Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport.
Location	Nearshore
Frequency	10 years
Last Completed	2017
Potential Collaborators	NOAA, RIDEM, CRMC, URI-CRC

Project Description	This project established baseline conditions of the installation's nearshore environment through a variety of assessments and surveys including: marine fish surveys, benthic surveys, a marine mammal survey, and water quality monitoring. General marine fish surveys were conducted for pelagic and demersal populations for at least one annual cycle in order to assess the presence of migratory species throughout the year. Implementation of this project ensured compliance with the requirement for the installation to collect baseline flora/fauna inventories that are to be included in the INRMP. In addition, the information collected was used to fill in important informational gaps in understanding the roles of the various species and habitats occurring within the nearshore environments of the installation. Collected data benefits EFH managed fishery species, known and proposed threatened and endangered species, various migratory birds, and cetaceans. Surveys for Atlantic and shortnose sturgeon will be completed in the future, as well as surveys for surrounding marine habitat to determine whether these species are present, especially in habitat adjacent to NAVSTA Newport. Listening devices will be installed for passive acoustic monitoring of animals equipped with acoustic devices and may be migrating through and using habitat adjacent to NAVSTA Newport.

Project 13. Continue monitoring the health and distribution of SAV.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation. Objective 1.5. Promote and implement alternative stormwater management approaches, including low-impact development, to minimize adverse impacts of surface runoff from impervious areas, and to promote water quality within the watershed.
Location	Nearshore
Frequency	3 years
Last Completed	2017
Potential Collaborators	Save the Bay, CRMC, URI, URI-CRC
Project Description	The Rhode Island Eelgrass Mapping Taskforce maps SAV throughout Rhode Island coastal waters, including Narragansett Bay, every three to five years. A recent study recommended that this aerial mapping occur every three years (Bradley et al. 2012). NAVSTA Newport will obtain this aerial mapping data from the Taskforce as available. In addition, the

	installation will annually monitor the health of SAV beds in the nearshore environment. This annual monitoring protocol will be developed in consultation with the potential collaborators, and it ideally will be compatible with the Seagrassnet protocol (www.seagrassnet.org), so the installation data can be incorporated into this worldwide database.

Project 14. Continue restoration of SAV beds.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 1.4. Enhance the function(s) and value(s) of NAVSTA Newport's aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport.
Location	Nearshore
Frequency	5 years
Last Completed	Near completion
Potential Collaborators	Save the Bay
Project Description	NAVSTA Newport will work with Save the Bay to obtain SAV plant material and to do transplants in those areas that have suitable habitat. This project includes SAV restoration design/plan, SAV planting, and monitoring to determine the success of SAV transplants at restoration sites. The SAV restoration project should incorporate design elements that maximize the likelihood of long-term survival and persistence of the restored SAV community. Some of these design elements or options involve planting SAV at multiple sites, depths, and densities. Other design options include planting in multiple years or at different times of the year, planting different types of stock (i.e., whole plants, tubers, bare roots, or seeds), and using fences or exclosures to limit herbivory. Each design option or strategy must be considered in the context of how much plant material, human resources, equipment, and funding are available to properly plan and implement the restoration project. Refer to the *SAV Restoration Handbook: A Guide for Restoring SAV on DOD Installations* (DOD Legacy Program and U.S. Army Environmental Center n.d.) for more details on designing a restoration project.

Project 15. Conduct a stream and riparian habitat condition assessment to identify areas in need of restoration.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation.
Location	Five streams occur within the installation
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	NRCS, Soil Conservation Districts, RIDEM
Project Description	NAVSTA Newport will conduct a stream/riparian condition assessment (using a rapid stream assessment method) along the five streams that course through the Installation. Based on the results, stream areas will be prioritized to determine sections in greatest need of bank stabilization, riparian buffer reforestation, and in-stream habitat restoration. Target date for this project is 2021.

Project 16. Restore priority stream reaches and riparian areas.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 1.3. Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport.
Location	Priority stream reaches and riparian areas
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	NRCS, Soil Conservation Districts, RIDEM, USACE (New England District)
Project Description	NAVSTA Newport will conduct stream/riparian restoration as needed along the five streams that course through the Installation. Areas will be

	prioritized based on results on stream habitat condition assessments. Target date for this project is 2021.

Project 17. Mark storm drains with "Drains to the Bay."

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among NAVSTA Newport's internal and external stakeholders. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, NGOs, universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 5.2. Implement training, education, outreach, and stewardship initiatives for ecosystem management. Objective 5.4. Educate NAVSTA Newport employees, tenants, housing residents, contractors, and academic institutions about natural resources issues on NAVSTA Newport and BMPs to protect Narragansett Bay watershed, and engage these parties in NAVSTA Newport's INRMP and conservation initiatives. Objective 6.2. Develop partnerships with the NOAA NMFS, Rhode Island Natural Heritage Program, Save the Bay, RICRMC, DOD PIF, academic institutions, and other local agencies and organizations to implement wildlife monitoring and protection programs and habitat restoration projects. Objective 6.3. Coordinate natural resources activities with local community groups, conservation organizations, and private groups.
Location	Installation-wide
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	Save the Bay
Project Description	To engage with the community and to prevent pollution into Narragansett Bay, NAVSTA Newport will partner with Save the Bay to run volunteer events with military residents, personnel, and community partners such as Boy/Girl Scouts and school groups. Event leaders will explain the connection between our storm drains and Narragansett Bay, and volunteers will mark storm drains with "Drains to the Bay." This will raise awareness for the volunteers who participate, as well as for the general public. Target date for this project is 2021.

Project 18. Annually conduct a trash clean-up along the installation shoreline.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, NGOs, universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport. Objective 6.3. Coordinate natural resources activities with local community groups, conservation organizations, and private groups.
Location	Shoreline
Frequency	1 year
Last Completed	2020
Potential Collaborators	Clean the Bay, Save the Bay
Project Description	An annual shoreline trash clean-up will be organized, with volunteers recruited to participate. This clean-up can be held on volunteer-oriented days such as Earth Day or National Public Lands Day.

Project 19. Develop a climate change vulnerability assessment and adaptation plan.

Applicable INRMP Goal(s)	Goal 7. Assess the potential impacts of climate change to natural resources of NAVSTA Newport; identify significant natural resources at the installation that are likely to be affected by potential changes in climate and respective sea-level rise; and identify and implement adaptive management strategies to ensure the long-term sustainability of those resources and the military mission.
Applicable INRMP Objective(s)	Objective 7.2. Conduct a vulnerability assessment of how climate change may affect the natural resources of interest for NAVSTA Newport, and develop and implement a climate adaptation plan for NAVSTA Newport to adapt and maintain a cost-effective and legally compliant natural resource program.
Location	Installation-wide
Frequency	Ongoing
Last Completed	Not yet completed
Potential Collaborators	URI-CRC

Project Description	The DoD has released the *Climate Adaptation for DoD Natural Resource Managers, A Guide to Incorporating Climate Considerations into Integrated Natural Resource Management Plans* (DoD 2019). As part of the step-by-step process for INRMP adaptation, installations are required to develop strategies and actions to reduce climate change risks and implement adaptation actions and projects. NAVSTA Newport will: • Identify potential adaptation strategies and actions • Evaluate the effectiveness/feasibility of possible strategies • Define criteria for evaluation • Evaluate strategies against criteria • Select priority risk reduction • Determine how project/action fits within existing efforts/authorities • Project planning and acquisition of funding

Project 20. Continue goose control including the use of a trained dog.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.6. Implement IMP controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.
Location	War College, Parade grounds, athletic fields in the training areas (Coddington Point); Building 690 (Commanding Officer's building)
Frequency	1 year
Last Completed	2020
Potential Collaborators	USDA, USFWS
Project Description	Canada geese are a nuisance on the training grounds, primarily because of their feces. To control the Canada goose population, NAVSTA Newport has been using trained dogs for the past three years as part of its pest management program. Trained dogs are accompanied by handlers and visit sites that geese regularly occupy in order to scare them away.

Project 21. Develop an Installation Conservation Design Plan.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 2. Sustain and enhance terrestrial habitats on NAVSTA Newport by preserving urban trees, using native plants in landscaping, and conserving riparian areas. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 2.1. Increase urban tree canopy and conserve individual trees and groups of historic trees within the urban environment. Objective 2.2. Design and maintain landscaped areas using native trees, shrubs, and herbaceous plants to reduce maintenance requirements. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport. Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species.
Location	Installation-wide
Frequency	n/a
Last Completed	Not yet completed
Potential Collaborators	n/a
Project Description	NAVSTA Newport will develop an Installation Conservation Design Plan to facilitate the integration of the installation's grounds maintenance and stormwater programs with the INRMP objectives. Implementation of this plan will provide multiple natural resource benefits, including enhancing wildlife habitat, promoting native plants and natural habitats, reducing non-point source pollution and conserving water. The plan will outline beneficial landscaping BMPs for grounds maintenance areas and no mow areas; stormwater management practices, including LID practices (e.g., elimination of curb and gutter; use of permeable pavers; use of mulch, mowed grass, or gravel for walkways) and green roofs; urban tree protection, maintenance, and restoration; habitat enhancement of landscaped grounds for wildlife and pollinator species (including where native plants, pollinator habitats, bluebird boxes, bat houses, and rain gardens can be installed), and restoration and management of natural areas (e.g., the tank farms) for wildlife and pollinator species. The plan also will include a blueprint of where these activities can occur on the Installation. Target date for this project is 2021.

Project 22. Promote pollinator habitat.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport. Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species.
Location	TBD
Frequency	Ongoing
Last Completed	Not yet completed
Potential Collaborators	RIDEM
Project Description	As part of the Installation Conservation Design Plan, NAVSTA Newport will increase habitat for valuable pollinators such as bats, bees, and butterflies. To provide habitat for native pollinators, diverse floral sources that provide a succession of flowers throughout the spring, summer and fall are needed so nectar and pollen are available to insects for the entire growing season. Flowers of different shapes also are needed to attract pollinators with different body sizes and mouthparts. Wildflower gardens will be created using native plants adapted to Rhode Island’s growing conditions and native pollinators. Certain areas may need to be designated as no-mow areas in order to allow flowering plants to flourish. Refer to the Rhode Island Pollinators and Agriculture guide published by the Heinz Center for Science, Economics & Environment for more information on pollinator habitat enhancement (The Heinz Center 2013). Once established, these sites also can be utilized as future Watchable Wildlife Areas. Target date for this project is 2021.

Project 23. Install osprey nesting platforms.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport.
Location	Coddington Cove, Defense Fuel Support Point
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	USFWS, RIDEM

Project Description	To enhance osprey and peregrine falcon populations, NAVSTA Newport will consult with RIDEM's DFW to construct two artificial nesting platforms. These will provide nesting habitat for the birds. Tentatively, two locations are proposed for nesting platforms: Coddington Cove and the Defense Fuel Support Point. The specific location for the platforms should be located near shallow, clear water, if possible, and offer some privacy for the birds. Areas of heavy human use or traffic are not advised. Ospreys prefer a clear view in all directions so the platform should not be located adjacent to dense trees that will overtop the platform. However, scattered trees near the platform are acceptable, because they provide perching sites for the osprey. Avoid placing the platform near electrical lines that may pose a hazard. The best time of year to place a platform is the fall. Nesting platforms are generally 20- to 30-foot-high poles with a 3-foot square platform at the top. Placing several 1- to 2-foot-long dead sticks on the platform, when it is erected, will encourage osprey to use the platform. Once established, the NRM can determine if it would be possible to locate Watchable Wildlife Areas near the platforms to allow for public viewing. Target date for this project is 2021.

Project 24. Establish up to five Watchable Wildlife Areas.

Applicable INRMP Goal(s)	Goal 4. Provide sustainable natural resources-related outdoor recreation opportunities. Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among NAVSTA Newport's internal and external stakeholders.
Applicable INRMP Objective(s)	Objective 4.3. Develop and promote additional opportunities/sites for passive outdoor recreation, including establishment of watchable wildlife areas and nature trails. Objective 5.2. Implement training, education, outreach, and stewardship initiatives for ecosystem management.
Location	Tentative locations: near newly established pollinator gardens and/or osprey nesting platforms; the sandy spit near the playground at Coasters Harbor; Dewey Field; the shoreline along the southern portion of Coddington Cove; the southwestern corner of Coasters Harbor Island; or any other location that is scenic and/or high in biodiversity.
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	n/a

Project Description	Watchable Wildlife Areas will provide locations for passive recreational enjoyment of the installation's open spaces. Areas that provide natural scenery and biodiversity are ideal locations, provided that human access does not negatively affect wildlife. To promote access to these locations, NAVSTA Newport will provide walking trails and benches where possible. These Watchable Wildlife Areas provide an opportunity for the installation to educate base residents and personnel about natural resources at NAVSTA Newport; thus interpretive signs will be installed. Interpretive signs can address the following topics: • Narragansett Bay ecosystem • wetlands • waterfowl and shorebirds • invasive species Target date for this project is 2021.

Project 25. Develop and print educational brochures or factsheets.

Applicable INRMP Goal(s)	Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among NAVSTA Newport's internal and external stakeholders.
Applicable INRMP Objective(s)	Objective 5.2. Implement training, education, outreach, and stewardship initiatives for ecosystem management.
Location	n/a
Frequency	Ongoing
Last Completed	n/a
Potential Collaborators	USFWS, RIDEM, Save the Bay
Project Description	NAVSTA Newport will develop and print educational brochures and factsheets to share with installation residents, personnel, and visitors. These resources can be used to increase awareness of the installation's natural resources and the programs in place to conserve them. The following brochures and factsheets will be considered: • *Threatened and Endangered Species*: Develop informational materials (e.g., a brochure or fact sheet) for hunters, fishers, and other recreational users to prevent accidental take of federal and state-listed threatened, endangered, or candidate species, or other species of concern. • *Species of interest*: Address charismatic species, nuisance species (e.g., raccoons), and other wildlife (e.g., fox). Include information on how there are no venomous snakes in Rhode Island.

	• *Invasive Species*: Offer information to fishers and boaters on how to reduce the spread of invasive species such as milfoil and zebra mussels by cleaning equipment and avoiding contamination. • *Feral Cats*: Educate the personnel and residents at NAVSTA Newport on how to reduce the installation's feral cat population. Strategies should emphasize getting pets spayed and neutered, not feeding stray cats, and reporting stray cats. *Don't Let Your Cat Go AWOL! Indoor Cats are Safe Cats* (Appendix G), serves as an example. • *Coyotes*: Continue disseminating the installation's coyote brochure (see Appendix G). • *Reptiles and Amphibians*: A reptile and amphibian educational pamphlet to inform NAVSTA Newport residents, personnel, and visitors of the following: o No venomous snakes exist in Rhode Island. Snakes are a natural part of the ecosystem and should be left alone. o Contact information for a professional who can safely remove snakes in case people encounter a snake in a high-traffic area or near their dwelling. o Under Rhode Island state law, it is illegal to possess most native turtle species, except for the common snapping turtle (RIDEM n.d.[b]). o Turtles should not be picked up unless they are in immediate danger, and even so they should be placed as close as possible to where they were found. Turtles are territorial and will attempt to return to their home range; in doing so they may encounter hazards, particularly roads (RIDEM n.d.[b]). o Sea turtles, if sighted, should not be disturbed or harassed in any way. o Contact information for personnel that the public can call if turtles are sighted on or near NAVSTA Newport.

Project 26. Attend training.

Applicable INRMP Goal(s)	Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among NAVSTA Newport's internal and external stakeholders.
Applicable INRMP Objective(s)	Objective 5.1. Provide adequate staffing, equipment, technology, and training for the INRMP at NAVSTA Newport to ensure proper implementation of this INRMP.

Location	n/a
Frequency	Ongoing
Last Completed	n/a
Potential Collaborators	n/a
Project Description	The NRM will attend the following training: • invasive species management • Migratory Bird Treaty Act • coastal restoration techniques • climate change/sea-level rise adaptation • GIS/GPS • Annual training attendance of the National Military Fish and Wildlife Association Training Conference

Project 27. Conduct a 5-year review for Operation and Effect to the INRMP.

Applicable INRMP Goal(s)	All goals
Applicable INRMP Objective(s)	All goals
Location	Installation-wide
Frequency	5 years
Last Completed	2014
Potential Collaborators	RIDEM, NOAA, USFWS
Project Description	The INRMP will be updated annually, as well as reviewed for operation and effect every five years (including partner signatures), per the Sikes Act. Failure to maintain an updated INRMP would violate the Sikes Act and could subject the installation to enforcement actions from federal and state wildlife regulatory agencies that could affect the military mission. The objective of the NAVSTA Newport INRMP is to furnish recommendations and scheduled implementation for the proper stewardship, management, and protection of the natural resources at the installation. Updates entail the incorporation of new survey data, updates of existing GIS layers, incorporation of any species that might become listed or identified as being at risk, incorporation of changes in natural resources management, and update of the INRMP project implementation tables.

Project 28. Conduct reptile and amphibian surveys at Tank Farms 1-5.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments.
Location	Tank Farms 1-5
Frequency	n/a
Last Completed	Not yet completed
Potential Collaborators	USFWS, RIDEM
Project Description	Conduction of an inventory of the amphibians and reptiles present at Tank Farms 1-5 of NAVSTA Newport. Environmental Readiness Program Manual, dated September 2019, requires each installation to conduct surveys to develop an inventory of fish and wildlife species and their habitats that may be present on the installation. Data collected during the investigation will be used to update this INRMP.

Project 29. Purchase and install an electronic permit system.

Applicable INRMP Goal(s)	Goal 4. Provide sustainable natural resources-related outdoor recreation opportunities.
Applicable INRMP Objective(s)	Objective 4.2. Develop and implement a comprehensive fishery management program for NAVSTA Newport that will include sustainable harvest via the recreational fishing program.
Location	Tank Farms 1-5
Frequency	One-time
Last Completed	Not yet completed
Potential Collaborators	n/a
Project Description	Purchase and install an electronic permit system for recreational access for fishing and hunting within NAVSTA Newport. There is currently no fishing and hunting program at NAVSTA Newport; however the program may be reinstated in the future.

Project 30. Conduct natural resources surveys.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize “takes” of these species resulting from military readiness activities at NAVSTA Newport.

	Objective 3.4. Monitor populations and herd health of select game species to adjust harvest limits, as needed.
Location	Installation-wide
Frequency	5 years
Last Completed	2020
Potential Collaborators	USFWS, RIDEM
Project Description	Update of the Installation's NHI report (Natural Resources Inventory and Assessment of Naval Station Newport, Newport County, RI dated February 2006). Determination of the presence of state or federally listed threatened or endangered species or species of concern that may occur at NAVSTA Newport.

5.2 PROJECT RELATIONSHIP TO GOALS AND OBJECTIVES

Table 5-1 is a cross-reference table showing the alignment of projects to INRMP goals/objectives. Note that projects are activities that require programmed or external funding. In Chapter 4, additional management actions are described for the implementation of the INRMP goals and objectives.

Table 5-1. Projects and Goals/Objectives Cross-reference Table.

Goals / Objectives	Applicable Projects
Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.	
Objective 1.1. Assess biological conditions, including water quality, of NAVSTA Newport's aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation.	Project 8. Conduct an installation-wide wetlands delineation. Project 9. Evaluate condition of wetlands and the shoreline, and prioritize areas in need of wetlands restoration and living shorelines restoration. Project 12. Conduct a nearshore habitat assessment and species inventory. Project 13. Continue monitoring the health and distribution of SAV. Project 15. Conduct a stream and riparian habitat condition assessment to identify areas in need of restoration.
Objective 1.2. Enhance the function(s) and value(s) of NAVSTA Newport's aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible.	Project 9. Evaluate condition of wetlands and the shoreline, and prioritize areas in need of wetlands restoration and living shorelines restoration. Project 10. Restore wetlands characterized as a high restoration priority. Project 11. Restore eroded coastal areas identified as a high restoration priority. Project 14. Continue restoration of SAV beds.

Goals / Objectives	Applicable Projects
Objective 1.3. Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable.	Project 8. Conduct an installation-wide wetlands delineation. Project 9. Evaluate condition of wetlands and the shoreline, and prioritize areas in need of wetlands restoration and living shorelines restoration. Project 16. Restore priority stream reaches and riparian areas.
Goal 2. Sustain and enhance terrestrial habitats on NAVSTA Newport by preserving urban trees, using native plants in landscaping, and conserving riparian areas.	
Objective 2.1. Increase urban tree canopy, and conserve individual trees and groups of historic trees within the urban environment.	Project 21. Develop an Installation Conservation Design Plan.
Objective 2.2. Design and maintain landscaped areas using native trees, shrubs, and herbaceous plants to reduce maintenance requirements.	Project 21. Develop an Installation Conservation Design Plan.

Goals / Objectives	Applicable Projects
Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.	
Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments.	Project 1. Continue annual monitoring of birds (including migratory and RTE species), and a point count survey every 5 years. Project 2. Develop a Bat and Bird Conservation Strategy. Project 4. Conduct annual acoustic monitoring for bats using full spectrum bat detectors. Project 4. Conduct a mist-net survey for *Myotis* bat species in natural habitat areas. Project 5. Enhance wildlife habitats by installing bat and bluebird boxes. Project 7. Survey for the presence of the New England cottontail rabbit. Project 12. Conduct a nearshore habitat assessment and species inventory. Project 23. Install osprey nesting platforms. Project 28. Conduct reptile and amphibian surveys at Tank Farms 1-5. Project 30. Conduct natural resources surveys.
Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport.	Project 1. Continue annual monitoring of birds (including migratory and RTE species), and a point count survey every five years. Project 12. Conduct a nearshore habitat assessment and species inventory. Project 30. Conduct natural resources surveys.

Goals / Objectives	Applicable Projects
Objective 3.3. Restore and enhance wildlife habitats on NAVSTA Newport.	Project 5. Enhance wildlife habitats by installing bat and bluebird boxes. Project 12. Conduct a nearshore habitat assessment and species inventory. Project 14. Continue restoration of SAV beds. Project 16. Restore priority stream reaches and riparian areas. Project 18. Annually conduct a trash clean-up along the installation shoreline. Project 21. Develop an Installation Conservation Design Plan. Project 22. Promote pollinator habitat. Project 23. Install osprey nesting platforms.
Objective 3.4. Monitor populations and herd health of select game species to adjust harvest limits, as needed.	Project 30. Conduct natural resources surveys.
Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species.	Project 6. Implement the invasive species management plan, once completed, with invasive species surveys, control, as well as habitat restoration efforts that include early successional habitat and control for invasive species. Project 21. Develop an Installation Conservation Design Plan. Project 22. Promote pollinator habitat.
Objective 3.6. Implement IMP controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.	Project 6. Implement the invasive species management plan, once completed, with invasive species surveys, control, as well as habitat restoration efforts that include early successional habitat and control for invasive species Project 20. Continue goose control including the use of a trained dog.

Goals / Objectives	Applicable Projects
Goal 4. Provide sustainable natural resources-related outdoor recreation opportunities.	
Objective 4.1. Manage NAVSTA Newport's fishing program to allow for the maximum public participation possible without compromising the military mission, and to enable hunters and recreational fishers to harvest the annual quotas recommended to maintain sustainable populations.	Project 29. Purchase and install an electronic permit system.
Objective 4.2. Develop and implement a comprehensive fishery management program for NAVSTA Newport that will include sustainable harvest via the recreational fishing program.	Project 29. Purchase and install an electronic permit system.
Objective 4.3. Develop and promote additional opportunities/sites for passive outdoor recreation, including establishment of watchable wildlife areas and nature trails.	Project 24. Establish up to five Watchable Wildlife Areas.
Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among NAVSTA Newport's internal and external stakeholders.	
Objective 5.1. Provide adequate staffing, equipment, technology, and training for the INRMP at NAVSTA Newport to ensure proper implementation of this INRMP.	Project 26. Attend training.
Objective 5.2. Implement training, education, outreach, and stewardship initiatives for ecosystem management.	Project 17. Mark storm drains with "Drains to the Bay." Project 24. Establish up to five Watchable Wildlife Areas. Project 25. Develop and print educational brochures or factsheets.

Goals / Objectives	Applicable Projects
Objective 5.3. Provide opportunities for public access among regional stakeholders for environmental education and scientific research and study consistent with resource conservation, in coordination with NAVSTA Newport's INRMP.	(no project identified)
Objective 5.4. Educate NAVSTA Newport employees, tenants, housing residents, contractors, and academic institutions about natural resources issues on NAVSTA Newport and BMPs to protect Narragansett Bay watershed, and engage these parties in NAVSTA Newport's INRMP and conservation initiatives.	Project 17. Mark storm drains with "Drains to the Bay."
Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.	
Objective 6.1. Maintain interagency cooperation with the USFWS and RIDEM.	(no project identified)
Objective 6.2. Develop partnerships with the NOAA NMFS, Rhode Island Natural Heritage Program, Save the Bay, RICRMC, DOD Partners in Flight (PIF), academic institutions, and other local agencies and organizations to implement wildlife monitoring and protection programs and habitat restoration projects.	Project 17. Mark storm drains with "Drains to the Bay."

Goals / Objectives	Applicable Projects
Objective 6.3. Coordinate natural resources activities with local community groups, conservation organizations, and private groups.	Project 17. Mark storm drains with "Drains to the Bay." Project 18. Annually conduct a trash clean-up along the installation shoreline.
Goal 7. Assess the potential impacts of climate change to natural resources of NAVSTA Newport; identify significant natural resources at the installation that are likely to be affected by potential changes in climate and respective sea-level rise; and identify and implement adaptive management strategies to ensure the long-term sustainability of those resources and the military mission.	
Objective 7.1. Participate in, contribute to, or at least monitor the findings of regional partnerships focused on regional or landscape-scale assessment, monitoring, and adaptation of natural resources to climate change.	(no project identified)
Objective 7.2. Conduct a vulnerability assessment of how climate change may affect the natural resources of interest for NAVSTA Newport, and develop and implement a climate adaptation plan.	Project 19. Develop a climate change vulnerability assessment and adaptation plan.
Objective 7.3. Implement natural resource management strategies and BMPs that provide conservation benefits to the ecosystem and are intended to address risks posed by climate change.	(no project identified)
All goals applicable	
All Objectives applicable	Project 34. 5-Year INRMP Update to incorporate changes from annual reviews and revisions.

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6.0 INRMP IMPLEMENTATION

Implementation of this INRMP will follow an annual strategy that addresses legal requirements, DOD and Navy directive or policy requirements, funding, implementation responsibilities, technical assistance, labor resources, and technological enhancements. This INRMP will be considered implemented once the following actions are completed:

1) Funding is secured for completion of all Environmental Readiness Level (ERL) 4 projects, as described in Section 6.3.
2) Installation is staffed with a sufficient number of professionally trained environmental staff needed to perform the tasks required by the INRMP.
3) Annual coordination with all cooperating offices is performed.
4) Specific INRMP action accomplishments that are undertaken are documented each year.

The following sections provide an overview of the role that implementation of this INRMP would play in understanding project development and classification, achieving no net loss, identifying funding sources, establishing commitment, and endorsing the use of cooperative agreements. The project table presented in Appendix C provides information for the implementation schedule, prime legal driver and initiative, class, Navy assessment level, cost estimate, and funding source for each of the projects proposed in this INRMP. The project list in Appendix C summarizes the funding-dependent projects according to the ERLs described in Section 6.1.2.

6.1 PROJECT DEVELOPMENT AND CLASSIFICATION

This INRMP is a public document that requires the mutual agreement of the installation, USFWS, and state fish and wildlife agencies. It is, therefore, crucial that these entities reach a common understanding as to which projects are most likely to be funded through the sources identified in Section 6.3. An annual strategy must be adopted for INRMP funding that addresses the installation's legal requirements. The Navy programming hierarchy is described in Section 6.1.1 and project classification is described in Section 6.1.2.

6.1.1 Programming Hierarchy

The Navy funding classification of recurring and non-recurring projects consists of four ERLs, as defined by M-5090.1. The ERLs, as defined below, are listed in order of funding priority, where ERL 4 is the absolute minimum requirement to achieve compliance and has the highest funding priority.

Environmental Readiness Level 4 (ERL 4) – Environmental Compliance

- ERL 4 is for legal requirements derived from existing laws, regulations, executive orders, Final Governing Standards (FGS), or the Overseas Environmental Baseline Guidance Document (OEBGD), as applicable; and applies to Navy activities, platforms, and operations.

Environmental Readiness Level 3 (ERL 3) – Navy or DOD Policy Requirement

- ERL 3 is for requirements derived from DOD policy and Navy policy, or proactive initiatives that could enable future compliance or result in a positive return on Navy investments. They could also support critical readiness activities by decreasing encumbrances of statutory compliance requirements. These efforts are not mandated by law or other federal, state, or local requirements but would minimize current or future impacts (including costs) to the Navy mission.

Environmental Readiness Level 2 (ERL 2) – Pending Requirements for Future Compliance

- ERL 2 is for requirements derived from pending Federal, State, or local legal requirements, laws, regulations, or EOs that could enable future compliance but result in less certain returns on investments and uncertain benefits to the Navy mission. These project efforts are not mandated by existing law or other Federal, State, or local requirements. Funding requirements should be based on best available scientific or commercial data; or on pending federal, state, or local regulations under development (where publication is scheduled) under model State regulations or permit standards, if available.

Environmental Readiness Level 1 (ERL 1) – Navy Environmental Stewardship

- ERL 1 is for investments in environmental leadership and general proactive environmental stewardship.

6.1.2 Project Classification

The list of projects described in this INRMP consists of both “must fund” compliance-type projects and stewardship-type projects. “Must fund” compliance-type projects and activities must meet recurring natural and cultural resources conservation management requirements or current legal compliance needs, including EOs. These projects are designated ERL 4 in the Navy funding classification system, described above in Section 6.1.1.

“Must fund,” or ERL 4, projects could include:

- developing, updating, and revising INRMPs;
- salaries and annual training of professional personnel, in accordance with Individual Development Plans, involved in the development and implementation of INRMPs;
- terms and conditions of biological opinions issued by the USFWS or NMFS;
- baseline surveys to keep INRMPs current;
- biological surveys to determine population status of endangered, threatened, and sensitive species;
- survey and monitoring programs to support the MBTA and related permits;
- wetland surveys for planning, monitoring, and/or permit applications;

- erosion control measures required in order to remain in compliance with natural resources protection regulations and to maintain land condition for realistic training operations;
- support of leadership roles or executive agent responsibilities for the Coastal America Program, Coral Reef Protection Program, Chesapeake Bay Program, and Mojave Desert Ecosystem Management Initiative; and
- MOU/MOA commitments.

This list is not meant to be all-inclusive, and not all examples will be applicable to the installation; the intent is to provide an overview of the types of projects that could be classified as compliance or "must fund" projects.

INRMP projects are developed based on the unique circumstances facing an installation, and INRMPs should include only valid projects and programs that enhance an installation's natural resources, promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership and proactive environmental stewardship. These projects are considered "stewardship" projects and are also designated ERL 4 in the Navy funding classification system.

Examples of stewardship projects include, but are not limited to:

- community outreach activities such as Earth Day and Migratory Bird Day activities;
- education and public awareness projects such as interpretive displays, oral histories, watchable wildlife areas, nature trails, wildlife checklists, and conservation teaching materials;
- biological surveys or habitat protection for non-listed species;
- management and execution of volunteer and partnership programs;
- demonstration plantings of native plant materials;
- experimental conservation techniques;
- forest stand improvements and other management efforts; and
- wildlife management efforts.

All INRMP projects must be entered into the Environmental Program Requirements Web system (EPR-web) to receive funding. CNO Environmental Readiness Division is the final authority for designating the appropriate ERL for a given INRMP project.

6.2 ACHIEVING NO NET LOSS OF MILITARY MISSION

Section 101(b)(1)(I) of the Sikes Act states that each INRMP shall, to the extent appropriate and applicable, and consistent with the use of the installation to ensure the preparedness of the Armed Forces, provide for "no net loss in the capability of military installation lands to support the military mission of the installation." It is DOD policy that appropriate management objectives to protect mission capabilities of installation lands (from which annual projects are developed) be clearly articulated and receive high priority in the INRMP planning process (Navy 2006a).

The effectiveness of this INRMP in preventing "net loss" will be evaluated annually. Mission requirements and priorities identified in this INRMP will, where applicable, be integrated into other environmental programs and policies. It is not the intent that natural resources are to be consumed by mission requirements, but rather are sustained for the use of mission requirements. In order to achieve this, the goal of this INRMP is to conserve the environment for the purpose of the military mission. There may be instances in which a "net loss" may be unavoidable in order to fulfill regulatory requirements other than the Sikes Act, such as complying with a biological opinion under the provisions of the ESA, or from the protection of wetlands under the provisions of the CWA. However, both the USFWS and USACE are required to adhere to the Sikes Act provision of no net loss. Loss of mission capability in these instances will be identified in the annual update of the INRMP and will include a discussion of measures being undertaken to recapture any net loss in mission capability.

6.3 FUNDING SOURCES

Once INRMP projects have been validated and entered into EPR-web, ERL 4 and 3 projects are typically programmed in for funding. ERL 2 and 1 projects are not usually funded through the EPR-web system, and alternate sources of funding should be sought for these projects. EPR-web project entries should include clear justification of funds being requested so that: 1) natural resources funds are distributed wisely, and 2) funding levels are not threatened by the use of funds in ways that are inconsistent with funding program rules (Navy 2006a). The primary sources for funding Navy INRMPs include the following:

1) Operation and Maintenance, Navy (O&MN) Environmental Funds
2) DOD Legacy Resource Management Program (Legacy Program) Funds
3) Forestry Revenues
4) Agricultural Outleasing
5) Fish and Wildlife Fees
6) Recycling Funds
7) Strategic Environmental Research and Development Program (SERDP) Funds
8) Other Non-DOD Funds

6.3.1 O&MN Environmental Funds

A majority of natural resources projects are funded with O&MN environmental funds, and are primarily restricted to support "must-fund" environmental compliance projects (i.e., ERL 4 projects). O&MN funds are generally not allocated for ERL 1–3 projects. Other limitations for the use of O&MN funds include the following:

- Only the initial procurement, construction, and modification of a facility or project are considered valid environmental funding requirements. The subsequent operation, modification due to mission requirements, maintenance, repair, or eventual replacement is considered a Real Property Maintenance funding requirement.

- When natural resources requirements are tied to a specific construction project or other action, funds for the natural resources requirements should be included in the overall project costs.

O&MN Environmental Funds are expected to be the primary source of funding for NAVSTA Newport INRMP Environmental Compliance projects.

6.3.2 DOD Legacy Resource Management Program

The Legacy Resource Program was part of a special Congressionally-mandated initiative for funding military conservation projects. Although the Legacy Program was originally funded from 1991 to 1996 only, funds for new projects have continued to be available through this program. Legacy Program funds can be used for a variety of conservation projects, such as regional ecosystem management initiatives, habitat preservation efforts, archaeological investigations, invasive species control, monitoring and predicting migratory patterns of birds and animals, and national partnerships and initiatives, such as National Public Lands Day. More information on requirements for Legacy Resource Program applications can be found at: https://www.denix.osd.mil/legacy/home/.

Requests for Legacy funds should consider the following:

- The availability of Legacy Program funds is generally uncertain early in the year.
- Pre-proposals for Legacy Program projects are due in March and submitted using the Legacy Program Tracker Website: https://www.denix.osd.mil/legacy/home/.
- Project proposals are reviewed by the Navy chain of command before being submitted to the DOD Legacy Resources Management Office for final project selection.
- The Legacy Program website provides further guidance on the proposal process and types of projects requested.

Legacy Program funds should be considered as a potential funding source for NAVSTA Newport INRMP projects.

6.3.3 Forestry Revenues – N/A

Forestry Revenues originate from the sale of forest products on Navy lands, and can be used to fund forestry and potentially other natural resources management programs. NAVSTA Newport does not have the potential for Forestry Revenues, so this Navy funding source is not applicable.

6.3.4 Agricultural Outleasing Funds – N/A

Agricultural Outleasing funds are collected through the leasing of Navy-owned property for agricultural use. NAVSTA Newport does not have any Agricultural Outleases so this funding source is not applicable.

6.3.5 Fish and Wildlife Fees – N/A

Fish and wildlife fees are generally collected as part of installation fishing, or trapping programs. These fees are deposited and used in accordance with the Sikes Act and DOD financial management regulations. The Sikes Act specifies that user fees collected for fishing, or trapping shall be used only on the installation from where they are collected, and be used exclusively for fish and wildlife conservation and management at the installation where collected.

6.3.6 Recycling Funds

Installations that have a Qualified Recycling Program (QRP) may use their proceeds for some types of natural resources projects. Any proceeds collected as part of the installation QRP must first be used to cover QRP costs, and then up to 50 percent of the net proceeds can be for pollution abatement, pollution prevention, composting, alternative fueled vehicle infrastructure support, vehicle conversion, energy conversion, or occupational safety and health projects, with first consideration given to projects included in the installation's pollution prevention plans. Remaining funds may be transferred to the non-appropriated MWR account for approved programs, or retained to cover anticipated future program costs.

6.3.7 Strategic Environmental Research and Development Program (SERDP) Funds

The SERDP is DOD's corporate environmental research and development program, planned and executed in full partnership with the Department of Energy and EPA, with participation by numerous other federal and non-federal organizations (Navy 2006a). SERDP funds are allocated for environmental and conservation projects through a competitive process. The focus of SERDP is on cleanup, compliance, conservation, and pollution prevention technologies. Due to the competitive process involved with allocation of SERDP funds, NAVSTA Newport is not expected to receive funds through this source.

6.3.8 Other Non-DOD Funds

Non-DOD funds, such as those received from grant programs, are available to fund natural resources management projects, such as watershed management and restoration, habitat restoration, and wetland and riparian area restoration. Federally funded grant programs typically require non-federal matching funds; however, installations can partner with other groups for preparing proposals for eligible projects.

Other sources of funding may be available for natural resources that the installation may not be able to apply for directly, but could obtain funding for projects by partnering with the state or nonprofit organizations. Section 3.6 discusses potential partnerships and collaboration available to NAVSTA Newport. NAVSTA Newport should consider grant funding and partnerships as a potential funding source for INRMP projects.

Some potential opportunities for funding and grants in collaboration with NAVSTA Newport partners include the following:

- RICRMC
  - CRMC's *Coastal and Estuarine Habitat Restoration Program and Trust Fund* funds habitat restoration projects.
  - Municipalities, committees, nonprofit organizations, civic groups, educational institutions, and state agencies are eligible to propose projects for funding; it may be possible for NAVSTA Newport to partner with these entities on a joint project.

  - Annual funding for projects is $225,000. Individual project awards generally range from $5,000 to $50,000 per year.

- National Fish and Wildlife Foundation (NFWF)
  - NFWF has more than 70 grant programs to protect and restore wildlife and habitats, for example:
    - *Pulling Together Initiative* – This grant may be applicable to invasive species management on NAVSTA Newport.
    - *America's Great Outdoors: Landscape Conservation Stewardship Program* – This grant could be used to support a regional collaboration between NAVSTA Newport and partners focused on conserving wildlife, plants, and natural resources on Aquidneck Island and in Narragansett Bay.
    - *Five Star and Urban Waters Restoration Program* – This funding is focused on stewardship and restoration of coastal, wetland and riparian ecosystems.
    - *New England Cottontail* – A grant has been established for conservation work but currently is only relevant to Maine and New Hampshire.
  - Federal, state, and local governments, educational institutions, and nonprofit organizations are eligible to apply.

6.4 COMMITMENT

This INRMP will require formal adoption by the NAVSTA Newport Commanding Officer to ensure commitment for pursuing funding and to execute all ERL 4 projects, subject to the availability of funding. Funding of ERL 4 projects should be pursued within the specific timeframes identified in the projects table in Appendix C of this INRMP.

6.5 COOPERATIVE AGREEMENTS

A cooperative agreement is used to acquire goods or services, or stimulate an activity that will be implemented for the public good. Section 103a of the Sikes Act (16 USC §670c-1) provides the authority to enter into cooperative agreements with state and local governments, NGOs, and individuals to provide for the maintenance and improvement of natural resources or to benefit natural and historic research on DOD installations. In addition to standard cooperative agreements, examples of other agreements include MOAs/MOUs and Cooperative Assistance Agreements. Funds appropriated for multiyear agreements during a fiscal year may be obligated to cover the cost of goods and services provided under a cooperative agreement entered into or through an agency agreement during any 18-month period beginning in that fiscal year, without regard to whether the agreement crosses fiscal years (31 USC §1535). Cooperative agreements entered into are subject to the availability of funds.

EO 13352, *Facilitation of Cooperative Conservation* (26 August 2004), directs that the Secretaries of the Interior, Agriculture, Commerce, and Defense, and the Administrator of the EPA shall, to the extent permitted by law and subject to the availability of appropriations and in coordination with each other as appropriate:

- carry out the programs, projects, and activities of the agency that they respectively head that implements laws relating to the environment and natural resources in a manner that facilitates cooperative conservation;
- take appropriate account, and respect the interests, of persons with ownership or other legally recognized interests in land and other natural resources;
- properly accommodate local participation in federal decision making; and
- provide that the programs, projects, and activities are consistent with protecting public health and safety.

NAVSTA Newport has a cooperative agreement with NMFS for handling marine mammals or sea turtle strandings and whale necropsies. In the event of a live or dead stranding on NAVSTA Newport, installation personnel will immediately contact the NMFS regional stranding coordinator(s) and secure the area.

The installation also has an agreement with Narragansett Tribe and the Rhode Island Fisherman's Association (Appendix S) to allow access for fishing in waters adjacent to the station that have been designated as secure areas.

7.0 REFERENCES

American Bird Conservancy. 2009. Saving Migratory Birds for Future Generations: The Success of the Neotropical Migratory Bird Conservation Act. Washington, D.C. Available at: http://www.abcbirds.org/newsandreports/special_reports/act_songbirds.pdf. Last accessed 27 February 2019. 23 pp.

AFPMB (Armed Forces Pest Management Board). 2012. Technical Guide No. 37: Integrated Management of Stray Animals on Military Installations. Available at: https://www.acq.osd.mil/eie/afpmb/. Last accessed 16 December 2020. 16 pp.

Atlantic Coast Joint Venture. 2008. New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Implementation Plan. Available at: http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf. Last accessed 27 February 2019. 92 pp. + Appendices.

Atlantic Coast Joint Venture. Updated July 2009. Atlantic Coast Joint Venture Strategic Plan. Available at: http://www.acjv.org/documents/ACJV_StrategicPlan_2009update_final.pdf. Last accessed 27 February 2019. 36 pp. + Appendices.

Avian Power Line Interaction Committee. 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/SOSC/sosc_27.pdf. Last accessed 26 February 2019. 36 pp. + Appendices.

Benton, N., J.D. Ripley, and F. Powledge, Eds. 2008. Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers. ISBN 0-9711053-8-3. Arlington, VA: NatureServe. Available at: http://www.DODbiodiversity.org. Last accessed 27 February 2019.

Bradley, M., R. Hudson, M.C. Ekberg, and K. Raposa. 2012. Mapping Submerged Aquatic Vegetation in Rhode Island Coastal Waters. University of Rhode Island, Save the Bay, and National Estuarine Research Reserve. Available at: http://www.crmc.ri.gov/sav/2012_Mapping_Submerged_Aquatic_Vegetation.pdf. Last accessed 04 December 2013. Last accessed 23 February 2019. 10 pp.

Bradley, M., R., Chaffee, C., and K. Raposa. 2017. 2016 Tier 1 Mapping of Submerged Aquatic Vegetation (SAV) in Rhode Island and 20-year Change Analysis. Available at: http://www.crmc.ri.gov/sav/2016_SAVTier1Mapping.pdf. Last accessed 27 February 2019. 15 pp.

Butler, B. J. and E. H. Wharton, Eds. 2002. The Forests of Rhode Island. U.S. Department of Agriculture Forest Service, Northeastern Research Station: Newtown Square, PA. Available at: http://www.dem.ri.gov/programs/bnatres/forest/pdf/riforest.pdf. Last accessed 4 March 2019. 26 pp.

Cal-IPC. (California Invasive Plant Council). 2012. Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd ed.). Cal-IPC Publication 2012-03. California Invasive Plant Council, Berkeley, CA. Available at: https://www.cal-ipc.org/solutions/prevention/. Last accessed 4 March 2019. 72 pp.

CDC (Centers for Disease Control and Prevention). 2010. Ehrlichiosis: Symptoms, Diagnosis, and Treatment. [Website]. Available at: http://www.cdc.gov/ehrlichiosis/symptoms/index.html. Last accessed 16 December 2020.

CDC (Centers for Disease Control and Prevention). 2012a. Statistics and Epidemiology: Annual Cases of Ehrlichiosis in the United States.[Website]. Available at http://www.cdc.gov/ehrlichiosis/stats/. Last accessed 16 December 2020.

CDC (Centers for Disease Control and Prevention). 2012b. Preventing Ticks in the Yard. [Website]. Available at: http://www.cdc.gov/ticks/avoid/in_the_yard.html. Last accessed 16 December 2020.

CDC (Centers for Disease Control and Prevention). 2017. https://www.cdc.gov/lyme/datasurveillance/maps-recent.html. [Website]. Available at: https://www.cdc.gov/lyme/datasurveillance/index.html. Last accessed 24 March 2019.

CDC (Centers for Disease Control and Prevention). 2018. West Nile Virus. [Website]. Available at: http://www.cdc.gov/westnile/index.html. Last accessed 24 March 2019.

City of Newport. 2017. Comprehensive Land Use Plan. Available at: http://www.cityofnewport.com/home/showdocument?id=16539. Last accessed 24 March 2019. 14 pp.

Clark, K. E. and L. J. Niles. 2013. Northern Atlantic Regional Shorebird Plan. Version 1.0. U.S. Shorebird Conservation Plan and NJ Division of Fish and Wildlife. Available at: http://www.shorebirdplan.org/wp-content/uploads/2013/01/NATLAN4.pdf. 17 pp. + Appendices.

CFR (Code of Federal Regulations). 2000. Title 50, Section 10.13. List of Migratory Birds. Available at: http://www.gpo.gov/fdsys/granule/CFR-2000-title50-vol1/CFR-2000-title50-vol1-sec10-13/content-detail.html. Last accessed 16 December 2020.

CFR (Code of Federal Regulations). 2002. Title 32, Part 190. Natural Resources Management Program. Available at: http://www.gpo.gov/fdsys/granule/CFR-2002-title32-vol1/CFR-2002-title32-vol1-part190/content-detail.html. Last accessed 16 December 2020.

CFR (Code of Federal Regulations). 2012. Title 50, Parts 223 and 224. Endangered and Threatened Wildlife and Plants; Threatened and Endangered Status for Distinct Population Segments of Atlantic Sturgeon in the Northeast Region (Final Rule). Federal Register 77:24 (February 6, 2012) p. 5880.

CFR (Code of Federal Regulations). 2013. Title 50, Sections 17.11 and 17.12. Endangered and Threatened Wildlife and Plants. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=25ac49659469fc02ff12d80d8ffe5ee0&node=50:2.0.1.1.1.2.1.1&rgn=div8. Last accessed 8 September 2013. Last accessed 16 December 2020.

CFR (Code of Federal Regulations). 2013b. Title 50, Part 17. Review of Native Species that are Candidates for Listing as Endangered or Threatened (Proposed Rule). Federal Register 78:226 Part II (November 22, 2013) p. 70117. Available at: http://www.gpo.gov/fdsys/pkg/FR-2013-11-22/pdf/2013-27391.pdf. Last Accessed 16 December 2020.

CFR (Code of Federal Regulations). 2017. Title 50, Part 226. Endangered and Threatened Species; Designation of Critical Habitat for the Endangered New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments of Atlantic Sturgeon and the Threatened Gulf of Maine Distinct Population Segment of Atlantic Sturgeon. Federal Register 82:158 (August 17, 2017) p. 39160.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center. Available at: https://www.nrc.gov/docs/ML1801/ML18019A904.pdf. Last accessed 16 December 2020.

CRMC (Rhode Island Coastal Resources Management Council). n.d. Rules & Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast. Available at: http://www.planning.ri.gov/documents/LU/legtask/CRMC_Coastal-wetland-Rules_2013.pdf. Last accessed 13 February 2019.

CRMC (Rhode Island Coastal Resources Management Council). 2009. Aquidneck Island Special Area Management Plan for Portsmouth, Middletown, and Newport, Coastal Development Regulations. Available at: http://www.crmc.ri.gov/regulations/SAMP_AquidneckIsland.pdf. 35 pp. Last accessed 13 February 2019.

CRMC (Rhode Island Coastal Resources Management Council). 2010. Rhode Island Ocean Special Area Management Plan (SAMP). Available at: http://seagrant.gso.uri.edu/oceansamp/pdf/samp_crmc_revised/RI_Ocean_SAMP.pdf. Last accessed 13 February 2019. 1,021 pp.

CRMC (Rhode Island Coastal Resources Management Council). 2020. The State of Rhode Island Coastal Resources Management Program, As Amended, a.k.a. Red Book: 650-RICR-20-00-01. May 13, 2020, Available at: http://www.crmc.ri.gov/regulations/RICRMP.pdf. Last accessed 10 December 2020. 268 pp.

DOD (Department of Defense). 2018. Department of Defense (DOD) Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual*. Dated 29 May 2008 with Incorporating Changes dated 31 August, 2018. Available online at: https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/415007p.pdf?v. Last accessed 27 February 2019. 39 pp.

DOD (Department of Defense). 2018. Department of Defense Instruction (DODI) 4715.03: Natural Resources Conservation Program. Incorporating Change 2 Dated 31 August. Available at: https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/471503p.pdf?ver=2018-11-13-125207-877. Last accessed 15 January 2019. 41 pp.

DOD (Department of Defense). 2019. Department of Defense Instruction (DODI) 4715.03: Natural Resources Conservation Program. Incorporating Change 2 Dated 31 August. Available at: https://www.nwf.org/-/media/Documents/PDFs/NWF-Reports/2019/DoD-Adaptation-Guide.ashx. Last accessed 15 June 2020. 128 pp.

DOD (Department of Defense). 2002. Department of Defense Instruction (DODI) 1100.21: Voluntary Services in the Department of Defense. Available at: https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/110021p.pdf?ver=2019-04-15-120138-457. Last accessed 15 December 2020.

DOD NRP (Department of Defense Natural Resources Program). 2016. Adaptation Planning for Climate Change in Integrated Natural Resource Management Plans. Available at: http://www.dodnaturalresources.net/DoD_CC_INRMP_Fact_Sheet_8-12-16.pdf. Last accessed 16 January 2019.

DOD PIF (Department of Defense Partners in Flight). 2013. Homepage [Website]. Available at: http://www.DODpif.org/. Last accessed 16 December 2020.

DOD PIF (Department of Defense Partners in Flight). 2014. DOD PIF Strategic Plan. Available at: http://www.DODpif.org/plans/stratplan.php. Last accessed 27 February 2019. 44 pp.

DODI PMP (Department of Defense Instruction Pest Management Plan). 2018. DOD Pest Management Plan. Available at https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/415007p.pdf?v. Last Accessed 20 March 2019.

DOD and USACE (Department of Defense Legacy Program and U.S. Army EnvironmentalCenter). 2005. SAV restoration handbook: A Guide for Restoring SAV on DOD Installations. Horne Engineering Services, Inc. Available at: https://www.denix.osd.mil/nr/vegetationandhabitat/sav/guidance/sav-restoration-handbook-a-guide-for-restoring-sav-on-dod-installations/. Last accessed 24 February 2019. 134 pp. + Appendices.

DOD and USFWS (Department of Defense and U.S. Fish and Wildlife Service). 2004. Integrated Natural Resources Management Plans. Available online at: https://www.fws.gov/fisheries/sikes_act/documents/INRMP%20Fact%20Sheet.pdf. Accessed 16 December 2020.

Endangered Species Act of 1973. 7 U.S.C. § 136, 16 U.S.C. § 1531, et seq., as amended.

Enser, R., D. Gregg, C. Sparks, P. August, P. Jordan, J. Coit, C. Raithel, B. Tefft, B. Payton, C. Brown, C. LaBash, S. Comings, and K. Ruddock. 2011. Rhode Island Ecological Communities Classification. Technical Report. Rhode Island Natural History Survey, Kingston, RI. Available at: www.rinhs.org. Last accessed 14 February 2018.

EPA (U.S. Environmental Protection Agency). n.d.(a). WATERS GeoViewer. [Website]. Available at: https://www.epa.gov/waterdata/waters-geoviewer. Last accessed 18 February 2019.

EPA (U.S. Environmental Protection Agency). n.d.(b). Watershed Assessment, Tracking, and Environmental Results. [Website]. Available at: http://ofmpub.epa.gov/waters10/attains_waterbody.control?p_list_id=RI0007030E-01A&p_report_type=T&p_cycle=2012. Last updated: 17 February 2019.

EPA (U.S. Environmental Protection Agency). n.d.(c). Wetlands and West Nile Virus. [Website]. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi/30005UPA.PDF?Dockey=30005UPA.PDF. Last accessed 27 February 2019.

EPA (U.S. Environmental Protection Agency). n.d.(d) Clean Water Act §230.3(q-1) Definitions.

EPA (U.S. Environmental Protection Agency). 2004. Wetlands Overview. EPA 843-F-04-011a. Office of Water, December 2004. Available at: https://www.epa.gov/wetlands. Last accessed 17 Februrary 2019.

EPA (U.S. Environmental Protection Agency). 2007. National Estuary Program Coastal Condition Report, Chapter 3: Northeast National Estuary Program Coast Condition, Narragansett Bay Estuary Program. Available at: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=60000CWA.TXT. Last accessed 27 January 2019.

EPA (U.S. Environmental Protection Agency). 2012a. Ecoregions of New England. [Website]. Available at: https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NHEERL&dirEntryId=209857. Last accessed 17 February 2019.

EPA (U.S. Environmental Protection Agency). 2012b. Coastal Watershed Factsheets – Nearshore Waters and Your Coastal Watershed. [Website]. Available at: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=200050HE.TXT. Last accessed 24 March 2019.

EPA (U.S. Environmental Protection Agency). 2016a. Climate Change Indicators in the United States. Fourth Edition. Available at: https://www.epa.gov/sites/production/files/2016-08/documents/climate_indicators_2016.pdf. Last accessed 30 January 2019.

EPA (U.S. Environmental Protection Agency). 2016b. Beneficial Landscaping: Environmentally-Friendly Landscaping. [Website]. Last updated 21 February 2016. Available at: https://archive.epa.gov/wastes/conserve/tools/greenscapes/web/html/brochure.html. Last accessed 22 October 2013.

EPA (U.S. Environmental Protection Agency). 2019. How Wetlands Are Defined. [Website]. Available at: https://www.epa.gov/cwa-404/how-wetlands-are-defined-and-identified-under-cwa-section-404#:~:text=%22Wetlands%20are%20areas%20that%20are,life%20in%20saturated%20soil%20conditions.. Last accessed 20 November 2020.

Executive Climate Change Council Science and Technical Advisory Board. 2016. Current State of Climate Science in Rhode Island, a Report from the STAB to the EC4. Available at http://climatechange.ri.gov/documents/ec4-science-and-technical-advisory-board-report.pdf. Last accessed 11 February 2020.

FEMA (Federal Emergency Management Agency) 2020. FEMA Flood Map Service Center. Available at: https://msc.fema.gov/portal/home. Last accessed 20 November 2020.

Fish and Wildlife Conservation Act. 1980. 16 U.S.C. 2901-2911. 94 Stat. 1322. Available at: http://www.fws.gov/laws/lawsdigest/fwcon.html. Last accessed 15 January 2020.

FAO (Food and Agriculture Organization of the United Nations). Biodiversity for a World without Hunger: Pollinators. 2013. [Website]. Available at: http://www.fao.org/biodiversity/components/pollinators/en/. Last accessed 6 November 2013.

Gould, L. L. 2005. “The Invasives Beat: What’s Here and Where Is It?” *Rhode Island Naturalist*; Science and News from the *Rhode Island Natural History Survey* (12)1: 18-19.

Harvey, M. J., J. S. Altenbach, and T. L. Best. 2011. Bats of the United States and Canada. Johns Hopkins University Press, Baltimore, Maryland.

Heffner, Leanna, Rebecca Williams, Virginia Lee, Pam Rubinoff, and Carissa Lord. 2012. Climate Change in Rhode Island: Past, Present, and Future. Graduate School of Oceanography and Coastal Resources Center, University of Rhode Island. Available at: https://www.researchgate.net/publication/263008850_CLIMATE_CHANGE_RHODE_ISLAND'S_COASTS_PAST_PRESENT_AND_FUTURE. Last accessed 22 February 2019. pp. + References.

Hoegh-Guldberg, O. and Cai, Rongshuo. 2014. The Ocean. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (eds Barros, V.R., *et al*.). Cambridge University Press.

Hermes, O.D., L.P. Gromet, and D.P.Murray. 1994. Bedrock Geologic Map of Rhode Island, Office of the Rhode Island State Geologist.

Hill, J., and J. Smith. 1984. Bats: A Natural History. University of Texas Press, Austin, Texas.

Hoover, Gregory A. 2001. Penn State College of Agricultural Sciences Cooperative Extension Entomological Notes: Gypsy Moth. The Pennsylvania State University, State College, PA. Available at: https://extension.psu.edu/gypsy-moth. Last accessed 7 August 2020.

Kenney, Robert D., and Kathleen J. Vigness-Raposa. 2010. Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan. University of Rhode Island, Kingston, Rhode Island. Available online at: http://seagrant.gso.uri.edu/oceansamp/pdf/appendix/10-Kenney-MM&T_reduced.pdf. Last accessed 23 February 2019. 286 pp.

Lang, S. 2013. Email, dated 20 June 2013. Piping Plover Nest at 2nd Beach in Middletown. Submitted to S. Kam, NAVSTA Newport.

Leidos, Inc. and Louis Berger, Inc. 2017. Climate Change Installation Adaption and Resilience Planning Handbook. Final Report. January 2017.

Loss, S. R., T. Will, and P.P. Marra. 2013.”The Impact of Free-ranging Domestic Cats on Wildlife in the United States.” *Nature Communications* 4, Article 1396. (doi:10.1038/ncomms2380).

LymeNet. 2020. Frequently Asked Questions. [Website]. East Brunswick, New Jersey: The Lyme Disease Network of New Jersey. Available online at: http://www.lymenet.org/help.shtml. Last accessed 15 February 2019.

Manem Waterbird Working Group. 2006. Waterbird Conservation Plan for the Mid-Atlantic/New England/Maritimes Region: 2006-2010. Available at: http://atlanticmarinebirds.org/downloads/MANEM_plan.pdf. 44 pp. Last accessed 19 February 2019.

Marine Mammal Protection Act. 1972. 16 U.S.C. § 1401et seq., as amended.

Marstel-Day, Inc. 2010. Bldg. 1268 CHI Courtyard Improvements: LID Drainage Design, Naval Station Newport. From Scope of Work: Walkway at Bldg. 1268 CHI. Available at: https://intranet.marstel-day.com:987/projects/navy/NAVSTA/Shared%20Documents/Incoming%20Files/LID/BLDG%201268.pdf. Last accessed 14 October 2013.

Matuk, V., L. T. Johnson, D. Norton, V. V. Way, J. Thompson, and L.McMartin. 2009. Preventing the Spread of Aquatic Invasive Species—Best Management Practices for Boaters. Available at: https://dbw.parks.ca.gov/pages/28702/files/bmp-boaters.pdf. Last accessed 4 March 2019.

Melillo, J. M., T.C. Richmond, and G. W. Yohe, Eds., 2014. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2

Michael Baker Jr., Inc. 2011. Final Hazardous Waste Contingency Plan, Naval Station Newport, Newport, Rhode Island. 128 pp.

Migratory Bird Treaty Act of 1918. 16 USC § 703–716.

Moll, T.E., J.S. Krumholz, G.H. Mitchell, C.G. Tompsett, T.E. Vars, and Z.D. Singer-Leavitt. 2016. Haul-out Counts and Photo-Identification of Pinnipeds in Narragansett Bay, Rhode Island: 2015/16 Annual Progress Report. Prepared for U.S. Fleet Forces Command, Norfolk, Virginia. December 2016.

NatureServe. 2013. "Ecosystems 101." *LandScope America.* http://www.landscope.org/explore/ecosystems/ecosystems_101/. Last accessed 22 February 2019.

NAVFAC (Naval Facilities Engineering Command). 2011. Hazardous Waste Contingency Plan.

NAVFAC (Naval Facilities Engineering Command). 2012. Spill Prevention Control and Countermeasure Plan (SPCC). 47 pp. + Appendices.

NAVFAC (Naval Facilities Engineering Command). 2014. Pollinator Friendly Pesticide Applicator Best Management Practices. Available at: http://www.dodpollinators.org/Pollinator_BMPs_factsheet.pdf. Last accessed 24 April 2019.

NAVFAC Atlantic (Naval Facilities Engineering Command Atlantic). 2009. Integrated Pest Management Plan, Naval Station Newport, Newport, Rhode Island. Prepared by Geo-Marine. May.

NAVFAC MIDLANT (Naval Facilities Engineering Command Mid-Atlantic). 2008. Naval Station Newport Vision 2035 Master Plan. Final Report. Prepared for Commander, Naval Installations Command, Naval Station Newport, by EDAW AECOMM, DMJM Design, Fitzgerald and Halliday. 120 pp. July.

NAVFAC MIDLANT (Naval Facilities Engineering Command Mid-Atlantic). 2012. Site Management Plan for Naval Station Newport, Newport, Rhode Island. Tetra Tech, Inc. Contract: N62470-08-D-1001. Task Order: WE50.

NAVSTA Newport (Naval Station Newport). 2001. Naval Station Newport Integrated Natural Resouces Management Plan, Newport, Rhode Island. Prepared for NAVFAC and Naval Station Newport Environmental Department by The Louis Berger Group, Inc.

NAVSTA Newport (Naval Station Newport). 2003. Tank Farms 1–5 and Carr Point Final Wetland Survey Report.

NAVSTA Newport (Naval Station Newport). 2004. Phase II Stormwater Management Program Plan. Prepared by the ESS Group, Inc., East Providence, RI. 25 pp.

NAVSTA Newport (Naval Station Newport). 2008a. NAVSTA Newport Vision 2035: Master Plan Community Brief. NAVSTA Newport, RI. Prepared by EDAW/AECOM. Available at: http://www.rabnewportri.org/enclosures/Sept2008Encl2.pdf. Last accessed 17 January 17, 2019.

NAVSTA Newport (Naval Station Newport). 2008b. Encroachment Action Plan: NAVSTA Newport, RI. Prepared by Ecology & Environment.

NAVSTA Newport (Naval Station Newport). 2011a. Preliminary Final Environmental Assessment for the Development of Wind Energy Facilities at NAVSTA Newport. Prepared by McLaughlin Research Corporation and Geo-Marine, Inc. August.

NAVSTA Newport (Naval Station Newport). 2012b. Industrial Stormwater Management Pollution Prevention Plan.

NAVSTA Newport (Naval Station Newport). 2013. History: The Navy and Narragansett Bay. [Website]. Available at: http://www.cnic.navy.mil/regions/cnrma/installations/ns_newport/about/history.html. Last accessed 17 January 2019.

NAVSTA Newport (Naval Station Newport). 2014a. Instruction 5090.26B: NAVSTA Newport Recreational Fishing Procedures. July 21, 2014.

NAVSTA Newport (Naval Station Newport). 2014b. Naval Station Newport Recreational Fishing Procedures. Available at: https://www.cnic.navy.mil/content/dam/cnic/cnrma/pdfs/NAVSTA%20Newport/Instructions/5090.26B%20Fishing%20Instruction%20Signed%20July%2021%202014.pdf. Last accessed 24 April 2019.

NAVSTA Newport (Naval Station Newport). 2017. Integrated Natural Resources Management Plan Addendum for Outlying Parcels: Fisher’s Island Annex, Seneca Lake Detachment, and Dodge Pond Field Station. Naval Station Newport, Newport Rhode Island. Prepared for NAVFAC and Naval Station Newport Environmental Department by Tetra Tech, Inc.

NAVSTA Newport (Naval Station Newport). 2018. Navalog, User Guide & Reference. December 12, 2018. Available onlune at: https://www.cnic.navy.mil/regions/cnrma/installations/ns_newport/news/navalog/navalogs-from-2018.html. Last accessed 17 January 2019.

NAVSTA Newport (Naval Station Newport). 2019. Installation Information. Available at: http://www.cnic.navy.mil/regions/cnrma/installations/ns_newport.html. Last accessed 27 February 2019.

Navy (U.S. Department of the Navy). 2006a. Integrated Natural Resources Management Plan Guidance for Navy Installations: How to Prepare, Implement, and Revise Integrated Natural Resources Management Plans (INRMP). Available at: https://www.ready.navy.mil/content/dam/navfac/Specialty%20Centers/Engineering%20and%20Expeditionary%20Warfare%20Center/Environmental/Restoration/er_pdfs/g/navy-ev-rpt-inrmp-guide-199809.pdf. Last accessed 20 November 2020.

Navy (U.S. Department of the Navy). 2006b. Special Incident Reporting. Chief of Naval Operations Instruction (OPNAVINST) 3100.6H. 3 February 2006. Available at: http://navybmr.com/study%20material/OPNAVINST%203100.6.pdf. Last accessed 27 February 2019. 166 pp.

Navy (U.S. Department of the Navy). 2007. Encroachment Management Programs, Procedures and Guidelines. Chief of Naval Operations Instruction (OPNAVINST) 11010.40. March 27, 2007. Available online at: https://www.secnav.navy.mil/doni/Directives/11000%20Facilities%20and%20Land%20Management%20Ashore/11-00%20Facilities%20and%20Activities%20Ashore%20Support/11010.40.pdf. Last accessed 4 March 2019. 33 pp.

Navy (U.S. Department of the Navy). 2015. Integrated Cultural Resources Management Plan (2014-2018), Naval Station Newport, Newport, Rhode Island, Final Report. Prepared by Naval Facilities Engineering Command, Mid-Atlantic, Norfolk, Virginia. October 2015. pp.

Navy (U.S. Department of the Navy). 2017. Nearshore Surveys, Naval Station Newport, Rhode Island, Draft Report. Prepared for NAVFAC Mid-Atlantic by Versar, Inc., under NAVFAC Contract N62470-13-D-8017, Delivery Order WE07. Springfield, Virginia.

Navy (U.S. Department of the Navy). 2019a. OPNAV Manual 5090.1 (OPNAV M-5090.1). Environmental Readiness Program Manual. Dated January 10, 2014. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington DC. Available at: https://www.med.navy.mil/sites/nmcphc/Documents/program-and-policy-support/OPNAV-M-5090.1E.pdf. Last accessed 20 February 2021.

Navy (U.S. Department of the Navy). 2019b. OPNAV Instruction 5090.1E (OPNAVINST 5090.1). Environmental Readiness Program. Dated September 3, 2019. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington DC. Available at: https://www.secnav.navy.mil/doni/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-00%20General%20Admin%20and%20Management%20Support/5090.1E.pdf. Last accessed 13 February 2020. 4 pp.

NBEP (Narragansett Bay Estuary Program). 2012. Comprehensive Conservation and Management Plan (CCMP). Available at: http://nbep.org/about/comprehensive-conservation-management-plan/. Last accessed January 27 2019.

NBEP (Narragansett Bay Estuary Program). 2017. "State of Narragansett Bay and its Watershed." Available at http://nbep.org/01/wp-content/uploads/2017/10/State-of-Narragansett-Bay-and-Its-Watershed-Summary-Report.pdf. Last accessed 13 February 2019.

NEC Regional Technical Committee. 2013. *Best Management Practices: How to Make and Manage Habitat for the New England Cottontail.* Available at: https://newenglandcottontail.org/sites/default/files/research_documents/Best%20Management%20Practices%20for%20New%20England%20Cottontail.pdf. Last accessed 3 March 2019.

NMFS (National Marine Fisheries Service). 2019. Cusk (*Brosme brosme*). Available at: https://www.fisheries.noaa.gov/species/cusk. Last accessed 18 February 2019.

NOAA (National Oceanic and Atmospheric Administration) 2010. 1981-2010 Normals Data, Annual/Seasonal Normals at T.F. Green Airport, National Climatic Data Center Climate Data. Available at: http://www.ncdc.noaa.gov/land-based-station-data/climate-normals/1981-2010-normals-data. Last accessed 4 March 2019.

NOAA (National Oceanic and Atmospheric Administration). 2013. Letter: Information on Species Listed under the Endangered Species Act at Naval Station Newport, Newport, Rhode Island. Submitted by Mary A. Colligan, Assistant Regional Administrator for Protected Resources. Dated 28 June 2013. Gloucester, MA. 3 pp.

NOAA (National Oceanic and Atmospheric Administration). 2019. Marine Mammals. Available at: https://www.noaa.gov/education/resource-collections/marine-life/marine-mammals#:~:text=Threats%20and%20protection,%2C%20harassment%2C%20and%20ship%20strikes. Last Accessed 7 August 2020

NOAA (National Oceanic and Atmospheric Administration). 2020. NOAA Essential Fish Habitat Mapper. Available at: https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper. Last accessed 1 September 2020.

NOAA (National Oceanic and Atmospheric Administration) Fisheries. n.d. Atlantic Sturgeon: About the Species. Available at: https://www.fisheries.noaa.gov/species/atlantic-sturgeon#:~:text=lifetime%20egg%20production.-,Threats,from%20rivers%2C%20and%20vessel%20strikes. Last accessed 15 June 2020.

NOAA (National Oceanic and Atmospheric Administration) Fisheries. 2019. NOAA Fisheries Greater Atlantic Regional Fisheries Office Essential Fish Habitat (EFH) Assessment & Fish and Wildlife Coordination Act (FWCA) Worksheet. Available at: file:///C:/Users/sandra/Downloads/EFHWorksheet_revisions%202019%20final%20(1).pdf. Last accessed 15 June 2020.

OSD (Office of the Under Secretary of Defense). 2006. Memorandum: Integrated Natural Resource Management Plan (INRMP) Template, dated 14 August 2006. Available at: https://www.denix.osd.mil/nr/focus-areas/integrated-natural-resource-management-plans-inrmps/guidance/dod-inrmp-template/. Last accessed 9 January 2019.

Osenkowski, J. 2014. Email, dated 29 April 2014. Newport INRMP Agency Review. Submitted to S. Kam, NAVSTA Newport.

Rhode Island General Law. 2007.Chapter 45-61.2. The Smart Development for a Cleaner Bay Act of 2007. Available at: https://law.justia.com/codes/rhode-island/2010/title45/chapter45-61.2/. Last accessed 22 February 2019.

Rhode Island Sea Grant. 2013a. Sea Level Rise: Trends and Impacts. Available at: http://www.beachsamp.org/wp-content/uploads/2016/09/climate_SLR_factsheet2013.pdf. Last accessed 29 February 2019.

Rhode Island Sea Grant. 2013b. Sea Level Rise and the Conservation of Coastal Wetlands. Available at: https://www.landandwaterpartnership.org/documents/Summit2014/3G-SLAMM_fact_sheet.pdf. Last accessed 29 February 2019.

Rhode Island Sea Grant. 2013c. Precipitation and Storms in Rhode Island: Trends and Impacts. Available at: http://www.beachsamp.org/wp-content/uploads/2016/09/climate_storms_factsheet2013.pdf. Last accessed 24 April 2019.

Rhode Island Sea Grant. 2014. Rhode Island Shellfish Management Plan. Joint project of the University of Rhode Island, Rhode Island Coastal Resources Management Council, and Rhode Island Department of Environmental Management. Available at: http://www.rismp.org/about/. Last accessed 27 February 2019.

Rhode Island Wild Plant Society. n.d. Going Native: Selecting Non-invasive Plants for Your Landscape. Available at: https://www.ecolandscaping.org/12/designing-ecological-landscapes/native-plants/going-native-the-sustainable-choice/. Last accessed 23 February 2019.

RICRMC (Rhode Island Coastal Resources Management Council). n.d. Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast. Available at: http://www.crmc.ri.gov/regulations.html . Last accessed 20 January 2020.

RICRMC (Rhode Island Coastal Resources Management Council). 2009. Aquidneck Island Special Area Management Plan Coastal Development Regulations. Available at: http://www.crmc.ri.gov/regulations/SAMP_AquidneckIsland.pdf. Last accessed 25 February 2019. 35 pp.

RICRMC (Rhode Island Coastal Resources Management Council). 2011. Rhode Island Ocean Special Area Management Plan. Prepared by J. McCann, University of Rhode Island Coastal Resources Center/Rhode Island Sea Grant College Program. Available at: http://www.crmc.ri.gov/samp_ocean/finalapproved/RI_Ocean_SAMP.pdf Last accessed 23 February 2019. 1021 pp.

RICRMC (Rhode Island Coastal Resources Management Council). 2012. The State of Rhode Island Coastal Resources Management Program: As amended. Available at: http://www.crmc.ri.gov/regulations/RICRMP.pdf. Last accessed 23 February 2019.

RICRMC (Rhode Island Coastal Resources Management Council). 2013. Submerged Aquatic Vegetation (Eelgrass). [Website]. Available at: http://www.crmc.ri.gov/sav.html. Last accessed 22 February 2019.

RICRMP (Rhode Island Coastal Resources Management Program). 2018. The Red Book. Available at http://www.crmc.ri.gov/regulations/RICRMP.pdf. Last accessed 23 February 2019.

RIDEM (Rhode Island Department of Environmental Management). n.d. (a) Groundwater Classification, Wellhead Protection Areas and Drinking Water Reservoir Watersheds for Rhode Island. Available at: http://www.dem.ri.gov/maps/mapfile/gw10/pdf/statemap.pdf. Last accessed 22 February 2019.

RIDEM (Rhode Island Department of Environmental Management). n.d. (b) Wildland Fire Weather Information for Rhode Island. Available at: http://www.dem.ri.gov/programs/bnatres/forest/pdf/firewthr.pdf. Last accessed 22 February 2019.

RIDEM (Rhode Island Department of Environmental Management). 1989. Rhode Island Erosion and Sediment Control Handbook. Prepared by USDA Soil Conservation Service and Rhode Island Department of Environmental Management, with input from Stormwater Management and Erosion Control Advisory Committee. Available at: http://www.dot.ri.gov/about/Soil_Erosion_Sediment_Control_Handbook.php. Last accessed 22 February 2019. 221 pp. + Appendices.

RIDEM (Rhode Island Department of Environmental Management). 2015. 2015 Rhode Island Wildlife Action Plan. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/swap/elemgyde.pdf. Last Accessed 22 February 2019.

RIDEM DFE (Rhode Island Department of Environmental Management Division of Forest Environment). 2005. Rhode Island Forest Resources Management Plan. State Guide Plan Element 161, Report 108. Prepared by RIDEM's Rhode Island Department of Administration Statewide Planning Program. 53 pages plus appendices. Available at: http://www.planning.ri.gov/documents/guide_plan/forestplan.pdf. Approx. 40 pp. + Appendices. Last accessed 22 February 2019.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). n.d. (a). Native Snakes of Rhode Island. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/snake.pdf. Last accessed 20 February 2019.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). n.d. (b). Turtles in Rhode Island. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/turtle.pdf. Last accessed 20 February 2019.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). n.d. (c) What You Should Know about Bats. Available at: https://rhodeislandwoods.uri.edu/files/bats.pdf. Last accessed 20 February 2019.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife. n.d. (d). White-tailed Deer in Rhode Island. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/deer.pdf. Last accessed 25 February 2019

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). 2006. Management & Response Protocols for Incidents Involving Coyotes. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/coyotpol.pdf. Last accessed 27 February 2019.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). 2015. Comprehensive Wildlife Conservation Strategy. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/swgplan.pdf. Last accessed 27 February 2019. 357 pp.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). 2013. Rabies: The Facts You Need to Know Now. [Website]. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/rabies.pdf. Last accessed 25 February 2020.

RIDEM DFW (Rhode Island Department of Environmental Management Division of Fish and Wildlife). 2019. Homepage [Website]. Available at: http://www.dem.ri.gov/programs/fish-wildlife/. Last accessed 27 February 2019.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2005. State of Rhode Island and Providence Plantations Water Monitoring Strategy 2005-2010. Providence, RI: RIDEM OWR. Available at: http://www.dem.ri.gov/bayteam/documents/DEM%20Water%20Monitoring%20Strategy%202005-2010.pdf. Last accessed on 22 February 2019..

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2007. Perimeter, Riverbank, and Floodplain Wetlands. Wetlands #9 Fact Sheet.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2008a. Ground Water and Wetlands Protection Program: Avoidance and Minimization Guidance. Available at: http://www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/avoidmin.pdf.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2008b. What's the Scoop on Wetlands? Providence, RI: RIDEM OWR. Available at: http://www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/scoop.pdf. Last accessed 22 February 2019. 53 pp.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2009. Water Quality Regulations 2006, Amended May 2009. Available at: http://www.dem.ri.gov/pubs/regs/regs/water/h20q09.pdf. Last accessed 26 November 2013. 149 pp.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2010. Freshwater Wetlands Program: Wetland BMP Manual. Available at: http://www.dem.ri.gov/programs/water/permits/wetbmp.php. Last accessed 23 February 2019.100 pp.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2018. State of Rhode Island 2016 Impaired Waters Report, Final. Providence, RI: RIDEM OWR. Available at: http://dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/iwr16.pdf. Last accessed 22 February 2019. 78 pp.

RIDEM OWR (Rhode Island Department of Environmental Management Office of Water Resources). 2019. Water Quality Regulations. Available at: http://dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/ri-water-monitoring-strategy-19.pdf. Last accessed 9 August 2020. 144 pp.

RIGIS (Rhode Island GIS Geographic Information System). 2013. Soil Survey Geographic (SSURGO) Soil Polygons; Soils13. Environmental Data Center, University of Rhode Island. Available at: http://www.edc.uri.edu/rigis. Last accessed 17 August 2020.

RINHS (Rhode Island Natural History Survey). 2006. Natural Resources Inventory and Assessment of Naval Station Newport, Newport County, Rhode Island. Prepared by K. Puryear, Ecological Inventory, Monitoring, and Stewardship Program. Kingston, RI. 118pp + Figures.

Rodgers, S. E., and T.N. Mather. 2007. "Human *Babesia Microti* Incidence and *Ixodes Scapularis* Distribution, Rhode Island, 1998-2004." *Emerging Infectious Diseases* 13(4):633-635. (doi: 10.3201/eid1304.061035).

Reubush, T.K. II, Cassaday, P.B., Marsh, H.J., Lisker. S.A., Voorhees, D.B., Mahoney E.B., and G.R. Healy. 1977. "Human Babesiosis on Nantucket Island: Clinical Features." *Annals of Internal Medicine* 86(1):6-9. (doi:10.7326/0003-4819-86-1-6).

Save the Bay. 2013. Coastal Erosion and Adaptation on the Rhode Island Coastline, Summary Report. Available at: http://www.crmc.ri.gov/coastalresilience/RI_Coastal_Erosion_Adaptation.pdf. Last accessed 19 January 2020. 14 pp.

Sikes Act Improvement Act of 1997. U.S.C. Title 16 § 670a. Cooperative Plan for Conservation and Rehabilitation. https://www.law.cornell.edu/uscode/text/16/670a. Last Accessed 15 November 2019.

Smith, L., S. Whitehouse, and C. A. Oviatt. 2010. "Impacts of Climate Change on Narragansett Bay." *Northeastern Naturalist* 17(1):77-90. Available at: https://www.jstor.org/stable/40664840?seq=1. Last Accessed 7 August 2020. 14 pp.

State of Rhode Island. n.d. General Laws, Fish and Wildlife, Endangered Species of Animals and Plants. Title 20-37-3. http://webserver.rilin.state.ri.us/Statutes/TITLE20/20-37/20-37-3.HTM. Last accessed 15 January 2020.

Stein, B. A., Ph.D. 2008. "Biodiversity and the Military Mission." *Conserving Biodiversity on Military Lands. A Guide for Natural Resource Managers.* NatureServe. http://www.DODbiodiversity.org/introduction/index.html. Last accessed 22 February 2019.

Strickland, J. 2011. "Indiana: Climate Change Raises Stakes in Efforts to Conserve Endangered Indiana Bat." *U.S. Fish & Wildlife Service Open Spaces.* Last accessed 22 February 2019. Available at: http://www.fws.gov/news/blog/index.cfm/2011/5/24/Indiana-Climate-Change-Raises-Stakes-in-Efforts-to-Conserve-Endangered-Indiana-Bat.

Tefft, B. C. 2018. 2017–18 Rhode Island White-tailed Deer Status Report. Rhode Island Department of Environmental Management (RIDEM) Division of Fish and Wildlife (DFW). West Kingston, RI: RIDEM DFW. Available at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/deerharv.pdf. Last accessed 15 January 2020. 11 pp.

Tetra Tech, Inc. 2008. Wetland Delineation and Waterbody Identification Report, NUSC Disposal Area, Town of Middletown, Newport County, Rhode Island. Prepared for Naval Station Newport.

Tetra Tech, Inc. 2011. Memorandum: Wetland Functions and Values Assessment at Coddington Cove RFA, NAVSTA Newport.

Tetra Tech, Inc. 2012. Avian Risk Assessment for a Proposed Wind Project at Naval Station Newport, Rhode Island. Prepared for Naval Facilities Engineering Command – Mid-Atlantic.

Tetra Tech, Inc. 2013. Vegetation Community Classification, Flora and Fauna, and Wetlands Surveys and Mapping Conducted in Support of NAVSTA Newport INRMP Update. August and October.

Tetra Tech, Inc. 2014. Final Bat Assessment Report, Naval Station Newport, Newport, Rhode Island. Arlington, Virginia. 38 pp.

Tetra Tech, Inc. 2019a. Northern Long-eared Bat Presence/Absence Survey Report: Naval Station Newport. 52 pp.

Tetra Tech, Inc. 2019b. Baseline Bat Acoustic Survey Report, Naval Station Newport, Rhode Island. 52 pp.

The Conservation Agency. 2014. Narragansett Bay Coyote Study. [Website]. Available at: http://theconservationagency.org/narragansett-bay-coyote-study/. Last accessed 19 January 2020

The Heinz Center. 2013. Rhode Island Pollinators and Agriculture. Available at: https://conbio.org/images/content_publications/RIPollinatorsandAgriculture.pdf. Last accessed 15 January 2020.

Town of Middletown. 2007. Generalized Land Use Map. Available at: https://planning.middletownri.com/geographic-information-system/. Last accessed 26 August 2020.

URI (University of Rhode Island) Climate Change Collaborative. 2011. Climate Change in Rhode Island: What's Happening Now and What You Can Do. Rhode Island Sea Grant. Available at: http://oceanservice.noaa.gov/education/pd/climate/teachingclimate/climate_change_in_rhode_island.pdf. Last accessed 16 January 2019. 4 pp.

URI (University of Rhode Island)-Coastal Resources Center (CRC). 2018. Rhode Island Coastal Resources Management Council Shoreline Change Special Area Management Plan (SAMP). Available at: http://www.beachsamp.org/wp-content/uploads/2018/09/BeachSAMP_Cover_JCBTribute_Cred-Ack_TOC_FINAL.pdf. Last accessed 21 March 2019.

URI (University of Rhode Island) Cooperative Extension. n.d. Learning from the Past: Rhode Island Forest History. Available at: https://rhodeislandwoods.uri.edu/files/HISTORY-dragged.pdf. Last accessed 24 April 2019.

USDA (United States Department of Agriculture). 1981.Soil Survey of Rhode Island, Soil Conservation Service. Available at: http://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=RI. Last Accessed 14 February 2020.

USDA – FS (U.S. Department of Agriculture – Forest Service). 2012. Non-native Invasive Species Best Management Practices: Guidance for the U.S. Forest Service Eastern Region. Available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5412628.pdf. Last accessed 4 March 2019. 231 pp. + References and Appendices.

USDA – FS (U.S. Department of Agriculture – Forest Service). 2013. Forests on the Edge: Wildfire Report. Available at: http://www.fs.fed.us/openspace/fote/wildfire-report.html. Last accessed 15 February 2020.

USDA-FS (U.S. Department of Agriculture – Forest Service). 2020. Urban and Community Forestry Program. [Website]. Last modified 19 March 2013. Available at: https://www.fs.usda.gov/managing-land/urban-forests/ucf#:~:text=The%20Urban%20%26%20Community%20Forestry%20(UCF,and%20towns%20of%20all%20sizes.. Last accessed 15 February 2020.

USDA-FS (U.S. Department of Agriculture – Forest Service). 2018. New England and Northern New York Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the New England Climate Change Response Framework Project. Available at: https://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs173.pdf. Last accessed 24 April, 2019.

USDA-FS (U.S. Department of Agriculture – Forest Service). 2020. Urban and Community Forestry Program. [Website]. Last modified 19 March 2013. Available at: https://www.fs.usda.gov/managing-land/urban-forests/ucf#:~:text=The%20Urban%20%26%20Community%20Forestry%20(UCF,and%20towns%20of%20all%20sizes.. Last accessed 15 February 2020.

USDA - NISIC (United States Department of Agriculture – National Invasive Species Information Center). n.d. Manager's Tool Kit: Prevention. [Website]. Available at: http://www.invasivespeciesinfo.gov/toolkit/preventionbmp.shtml. Last accessed 6 August 2020.

USDA-NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service). n.d. Native Understory Forbs and Grasses for Pollinator and Insect Utilization in Southeastern Longleaf Pine Ecosystems. Available at: https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/gapmcpu10201.pdf. Last accessed 14 February 2020. 10 pp.

USDA-NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service). 2012. Hydric Soils. State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties. Survey Area Version 9. 25 May. 18 pp.

USDA USFS APHIS (U.S. Department of Agriculture, U.S. Forest Service, Animal and Plant Health Inspection Service). 2012. Gypsy Moth Management in the United States: a cooperative approach. Final Supplemental Environmental Impact Statement. Available at: https://www.fs.usda.gov/naspf/sites/default/files/volume-ll-chapters-1-8-appendixes-a-e-revised-120910.pdf. Last accessed 24 April 2019.

USFWS (U.S. Fish and Wildlife Service). 2009. Piping plover (*Charadrius melodus*) 5-Year Summary and Review. Available at https://ecos.fws.gov/docs/five_year_review/doc3009.pdf. Last accessed 22 February 2019.

USFWS (U.S. Fish and Wildlife Service). 2011. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition To List the Eastern Small Footed Bat and the Northern LongEared Bat as Threatened or Endangered. Available at https://www.govinfo.gov/content/pkg/FR-2011-06-29/pdf/2011-16344.pdf#page=1. Last accessed 01 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2013. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern SmallFooted Bat and the Northern LongEared Bat as Threatened or Endangered. Available at https://www.govinfo.gov/content/pkg/FR-2013-10-02/pdf/2013-23753.pdf#page=1. Last accessed 01 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2015a. Endangered and Threatened Wildlife and Plants; Listing the Northern LongEared Bat With a Rule Under Section 4(d) of the Act. Available at https://www.govinfo.gov/content/pkg/FR-2015-01-16/pdf/2015-00644.pdf#page=1. Last accessed 01 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2015b. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the New England Cottontail as an Endangered or Threatened Species. Available at https://www.govinfo.gov/content/pkg/FR-2015-09-15/pdf/2015-22885.pdf. Last accessed 22 February 2019.

USFWS (U.S. Fish and Wildlife Service). 2016. Endangered and Threatened Wildlife and Plants; Determination That Designation of Critical Habitat Is Not Prudent for the Northern Long-Eared Bat. Available https://www.govinfo.gov/content/pkg/FR-2016-04-27/pdf/2016-09673.pdf#page=1. Last accessed 01 February 2020.

USFWS (U.S. Fish & Wildlife Service). 2019. Listings and Occurrences for Rhode Island, Environmental Conservation Online System. [Website]. Available at: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=RI. Last accessed 14 February 2019.

USGS (U.S. Geological Survey). n.d. White-nose Syndrome. [Website]. Available at: https://www.usgs.gov/centers/nwhc/science/white-nose-syndrome?qt-science_center_objects=0#qt-science_center_objects. Last accessed 2 Augst 2020.

White-Nose Syndrome.org. n.d. Decontamination [Website]. Available at: http://www.whitenosesyndrome.org/topics/decontamination. Last accessed 13 February 2020.

INTERNET SOURCES

American Bird Conservancy, “Saving Migratory Birds for Future Generations: The Success of the Neotropical Migratory Bird Conservation Act”
http://www.abcbirds.org/newsandreports/special_reports/act_songbirds.pdf

Aquidneck Island Land Trust
www.ailt.org

Armed Forces Pest Management Board (AFPMB)
https://www.acq.osd.mil/eie/afpmb/

Association of National Estuary Programs
www.nationalestuaries.org

Atlantic Coast Joint Venture, “Atlantic Coast Joint Venture Strategic Plan”
http://www.acjv.org/documents/ACJV_StrategicPlan_2009update_final.pdf

Atlantic Coast Joint Venture,
https://acjv.org/

Avian Power Line Interaction Committee, “Reducing Avian Collisions with Power Lines: The State of the Art in 2012”
https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/SOSC/sosc_27.pdf

Brown University
http://www.brown.edu/

Butler, Brett J. and Eric H. Wharton, Eds., "The Forests of Rhode Island"
http://www.dem.ri.gov/programs/bnatres/forest/pdf/riforest.pdf

California Invasive Plant Council (Cal-IPC), "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd ed.)"
http://cal-ipc.org/docs/bmps/dd9jwo1ml8vttq9527zjhek99qr/BMPLandManager.pdf

Centers for Disease Control and Prevention, "Ehrlichiosis: Symptoms, Diagnosis, and Treatment"
http://www.cdc.gov/ehrlichiosis/symptoms/index.html

Centers for Disease Control and Prevention, "Lyme Disease Incidence Rates by State 2009-2018"
https://www.cdc.gov/lyme/stats/tables.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Flyme%2Fstats%2Fchartstables%2Fincidencebystate.html

Centers for Disease Control and Prevention, "Parasites: Babesiosis"
http://www.cdc.gov/parasites/babesiosis/gen_info/index.html

Centers for Disease Control and Prevention, "Preventing Ticks in the Yard"
http://www.cdc.gov/ticks/avoid/in_the_yard.html

Centers for Disease Control and Prevention, "Statistics and Epidemiology: Annual Cases of Ehrlichiosis in the United States"
http://www.cdc.gov/ehrlichiosis/stats/#geography

Centers for Disease Control and Prevention, "West Nile Virus"
http://www.cdc.gov/westnile/index.html

Coastal and Estuarine Research Federation
http://www.erf.org/

Commander, Navy Region Mid-Atlantic (CNRMA)
http://www.cnic.navy.mil/regions/cnrma.html

The Conservation Agency, "Narragansett Bay Coyote Study"
http://theconservationagency.org/narragansett-bay-coyote-study/

Department of Defense (DOD), Partners in Amphibian and Reptile Conservation (PARC)
https://parcplace.org/

Department of Defense (DOD), Partners in Flight (PIF)
http://www.dodpif.org/

Department of Defense (DOD), Legacy Resource Management Program
https://www.denix.osd.mil/legacy/home/

Department of Defense (DOD) Instruction 4715.03 – Natural Resources Conservation Program
https://www.fedcenter.gov/Bookmarks/index.cfm?id=17578&pge_prg_id=23590&pge_id=1938

Environment Rhode Island
http://www.environmentrhodeisland.org/

Executive Order 13148 – Greening the Government through Leadership in Environmental Management
https://www.fedcenter.gov/Bookmarks/index.cfm?id=49&pge_prg_id=0&pge_id=1584

Federal Emergency Management Agency (FEMA) Map Service Center – Current Issued Flood Maps
https://msc.fema.gov/portal/home

Food and Agriculture Organization of the United Nations – Global Action on Pollination Services for Sustainable Agriculture
http://www.fao.org/pollination/background/en/

Lyme Disease Tick Facts
https://www.cdc.gov/lyme/index.html

Manem Waterbird Working Group, "Waterbird Conservation Plan for the Mid-Atlantic/New England/Maritimes Region: 2006-2010"
http://atlanticmarinebirds.org/downloads/MANEM_plan.pdf

Narragansett Bay Estuary Program (NBEP)
http://nbep.org/

National Oceanic and Atmospheric Administration (NOAA)
www.noaa.gov

National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center – 1981-2010 Climate Normals
http://www.ncdc.noaa.gov/land-based-station-data/climate-normals/1981-2010-normals-data

Natural Resources Conservation Service (NRCS)
http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

Natural Resources Conservation Service (NRCS), Insects and Pollinators
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/

Nature Conservancy – Rhode Island Chapter
https://www.nature.org/en-us/about-us/where-we-work/united-states/rhode-island/

Naval Station Newport – History
http://www.cnic.navy.mil/regions/cnrma/installations/ns_newport/about/history.html

New England Interstate Water Pollution Control Commission (NEIWPCC)
http://www.neiwpcc.org/

North Atlantic Coast Cooperative Ecosystems Unit
https://naccesu.uri.edu/

Northern Atlantic Regional Shorebird Plan
http://www.shorebirdplan.org/wp-content/uploads/2013/01/NATLAN4.pdf

The North Atlantic Landscape Conservation Cooperative (NALCC)
https://www.fws.gov/northeast/test/northatlanticlcc/

Oyster Restoration Workgroup, "Water Quality Parameters"
http://www.oyster-restoration.org/how-to-monitor-sites-using-oyster-restoration-metrics/water-quality-parameters/.

Restore America's Estuaries
http://www.estuaries.org/

Rhode Island Bays, Rivers, and Watersheds Coordination Team (BRWCT)
http://www.dem.ri.gov/bayteam/index.htm

Rhode Island Coastal Resources Management Council
http://www.crmc.ri.gov/

Rhode Island Coastal Resources Management Council, "Submerged Aquatic Vegetation (Eelgrass)"
http://www.crmc.ri.gov/sav.html

Rhode Island Department of Environmental Management (RIDEM)
http://www.dem.ri.gov/

Rhode Island Department of Environmental Management, Division of Fish and Wildlife, "2017-18 Rhode Island White-Tailed Deer Status Report"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/deerharv.pdf

Rhode Island Department of Environmental Management, Division of Fish and Wildlife, "Comprehensive Wildlife Conservation Strategy"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/swgplan.pdf

Rhode Island Department of Environmental Management, Division of Fish and Wildlife, "Management & Response Protocols for Incidents Involving Coyotes"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/coyotpol.pdf

Rhode Island Department of Environmental Management, Division of Fish and Wildlife, "Native Snakes of Rhode Island"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/snake.pdf

Rhode Island Department of Environmental Management Division of Fish and Wildlife, "Rabies: The Facts you Need to Know Now"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/rabies.pdf

Rhode Island Department of Environmental Management, Division of Fish and Wildlife, "Turtles in Rhode Island"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/turtle.pdf

Rhode Island Department of Environmental Management, Division of Fish and Wildlife, "White-Tailed Deer in Rhode Island"
http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/deer.pdf

Rhode Island Forest Resources Management Plan
http://www.planning.ri.gov/documents/guide_plan/forestplan.pdf

Rhode Island Pollinators and Agriculture
https://conbio.org/images/content_publications/RIPollinatorsandAgriculture.pdf

Rhode Island Sea Grant Program
https://seagrant.gso.uri.edu/

Rhode Island Sea Grant, "Rhode Island Shellfish Management Plan"
http://www.rismp.org/about/

Rhode Island Wild Plant Society
http://www.riwps.org/Going_Native_-_Selecting_Non-Invasive_Plants.pdf

Save the Bay
http://www.savebay.org

Strategic Environmental Research and Development Program (SERDP)
http://www.serdp.org/

University of Massachusetts
http://www.massachusetts.edu/index.html

University of Rhode Island
www.uri.edu

University of Rhode Island Environmental Data Center, "Summer Flounder"
http://www.edc.uri.edu/restoration/html/gallery/fish/summer.htm

University of Rhode Island School of Oceanography
http://www.gso.uri.edu/

U.S. Army Corps of Engineers (USACE)
http://www.usace.army.mil/

U.S. Coast Guard (USCG)
http://www.uscg.mil/

U.S. Department of Agriculture (USDA)
https://www.usda.gov/

NOAA Consultations for Essential Fish Habitat
https://www.fisheries.noaa.gov/national/habitat-conservation/consultations-essential-fish-habitat

U.S. Environmental Protection Agency (EPA)
www.epa.gov

U.S. Environmental Protection Agency, Beneficial Landscaping
https://www.epa.gov/watersense/landscaping-tips

U.S. Environmental Protection Agency, Emergency Management
https://www.epa.gov/emergency-response

U.S. Environmental Protection Agency (EPA), Wetlands Definitions
https://www.epa.gov/cwa-404/how-wetlands-are-defined-and-identified-under-cwa-section-404#:~:text=%22Wetlands%20are%20areas%20that%20are,life%20in%20saturated%20soil%20conditions.

U.S. Fish and Wildlife Service
www.fws.gov

U.S. Fish and Wildlife Service, Endangered Species – Section 7 Consultation: A Brief Explanation
http://www.fws.gov/midwest/endangered/section7/section7.html

U.S. Fish and Wildlife Service, New England Cottontail Species Profile
https://www.fws.gov/northeast/newenglandcottontail/

U.S. Fish and Wildlife Service, Red Knot Species Profile
https://ecos.fws.gov/ecp/species/1864

U.S. Forest Service, U.S. Forest Service: Gypsy Moth in North America
https://www.nrs.fs.fed.us/disturbance/invasive_species/gm/

U.S. Forest Service, Urban and Community Forestry
https://www.fs.usda.gov/managing-land/urban-forests/ucf

U.S. Geological Survey (USGS)
www.usgs.gov

United States Geological Survey, "White-Nose Syndrome"
https://www.usgs.gov/centers/nwhc/science/white-nose-syndrome?qt-science_center_objects=0#qt-science_center_objects

U.S. Government Printing Office, List of Migratory Birds
https://www.govinfo.gov/app/details/CFR-2000-title50-vol1/CFR-2000-title50-vol1-sec10-13

U.S. Government Printing Office, List of Migratory Birds, List of Threatened and Endangered Wildlife
http://www.ecfr.gov/cgi-bin/text-idx?SID=25ac49659469fc02ff12d80d8ffe5ee0&node=50:2.0.1.1.1.2.1.1&rgn=div8

White-Nose Syndrome.org, "Decontamination"
http://www.whitenosesyndrome.org/topics/decontamination

ONLINE GIS RESOURCES FOR NAVSTA NEWPORT

ESRI
ESRI Data and Maps (Imagery, county/state boundaries, basemaps)
https://livingatlas.arcgis.com/en/home/

National Oceanic and Atmospheric Administration
Bathymetry and Global Relief
https://www.ngdc.noaa.gov/mgg/bathymetry/relief.html

Essential Fish Habitat
http://www.habitat.noaa.gov/protection/efh/newInv/index.html

Endangered Species Mapper
https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27

Environmental Sensitivity Index
http://response.restoration.noaa.gov/esi

Rhode Island Geographic Information System
SAV, Water Quality, Soils, Shellfish Harvest Areas, WBD Watersheds, Townships, Hydrography
https://www.rigis.org/

U.S. Department of Agriculture
Land Use Land Cover
http://datagateway.nrcs.usda.gov/GDGOrder.aspx

U.S. Environmental Protection Agency
303d Impaired Waterways
https://www.epa.gov/tmdl

U.S. Fish and Wildlife Service
USFWS Threatened & Endangered Species Active Critical Habitat Report
http://ecos.fws.gov/crithab/

U.S. Geological Survey
Digital Elevation Model
http://viewer.nationalmap.gov/viewer/

U.S. Navy GeoReadiness: Common Installation Picture
GeoReadiness Program Mission
https://cdn.ymaws.com/www.mapps.org/resource/resmgr/federal_liaison_notes/maidl_dod_dhs_11172011.pdf

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APPENDIX A

LIST OF ACRONYMS AND ABBREVIATIONS

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
APC	Area of Particular Concern
AFPMB	Armed Forces Pest Management Board
Bay	Narragansett Bay
BMP	best management practice
BCID	Bat Call Identification (software)
BRAC	Base Realignment and Closure Commission
BRWCT	Bays, Rivers, and Watersheds Coordination Team
CA	Cooperative Agreement
CAC	Common Access Card
CBMD	Coordinated Bird Monitoring Database
CC	Canton-Urban Land Complex
CCMP	Comprehensive Conservation and Management Plan
CDC	Centers for Disease Control
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIP	Common Installation Picture
CMP	Hazardous Materials Control and Management Plan
CMZA	Coastal Zone Management Act
CNIC	Commander Naval Installations Command
CNO (N45)	Chief of Naval Operations Energy and Environmental Readiness Division
CNRMA	Commander, Navy Region Mid-Atlantic
CO	Commanding Officer
COMNAVFACENGCOM	Commander, Naval Facilities Engineering Command
CRMC	Coastal Resources Management Council
CWA	Clean Water Act
CWD	Chronic Wasting Disease
CZMA	Coastal Zone Management Act
D.C.	District of Columbia
DEM	Department of Environmental Management
DFSP	Defense Fuel Support Point
DFW	Division of Fish and Wildlife
DIR	directives
DNA	Deoxyribonucleic acid
DOC	Directorate of Contracting
DOD	Department of Defense
DODI	Department of Defense Instruction
DODINST	Department of Defense Instruction
DOE	Department of Energy
DPS	distinct population segments

EAP	Encroachment Action Plan
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPR	Environmental Program Readiness
EQCC	Environmental Quality Control Committee
EQRB	Environmental Quality Review Board
ERL	Environmental Readiness Level
ESA	Endangered Species Act
ESC	erosion and sediment control
ESI	Environmental Sustainability Index
et seq.	and following sections
EUL	Enhanced Use Leasing
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FRP	Facility Response Plan
FWS	Fish and Wildlife Services
GIS	Geographic Information System
GPS	global positioning system
GSD	ground sample distance
HGE	human granulocytic ehrlichiosis
HME	human monocytic ehrlichiosis
HW	Hazardous Waste
HWAA	Hazardous Waste Accumulation Area
ICO	Installation Commander Officer
ICRMP	Integrated Cultural Resources Management Plan
IEPM	Installation Environmental Program Manager
IHA	Incidental Harassment Authorization
INRMP	Integrated Natural Resources Management Plan
IPC	Invasive Plant Council
IPANE	Invasive Plant Atlas of New England
IPM	integrated pest management
IPMC	Installation Pest Management Coordinator
IPMP	Installation Pest Management Plan
IRP	Installation Restoration Program
ISSA	Installation Service Support Agreement
ITT	Information Tickets and Travel
LCC	Landscape Conservation Cooperative
LDF	Lyme Disease Foundation
LEED	Leadership in Energy and Environmental Design
LID	low-impact development
LNG	liquid natural gas
LOA	Letter of Authorization
LQG	large quantity generator
MBTA	Migratory Bird Treaty Act
MIDLANT	Navy Region Mid-Atlantic Command

MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSA	Magnuson-Stevens Fishery Conservation and Management Reauthorization Act
MWR	Morale, Welfare and Recreation
NACESU	North Atlantic Cooperative Ecosystem Studies Unit
NALCC	North Atlantic Landscape Conservation Cooperative
NAVFAC	Naval Facilities Engineering Command
NAVSTA	Naval Station
Navy	Unites States Department of the Navy
NBEP	Narragansett Bay Estuary Program
NCDC	National Climactic Data Center
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NETC	Naval Education and Training Command
NFWF	National Fish and Wildlife Foundation
NGO	nongovernmental organization
NHP	Natural Heritage Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint source
NR	Natural Resources
NRCS	Natural Resources Conservation Service
NRM	Natural Resources Manager
NRP	Natural Resources Program
NUSC	Naval Underwater System Center
NUWC	Naval Undersea Warfare Center
NWC	Naval War College
NWP	Nationwide Permit
O&MN	Operation and Maintenance, Navy
OPNAV	Chief of Naval Operations
OPNAVINST	Chief of Naval Operations Instructions
OSD	Office of the Under Secretary of Defense
OWR	Office of Water Resources
PAO	Public Affairs Office
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
PLC	Product Line Coordinator
POC	Point of Contact
PWD	Public Works Department
PWO	Professional Wastewater Operator
QRP	Qualified Recycling Program
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act

RDT	Research Development Test
RDT&E	Research, Development, Testing, and Evaluation
RFA	Rubble Fill Area
RI	Rhode Island
RICRMC	Rhode Island Coastal Resources Management Council
RICRMP	Rhode Island Coastal Resources Management Program
RIDEM	Rhode Island Department of Environmental Management
RIDEM DFW	RIDEM Division of Fish and Wildlife
RIEMA	Rhode Island Emergency Management Agency
RIGL	State of Rhode Island General Law
RIGIS	Rhode Island GIS Geographic Information
RIISC	Rhode Island Invasive Species Council
RINHS	Rhode Island Natural History Survey
ROD	Record of Decision
ROW	right of way
RSIMS	Regional Shore Installation Management System
RTE	rare, threatened, and endangered
SAIA	Sikes Act Improvement Act of 1997
SAMP	Special Area Management Plan
SARA	Superfund Amendments and Reauthorization Act
SAV	submerged aquatic vegetation
SDSFIE	standards for facilities, infrastructure, and environment
SECNAVINST	Secretary of the Navy Instruction
SER	Shore Establishment Realignment
SERDP	Strategic Environmental Research and Development Program
Sikes Act	Sikes Act Improvement Act of 1997
SJA	Staff Judge Advocate
SMP	Site Management Plan
SMPP	Stormwater Management Program Plan
SMPPP	Stormwater Management Prevention Program Plan
SOP	Scope of Work
SPCC	Spill Prevention, Control, and Countermeasure
SSURGO	Soil Survey Geographic
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
URI	University of Rhode Island
URI-CRC	URI Coastal Resources Center
U.S.	United States
USC	United States Code
USACE	United States Army Corps of Engineers
USCCSP	United States Climate Change Science Program
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

USGCRP	U.S. Global Change Research Program
USGS	United States Geological Survey
WET	wetland
WNS	white-nose syndrome
WNV	West Nile Virus

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APPENDIX B

THREATENED AND ENDANGERED SPECIES FACT SHEETS

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Sharp-shinned Hawk

Accipiter striatus

Identification

In North America, the Sharp-shinned Hawk is the smallest of the forest accipiters. Accipiters have short, rounded wings and a long, banded tail, allowing them to maneuver easily through dense forest canopy in pursuit of agile, smaller prey.

Sharp-shinned Hawks are one of the smallest hawks. They are 10 to 14 inches long, with a wingspan of 21 to 27 inches. They weigh only three to five ounces, with females weighing almost twice as much as males. Adult "sharpies" have a gray back (bluish -gray in males, brownish-gray in females) and reddish, horizontally-barred breast and belly. Immatures have dark brown backs and cream-colored breast and bellies with dark vertical streaking. Eye color in all accipiters changes with age. As an immature bird, the eye color of the Sharp-shinned Hawk is yellow. The color gradually progresses to orange, and eventually becomes dark red, usually in older adults.

Field identification of Sharp-shinned Hawks can be difficult, as they resemble the somewhat larger Cooper's Hawk in relative size, color, and shape. However, in flight, sharpies have a less protruding head and a shorter tail with a squared formation at the end. Sharp-shins appear more buoyant but less stable in flight than other accipiters. Their wing beat is quick, deep strokes and a flapping motion at the "wrist."

Nesting

Sharp-shinned Hawks nest throughout the United States and Canada in dense second growth forests. Sharp-shins do not always return to nest in the same territory each spring, but if they do, a new nest is built. Both members of the pair participate in constructing a stick nest in the crotch of a tree, or on a branch near the tree trunk. Four or five bluish-white eggs with brown speckling are laid in late May or June. Incubation duties are shared by the pair, and hatching occurs in 23 to 27 days. The male provides most of the food while the female defends the nestlings against predators.

Migration

Sharpies migrate south between early September and the end of October. They return north in April and May. When migrating, Sharp-shinned Hawks follow mountain ridgelines more closely than most other raptors. These are the most common hawks observed along most western flyways. In the Goshute Mountains of Nevada, they account for 31 percent of the total number of raptors observed, and 57 percent of the total trapped and banded.

Conservation

Since they feed mainly on small birds, which in turn feed mostly on insects, Sharp-shin populations are valuable indicators of pesticide contamination and the overall health of forest ecosystems.

Northern Harrier

Circus cyaneus

Identification

The Northern Harrier is a long, lean, lanky, narrow-winged, and long-tailed raptor of medium size. Females are noticeably larger and more broadly proportioned than males. Adult plumages are sexually dimorphic. Males are silver gray above and white below. Wing tips, seen from above or below, are jet black. Females are tawny above or below, with brown streaking extending down the sides of the chest and flanks. Immatures of both sexes have chocolate brown backs and rusty overtones; they are rich orange to cinnamon below and show no obvious streaking. In spring, subadult males and females show a mixture of the lighter adult plumage and the darker immature plumage. In all plumages, there is a large, conspicuous white patch on the rump.

Habitat and Prey

Northern Harriers are found throughout the northern hemisphere. In the Americas they breed throughout North America from Alaska and Canadian provinces south of tundra regions south as far as Baja California, New Mexico, Texas, Kansas, and North Carolina. They are only rarely seen breeding in parts of the Atlantic coastal states, such as Vermont, Rhode Island, and Maine and are similarly rare in the arid and mountainous western interior, including most of California, Oregon, and Washington. Their winter range is from southern Canada to the Caribbean and Central America. Northern Harriers are found mainly in open habitats such as fields, savannas, meadows, marshes, upland prairies, and desert steppe. They also occur in agricultural areas and riparian zones. The densest populations are found in large expanses of undisturbed, open habitats with dense, low vegetation. In eastern North America Northern Harriers are found most frequently in wetland habitats. In western North America they are most abundant in upland habitats such as desert steppe. Northern Harriers avoid forested and mountainous areas.

The Northern Harrier diet is variable, depending on dominant prey types in the area. In areas with large populations of small mammals, they make up 95% of the diet. In northern grasslands, the diet may be almost exclusively voles. Northern Harriers also eat other small vertebrates, including snakes, frogs, passerine birds, and small waterfowl. When hunting for food, Northern Harriers glide at a slow pace close to the ground until prey is found. Northern Harriers then dive quickly to capture their prey. They may also hide in vegetation, waiting to pounce on prey. They sometimes store extra prey to eat later.

Nesting

Adult males show interesting behaviors during mating season. The male courts the female by flying high in the air and then diving down while twirling and spinning. Males are sometimes polygynous and have 1 to 3 mates. During incubation the male provides food for the female, but he doesn't approach the nest. When he is near the nest he will call out, and as she comes to him he drops the food to her. During the breeding season Northernn

Harriers become very territorial and will attack other hawks, birds, or humans that approach their nesting areas. Females are monogamous. This is due, not only to the female-biased sex ratio, but also to the abundance of food during the spring.

Northern Harriers often nest in loose colonies of 15 to 20 individuals. The nest, built mostly by the female, is made out of sticks and padded on the inside with grass. The nest is built on the ground, often on raised mounds of dirt or clumps of vegetation. Eggs are laid from mid-May to early June. They are white with a blue tint and occasionally have brown spots. Three to five eggs are laid, and only the female performs incubation. The eggs hatch in approximately 31 to 32 days. Male Northern Harriers will contribute to the feeding of their offspring during the time they are in the nest and will watch over the nest for a maximum of five minutes when the female is away.

Migration

For Northern Harriers spring and fall migration periods are protracted. The Northern Harrier has the longest overall migration period of any North American raptor. In spring, adult males begin to pass through coastal and interior sites in late February and early March. Females follow in mid-March through April and subadults through May and into early June. This staggered pattern of migration is reversed in the fall. Immature birds can be seen passing hawk-watch sites (either as migrants or during postfledgling dispersal) in mid-July through September. Females appear through October, and males are most common during November and on into early December. This general schedule is not absolute. Adult males and females can and do occur as early as late August at northeast hawk-watch points.

Though the bird is not reluctant to cross open water, watch sites located near the coast or on the shore of the Great Lakes record greater numbers of Northern Harriers than do those inland. On the interior ridges, Northern Harriers often ignore updrafts and fly wide of the ridge and are often seen crossing them heading north. Though Northern Harriers are commonly seen migrating alone, pairs and small groups of three to five birds are often reported, particularly when large numbers occur. These small groups travel in single file.

Conservation

No conservation measures have been enacted specifically for this species; however, conservation measures for waterfowl and habitat management for game birds has increased local numbers of nesting Northern Harriers. The species is abundant enough to be rated "Least Concern" by the IUCN. It is protected under the Migratory Bird Act.

The Cooper's Hawk is an increasingly common breeder and overwintering species in the Hudson River Valley.

Conservation Status

The Cooper's Hawk is a Species of Greatest Conservation Need and a Species of Special Concern in New York State. However, NYS Breeding Bird Atlas data indicate a significant increase of the overall distribution, including in the Hudson River Valley in the past twenty years.


J. Nadler

Identification

This woodland raptor is crow-sized, with rounded wings, a long brown/black banded tail, often rounded at the end, and a hooked bill. The adult is mainly gray/brown above, barred rusty brown below, with a strong contrast between the dark crown and paler nape and back. The immature is paler, with brown upperparts, and dark-streaked whitish or buffy underparts. The call is a rapid "ca-ca-ca-ca" with a harsh staccato quality.

Habitat

This species occupies deciduous and mixed forests as well as open woodland habitats such as woodlots and riparian woodlands. It generally prefers deep woods, using thick cover both for nesting and hunting. Openings, especially where hedgerows or windbreaks offer shelter for prey species, may also be used when foraging. It is tolerant of human disturbance and habitat fragmentation.

Food

The Cooper's Hawk primarily eats medium-sized birds, such as Mourning Doves, Northern Flickers, Blue Jays, and European Starlings, but sometimes it will eat small birds and some larger birds up to size of an adult Ruffed Grouse, and small ground-foraging mammals. It typically hunts from an inconspicuous perch or searches in flight. It is frequently attracted to birds at feeders, especially in the winter. Hunting territories range from 1 to 2 square miles.

Nesting

The nest is a broad, flat platform of sticks lined with bark chips and flakes built by the male in a dense patch of trees, usually deciduous. They also will use a modified squirrel or crow nest. It is generally located 20-60 feet up in a tree near the trunk or on a horizontal branch. A nesting territory must be at lest 1.5 acres in size.

Threats

- Habitat destruction and fragmentation due to deforestation or development.
- Disturbance of nesting sites by human activity.
- Predation by raccoons.

Management Recommendations

- Minimize forest fragmentation.
- Avoid thinning tree stands in order to maintain the preferred density of cover.
- Avoid cutting and thinning of trees in an area of at least 2.4 acres around a known nest site.
- Protect known nest sites from human disturbance during nesting season.
- Reduce raccoon access to nests by placing raccoon guards on nest trees.

This species summary is adapted from Curtis et al. 2006, James 1984 and NatureServe 2008.

For additional information, see the following references:

Boal, C. W., and R. W. Mannan. 1998. Nest site selection by Cooper's Hawks in an urban environment. Journal of Wildlife Management 62:864-871.

Curtis, O. E., R. N. Rosenfield and J. Bielefeldt. 2006. Cooper's Hawk. (Accipiter cooperii). The Birds of North America Online (A. Poole, ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database: http://bna.birds.cornell.edu/BNA/account/Coopers_Hawk/.

James, R. T. 1984. Habitat Management Guidelines for Ontario's Forests: Nesting Accipiers, Buteos and Eagles. Ongtario Ministry of Natural Resources. http://www.mnr.gov.on.ca/mnr/forests/forestdoc/guidelines/pdfs/buteos.pdf.
NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Rosenfield, R. N. 1988. Cooper's Hawk. Pages 328–330, 331–332, 349–352 in Handbook of North American Birds, vol. 4, part 1: Diurnal Raptors (R. S. Palmer, ed.). Yale University Press, New Haven, CT.

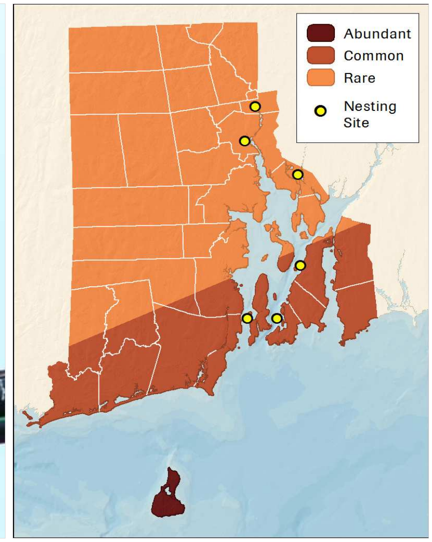
Peregrine Falcon

BIRDS

Nest Box Birds

Falco peregrinus

Photo: Peter WC Paton



~See map disclaimer in profiles introduction

Distribution & Abundance

The Peregrine Falcons documented in Rhode Island consist of two subspecies. F. p. anatum formerly nested throughout the Northeast, and was extirpated due to eggshell thinning from DDT poisoning. Hybrid birds were reintroduced to its former range through nest-box and hatching programs, and the progeny of these birds have repopulated parts of the Northeast, including Rhode Island. The anatum subspecies winters along the coast in the SE United States. F. p. tundrius nest in the high Arctic and migrates through Rhode Island to their wintering grounds in South America. Due to population declines, this species was federally-listed as Endangered, but with recovery efforts led by the USFWS, this species was taken off the List of Threatened and Endangered Species in 1999. Currently, there are about five known nesting sites in Rhode Island, primarily nest boxes on larger bridges (e.g., Pell Bridge) and skyscrapers (Bank of America building) in downtown Providence. Migrant F. p. tundrius are consistently seen in coastal Rhode Island in the fall, particularly on Block Island (where researchers have been actively banding birds and monitoring movements with satellite-transmitters). With the continued expansion of the regional population, additional nesting activity is imminent, which will require monitoring efforts to track the dynamics of nesting sites. In addition, there will be a need for continued coordination between property owners with peregrine nests and local and federal law enforcement agencies to ensure that management actions are taken to ensure that peregrines are not disturbed during the nesting cycle.

Status

CITES: I. IUCN Rank: LC. FED: FWS. STSTAT: SE. SRANK: SZN. GRANK: G4. STATE: E-1. RSGCN: H-VH. PIF BCPSN: Tier II C. CODES: B. Res/B: 1. GRP: 90. PRIOR: 1. Climate Change Vulnerability: Low = by 2100 (Precipitation change)

Threats and Actions

Threat 1 - Residential and commercial development; Lack of suitable nesting habitat

Actions:
- *Species recovery; Creating nest boxes. Rank: 3*

Threat 2 - Natural system modifications; Loss of suitable foraging habitat during migration

Actions:
- *Site/area management; Create and maintain early successional habitat. Rank: 2*
- *Site/area protection; Conserve suitable early successional habitat near bluffs. Rank: 1*

Wolf Island (/refuge/Wolf_Island/)

National Wildlife Refuge | Georgia

American Oystercatcher

Haematopus palliatus

Enlarge Image
(/uploadedImages/Region_4/NWRS/Zone_3/Savannah_Coastal_Refuges_Complex/Blackbeard_Island/Images/AMOY-ProfileLarge.jpg?n=6048)

A large, boldly patterned bird, the American Oystercatcher is conspicuous along ocean shores and salt marshes. True to its name, it is specialized in feeding on bivalves (oysters, clams, and mussels) and uses its brightly colored bill to get at them.

Description and Diet

Large, pied shorebird (40–44 cm long; 400–700 g), dark above on head and mantle, white on breast and flanks. Long, straight, bright red to orange bill. Long, pale pink legs, lacks hallux. Bright yellow iris, sometimes with dark flecks. Shows narrow, white wing stripe in flight. Long reddish bill laterally compressed. Yellow eyes with red eye ring and black head and neck, contrasting with brown mantle, distinguishes this from other species. Males and females visually indistinguishable. Juveniles have varying degrees of dusty orange to gray on bill and mottled brown feathers on back until fully mature. Otherwise similar to adult.

Oystercatchers feed almost exclusively on shellfish and other marine invertebrates including mussels and clams of many varieties, limpets, oysters, sea urchins, starfish, crabs, and worms.

Habitat

During the breeding season, American Oystercatchers can be found in coastal habitats including sand or shell beaches, dunes, saltmarsh, marsh islands, mudflats, and dredge spoil islands made of sand or gravel. During migration and winter, look for them feeding in mud or sand flats exposed by the tide, or on shellfish beds. These conspicuous birds tend to roost on beaches, dunes, or marsh islands near their foraging sites, and rarely venture far inland.

Facts About American Oystercatcher

Diet

Specialized in feeding on bivalves such as oysters, clams, and mussels

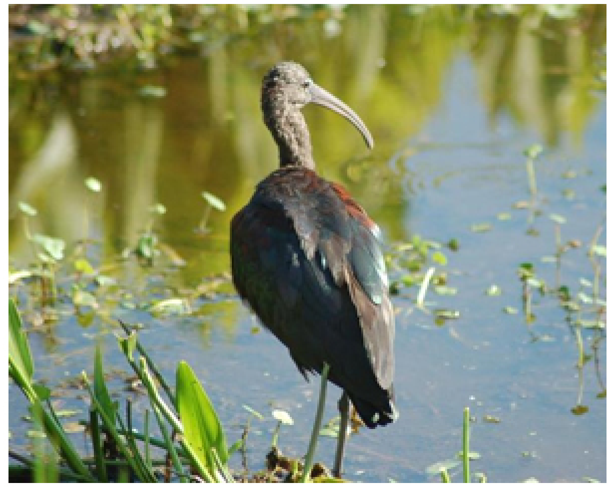
Habitat

Glossy Ibis - *Plegadis falcinellus*

[Characteristics](#)
[Range](#)
[Habitat](#)
[Diet](#)
[Life Cycle](#)
[Behavior](#)

Classification

Phylum: Chordata
Class: Aves
Order: Ciconiiformes
Family: Threskiornithidae
Genus: Plegadis



Zoom

Image Credit: Joy Viola
Northeastern University, Bugwood.org

ICUN Redlist - World Status: L Least Concern

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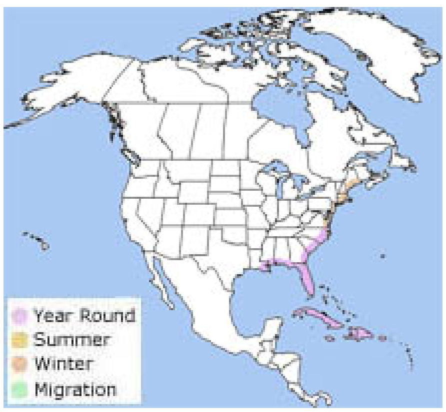
Audio Credit: **xeno-canto.org** Allen T. Chartier

Characteristics

Zoom Image Credit: Joy Viola
Northeastern University, Bugwood.org

The glossy ibis is about 20 inches tall with a wingspan of about three feet. It has a long, dark gray bill that is curved down. It has dark purple to black feathers on its head, neck, back and belly. Its legs are long and black and its wings and tail are a shiny green. In breeding season the glossy ibis has rusty-red feathers and a pale blue line around its face.

Range



The glossy ibis can be found along the east coast of the United States from Maine to Texas. In the winter it lives from the Carolinas south to Florida and along the Gulf Coast to Texas. It is also found in Central America, South America, Africa, southern Eurasia and Australasia.

Habitat

Zoom Image Credit: Joy Viola
Northeastern University, Bugwood.org

The glossy ibis can be found in a variety of wetlands including marshes, estuaries, coastal bays, flooded fields and swamps.

Diet

Zoom Image Credit: Joy Viola
Northeastern University, Bugwood.org

The glossy ibis probes in the mud and silt with its bill looking for prey like the fiddler crab, crawfish, insects and small snakes.

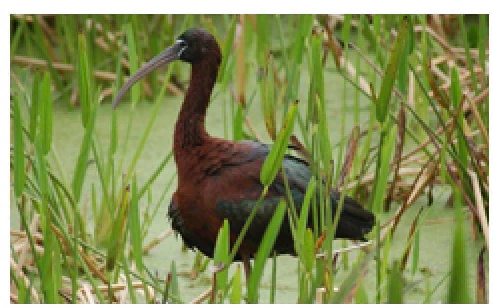
Life Cycle

Zoom Image Credit: Alfred Viola
Northestern University, Bugwood.org

The glossy ibis lays three or four eggs in a nest of twigs and sticks. The nests are usually built in trees or bushes but are sometimes built on the ground. They build their nests in colonies that include the nests of other ibises as well as the nests of other species like egrets and herons. Occasionally, the glossy ibis will use an abandoned snowy egret nest. The glossy ibis is very territorial during nesting.

The eggs take about three weeks to hatch. The female and male incubate the egg, but the female does most of the work. Both parents feed the chicks. The chicks fledge in about a month. They leave the nest and start to forage for food with their parents when they are two months old.

Behavior



Zoom Image Credit: Joy Viola
Northeastern University, Bugwood.org

The glossy ibis is relatively new to North America. It came here from Africa. It probably flew across the Atlantic to South America and then slowly expanded its range to North America.

Great Blue Heron

At a Glance

Scientific Name: *Ardea herodias*

Body Length: 63 inches

Wingspan: 72 inches

Weight: 4-6 lbs.

Avg. Lifespan: 15 years

Diet: mostly fish, but will also eat amphibians, reptiles, and invertebrates

Habitat: swamps, marshes, rivers, lakes, almost anyplace with fresh to brackish water

Reproduction: lays 3-5 pale blue eggs
Incubation Period: 25-29 days
Nestling Period: 60 days

How can a great blue heron be distinguished from other birds?

The great blue heron is a large iconic bird of the Chesapeake Bay watershed. The body of the great blue heron is long and narrow covered in grayish feathers. They have a long grayish neck that can help identify them when they are flying. Its head consists of a large black "eyebrow", yellow to red eyes, and a very long bill with at least some yellow to it.

What do great blue herons eat?

The diet of the great blue heron consists mostly of fish - any species large enough that it can catch and eat. Blue herons have also been known to eat amphibians, reptiles, invertebrates, small mammals, and even small birds. Their diet is not picky and they eat basically anything that they can swallow.

What predators do great blue herons have?

Crows and raccoons eat great blue heron eggs. Raccoons, hawks, eagles, and raccoons occasionally prey on adults and chicks. However, in general great blue heron adults are not commonly preyed on due to their large size and the lack of many large predators in North America.

Where do great blue herons live?

Great blue herons are found in most of North and Central America. They are found in almost all parts of the lower 48 states, coastal Central America, northwest South America, the Galapagos, and stretching up the pacific coast all the way to south central Alaska.

Do great blue herons migrate?

Some great blue herons, depending how far north they breed, do migrate. However the great blue herons that we have in the Mid-Atlantic are year round residents of the area. The birds do however leave their nesting sites when breeding is over, and they move back to being independent in their normal habitats.

Photo by Ian Plant

Great blue heron eggs

How do great blue heron raise their young?

Great blue herons select new mates every year, laying 2-7 eggs. These eggs are then incubated approximately 28 days until hatching. The young are then fed for around 60 days in the nest by both parents. Once the chicks are able to fly they leave the nest, however they still rely on their parents for food for a few more weeks until they can properly hunt on their own.

Are great blue heron endangered?

The great blue heron is listed as least concern due to its generally large range and large population. The species is also highly adaptable, allowing it to eat a diverse amount of food. The only major threat to all blue herons in general is nest disturbance. In many parts of the U.S. large amounts of noise near a nesting colony can cause the birds to abandon their nests. Also the increase of predatory birds, like bald eagles, from raptor introduction programs, leads to more harassment and preying on chicks. Many groups have now been trying to help great blue herons by stopping the destruction of their habitats, and attempting to establish safe and secluded nesting locations.

Fun Facts

- There are five confirmed subspecies of great blue heron, the one that we have locally is *Ardea herodias herodias.*
- Great Blue herons almost always swallow their prey whole!
- Heron is from *hairon* in old French meaning long necked, long legged wading bird, but in multiple other language it is possible it came from the word(s) to cry or shriek. This is referring to its croaking call.
- Although great blue herons have a different mate every year, they only have one mate unlike some birds who breed with multiple other birds every year.
- The great blue heron is the largest heron in North America.

Questions?

Contact us at info@chesapeakeconservancy.org

Sources:
http://www.birdweb.org/birdweb/bird/great_blue_heron#
http://www.arkive.org/great-blue-heron/ardea-herodias/
http://www.biokids.umich.edu/critters/Ardea_herodias/
http://www.etymonline.com/index.php?allowed_in_frame=0&search=heron
http://animals.nationalgeographic.com/animals/birds/great-blue-heron/

Chesapeake Conservancy
EXPLORE. CONSERVE. INNOVATE.

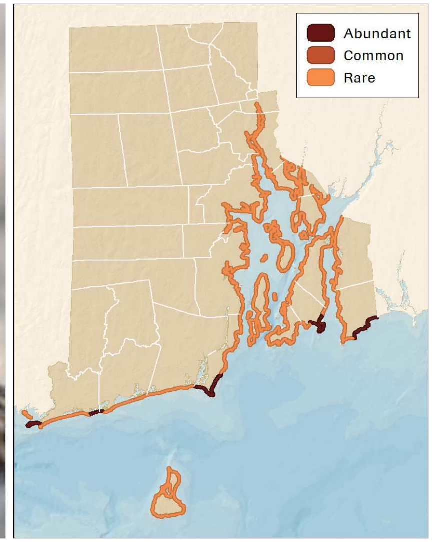
Red Knot

BIRDS

Intertidal and Mudflat Birds

Calidris canutus

Photo: USFWS



~See map disclaimer in profiles introduction

Distribution & Abundance

The Red Knot is a long-distance migrant that breeding in the high Arctic. Some populations winter in along the coast in the southern United States, whereas another population winters in southern South America. The rapidly declining "rufa" population was recently proposed for listing as a threatened species by the USFWS [final rule pending 2014]. Loss of foraging resources during spring migration at key staging grounds in the mid-Atlantic states, especially Horseshoe Crab eggs, has exacerbated their recent decline. In Rhode Island, Red Knots are primarily a spring and fall migrant, with birds occasionally wintering here. Northbound migrants first appear by mid-May, with peak numbers between the third week of May and the first week of June, which usually coincides with full or new moon when Horseshoe Crabs deposit eggs in the intertidal zone. Stragglers are occasionally present during the summer. The first fall migrants are evident by mid-July, with peak numbers between the first to third weeks of August. Red Knots use intertidal areas with substrates range in size from sand to cobble, where they often associate with Sanderlings, Semipalmated Sandpipers, Dunlin, and Black-bellied Plovers. This species also forages on small crustaceans on mudflats and the wrack zone on beaches. Red Knots have never been abundant in Rhode Island, but there is evidence of additional declines in recent years. At Napatree Point, where peak numbers are documented in Rhode Island, counts have exceeded 20 birds on only six occasions since 2005, which have all occurred during fall migration except for one occasion. Conservation actions include gaining a clearer understanding of the distribution and abundance of horseshoe crabs in the state, and an assessment of harvesting rates of horseshoe crabs in the state. In addition, steps may need to be taken to minimize human disturbance at key staging sites throughout the state.

Habitat Community: Intertidal Shore, Type: Sand Flat

Status

IUCN Rank: LC. FEDSTAT: PT. FED: FWS. SRANK: S3N. GRANK: G5. RSGCN: 1. Shrbrd: 1. USSCP: HI. AJV BCR: HH. CODES: M. Res/B: 0. GRP: 110. PRIOR: 1. Climate Change Vulnerability: High = by 2030 (Habitat loss)

Threats and Actions

Threat 1 - Recreational activities; Increased human disturbance at stopover migration sites

Actions:
- *Site/area management; Minimize human disturbance at stopover sites. Rank: 3*
- *Site/area protection; Protect stopover sites. Rank: 3*
- *Awareness and communications; Educate public about the importance of stopover sites. Rank: 2*

Threat 2 - Habitat shifting and alteration; Loss of stop over sites due to sea level rise

Actions:
- *Site/area protection; Land protection to allow for stop over foraging habitat migration. Rank: 3*

- *Education and awareness; Education of landowners about appropriate land management regarding mitigation of sea level rise on coastal property. Rank: 2*

Threat 3 - Lack of planning

Actions:
- *Data collection and analysis; Initiate monitoring of primary resources. Rank: 2*

Threat 4 - Other; Potential oil spill

Actions:
- *Policies and regulations. Rank: 2*
- *Compliance and enforcement. Rank: 2*

Refer to the Community: Intertidal Shore, Type: Sand Flat - Habitat Profile for additional threats to this species.

Piping Plover

Charadrius melodus

BIRDS
Beach Birds

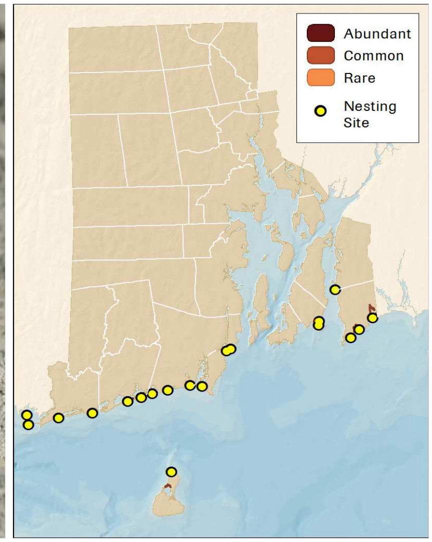


Photo: Peter WC Paton
~See map disclaimer in profiles introduction

Distribution & Abundance

The Piping Plover is a short-distance Nearctic migrant. The breeding distribution of the Piping Plover consists of three disjunct areas; the Atlantic Coast, the Great Lakes, and the Great Plains. In 1986, the Atlantic Coast population was listed by the USFWS as threatened, with the other range components also assigned ESA status. At the time of its listing, the Rhode Island population was down to about 10 nesting pairs. After federal protection and intensive management for the nearly three decades, the state-wide population now is estimated to be approximately 90 nesting pairs. Piping Plovers also occur in Rhode Island as migrants. This species does not winter this far north and the spring migration peak is not evident from local data, suggesting that most birds arrive directly on the breeding grounds. The fall migratory peak is more evident and occurs between late June and late July. Transient birds during fall consist of post-breeding adults and juvenile. Piping Plovers nest on coastal sandy beaches and dry overwash areas adjacent to tidewater. Adults and young forage in the intertidal zone of barrier beaches and also use mudflats, where they tend to occur on migration with Semipalmated Sandpipers, and Least and Semipalmated Sandpipers. The Piping Plover is one of the most intensively monitored birds in North America. Because of its federal status, continued monitoring, management, and protection of prime foraging areas are necessary.

Habitat Community: Coastal Beach and Dune, Type: Maritime Beach Strand

Status

IUCN Rank: NT. FEDSTAT: FE. FED: FWS. STSTAT: SE. SRANK: S1B,S1N. GRANK: G3. STATE: E-1(1-1). RSGCN: H-VH. NALCC: X (B). Shrbrd: 1. USSCP: HI. PIF BCPSN: Tier I A. AJV BCR: HH. CODES: B. Res/B: 1. GRP: 81. PRIOR: 1. Climate Change Vulnerability: High = by 2030 (Habitat loss)

Threats and Actions

Threat 1 - Residential and commercial development; Disturbance to nesting habitat and feeding areas

Actions:
- *Land/water protection; Work with state and non profits to conserve nesting and feeding habitats. Rank: 2*
- *Site/area protection. Rank: 2*
- *Site/area management. Rank: 3*
- *Education and awareness. Rank: 3*
- *Awareness and communications. Rank: 3*

Threat 2 - Problematic native species; Nest predators

Actions:
- *Education and awareness. Rank: 3*
- *Site/area management. Rank: 3*

- *Invasives/problematic species control. Rank: 3*

Threat 3 - Climate change and severe weather; Sea level rise

Actions:
- *Habitat and natural process restoration. Rank: 3*
- *Site/area protection. Rank: 3*
- *Site/area management.*

Threat 4 - Lack of planning

Actions:
- *Data collection and analysis; Initiate monitoring of primary resources. Rank: 3*

Threat 5 - Shipping lanes; Oil pollution

Actions:
- *Law and policy; Double hulled barge requirement. Rank: 2*
- *Site/area management.*

Refer to the Community: Coastal Beach and Dune, Type: Maritime Beach Strand - Habitat Profile for additional threats to this species.

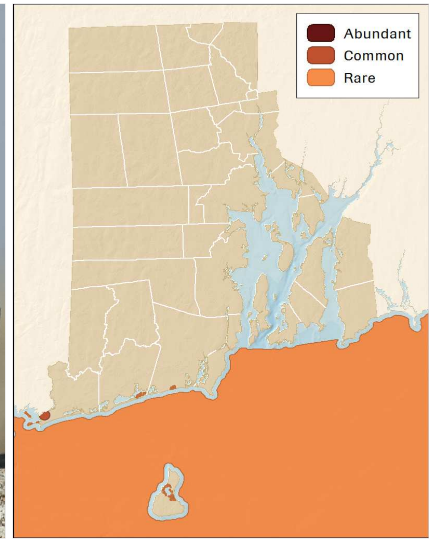
Roseate Tern

Sterna dougallii

BIRDS

Intertidal and Mudflat Birds

Photo: Peter WC Paton



~See map disclaimer in profiles introduction

Distribution & Abundance

The Roseate Tern is a long-distance Neotropical migrant that nests on offshore islands throughout the Northeast into Nova Scotia, Canada. This species winters off of Brazil. This species was federally-listed as endangered by the USFWS in 1987. Their populations were depressed during the shooting era of late 1800s, but rebounded and several moderately-sized nesting colonies were documented along the Rhode Island coast in the 1930s and 1940s. By 1950, this species was rare as a breeding species in Rhode Island, apparently due to a variety of factors including increases in the number of nesting gulls. Only 1-2 pairs nested at scattered sites until 1981, when the last nesting record was documented. This species is still seasonally common as a migrant, particularly during post-breeding dispersal (e.g., from Great Gull Island in Long Island Sound where the largest nesting colony in North America is located to Cape Cod where terns throughout the region stage before fall migration). Roseate Terns are consistently recorded staging at a few coastal sites including Trustom Pond, Charlestown Breachway, Great Salt Pond on Block Island, and at Napatree Point (where hundreds of adults and fledged young occur, usually during August). There is high conservation concern for this species due to the limited population size (<15,000 breeding birds) and recent population declines (North American Waterbird Plan 2007). Conservation issues in Rhode Island include protection of staging birds from disturbance and coordinated monitoring and research activities with adjacent states.

Habitat Community: Coastal Shrubland and Grassland, Type: Maritime Grassland

Status

IUCN Rank: LC. FEDSTAT: FE. FED: FWS. STSTAT: SH. SRANK: SHB,S1N. GRANK: G4. STATE: E-1(3-1). RSGCN: H-VH. PIF BCPSN: Tier IV . NATerns: 1. AJV BCR: HH. CODES: B. Res/B: 1. GRP: 54. PRIOR: 1. Climate Change Vulnerability: Med = by 2050 (Habitat loss)

Threats and Actions

Threat 1 - Recreational activities; Increased human disturbance at stopover migration sites

Actions:
- *Site/area management; Minimize human disturbance at stopover sites. Rank: 3*
- *Site/area protection; Protect stopover sites. Rank: 3*
- *Awareness and communications; Educate public about the importance of stopover sites. Rank: 2*

Threat 2 - Habitat shifting and alteration; Loss of stop over sites due to sea level rise

Actions:
- *Site/area protection; Land protection to allow for stop over foraging habitat migration. Rank: 3*
- *Education and awareness; Education of landowners about appropriate land management regarding mitigation of sea level rise on coastal property. Rank: 2*

Threat 3 - Lack of planning

Actions: • *Data collection and analysis; Initiate monitoring of primary resources. Rank: 2*

Threat 4 - Other; Potential oil spill

Actions: • *Policies and regulations. Rank: 2*

• *Compliance and enforcement. Rank: 2*

Threat 5 - Natural system modifications; Loss of sand lance, which is primary prey

Actions: • *Species management; Develop management plan for sand lance. Rank: 3*

Refer to the Community: Coastal Shrubland and Grassland, Type: Maritime Grassland - Habitat Profile for additional threats to this species.

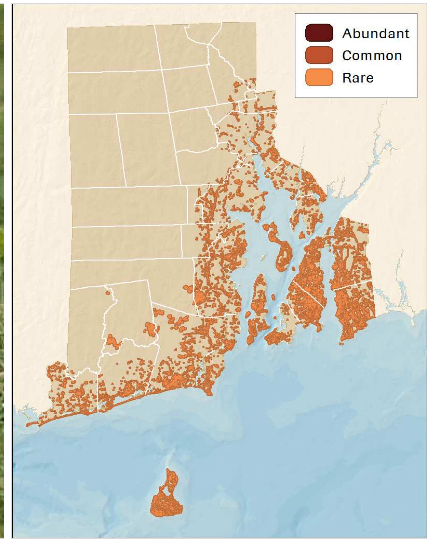
Horned Lark

BIRDS

Grassland Birds

Eremophila alpestris

Photo: Peter WC Paton



~See map disclaimer in profiles introduction

Distribution & Abundance

The Horned Lark is a widespread short-distance Nearctic migrant that nests throughout Canada and the United States, and winters throughout much of the United States. This species is characteristic of prairie habitats in the Midwest that likely expanded eastward with agricultural development. Horned Larks are probably among Rhode Island's rarest grassland species because they prefer large expanses of scarified ground with very short vegetation. In southern New England, only airports provide enough suitable habitat to support breeding populations. Horned Larks nested at the Quonset Airfield, but there have been no surveys in recent years and bird-strike mitigation at local airfields may have discouraged nesting. Territorial larks were formerly detected along beaches and parking lots, but this species appears to be extirpated as a breeding species from Rhode Island. Regional trend estimates in New England and mid-Atlantic states are uncertain based on BBS routes from 1966-2012 (annual trend = 0.1 (95% CI = -0.8 to 1.2), whereas across eastern North America their population is in steep decline (annual trend = -3.0 [95% CI = -2.4 to -3.8). Although the nesting population is virtually gone in Rhode Island, Horned Larks are common during fall migration. Flocks of several hundred birds consistently winter in Rhode Island, where they can be detected using large coastal grasslands and scarified areas (i.e., turf farms and corn fields) that few other avian species use during winter. Preservation of agricultural lands and coastal grasslands, with appropriate management, is needed to preserve Horned Larks in Rhode Island.

Habitat Community: Ruderal Forest, Type: Ruderal Forest

Status

IUCN Rank: LC. FED: FWS. STSTAT: C. SRANK: S1B,SZN. GRANK: G5. RSGCN: L-H. PIF BCPSN: Tier V. CODES: B. Res/B: 1. GRP: 43. PRIOR: 1. Climate Change Vulnerability: Low = by 2100 (Habitat loss)

Threats and Actions

Threat 1 - Natural system modifications; Loss of early successional habitat

Actions:
- *Habitat and natural process restoration; Create and maintain early successional habitat. Rank: 3*
- *Land/water protection; Work with state and local non profits to conserve suitable habitat. Rank: 3*
- *Resource and habitat protection. Rank: 3*
- *Education and awareness. Rank: 2*

Threat 2 - Residential and commercial development; Loss of early successional habitat due to development

Actions:
- *Land/water protection; Conserve early successional habitat. Rank: 3*

Threat 3 - Lack of planning

Snowy Egret

Egretta thula

BIRDS
Island Birds

Photo: Peter WC Paton

~See map disclaimer in profiles introduction

Distribution & Abundance

Snowy Egrets are long-distance Neotropical migrants that nest along the Atlantic and Pacific Coasts of North America and throughout the western US. The winter range is along the Gulf Coast, south throughout Central America, and into South America. Snowy Egrets prefer to nest in low trees on larger uninhabited islands in Narragansett Bay and on Block Island, with typically foraging habitat in salt marshes throughout coastal regions in the State. In Rhode Island, this species also began to nest in the early 1960s. Breeding numbers peaked earlier than the Great Egret, with the historical high counts ~300 nests in 1978-79, a steep decline to 91 pairs in 1984, an increase to 225 nests in 1991, and then a gradual decline to ~45 nests in 2013. Reasons for these local fluctuations are unclear, but nationwide the number of breeding pairs has been high conservation concern due to declining population trends (North American Waterbird Plan 2007). As with Great Egrets, conservation actions include monitoring of breeding birds, and protection of nesting sites and foraging sites from human disturbance, and monitoring impacts of sea-level rise on foraging habitat. Migrants stage in coastal salt marshes during spring and fall migration.

Habitat Community: Coastal Shrubland and Grassland, Type: Maritime Shrubland

Status

IUCN Rank: LC. FED: FWS. STSTAT: C. SRANK: S1B,SZN. GRANK: G5. STATE: E-1(3-1). RSGCN: L-VH. NALCC: X (B, NB). PIF BCPSN: Tier V. AJV BCR: M. CODES: B. Res/B: 1. GRP: 17. PRIOR: 1. Climate Change Vulnerability: Med = by 2050 (Habitat loss)

Threats and Actions

Threat 1 - Invasive and other problematic species and genes; Introduction of predators to predator free islands

Actions:
- *Species management; Prevent introduction of predators. Rank: 3*
- *Site/area management; Maintain forest/shrub habitat on nesting islands. Rank: 2*
- *Invasive/problematic species control; Control spread of phragmites in marshes and wetlands that are foraging habitat. Rank: 2*

Threat 2 - Recreational activities; Increased human disturbance of nesting habitat and foraging sites

Actions:
- *Awareness and communications; Educate public about disturbance factors. Rank: 2*
- *Policies and regulations; Policy regulations on buffer zones and land use or enforcement of existing policies including wetland buffer. Rank: 2*

Threat 3 - Habitat shifting and alteration; Loss of nesting and foraging habitat due to climate change

Actions:
- *Land/water protection; Protection of conservation of lands to allow for marsh migration. Rank:*

3

- *Habitat and natural process restoration; Restoration of feeding and nesting habitat. Rank: 3*

Threat 4 - Lack of planning

Actions:
- *Data collection and analysis. Rank: 2*

Threat 5 - Other; Potential oil spills

Actions:
- *Compliance and enforcement. Rank: 2*
- *Legislation. Rank: 2*

Refer to the Community: Coastal Shrubland and Grassland, Type: Maritime Shrubland - Habitat Profile for additional threats to this species.

Winter Wren

Troglodytes hiemalis L 4" (10 cm)

Winter Wren (Photo: Paul Stein/Creative Commons)

On a per-pound basis, the winter wren generates more song for its weight than any other North American songbird. This stubby-tailed, chocolate-brown mouse of a bird frequents wooded streamside habitats and coniferous forests, both in winter and summer. The long burbling song can be given from an exposed treetop perch in spring, or from inside a jumble of logs and tree roots when the wren takes a break from foraging. The winter wren nests across the northernmost states and Canadian provinces, and a high elevations in mountain ranges to the south. Winter wrens can be found almost anywhere there are dense woods. The more jumbled and tangled the forest floor is, the better.

What to Look and Listen For

The winter wren is one of North America's smallest birds, kinglet-sized and rounded in shape like a small teapot, with a short stubby tail for a spout. Its bill is short and thin. Dark brown feathers suit its skulking habits, for this is a bird that likes to hide among the leaf litter or crawl into dark crevices in rocks or the cavities created by fallen logs. (Its scientific name, *Troglodytes*, means "cave dweller.") Often found along stream banks or thick roadside tangles, this wren may pass unnoticed much of the time unless you are attuned to its double-click *chip* note. In the breeding season, however, males will often establish a perch on top of a snag and remain there for long periods as they sing their glorious, bubbly song.

When and Where to Look

In North America, winter wrens breed across Alaska and much of Canada and down into the coniferous forests of the northern United States. They also nest down the Appalachian chain at high elevations and in the Rockies, the Pacific Northwest, and along the California coast. They winter in most of the milder parts of this breeding range, and also throughout much of the lower half of the United States. Various races of the species have spread around the globe from Siberia through Europe and into Iceland, so travelers may find this familiar bird in northern settings around the world.

Feeding Behavior

Like all wrens, this little bird lives mainly on insects and spiders, although it has been known to eat fish on occasion, and may take berries in fall and suet from feeding stations in winter if the opportunity arises and other food is scarce. It tends to forage on the ground in a furtive manner, scrabbling about under fallen leaves like a mouse. It may also search, nuthatch-fashion, up and down tree trunks and along the larger limbs, probing bark crevices for prey.

Nesting Behavior

Males begin singing in earnest in early spring, both to defend territory and to attract mates. (The plural form is intentional: this species is often polygamous if given the chance.) Wing fluttering and other body actions add to the male's attraction during courtship time. He may build several "dummy" nests, but once a female has chosen the one that suits her, he helps her line it with animal hair or feathers. She lays about six eggs, and the responsibility for incubation is hers alone; it takes about two weeks. Once the young hatch, both sexes help feed the growing brood. The nestlings fledge at about 19 days of age.

—Norma Siebenheller

Hear it:

00:00 00:00

Bird song courtesy of Lang Elliott, NatureSound Studio.

Conserving South Carolina's At-Risk Species:

Species facing threats to their survival

www.fws.gov/charleston
www.fws.gov/southeast/endangered-species-act/at-risk-species

Golden-winged warbler

(*Vermivora chrysoptera*)

Golden-winged warbler/Tom Benson/Flickr Creative Commons

Description

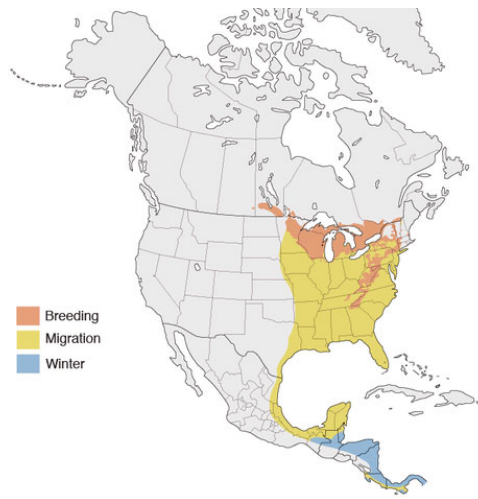
The Golden-winged warbler is a small, striking songbird averaging 12.1 cm (4.75 in.) in length and 8.8 g (0.31 oz.) in weight. Adult males have a yellow crown, a black mask, and a black throat. This bird has a white belly, gray back, and a yellow wing patch. Adult females and juveniles appear similar to the males but have a duller overall appearance and a greenish-yellow crown.

Range

The Golden-winged warbler is a northern breeding bird found in Southern Canada, the Northeastern United States, and extending south into the Appalachians. South Carolina composes the southernmost extent of the range where these birds occur in small numbers in the extreme northwestern part of the State. It has also been reported from the interior and coastal portions of the state during migration (eBird data). The Golden-winged warbler overwinters in Central America and northern South America.

Habitat

The Golden-winged warbler is an early-successional specialist species. They require shrubby habitat in upland or wetland areas, with sporadic tree cover and an understory of grass and forbs. They nest in disturbed sites such as abandoned farmland, aspen clearcuts, and burned forest stands. These early-successional habitats are short-lived and turn into mature forests, forcing the warblers out of the habitat.



Status

The U.S. Fish and Wildlife Service (Service) was petitioned to list the species in 2010. In 2011, the Service found that listing the species may be warranted but to date, a 12-month finding has not been issued. According to Breeding Bird Survey (BBS) trend data (1966-2010), Golden-winged warblers are declining at a rate of 2.6% per year in the Eastern BBS region. While the Golden-winged warbler is not currently ranked in South Carolina, it is considered of Highest Conservation Priority in South Carolina's State Wildlife Action Plan (SWAP).

Threats

Golden-winged warblers are currently facing declines from habitat loss, hybridization (Blue-winged warblers hybridize with Golden-winged warblers, producing viable offspring), and competition. Their preferred habitat is currently in decline in the face of urban sprawl, reforestation, and lower numbers of abandoned farm-lands. Historically fire, floods, wind-storms, and herbivores maintained habitat conditions conducive to disturbance-dependent species. Fire suppression, the loss of large canopy tress, and the extirpation of mega herbivores (e.g. - elk, bison) following European settlement, reduced the availability of early-successional habitat throughout the Eastern United States.

Management/Protection Needs

A variety of management techniques are available to create, maintain, or restore habitat for Golden-winged warbler. These techniques can be used to generate the preferred vegetation structure and configuration and are outlined at www.gwwa.org. Continue to survey and monitor for the species and protect known breeding locations.

References

Confer, John L., Patricia Hartman and Amber Roth. 2011. Golden-winged Warbler (*Vermivora chrysoptera*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/020

Roth, A.M., R.W. Rohrbaugh, T. Will, and D.A. Buehler, editors. 2012. Golden-winged Warbler Status Review and Conservation Plan. www.gwwa.org

South Carolina Department of Natural Resources - State Wildlife Action Plan: 2010-2015.

Contact

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www.fws.gov/charleston
www.fws.gov/southeast/endangered-species-act/at-risk-species

Conserving South Carolina's At-Risk Species:

Species facing threats to their survival

Little brown bat
(*Myotis lucifugus*)

Little brown bat/Photo credit: USFWS

Description
The little brown bat is a small to medium sized bat weighing 0.2 to 0.5 ounces and has a wingspan of 9 to 11 inches. The fur of the little brown bat is dark brown to cinnamon-buff with long glossy tips on the back and pale gray to buffy on the underside. The ears and membranes of the wing and tail are dark brown to black. A similar species, the northern long-eared bat (*Myotis septentrionalis*), has longer ears than the little brown bat and does not have long hairs on the feet. Female little brown bats are slightly larger than males, especially during the winter.

Range
Little brown bats are widely distributed from central Alaska and southern Canada into the southeastern and southwestern United States. The southern limit of the species is in northern portions of South Carolina, down into Georgia, Alabama, and Mississippi. In South Carolina during the summer, little brown bats are found primarily in the Blue Ridge mountains, though there have also been a few confirmed reports in the Piedmont, Sandhills and lower Coastal Plain regions. It is unknown where most of South Carolina's summer populations overwinter.

Habitat
Little brown bats are habitat generalists, using most cover types available to them in a variety of ecosystems. Much of their foraging activity is associated with aquatic habitats so lakes and streams seem to play a significant factor in habitat use. However, not much is known about specific habitat use and home range in South Carolina.

Status
The little brown bat is ranked by NatureServe as Globally Vulnerable—G3. In South Carolina, the little brown bat is considered rare to locally common in scattered colonies, and is listed as a Highest Priority species in the South Carolina 2015 State Wildlife Action Plan. The U.S. Fish and Wildlife Service (Service) is currently conducting a discretionary review of the species.

Threats
Primary threats to this species are from white-nose syndrome (WNS) which is estimated to have killed at least one million little brown bats from 2006 to 2010. The core region where much of the global population of little brown bats occur is now infected with WNS. Population declines have also been attributed to pesticides, the loss of roost sites in snags due to deforestation, control measures in nursery colonies, collecting bats for experimentation, and disturbance of individuals during hibernation. Mass dieoffs at hibernacula not related to WNS have been associated with vandalism and natural disasters such as floods. Wind energy is another potential threat to little brown bats. Global climate change is a potential threat as it may make southern hibernation sites unsuitable.

Management/Protection Needs
State law protects all bat species in South Carolina so extermination is not an acceptable form of bat control. The South Carolina Department of Natural Resources' Bat Conservation Plan should be consulted for alternatives. Habitat protection and management recommendations include working to prevent or reduce disturbance to natural and artificial roost structures, as well as to maternity colonies and hibernacula. Where and when possible, create or maintain patches of structurally diverse forest, providing a variety of suitable roosting and maternity sites. Forestry practices should incorporate buffers around known roosts, foraging areas, and migration corridors via landowner incentive programs, conservation easements, lease agreements, or purchases. Minimize large-scale pesticide use, especially around known foraging areas and maternity roosts. Continue to survey and monitor for the species. Further research is also needed to identify the best placement of wind turbines so as to minimize impacts to bats. Continue with education and outreach efforts on the species.

References
NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org.

South Carolina Department of Natural Resources - South Carolina Bat Conservation Plan: January 2017

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Northern Long-Eared Bat
Myotis septentrionalis

Photo by Steve Taylor, University of Illinois

This northern long-eared bat, observed during an Illinois mine survey, shows visible symptoms of white-nose syndrome.

The northern long-eared bat is federally listed as a threatened species under the Endangered Species Act. ***Endangered*** species are animals and plants that are in danger of becoming extinct. ***Threatened*** species are animals and plants that are likely to become endangered in the foreseeable future. Identifying, protecting and restoring endangered and threatened species is the primary objective of the U.S. Fish and Wildlife Service's Endangered Species Program.

What is the northern long-eared bat?

Appearance: The northern long-eared bat is a medium-sized bat with a body length of 3 to 3.7 inches and a wingspan of 9 to 10 inches. Their fur color can be medium to dark brown on the back and tawny to pale-brown on the underside. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*.

Winter Habitat: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible.

Summer Habitat: During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. They rarely roost in human structures like barns and sheds.

Reproduction: Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, females emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization.

After fertilization, pregnant bats migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats at the beginning of the summer, although larger maternity colonies have also been observed. Numbers of bats in roosts typically decrease from the time of pregnancy to post-lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years.

Feeding Habits: Like most bats, northern long-eared bats emerge at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation.

Range: The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Why is the northern long-eared bat in trouble?

White-nose Syndrome: No other threat is as severe and immediate as this. If this disease had not emerged, it is unlikely that northern long-eared bat populations would be experiencing such dramatic declines. Since symptoms were first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat's range, where it was most common before this disease. Numbers of northern long-eared bats (from hibernacula counts) have declined by up to 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread throughout the species' range, it is expected to continue to spread throughout the United States in the foreseeable future.

Other Sources of Mortality:

Although no significant population declines have been observed due to the sources of mortality listed below, they may now be important factors affecting this bat's viability until we find ways to address WNS.

Impacts to Hibernacula: Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats. Also, cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their energy stores, which may lead to bats not surviving through winter.

Loss or Degradation of Summer Habitat: Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range. Many forest management activities benefit bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, some forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.

Wind Farm Operation: Wind turbines kill bats, and, depending on the species, in very large numbers. Mortality from windmills has been documented for northern long-eared bats, although a small number have been found to date. However, there are many wind projects within a large portion of the bat's range and many more are planned.

What Is Being Done to Help the Northern Long-Eared Bat?

Disease Management: Actions have been taken to try to reduce or slow the spread of white-nose syndrome through human transmission of the fungus into caves (e.g. cave and mine closures and advisories; national decontamination protocols). A national plan was prepared by the Service and other state and federal agencies that details actions needed to investigate and manage white-nose syndrome. Many state and federal agencies, universities and non-governmental organizations are researching this disease to try to control its spread and address its affect. See www.whitenosesyndrome.org/ for more.

Addressing Wind Turbine Mortality: The Service and others are working to minimize bat mortality from wind turbines on several fronts. We fund and conduct research to determine why bats are susceptible to turbines, how to operate turbines to minimize mortality and where important bird and bat migration routes are located. The Service, state natural resource agencies, and the wind energy industry are developing a Midwest Wind Energy Habitat Conservation Plan, which will provide wind farms a mechanism to continue operating legally while minimizing and mitigating listed bat mortality.

Listing: The northern long-eared bat is listed as a threatened species under the federal Endangered Species Act. Listing a species affords it the protections of the Act and also increases the priority of the species for funds, grants, and recovery opportunities.

Hibernacula Protection: Many federal and state natural resource agencies and conservation organizations have protected caves and mines that are important hibernacula for cave-dwelling bats.

What Can I Do?

Do Not Disturb Hibernating Bats: To protect bats and their habitats, comply with all cave and mine closures, advisories, and regulations. In areas without a cave and mine closure policy, follow approved decontamination protocols (see http://whitenosesyndrome.org/topics/decontamination). Under no circumstances should clothing, footwear, or equipment that was used in a white-nose syndrome affected state or region be used in unaffected states or regions.

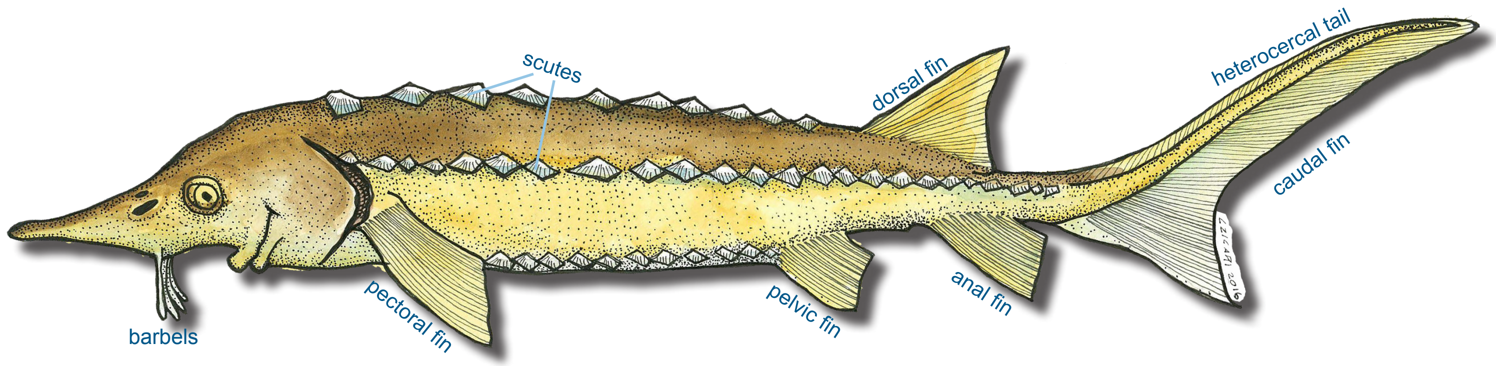
Leave Dead and Dying Trees Standing: Like most eastern bats, the northern long-eared bat roosts in trees during summer. Where possible and not a safety hazard, leave dead or dying trees on your property. Northern long-eared bats and many other animals use these trees.

Install a Bat Box: Dead and dying trees are usually not left standing, so trees suitable for roosting may be in short supply and bat boxes may provide additional roost sites. Bat boxes are especially needed from April to August when females look for safe and quiet places to give birth and raise their pups.

Support Sustainability: Support efforts in your community, county and state to ensure that sustainability is a development goal. Only through sustainable living will we provide rare and declining species, like the northern long-eared bat, the habitat and resources they need to survive alongside us.

Spread the Word: Understanding the important ecological role that bats play is a key to conserving the northern long-eared and other bats. Helping people learn more about the northern long-eared bat and other endangered species can lead to more effective recovery efforts. For more information, visit www.fws.gov/midwest/nleb and www.whitenosesyndrome.org

Join and Volunteer: Join a conservation group; many have local chapters. Volunteer at a local nature center, zoo, or national wildlife refuge. Many state natural resource agencies benefit greatly from citizen involvement in monitoring wildlife. Check your state agency websites and get involved in citizen science efforts in your area.



ATLANTIC STURGEON

MY SCIENTIFIC NAME

Acipenser oxyrhynchus oxyrhynchus

BY THE NUMBERS

Atlantic sturgeon can grow to 14 feet in length, and weigh up to 800 pounds. The largest on record was captured in Canada and weighed 811 pounds!

HOW TO IDENTIFY ME

I have a brown and tan body with a whitish belly. I do not have scales like most fish; my skin is rough, similar to sand paper. I have five rows of bony plates, called **scutes**, along the sides and top of my body. Like all sturgeon, I have a long forked **heterocercal tail**, the top of my tail fin is longer than the bottom. My snout is hard and upturned at the tip, with four whisker-like **barbels** below, and my mouth is soft and toothless.

WHY I MATTER AND WHAT'S BEEN HAPPENING

People used to catch me for my delicious meat and eggs, which were sold as a gourmet food called caviar. There was a very large commercial fishery for me in the 1880's. Fishing continued into the 1950's but by the 1990s many states no longer allowed fishing. Decades of pollution, overfishing and damming of rivers, which prevented us from reaching our home **spawning** grounds and eliminated a lot of our good nursery habitat, caused our numbers in the wild to become very low.

MY STATUS

In 2012, The National Oceanic and Atmospheric Administration listed us as endangered along parts of the eastern United States. It is illegal to fish for us, and illegal to take our eggs where we are endangered.

DID YOU KNOW?

- Atlantic sturgeon ancestors can be traced back 245 million years ago when dinosaurs roamed the earth.
- The species hasn't changed much in 120 million years, surviving even after dinosaurs went extinct.
- Those bony plates topped with sharp ridges on their sides and back are called **scutes**, making them look like "living dinosaurs."
- It spends most of its life in the ocean and coastal areas. But they migrate back to freshwater rivers where they were hatched to **spawn** and produce fish each year.
- Female Atlantic sturgeon spawn once every 2 to 6 years at ages 7 to 30 years old, depending on where they live.
- They are found from Canada to Florida (Figure 1).
- They were a reliable food source for people arriving in the 1600s and settling at Jamestown, VA, playing a major role in the history of the United States.
- Dams block them from getting back to their home spawning grounds, and their populations are very low compared to historical levels.

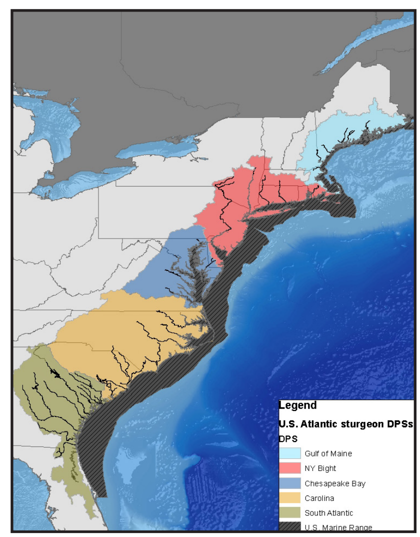


Figure 1 – Where Atlantic sturgeon are found along the United States. Credit: NMFS.

- There are populations that migrate back to rivers flowing into the Gulf of Maine, the New York Bight, the Chesapeake Bay, the Carolinas and South Atlantic coast.
- Adults swim up the James and York rivers of Virginia to spawn in spring and fall, too.
- Atlantic sturgeon leap completely out the water, making a loud splash which can be heard half a mile away and possibly further under water.

Fish illustration by Laury Zicari, USFWS, Retired.

MORE ABOUT US

This young Atlantic sturgeon was raised at a national fish hatchery and stocked into the Hudson river to help boost local populations back in 1994. Scientists wanted to learn whether hatchery fishes would return back to their home river as adults to spawn, just like other wild Atlantic sturgeon. Several have been recaptured as adults off the coast of DE and NJ, and in the Hudson River, and the number keeps growing. Atlantic sturgeon don't reproduce until they are at least 5 years old in southern rivers, and as old as 34 years in northern rivers, so it takes them a long time to build up their numbers in nature.

Biologists study Atlantic sturgeon to better understand their needs for survival and to determine how healthy they are in the wild. They track population numbers over time, identify the number of males and females, and measure body length and weight. This Atlantic sturgeon was captured in the Chesapeake Bay outside of the James River.

Four whisker-like barbels hang down from their snout to help them find food on the bottom of the river or the bay.

As bottom-feeders, they use their barbels to find food, and their toothless mouth acts like a vacuum, capturing worms, small fish and other small animals living on the bottom.

YOU CAN HELP ME

Get to know me, if you don't already. Help make me visible to people who don't have the chance to see me by sharing your stories about me. Get involved in efforts to help conserve my habitat and maintain my populations into the future.

Learn more about Atlantic sturgeon!
www.greateratlantic.fisheries.noaa.gov/protected/atlsturgeon/
www.youtube.com/watch?v=N-OiVb6CM8o

Appendix II -- FACT SHEET: RHODE ISLAND ODONATA

LYRE-TIPPED SPREADWING: *Lestes unguiculatus* Hagen

Adult size: 33-36mm.
Habitat: small temporary ponds
Flight season: July and August
Status: State Concern; Restricted and Rare
Number of populations: 4
Number of townships: 3
Number of counties: 3

Adult description: a splendidly colored, slight-of-build spreadwing, the Lyre-tipped is reliably identified in hand by the bowed inferior appendages of the males. However, what catches ones eye in mature males is the striking blue pruinosity on the thorax and the tip of the abdomen. The eyes are bright blue and the body metallic green. The dark thorax becomes bright blue with pruinosity in mature males, covering two lime green shoulder stripes. The tip of the abdomen of males is similarly pruinose, with a dark rear-ward pointing triangle on top of segment 8. Females are dark green to bronze above with pale yellow shoulder stripes and sides.

Habitat characteristics: in Rhode Island *L. unguiculatus* is found in small temporary freshwater ponds. It is also reported from gravel and sand pit ponds.

Range, local distribution, and abundance: *L. unguiculatus* is a widespread, transcontinental species in North America, ranging from British Columbia to the maritimes south to West Virginia and west through the plains to California (Donnelly 2004). It is the rarest spreadwing in Rhode Island. Westfall and May (1996) refer to it as common throughout the U.S. and into southern Canada, and in Ohio it is considered common as well (Glotzhober and McShaffrey 2002). However, Nikula et al (2003) suggest a population decline in Massachusetts and the species is rare in Connecticut (Wagner and Thomas 1999). After more than adequate surveys state-wide in Rhode Island the only records of *L. unguiculatus* are from at or near the coast. There are only four known breeding sites in the state, two of which are on Block Island. The remaining two are along the coast of Narragansett Bay. The species is rare and restricted in the state, and is listed as a species of Concern by the Rhode Island Natural Heritage Program.

Flight data: flight dates for *Lestes unguiculatus* in Rhode Island range from 17 July through 6 August, based upon specimen data. Peak activity occurs in July.

Ecology, behavior, and conservation: the rarity of this species in Rhode Island is puzzling given the references in the literature to its widespread and common status elsewhere. Unfortunately no historic data exist with which to compare current Rhode Island inventories, so we cannot reliably conclude that *L. unguiculatus* is or has been experiencing a decline in this state. However, we are confident in survey effort and confident in the placement of the species in the Natural Heritage Program's Concern category. The uncommon to rare nature of *L. unguiculatus* in all three southern New England states most certainly bears watching and a status upgrade may be warranted. It has been suggested that this species may not be tolerant of competition and thus is a colonizer which eventually dwindles in number and disappears as other species move in. Further study of *L. unguiculatus* at ponds where it has been reported here and throughout the region may provide answers to this interesting question.

Literature:

Donnelly, T.W. 2004. Distribution of North American Odonata Part III: Calopterygidae, Lestidae, Coenagrionidae, Protoneuridae, Platystictidae. Bulletin of American Odonatology 8 (2-3): 33-39.

Glotzhober, R.C. and D. McShaffrey. 2002. The dragonflies and damselflies of Ohio. Bulletin of the Ohio Biological Survey 14 (2): 1-364.

Nikula, B., J.L. Loose, and M.R. Burne. 2003. A field guide to the dragonflies and Damselflies of Massachusetts. Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program. 197pp.

Wagner, D.L. and M.C. Thomas. 1999. The Odonata fauna of Connecticut. Bulletin of American Odonatology Vol. 5(4): 59-85.

Westfall, M.J. Jr. and M.L. May. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL. 649pp.

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APPENDIX C

NAVSTA NEWPORT NATURAL RESOURCES PROJECTS LIST

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Project #	Project Description	INRMP Page Ref.	FY Scheduled Implementation	Prime Legal Driver	Navy Assessment Level	Cost Estimate	Funding Source	Target Date for Project Completion
1	Point count survey of all bird species present at NAVSTA Newport (including migratory and RTE species) every five years	204	FY25	B, D	ERL 4	$50,000 per 5 years	ENV, SERDP	Recurring every 5 years
2	Develop a Bat and Bird Conservation Strategy	205	FY21	A, C, D	ERL 4	$25,000 total	ENV	FY23
3	Bat monitoring that includes biannual acoustic monitoring for bats using full spectrum bat detectors, as well as an installation-wide roost search during the summer	205	FY25	A, B	ERL 4	$30,000 annual	ENV, SERDP	Recurring bi-annually
4	Conduct a mist-net survey for *Myotis* bat species in natural habitat areas	207	FY21	A, B	ERL 4	$20,000/ year	ENV, SERDP	Recurring every 3 years
5	Enhance wildlife habitats	207	FY22	B, C	ERL 1	$7,500 total	ENV	FY23
6	Implement the invasive species management plan, once completed, with invasive species surveys, control, as well as habitat restoration efforts that include early successional habitat and control for invasive species	208	FY21	B, C	ERL 3	$35,000	ENV	Recurring every year
7	Survey for the presence of New England cottontail rabbit	208	FY21	B, C	ERL 4	$30,000	ENV	FY21
8	Conduct an installation-wide wetland delineation	208	FY28	G, I	ERL 4	$75,000	ENV	Recurring every 10 years
9	Evaluate condition of wetlands and the shoreline, and prioritize areas in need of wetlands restoration and living shorelines restoration	209	FY21	G, I	ERL 4	$20,000	ENV	FY21
10	Restore wetlands characterized as a high restoration priority	210	FY21	G, I	ERL 4	$16,000/ acre[1]	ENV, Non-DOD	FY21
11	Restore eroded coastal areas identified as a high restoration priority	211	FY21	G, I	ERL 4	$2M/mile of shoreline	ENV, LP, Non-DOD	FY21

12	Conduct a nearshore habitat assessment and species inventory	212	FY28	E	ERL 4	$150,000	ENV	Recurring every 10 years
13	Continue monitoring the health and distribution of SAV	213	FY21	E	ERL 4	$145,000/ acre[1] project total	ENV, Non-DOD	Recurring every 3 years
14	Continue restoration of SAV beds	213	FY17-Awarded	E	ERL 4	$45,000/ acre[1]	ENV, Non-DOD	Recurring every 5 years FY23
15	Conduct a stream and riparian habitat condition assessment to identify areas in need of restoration	214	FY21	G, H, J	ERL 4	$25,000	ENV	FY21
16	Restore priority stream reaches and riparian areas	215	FY21	G, H, J	ERL 4	$150,000	ENV	FY21
17	Mark storm drains with “Drains to the Bay”	216	FY21	G	ERL 1	$500 total[2]	ENV, MWR, Non-DOD	FY21
18	Annually conduct a trash clean-up along the installation shoreline	217	FY21	G	ERL 1	$250/year	MWR	Recurring annually FY21
19	Develop a climate change vulnerability assessment and adaptation plan	218	FY21	A, L	ERL 3	$250,000	ENV	FY21
20	Continue goose control including use of a trained dog	219	FY21	B	ERL 2	TBD	ENV, MWR	Recurring annually
21	Develop an Installation Conservation Design Plan	220	FY21	A, L, M	ERL 1	$30,000 total	ENV	FY21
22	Promote pollinator habitat	221	FY21	B, C, M	ERL 3	$5,000	ENV, LP	Recurring annually
23	Install osprey nesting platforms	222	FY21	D	ERL 1	$20,000	ENV	FY21
24	Establish up to five Watchable Wildlife Areas	222	FY21	B	ERL 1	$10,000 each	ENV, MWR	FY21
25	Develop and print educational brochures or factsheets	223	FY21	B	ERL 1	$7,000 total	ENV	Recurring
26	Attend training	225	FY21	A, B	ERL 3	$10,000 total	ENV	Recurring, FY21
27	Conduct a 5-year review for Operation and Effect to the INRMP.	225	FY20	A, B	ERL 4	$56,000	ENV	FY24
28	Conduct reptile and amphibian surveys at Tank	226	FY21	A, B,	ERL 4	n/a	ENV	FY21

	Farms 1-5			C				
29	Purchase and install an electronic permit system.	226	FY21	n/a	ERL 4	TBD	ENV	FY21
30	Conduct natural resources surveys.	227	FY20	A, B, C	ERL 4	184,578	ENV	FY25

FISHERS ISLAND

Project #	Project Description	INRMP Page Ref.	FY Scheduled Implementation	Prime Legal Driver	Navy Assessment Level	Cost Estimate	Funding Source	Target Date for Project Completion
1	Stabilize beaches and bluffs to benefit birds of conservation concern	Addendum	FY28	G, I	ERL 4	N/A	ENV	FY28
2	Conduct an installation-wide invasive species inventory and develop an invasive species management plan	Addendum	FY23	B, C	ERL 3	N/A	ENV	FY23
3	Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts	Addendum	FY25	B, C	ERL 3	N/A	ENV	FY25
4	Enter migratory bird species occurrences in the DOD Partners in Flight program’s Coordinated Bird Monitoring Database	Addendum	FY22	B, D	ERL 4	N/A	ENV	FY22
5	Conduct an emergence count at least three times per year (bi-annually) to document use of bat roosts	Addendum	FY23, 25, 27, 29	A, B	ERL 4	N/A	ENV	Bi-Annually
6	Conduct baseline bat surveys, including acoustic monitoring, mist-netting, and summer bat roost searches. Repeat acoustic monitoring every 3–5 years	Addendum	FY22	A, B	ERL 4	N/A	ENV	FY22
7	Conduct a survey for rare, threatened, and endangered species	Addendum	FY22	B	ERL 4	ERL 4	ENV	FY22

8	Periodically monitor known and potential RTE species habitats (every 5 years)	Addendum	FY27	B	ERL 4	N/A	ENV	FY27
9	Conduct an installation-wide wetlands delineation	Addendum	FY27	G, I	ERL 4	N/A	ENV	FY27
10	Establish wildflower habitat including native milkweed varieties to support the monarch butterfly	Addendum	FY24	B, C, M	ERL 3	N/A	ENV	Recurring every 5 years FY24

SENECA LAKE

Project #	Project Description	INRMP Page Ref.	FY	Prime Legal Driver	Navy Assessment Level	Cost Estimate	Funding	Target Date for Project Completion
			Scheduled Implementation				Source	
1	Conduct an installation-wide invasive species inventory and develop an invasive species management plan	Addendum	FY23	B, C	ERL 3	N/A	ENV	FY23
2	Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts	Addendum	FY25	B, C	ERL 3	N/A	ENV	FY25
3	Monitor periodically (every 5 years) for presence of the federally endangered plant, *Rhodiola integrifolia ssp. Leedyi*	Addendum	FY25	B, C	ERL 4	N/A	ENV	FY25
4	Survey/monitor/control zebra mussels and other aquatic invasive species in the lagoon and nearshore area of Seneca Lake	Addendum	FY23	B, C	ERL 3	N/A	ENV	FY23
5	Enter migratory bird species occurrences in the DOD Partners in Flight program's Coordinated Bird Monitoring Database	Addendum	FY22	B, D	ERL 4	N/A	ENV	FY22

DODGE POND

Project #	Project Description	INRMP Page Ref.	FY	Prime Legal Driver	Navy Assessment Level	Cost Estimate	Funding	Target Date for Project Completion
			Scheduled Implementation				Source	
1	Conduct an installation-wide invasive species inventory and develop an invasive species management plan	Addendum	FY23	B, C	ERL 3	N/A	ENV	FY23
2	Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts	Addendum	FY25	B, C	ERL 3	N/A	ENV	FY25
3	Monitor periodically (every 5 years) for presence of the federally endangered plant, *Rhodiola integrifolia ssp. Leedyi*	Addendum	FY25	B, C	ERL 4	N/A	ENV	FY25

Primary Legal Driver

A	OPNAVINST 5090.1D, January 2014
B	Sikes Act of 1960, as amended
C	Endangered Species Act of 1973, 16 USC §1531 et seq.
D	Migratory Bird Treaty Act of 1918
E	Magnuson-Stevens Fishery Conservation and Management Act
F	Coastal Zone Management Act of 1972
G	Clean Water Act of 1972, as amended
H	Soil and Water Conservation Act of 1977, as amended
I	Executive Order 11990 (Protection of Wetlands)
J	Executive Order 11988 (Floodplain Management)
K	Executive Order 13112 (Invasive Species)
L	DODI 4715.03 (Natural Resources Conservation Program)
M	Executive Order 13148 (Greening the Government Through Leadership in Environmental Management

Navy Assessment Level / Navy Environmental Readiness Level (ERL)

ERL 4	Environmental Compliance Requirement
ERL 3	Navy or DOD Policy Requirement
ERL 2	Pending Requirements for Future Compliance
ERL 1	Navy Environmental Stewardship

Funding Source

ENV	Operation and Maintenance, Navy (O&MN) Environmental Funds
LP	Legacy Resource Management Program (Legacy Program) Funds
FR	Forestry Revenues
AO	Agricultural Outleasing
MWR	Morale, Welfare & Recreation (includes Fish and Wildlife Fees)
RF	Recycling Funds
SERDP	Strategic Environmental Research and Development Program (SERDP) Funds
Non-DOD	Other Non-DOD funds

APPENDIX D

SPECIES LISTS

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Flora Species			Site Name						
Growth Form [1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Grasslike (Grasses, sedges, and rushes) 48 species	*Agropyron repens*	Witch-grass		X					
	Ammophila breviligulata	Beachgrass						X	
	Andropogon virginicus	Broom-sedge		X	X				
	Anthoxanthum odoratum	Sweet Vernal Grass	X	X	X	X	X		
	Bromus tectorum	Downy Chess					X	X	
	Calamagrostis canadensis	Bluejoint					X		
	Carex lurida	Sedge				X			X
	Carex pensylvanica	Early Sedge			X				
	Carex scoparia	Broom-sedge			X		X		X
	Carex sp.	Sedge sp.		X					
	Carex sp.	Ovales group sedge							X
	Carex stipata	Awl-sedge				X			
	Carex swanii	Swan's Sedge			X				
	Carex vulpinoidea	Sedge	X	X	X	X			
	Cyperus esculentus	Nutsedge				X			
	Cyperus strigosus	Umbrella Sedge				X			X
	Dactylis glomerata	Orchard Grass	X	X	X	X		X	
	Eleocharis acicularis	Spike rush					X		
	Eleocharis palustris	Spike rush					X		
	Eleocharis sp.	Spikerush sp.				X			

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Flora Species			Site Name						
Growth Form [1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Grasslike (Grasses, sedges, and rushes) 48 species	*Eleocharis tenuis*	Slender Spikerush				X			
	Equisetum sp.	Horsetail sp.					X		X
	Eragrostis spectabilis	Purple Love-grass			X				
	Festuca ovina	Sheep fescue		X					
	Glyceria canadensis	Rattlesnake Grass							X
	Elytrigia repens	Quack Grass			X				
	Holcus lanatus	Velvet Grass	X	X	X	X	X	X	X
	Juncus bufonius	Toad's Rush				X			
	Juncus canadensis	Canada Rush				X	X		X
	Juncus effusus	Soft Rush	X		X	X	X		X
	Juncus sp.	Rush sp.		X					
	Juncus tenuis	Path Rush	X		X	X	X	X	X
	Lolium perenne	English Ryegrass					X		
	Panicum clandestinum	Deer Tongue	X	X	X				X
	Panicum dichotomum	Panic-grass			X				
	Panicum sp.	Grass sp.							X
	Panicum virgatum	Switchgrass		X					
	Phalaris arundinacea	Reed Canary-grass				X			
	Phleum pratense	Timothy	X		X	X	X		
	*Phragmites australis**	Common Reed				X			X
	Schizachyrium scoparium	Little Bluestem			X				
	Scirpus americanus	Olney-threesquare					X		

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Flora Species			Site Name						
Growth Form [1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Grasslike (Grasses, sedges, and rushes) 48 species	*Scirpus cyperinus*	Wool-grass				X	X		X
	Scirpus tabernaemontani	Softstem Bulrush				X	X	X	X
	Setaria viridus	Green foxtail	X	X	X	X			
	Spartina alterniflora	Salt-water Cordgrass							X
	Spartina pectinata	Freshwater-cordgrass			X				
Herbaceous Plants 155 species	*Achillea millefolium*	Common Yarrow	X	X	X	X	X	X	X
	*Alliaria petiolata**	Garlic Mustard					X	X	
	Allium schoenoprasum	Cultivated Chives					X		
	Allium vineale	Field Garlic					X	X	
	Ambrosia artemisiifolia	Common Ragweed			X			X	
	Anagallis arvensis	Scarlet Pimpernel			X			X	
	Apocynum androsaemifolium	Spreading Dogbane	X		X			X	
	Arctim minus	Lesser Burdock					X		
	Arisaema triphyllum	Jack in the Pulpit			X				
	Artemisia vulgaris	Common Mugwort	X	X		X	X		X
	Asclepias sp.	Milkweed sp.	X	X	X	X		X	
	Asclepias syriaca	Common Milkweed					X		X
	Asparagus officinalis	Asparagus						X	
	Aster divaricatus	White Wood Aster			X				
	Aster paternus	Toothed White-topped Aster			X				

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Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Herbaceous Plants 155 species	*Chenoopodium album*	Lamb's Quarters			X	X	X	X	
	Chimaphila umbellata	Pipsissewa			X				
	Chrysanthemum leucanthemum	Ox-eye Daisy				X	X	X	
	Cichorium intybus	Chickory			X				
	Cirsium vulgare	Bull Thistle	X			X		X	X
	Convallaria majalis	Lily-of-the-valley					X		
	Conyza canadensis	Horseweed			X				X
	*Coronilla varia**	Crown Vetch				X		X	
	Daucus carota	Queen Anne's Lace	X	X	X		X	X	X
	Dennstaedtia punctilobula	Hay-scented Fern			X				X
	Dianthus armeria	Deptford Pink	X			X			
	Epilobium coloratum	Purple-leaved Willow-Herb							
	Epilobium sp.	Willow-herb					X		
	Erigeron annuus	Daisy-fleabane				X	X	X	
	Erigeron strigosus	Lesser Daisy Fleabane			X	X			X
	Eupatorium dubium	Three-nerved Joe-Pye							

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Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Herbaceous Plants 155 species	*Eupatorium perfoliatum*	White Boneset				X	X		
	Euthamia graminifolia	Grass-leaved Goldenrod							X
	Euthamia tenuifolia	Slender-leaved Goldenrod	X						
	Fragaria virginiana	Wild Strawberry		X	X		X		
	Galium aparine	Cleavers		X					
	Galium mollugo	Wild Madder					X		
	Galium palustre	Marsh-bedstraw				X			
	Geranium sp.	Geranium						X	X
	Glaucium flavum	Sea-poppy						X	
	Glechoma hederacea	Gill-over-the-ground		X			X		
	Gratiola aurea	Golden Hedge-hyssop				X			
	Heracleum lanatum	Cow-parsnip				X		X	
	Hibiscus moscheutos	Swamp Rose-mallow						X	
	Hieracium caespitosum	King Devil		X					
	Hieracium pilosella	Mouse-ear		X			X		
	Hieracium sp.	Hawkweed sp.	X	X					
	Hypericum ellipticum	Pale St. John's Wort					X		
	Hypericum gentianoides	Orange-grass				X			X

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Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Herbaceous Plants 155 species	*Hypericum perforatum*	Common St. John's Wort	X	X	X		X	X	X
	Hypericum punctatum	Spotted St. John's Wort			X				
	Hypericum virginicum	Marsh St. Johnswort						X	
	Hypochoeris radicata	Cat's Ear		X	X				
	Hypoxis hirsuta	Yellow Star-grass			X				
	Impatiens capensis	Spotted Jewelweed			X	X	X		X
	Iris sp.	Blue Flag				X	X		
	Lactuca serriola	Prickly Lettuce							X
	Lathyrus japonicus	Beach-pea						X	
	Lathyrus latifolius	Everlasting Pea							X
	Lemna sp.	Duckweed					X		
	Lepidium campestre	Field Peppergrass			X	X	X		
	Lepidium virginicum	Poor-man's Pepper			X	X			
	Lespedeza capitata	Round-headed Bush-clover			X				
	Lechea tenuifolia	Narrow-leaved Pinweed			X				
	Linaria canadensis	Blue Toadflax			X				
	Linaria vulgaris	Butter 'n' Eggs	X	X	X				X
	*Lotus corniculatus**	Birdsfoot-trefoil			X			X	
	Ludwigia palustris	Common Water Purslane							X

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Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Herbaceous Plants 155 species	*Ludwigia palustris*	Common Water Purslane							X
	Lycopus americanus	American Water Horehound			X	X			
	Lysimachia quadrifolia	Whorled Loosestrife		X	X				
	Lysimachia terrestris	Swamp Candles							X
	*Lythrum salicaria**	Purple Loosestrife				X	X		X
	Maianthemum canadense	Canada Mayflower			X				
	Malva moschata	Musk Mallow						X	
	Medicago lupulina	Black Medick			X			X	
	Melampyrum lineare	Cow-wheat			X				
	Melilotus sp.	Sweet-clover		X			X		
	Monotropa uniflora	Indian Pipes			X				
	Oenothera biennis	Common Evening-primrose							
	Onoclea sensibilis	Sensitive Fern			X	X	X		X
	Osmunda cinnamomea	Cinnamon Fern			X				
	Oxalis europaea	Yellow Wood Sorrel				X			
	Oxalis stricta	Common Yellow	X				X		
	Penstemon laevigatus	Smooth Beard-tongue				X			
	Phytolacca americana	Pokeweed	X	X	X	X	X		X

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Flora Species			Site Name						
Growth Form[1]	Latin Name	Common Name	Tank Farm 1	Tank Farm 2	Tank Farm 3	Tank Farm 4	Tank Farm 5	Coastline	Railroad ROW
Herbaceous Plants 155 species	*Plantago aristata*	Bracted Plantain	X						
	Plantago lanceolata	English Plantain	X	X	X		X	X	X
	Plantago major	Broad-leaved Plantain			X	X	X		X
	Polygala polygama	Racemed Milkwort			X				
	Polygala sp.	Milkwort sp.						X	
	*Polygonum cuspidatum**	Japanese Knotweed			X		X	X	X
	Polygonum lapathifolium	Nodding Smartweed							X
	Polygonum persicaria	Lady's Thumb	X		X	X	X		X
	Polygonum sagittatum	Arrow-leaved Tearthumb							X
	Potentilla anserina	Silverweed				X			
	Potentilla argentea	Silvery Cinquefoil						X	
	Potentilla canadensis	Dwarf Cinquefoil		X	X		X		
	Potentilla simplex	Common Cinquefoil		X	X		X		
	Prenanthes alba	Rattlesnake Root			X				
	Prenanthes trifoliolata	Gall-of-the-earth			X				
	Ranunculus bulbosus	Common Buttercup		X			X		
	Ranunculus repens	Creeping Buttercup	X	X		X	X		
	Raphanus raphanistrum	Wild Radish				X	X		X

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Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Herbaceous Plants 155 species	*Rorippa palustris*	Marsh-cress				X			
	Rumex acetosella	Sheep-sorrel	X	X	X		X	X	
	Rumex crispus	Curly Dock			X	X	X	X	X
	Rumex obtusifolius	Broad-leaved Dock					X		
	Rumex orbiculatus	Water-dock					X		
	Salsola sp.	Saltwort						X	
	Sedum acre	Mossy Stonecrop						X	
	Sisyrinchium angustifolium	(narrow-leaved) Blue-eyed Grass							
	Solanum dulcamara	European bittersweet			X	X	X	X	X
	Solidago canadensis	Tall Goldenrod			X				
	Solidago rugosa	Rough Goldenrod		X	X	X	X		X
	Solidago sempervirens	Seaside Goldenrod						X	X
	Solidago sp.	Goldenrod	X	X		X	X	X	X
	Spergularia rubra	Common Sand-spurrey					X		
	Stachys tenuifolia	Smooth Hedge-nettle					X		X
	Stellaria graminea	Lesser Stitchwort		X					
	Stellaria media	Common Chickweed					X		
	Strophostyles helvula	Trailing Wild Bean							X
	Symplocarpus foetidus	Skunk-cabbage					X		
	Tanacetum vulgare	Tansy	X	X		X	X	X	X
	Taraxacum officinale	Common Dandelion		X	X		X	X	

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Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Herbaceous Plants 155 species	*Teucrium canadense*	American Germander							X
	Trifolium arvense	Rabbit's Foot Clover			X				
	Trifolium dubium	Least Hop-Clover			X				
	Trifolium hybridum	Alsike Clover				X	X		
	Trifolium repens	White Clover		X	X		X	X	
	Trifolium sp.	Hop Clover		X				X	
	Typha angustifolia	Narrow-leaved Cattail				X			X
	Typha latifolia	Common Cattail				X	X		
	Urtica procera	Tall Nettle					X		
	Verbascum thapsus	Common Mullein		X	X		X	X	X
	Verbena hastata	Blue Vervain				X			X
	Veronica peregrina	Neckweed					X		
	Veronica persica	Bird's-eye Speedwell			X				
	Veronica serpyllifolia	Thyme-leaved Speedwell					X		
	Vicia cracca	Cow-vetch		X			X		
	Viola fimbriatula	Downy Blue Violet			X				
	Viola lanceolata	Lance-leaved Violet		X			X		
	Viola sororia	Common Blue Violet					X		
	Xanthium strumarium	Common Cocklebur							X
Vines 9 species	*Calystegia sepium*	Hedge Bindweed			X			X	X
	Campsis radicans	Trumpet-creeper							X
	*Celastrus orbiculatus**	Asiatic Bittersweet	X	X	X	X	X	X	X

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Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Vines 9 species	*Cuscuta sp.*	Dodder sp.				X			
	Parthenocissus quinquefolia	Virginia Creeper	X	X	X	X	X	X	X
	Polygonum scandens	Climbing False Buckwheat				X			
	Smilax glauca	Bullbrier		X	X	X			X
	Smilax rotundifolia	Roundleaf greenbrier		X	X				
	Vitis aestivalis	Summer Grape	X					X	
	Vitis labrusca	Fox Grape						X	X
Woody Plants (Trees, shrubs, partly woody plants) 70 species	*Acer platanoides**	Norway Maple				X		X	X
	*Acer pseudoplatanus**	Sycamore Maple	X		X	X	X		
	Acer rubrum	Red Maple	X	X	X	X	X	X	X
	*Ailanthus altissima**	Tree-of-heaven							X
	Alnus glutinosa	European Alder				X			
	Alnus incana	Speckled Alder			X				X
	Amorpha fruticosa	False Indigo/ Indigobush						X	
	Aronia arbutifolia	Red Chokeberry		X	X				
	Betula alleghaniensis	Yellow Birch			X				
	Betula populifolia	Gray Birch	X	X	X				

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Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Woody Plants (Trees, shrubs, partly woody plants) 70 species	*Clethra alnifolia*	Sweet Pepperbush			X				
	Comptonia peregrina	Sweetfern			X		X		
	Crataegus sp.	Hawthorne sp.	X						X
	Elaeagnus angustifolia	Russian Olive		X			X		
	*Elaeagnus umbellata**	Autumn Olive	X	X	X	X	X	X	X
	*Euonymous alatus**	Winged Euonymous		X					
	Fagus grandifolia	American Beech			X				
	*Frangula alnus**	Glossy Buckthorn		X	X				
	Fraxinus americana	White Ash	X						
	Iva frutescens	Marsh-elder spe						X	
	Juglans nigra	Black walnut	X	X					
	Juniperus virginiana	Northern Red Cedar	X	X	X	X	X	X	X
	Larix decidua	European Larch				X			
	Ligustrum sp.	Privet sp.							X
	Lindera benzoin	Spicebush			X				
	*Lonicera japonica**	Japanese Honeysuckle	X		X	X	X		X

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Flora Species			**Site Name**						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Woody Plants (Trees, shrubs, partly woody plants) 70 species	*Lonicera morrowi**	Morrow's Honeysuckle	X	X	X	X	X	X	X
	Myrica pensylvanica	Northern Bayberry	X	X	X	X	X	X	X
	Nyssa sylvatica	Tupelo		X	X				
	Picea sp.	Spruce sp.				X			
	Pinus resinosa	Red Pine		X		X			
	Pinus strobus	White Pine	X	X	X	X	X		
	Populus alba	White Poplar							X
	Populus grandidentata	Big-toothed Aspen		X	X				X
	Populus tremuloides	Quaking Aspen				X			X
	Prunus avium	Bird Cherry		X					
	Prunus serotina	Wild Black Cherry	X	X	X	X	X		X
	Prunus sp.	Cherry sp.						X	
	Prunus virginiana	Choke Cherry	X	X		X			X
	Pyrus malus	Apple	X			X			X
	Pyrus spp.	Crabapple		X	X		X		
	*Quercus cerris**	European Turkey Oak				X			X

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Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Woody Plants (Trees, shrubs, partly woody plants) 70 species	*Quercus coccinea*	Scarlet Oak		X	X				
	Myrica pensylvanica	Northern Bayberry	X	X	X	X	X	X	X
	Quercus rubra	Northern Red Oak			X				X
	Quercus velutina	Black Oak	X	X	X				
	Rhus copallinum	Dwarf Sumac			X				X
	Rhus glabra	Smooth Sumac			X	X			X
	Rhus typhina	Staghorn Sumac	X	X	X	X		X	X
	*Robinia pseudoacacia**	Black Locust	X	X	X	X	X		X
	*Rosa multiflora**	Multiflora Rose	X	X	X	X	X	X	X
	*Rosa rugosa**	Rugosa Rose						X	X
	Rubus allegheniensis	Allegheny Blackberry	X	X	X	X			
	Rubus flagellaris	Prickly Dewberry		X	X		X		
	Rubus hispidus	Bristly Dewberry			X				
	Rubus phoenocolasius	Wineberry	X						
	Rubus sp.	Blackberry		X			X		X
	Salix babylonica	Weeping Willow				X	X		
	Salix bebbiana	Beaked Willow				X			X
	Salix discolor	Pussy Willow		X		X			X
	Salix nigra	Black Willow			X	X			

[1] Plants found during the 2005 survey of Naval Station Newport, Rhode Island (RINHS 2006) or a 2013 field survey conducted by Tetra Tech. Species that are considered non-native invasive in Rhode Island are indicated with an asterisk (*).

Flora Species			Site Name						
Growth Form[1]	**Latin Name**	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Woody Plants (Trees, shrubs, partly woody plants) 70 species	*Salix sp.*	Willow				X	X	X	
	Sambucus canadensis	Common Elderberry			X	X	X		X
	Sassafrass albidum	Sassafrass							X
	Spiraea sp.	Steeplebush	X		X				
	Spiraea tomentosa	Steeplebush		X		X			X
	Thuja occidentalis	Northern White Cedar		X				X	
	Ulmus americana	American Elm					X		
	Vaccinium corymbosum	Highbush Blueberry	X	X	X				
	Viburnum dentatum	Northern Arrowwood	X	X	X	X	X		X
	Viburnum plicatum	Japanese Snowball					X		

[1] Plants found during the 2005 survey of Naval Station Newport, Rhode Island (RINHS 2006) or a 2013 field survey conducted by Tetra Tech. Species that are considered non-native invasive in Rhode Island are indicated with an asterisk (*).

Site Totals:	Tank Farm 1	Tank Farm 2	Tank Farm 3	Tank Farm 4	Tank Farm 5	Coastline	Railroad ROW
Grasslike	8	11	17	20	16	6	16
Herbaceous	15	37	62	49	73	46	47
Vines	2	3	4	5	3	5	6
Woody vines	24	33	32	31	24	14	33
Woody plants	24	33	32	31	24	14	33
Site Totals:	**50**	**85**	**116**	**106**	**116**	**72**	**104**
Invasive:	7	7	7	12	10	10	14

Total plants: 282
Total native: 135
Total non-native: 147

Fauna Species			Site Name						
	Latin Name	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Mammals 11 species	*Blarina brevicauda*	Shorttail Shrew					X		
	Canis latrans	Coyote	X	X	X	X	X	X	X
	Didelphis virginiana	Virginia Opossum		X					X
	Felis catus	Feral Cat					X		
	Eptesicus fuscus	Big brown bat[1]				X	X	X	
	Lasiurus borealis	Eastern red bat[1]				X	X	X	X
	Lasiurus cinereus	Hoary bat[1]				X	X	X	
	Lasionycteris noctivagans	Silver-haired bat[1]				X	X	X	
	Mephitis mephitis	Striped Skunk							X
	Myotis lucifugus	Little brown bat[1]				X		X	
	Myotis septentrionalis	Northern long-eared bat[1]				X	X	X	
	Odocoileus virginianaus	White-tailed Deer	X	X	X	X	X		X
	Perimyotis subflavus [formerly *Pipistrellus subflavus*]	Tricolored bat [formerly eastern pipistrelle] [1]				X	X	X	
	Peromyscus leucopus	White-footed Mouse			X		X		
	Procyon lotor	Common Raccoon		X		X	X	X	X
	Sciurus carolinensis	Eastern Gray Squirrel			X		X		

[1] Bat monitoring surveys were conducted separately and did not cover all of these locations, but this species was definitively confirmed to be present at NAVSTA Newport. For more detail on presence of bat species at NAVSTA Newport, please refer to the Final Bat Assessment Report in Appendix L.

Fauna Species			Site Name						
	Latin Name	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
	Sylvilagus floridanus	Eastern Cottontail	X		X	X	X		X
	Vulpes/Urocyon sp.	Fox sp.							X
Herptiles 3 species	*Chelydra s. serpentina*	Common Snapping Turtle						X	
	Rana clamitans melanota	Green Frog			X		X		
	Thamnophis s. sirtalis	Eastern Garter Snake				X			
Lepidoptera 23 species	*Anatrytone logan*	Delaware Skipper		X				X	
	Ancyloxypha numitor	Least Skipper	X	X		X	X	X	
	Cercyonis pegala	Common Wood			X				
	Coenonympha tullia	Common Ringlet	X	X		X	X		
	Colias eurytheme	Orange Sulfur	X	X		X	X	X	
	Colias philodice	Clouded Sulfur	X	X		X	X	X	
	Danaus plexippus	Monarch Butterfly	X	X		X	X	X	
	Eudryas grata	Beautiful wood-nymph		X					
	Limenitis archippus	Viceroy						X	
	Lycaena phlaeas	American Copper	X	X		X	X	X	
	Papilio glaucus	Eastern Tiger Swallowtail	X	X	X	X	X	X	
	Papilio polyxenes	Black Swallowtail	X	X		X	X	X	
	Phyciodes tharos	Pearl Crescent	X	X		X	X	X	
	Pieris rapae	Cabbage White	X	X		X	X	X	

Fauna Species			Site Name						
	Latin Name	**Common Name**	**Tank Farm 1**	**Tank Farm 2**	**Tank Farm 3**	**Tank Farm 4**	**Tank Farm 5**	**Coastline**	**Railroad ROW**
Lepidoptera 23 species	*Poanes viator*	Broad-winged Skipper						X	
	Polites peckius	Pecks Skipper	X	X		X	X	X	
	Polites themistocles	Tawny-edged Skipper	X	X		X	X	X	
	Vanessa atalanta	Red Admiral						X	
	Vanessa cordui	Painted Lady	X	X		X	X	X	
Diptera	*Asilidae sp.*	Robberfly species	X						
Coleoptera	*Cicindella punctulata punctulata*	Punctured Tiger Beetle		X		X	X		
Arthropoda	*Hemigrapsus sanguineus*	Japanese shore crab (Asian shore crab)						X	
Gastropoda	*Succinia sp.*	Snail sp.					X		

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APPENDIX E

THREATENED AND ENDANGERED SPECIES AND SPECIES OF SPECIAL CONCERN

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Table E-1: Threatened and Endangered Species and Species of Special Concern Documented at NAVSTA Newport, Newport County, Rhode Island

Scientific Name	Common Name	Federal Status[1]	State Status[2]	Global Rank[3]	Habitat
Birds					
Accipiter cooperii	Cooper's hawk	-	C	G5	Mature woods with large canopy trees, mature understory, and dense ground layer; scattered openings and edges for feeding
Accipiter striatus	Sharp-shinned hawk	-	SH	G5	Wide range of woodland and forest types
Ardea herodias	Great blue heron	-	C	G5	Marshes, wetlands, shores, and tidal flats
Circus cyaneus	Northern harrier	-	SE	G5	Open habitats such as fields, savannas, meadows, marshes, upland prairies, and desert steppe, as well as agricultural areas and riparian zones
Falco peregrinus	Peregrine falcon	-	SE	G4	Rocky cliffs and outcrops, rivers, coastlines, mudflats, and lake edges
Haematopus palliatus	American oystercatcher	-	C	G5	Rocky, sandy or shell beaches, salt marshes and mudflats
Plegadis falcinellus	Glossy ibis	-	C	G5	Wetlands including marshes, estuaries, coastal bays, flooded fields and swamps
Zonotrichia albicollis	White-throated sparrow	-	C	G5	Woods, forest edges, pond and waterbody edges; in thickets, overgrown fields, parks and backyards during winter
Mammals					
Myotis lucifugus	Little brown bat	UR	-	G3	Caves and mines during winter, man-made structures and woods during the summer
Perimyotis subflavus	Tricolored bat	UR	-	G2	Grasslands, old fields, suburban areas, orchards, urban areas, woodlands
Myotis septentrionalis	Northern long-eared bat	FT	-	G1	Caves and mines during winter, woods during the summer
Invertebrates					
Lestes unguiculatus	Lyre-tipped Spreadwing	-	C	G5	Small temporary freshwater ponds, as well as gravel and sand pit ponds

[1]Federal Status
PE = Proposed Endangered
C = Candidate
- = none
FE = Federally Endangered
FT = Federally Threatened
UR = Under Review

[2]State Status
SE = State Endangered
ST = State Threatened
C = Concern
SH = Native species historically documented but occurrence in RI is currently unknown
* = Considered for state listing

[3]Global Rank
G1 = Critically Imperiled Globally
G2 = Imperiled Globally
G3 = Very Rare
G4 = Apparently Secure Globally
G5 = Demonstrably Secure Globally

Table E-2: Threatened and Endangered Species and Species of Special Concern Documented at Seneca Lake Detachment, Fishers Island Annex, and Dodge Pond Field Station

Scientific Name	Common Name	Federal Status[1]	State Status[2]	Global Rank[3]	Habitat	Parcel
Birds						
Charadrius melodus	Piping plover	FT	ST	G3	Open, sparsely-vegetated beaches and sandflats between the primary dune and high tide line	Fishers Island Annex
Sterna hirundo	Common tern	-	-	G3	Mature woods with large canopy trees, mature understory, and dense ground layer; scattered openings and edges for feeding	Fishers Island

[1]Federal Status
PE = Proposed Endangered
C = Candidate
- = none
FE = Federally Endangered
FT = Federally Threatened
UR = Under Review

[2]State Status
SE = State Endangered
ST = State Threatened
C = Concern
SH = Native species historically documented but occurrence in RI is currently unknown
* = Considered for state listing

[3]Global Rank
G1 = Critically Imperiled Globally
G2 = Imperiled Globally
G3 = Very Rare
G4 = Apparently Secure Globally
G5 = Demonstrably Secure Globally

APPENDIX F

MAPS

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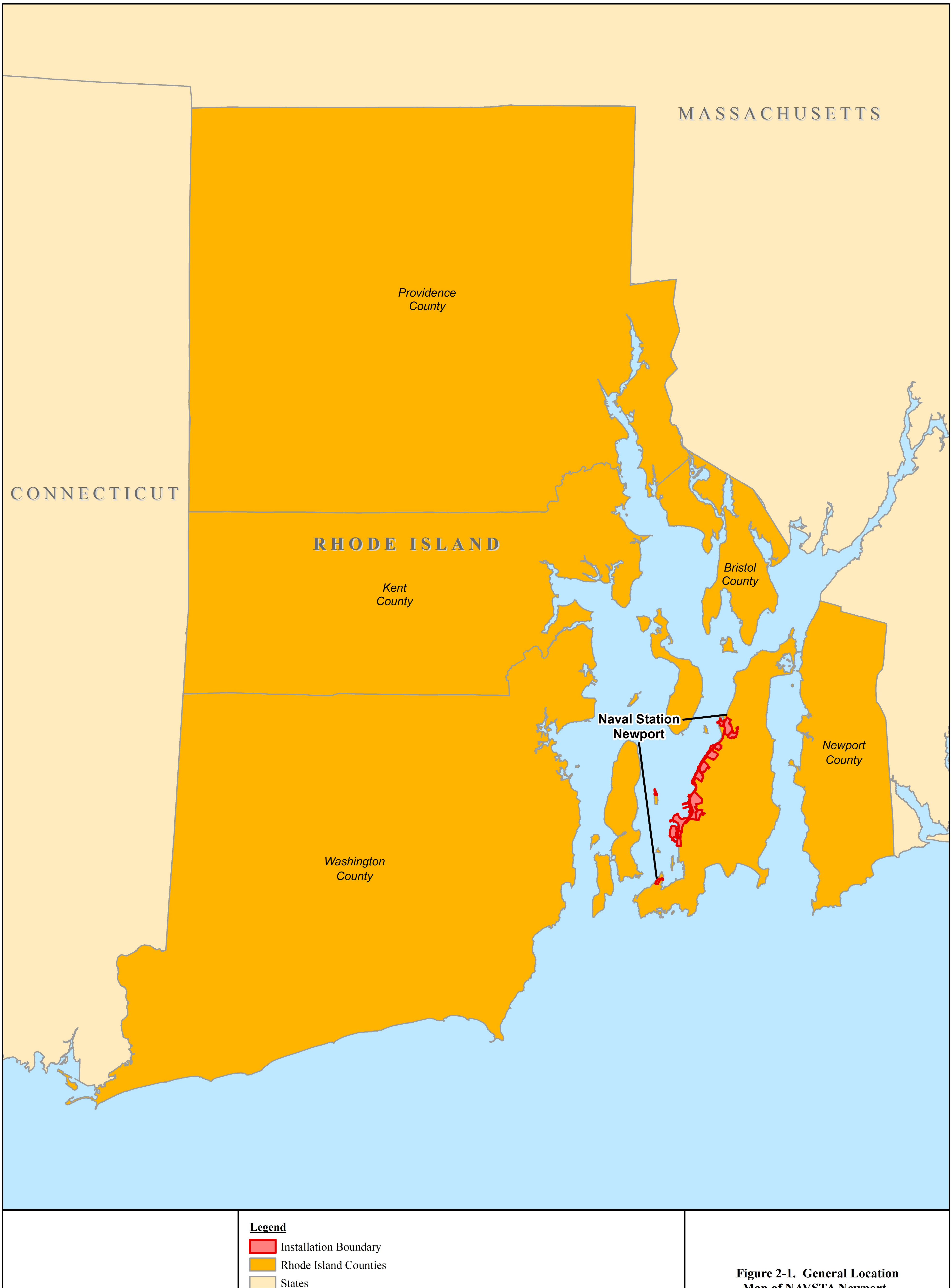


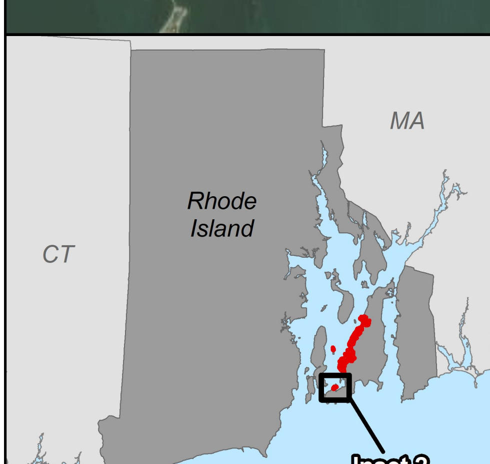
Source:
Navy 2019, RIGIS, NOAA 2016,
ESRI Data and Maps, 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 2-1. General Location Map of NAVSTA Newport, Newport County, Rhode Island.

Prepared For: **Naval Station Newport**

Prepared By: GSRC

Date:
August 2020



Source:
Navy 2019,
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Building
- Road/Paved Area
- Municipal Boundary

0 0.5 1 Miles
Kilometers
0 0.5 1

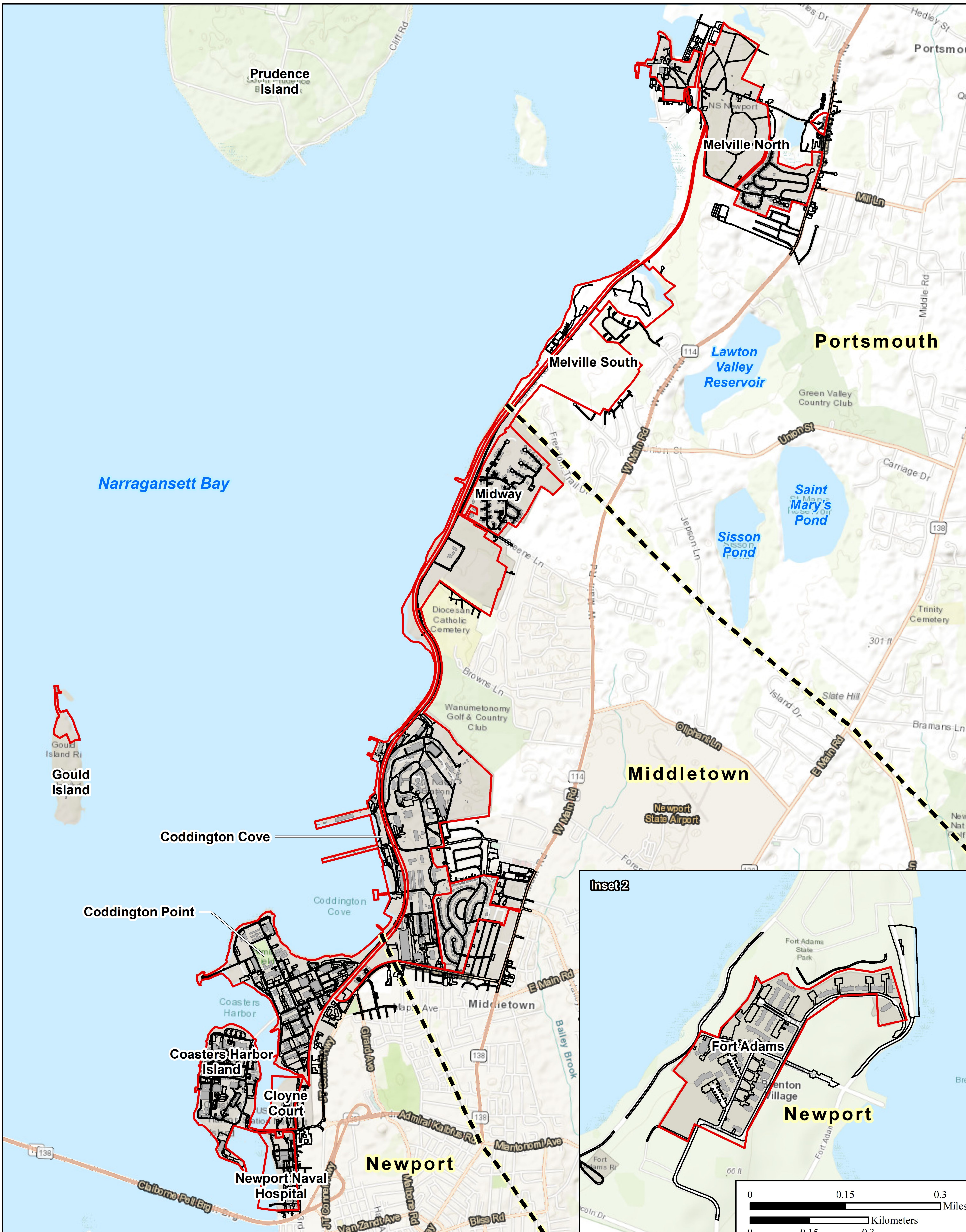
N

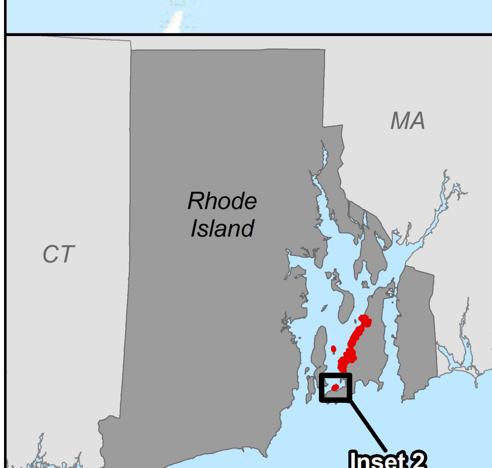
Figure 2-2, Sheet 1. Installation Areas at NAVSTA Newport, Newport County, Rhode Island.

Prepared For: **Naval Station Newport**

Prepared By: GSRC

Date: August 2020





Legend

- Installation Boundary
- Building
- Road/Paved Area
- Municipal Boundary

Source:
Navy 2019,
ESRI World Transportation and Topographic Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

0 0.5 1 Miles
0 0.5 1 Kilometers

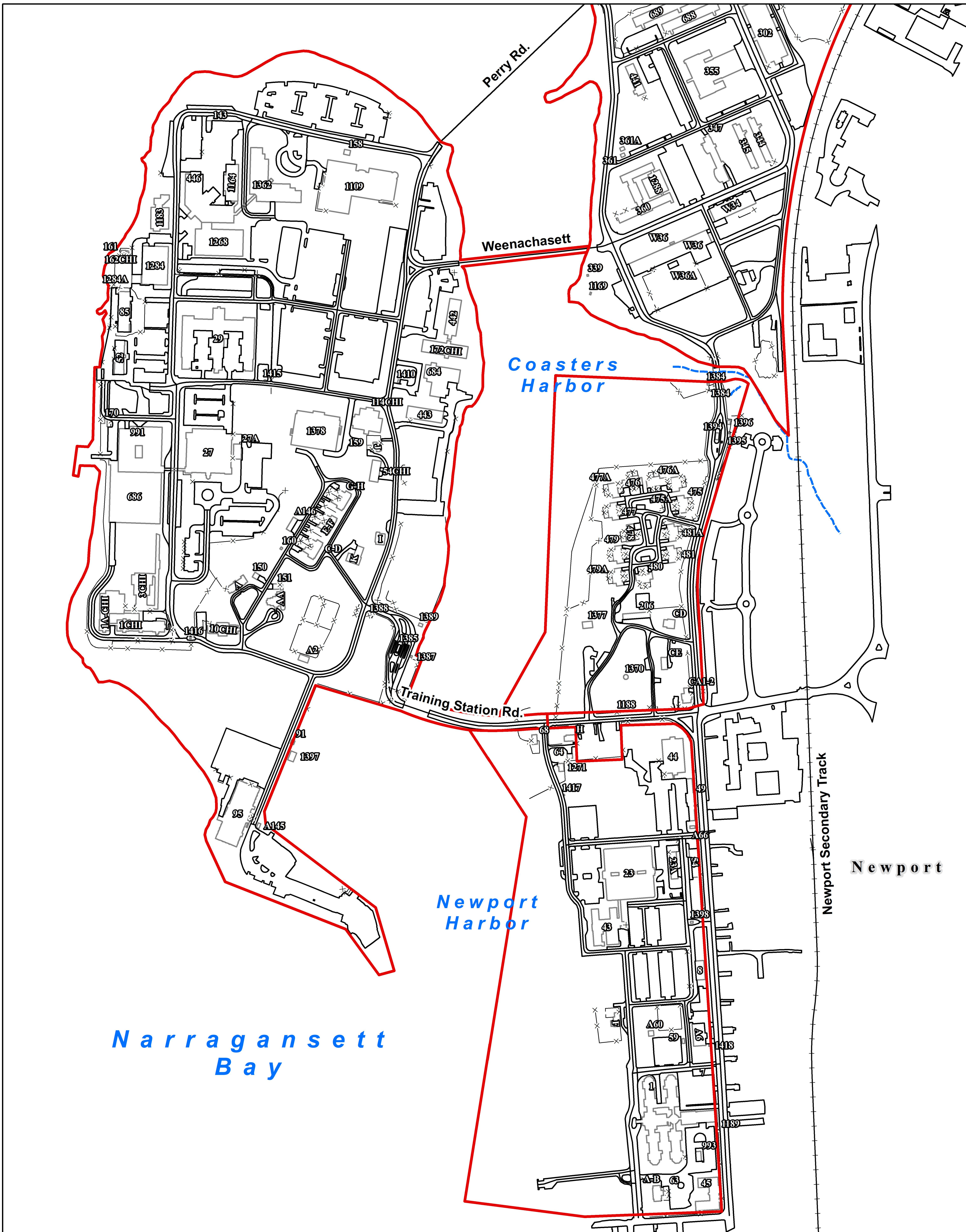
N

Figure 2-2, Sheet 2. Installation Areas at NAVSTA Newport, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: GSRC

Date: August 2020



Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond

0 0.08 0.16 Miles

0 0.08 0.16 Kilometers

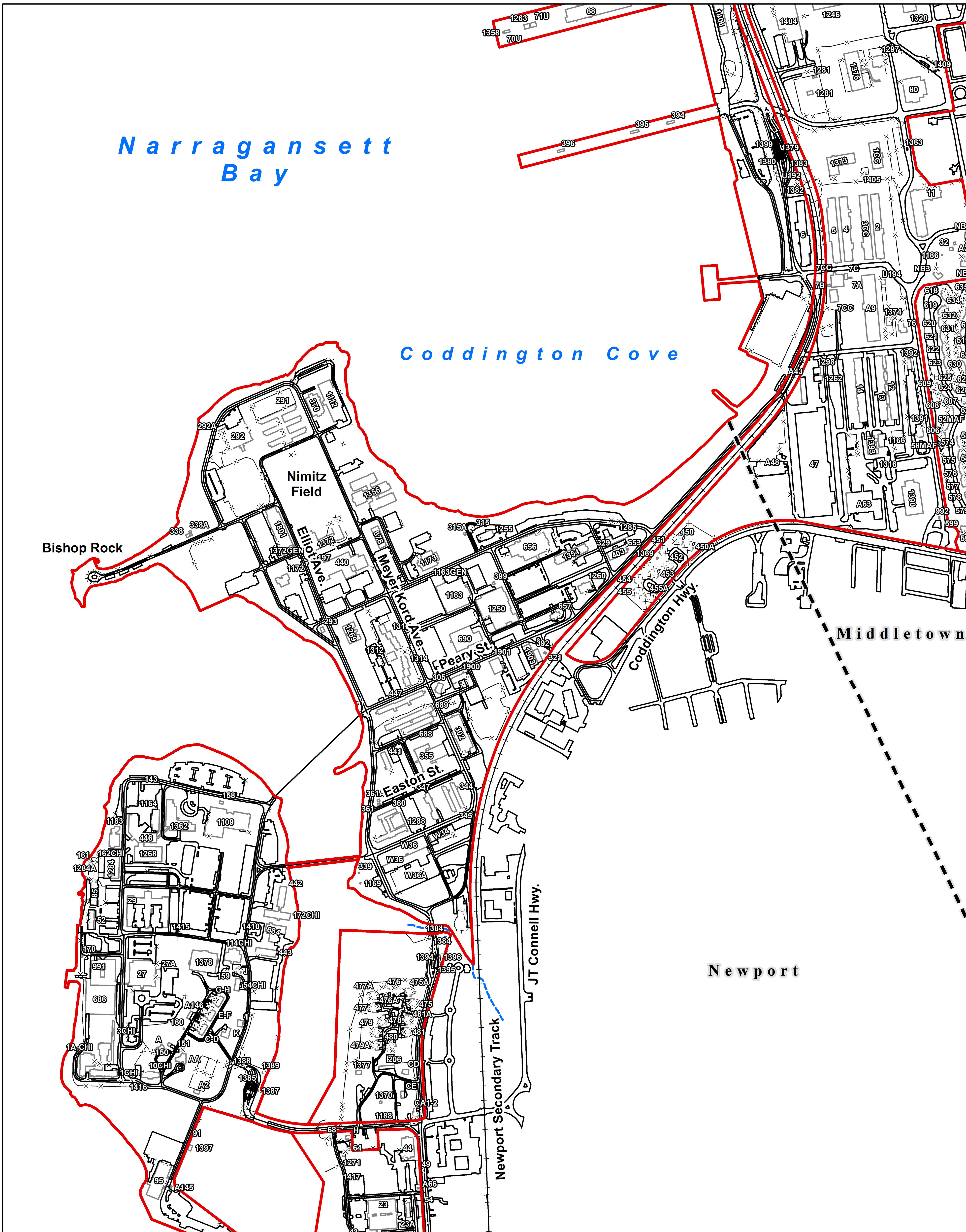
Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 2-2, Sheet 3. Installation Areas at Coasters Harbor Island, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020



Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

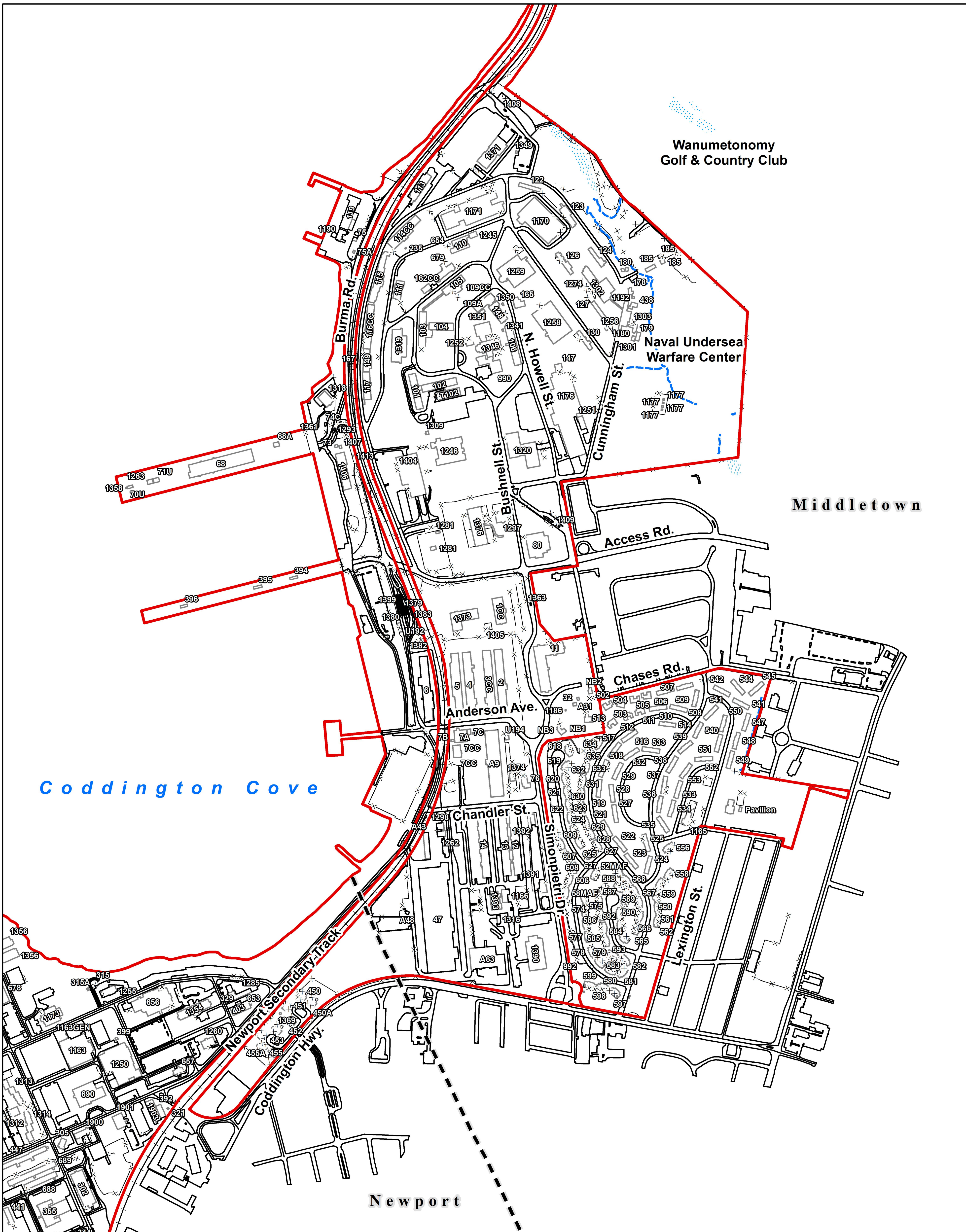
Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters

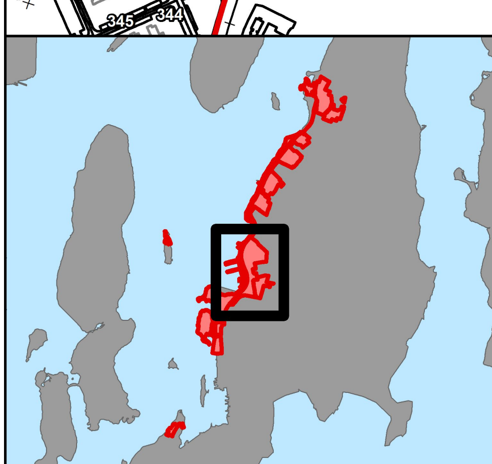
Figure 2-2, Sheet 4. Installation Areas at Coddington Point, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020





Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

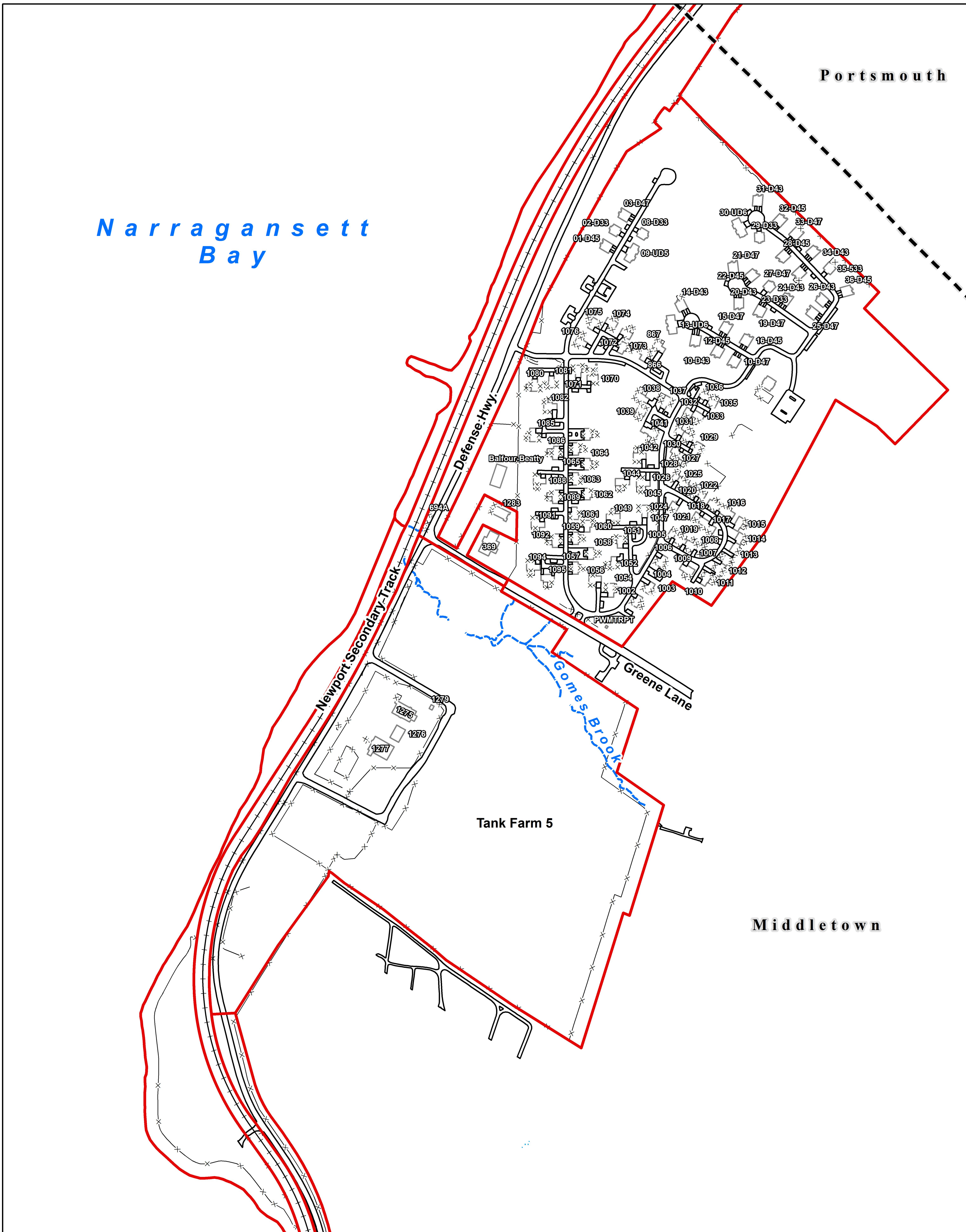
Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters

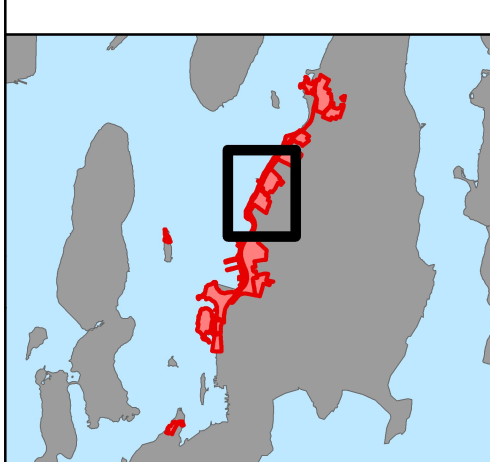
Figure 2-2, Sheet 5. Installation Areas at Coddington Cove, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: GSRC

Date: August 2020





Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond

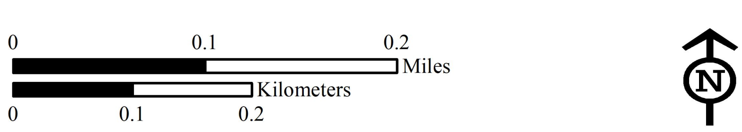


Figure 2-2, Sheet 6. Installation Areas at Midway, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:

Date:
August 2020

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond

0 0.1 0.2 Miles

0 0.1 0.2 Kilometers

N

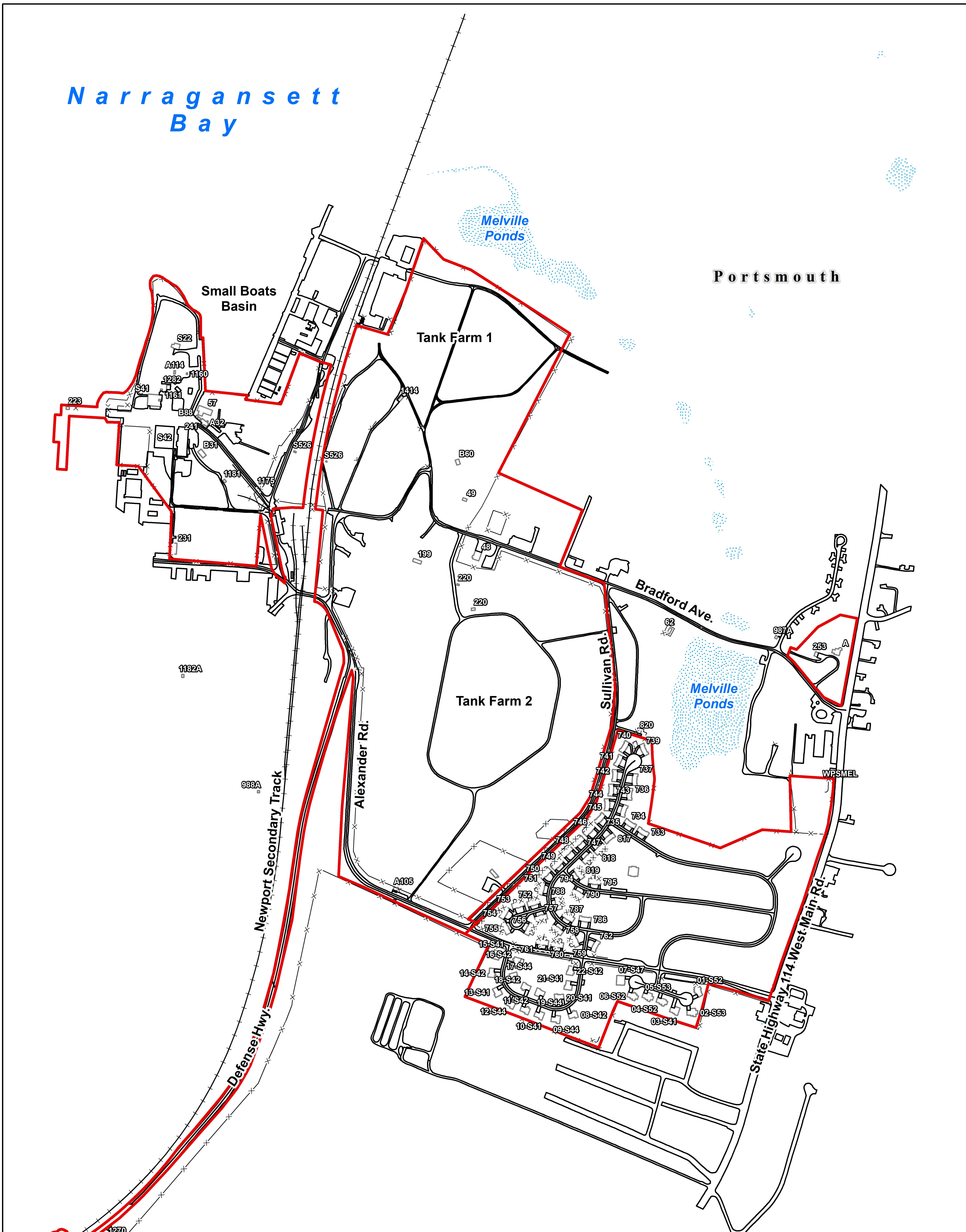
Figure 2-2, Sheet 7. Installation Areas at Melville South, Newport County, Rhode Island.

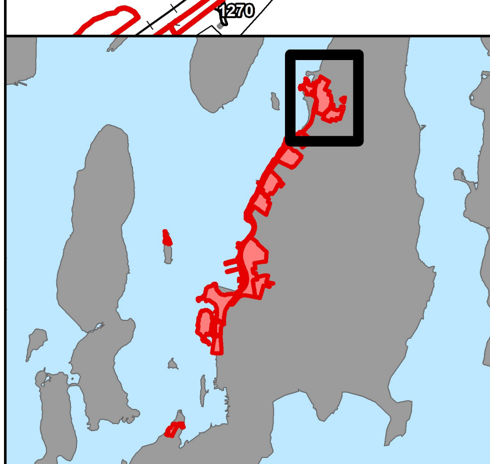
Prepared For: **Naval Station Newport**

Prepared By: GSRC

Date: August 2020

Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters





Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond

0 0.12 0.24 Miles

0 0.12 0.24 Kilometers

N

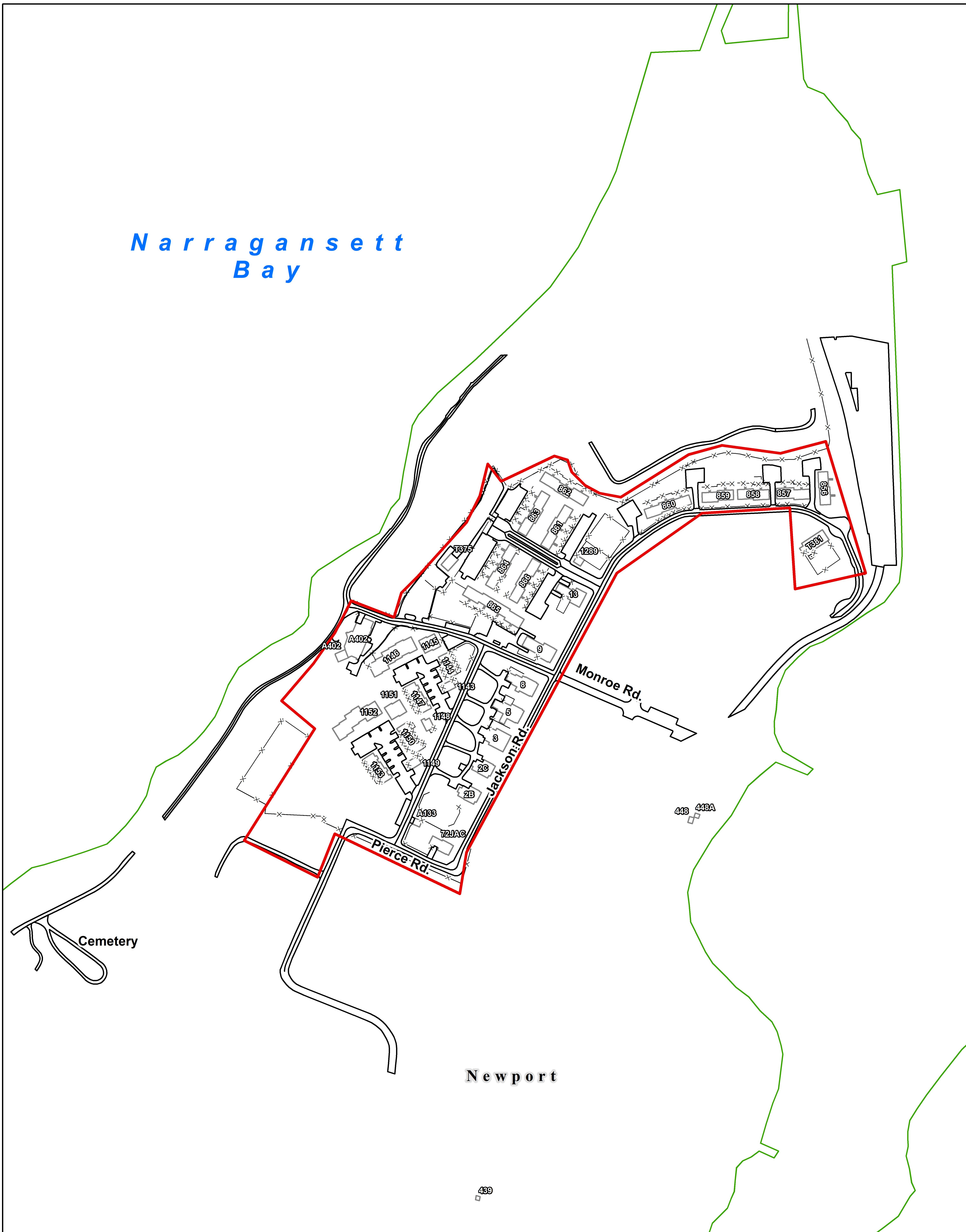
Figure 2-2, Sheet 8. Installation Areas at Melville North, Newport County, Rhode Island.

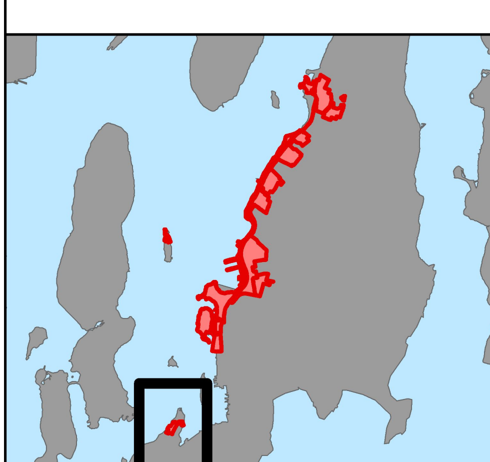
Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters





Source:
Navy 2019, RIGIS
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- Coastline

0 0.06 0.12 Miles

0 0.06 0.12 Kilometers

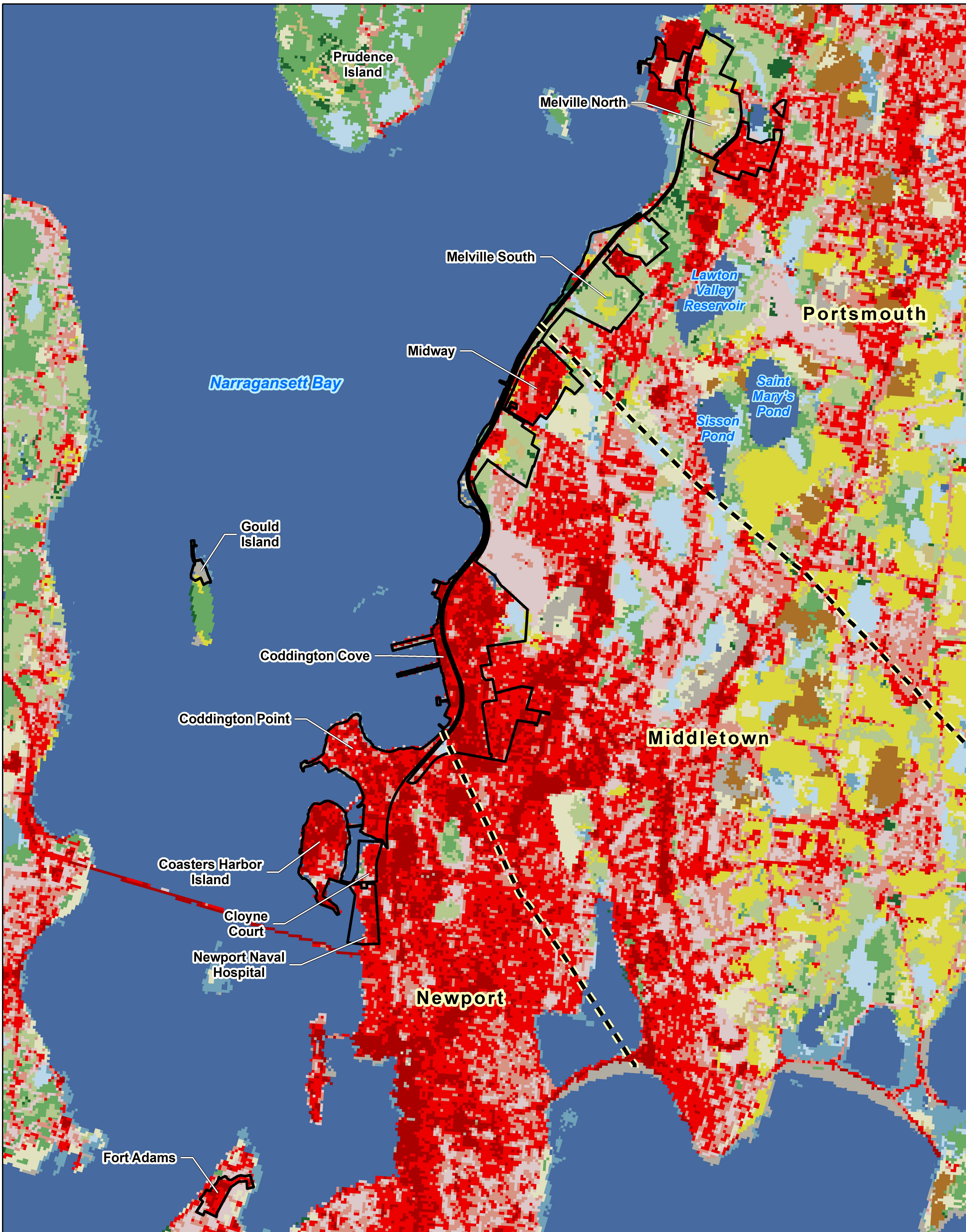
N

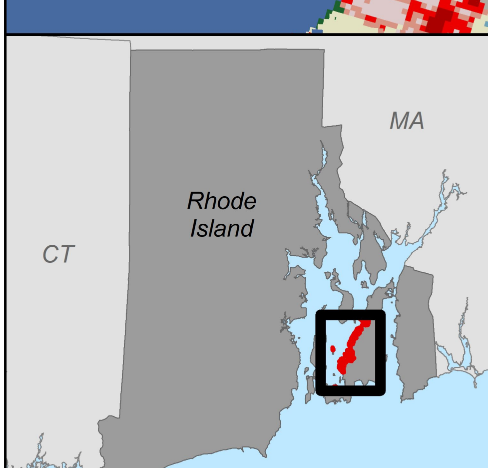
Figure 2-2, Sheet 9. Installation Areas at Fort Adams, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020





Legend

- Installation Boundary
- Municipal Boundary
- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceuous Wetlands
- Evergreen Forest
- Grassland/Herbaceuous
- Mixed Forest
- Open Water
- Pasture/Hay
- Shrub/Scrub
- Woody Wetlands

0 0.75 1.5 Miles

0 0.75 1.5 Kilometers

N

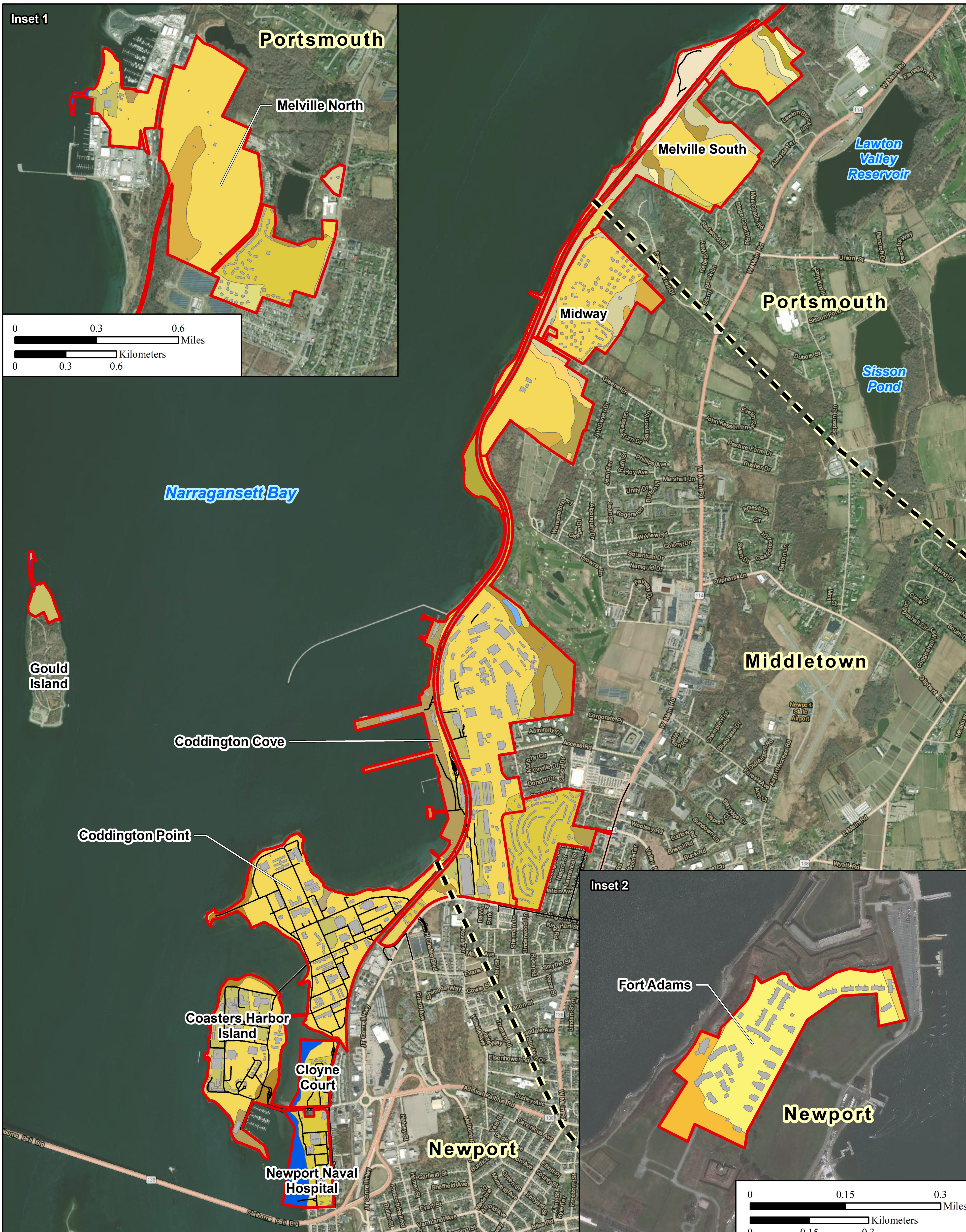
Figure 2-3, Sheet 1. 2016 Land Cover around NAVSTA Newport, Newport County, Rhode Island.

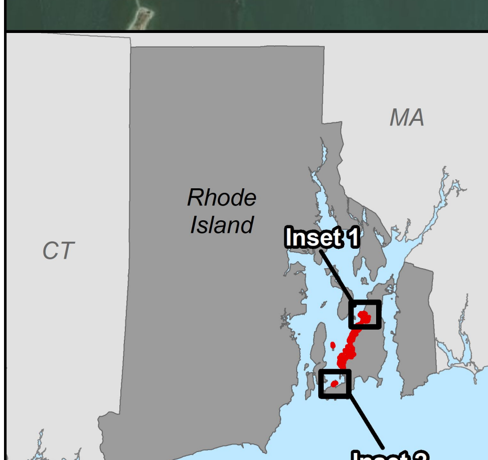
Prepared For: Naval Station Newport

Prepared By: GSRC

Date: August 2020

Source:
Navy 2019, USDA (NLCD 2016)
Coordinate System: WGS 84, UTM, Zone 19N, Meters





Legend

- Installation Boundary
- Road/Paved Area
- Building
- Municipal Boundary
- Bax - Beaches, Boulders
- Baz - Beaches, cobble
- Bc - Birchwood sandy loam
- CC - Canton-Urban land complex, very rocky
- CeC - Canton and Charlton fine sandy loams, 3 to 15 percent slopes, very rocky
- ChD - Canton and Charlton very stony fine sandy loams, 15 to 25 percent slopes
- Du - Dumps
- FtA - Fortress sand, 0 to 3 percent slopes
- Ma - Mansfield mucky silt loam
- MmA - Merrimac fine sandy loam, 0 to 3 percent slopes
- NP - Newport-Urban land complex
- NeA - Newport silt loam, 0 to 3 percent slopes
- NeB - Newport silt loam, 3 to 8 percent slopes
- NeC - Newport silt loam, 8 to 15 percent slopes
- PmA - Pittstown silt loam, 0 to 3 percent slopes
- PmB - Pittstown silt loam, 3 to 8 percent slopes
- PsB - Poquonock loamy fine sand, 3 to 8 percent slopes
- Rk - Rock outcrop
- Rp - Rock outcrop-Canton complex, 0 to 35 percent slopes, very stony
- Sa - Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
- Se - Stissing silt loam
- Sf - Stissing very stony silt loam
- UD - Udorthents-Urban land complex
- Ur - Urban land
- UrS - Urban land, 0 to 3 percent slopes, sandy substratum
- W - Water
- WgB - Windsor loamy sand, 3 to 8 percent slopes
- Ws - Water, saline

0 0.5 1 Miles

0 0.5 1 Kilometers

N

Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 2-4, Sheet 1. Soils at NAVSTA Newport, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: GSRC

Date: August 2020

Legend

Installation Boundary	FtA - Fortress sand, 0 to 3 percent slopes
Fence	NP - Newport-Urban land complex
Railroad	Sa - Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
Stream	UD - Udorthents-Urban land complex
Municipal Boundary	Ur - Urban land
Building	UrS - Urban land, 0 to 3 percent slopes, sandy substratum
Road/Paved Area	Ws - Water, saline
Lake/Pond	

0 0.08 0.16 Miles
0 0.08 0.16 Kilometers

Figure 2-4, Sheet 2. Soils
Coasters Harbor Island,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- Baz - Beaches, cobble
- FtA - Fortress sand, 0 to 3 percent slopes
- NP - Newport-Urban land complex
- PmB - Pittstown silt loam, 3 to 8 percent slopes
- Rk - Rock outcrop
- Rp - Rock outcrop-Canton complex, 0 to 35 percent slopes, very stony
- Sa - Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
- Se - Stissing silt loam
- UD - Udorthents-Urban land complex
- Ur - Urban land
- UrS - Urban land, 0 to 3 percent slopes, sandy substratum
- Ws - Water, saline

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

N

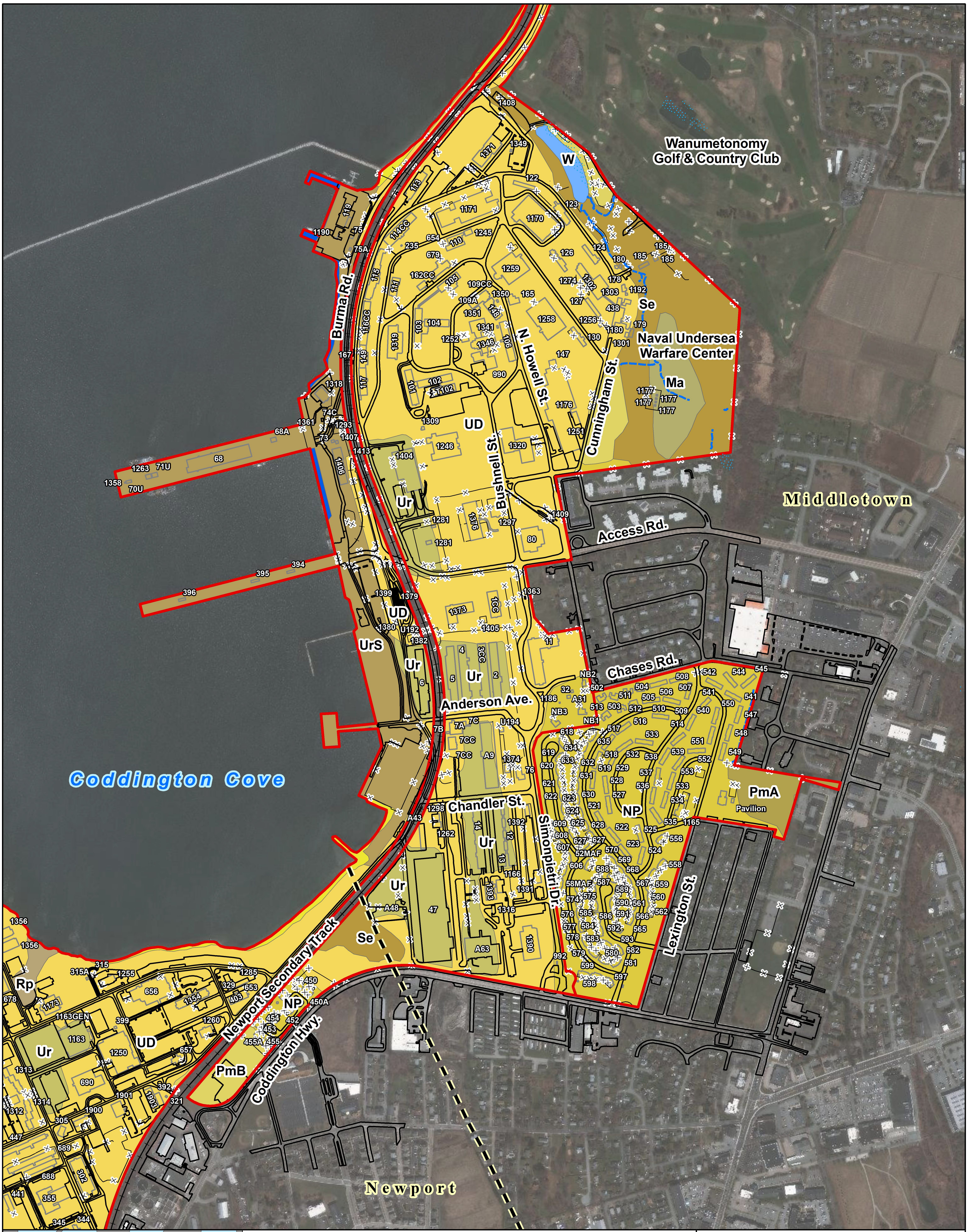
Figure 2-4, Sheet 3. Soils
Coddington Point,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters



Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- Bax - Beaches, Boulders
- Baz - Beaches, cobble
- Bc - Birchwood sandy loam
- CC - Canton-Urban land complex, very rocky
- CeC - Canton and Charlton fine sandy loams, 3 to 15 percent slopes, very rocky
- ChD - Canton and Charlton very stony fine sandy loams, 15 to 25 percent slopes
- Du - Dumps
- FtA - Fortress sand, 0 to 3 percent slopes
- Ma - Mansfield mucky silt loam
- MmA - Merrimac fine sandy loam, 0 to 3 percent slopes
- NP - Newport-Urban land complex
- NeA - Newport silt loam, 0 to 3 percent slopes
- NeB - Newport silt loam, 3 to 8 percent slopes
- NeC - Newport silt loam, 8 to 15 percent slopes
- PmA - Pittstown silt loam, 0 to 3 percent slopes
- PmB - Pittstown silt loam, 3 to 8 percent slopes
- PsB - Poquonock loamy fine sand, 3 to 8 percent slopes
- Rk - Rock outcrop
- Rp - Rock outcrop-Canton complex, 0 to 35 percent slopes, very stony
- Sa - Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
- Se - Stissing silt loam
- Sf - Stissing very stony silt loam
- UD - Udorthents-Urban land complex
- Ur - Urban land
- UrS - Urban land, 0 to 3 percent slopes, sandy substratum
- W - Water
- WgB - Windsor loamy sand, 3 to 8 percent slopes
- Ws - Water, saline

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

N

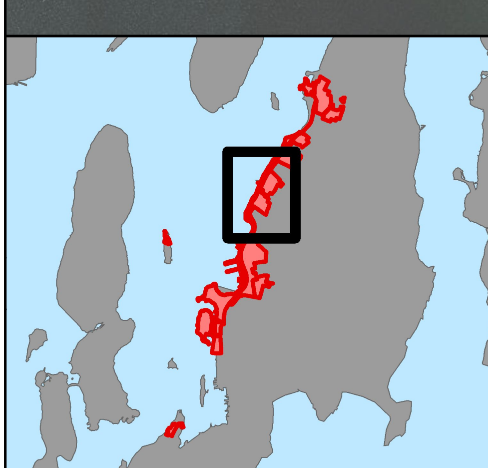
Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 2-4, Sheet 4. Soils Coddington Cove, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020



Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- Bax - Beaches, Boulders
- Baz - Beaches, cobble
- Bc - Birchwood sandy loam
- Du - Dumps
- NeB - Newport silt loam, 3 to 8 percent slopes
- NeC - Newport silt loam, 8 to 15 percent slopes
- PmA - Pittstown silt loam, 0 to 3 percent slopes
- PmB - Pittstown silt loam, 3 to 8 percent slopes
- PsB - Poquonock loamy fine sand, 3 to 8 percent slopes
- Se - Stissing silt loam
- Sf - Stissing very stony silt loam
- UD - Udorthents-Urban land complex
- WgB - Windsor loamy sand, 3 to 8 percent slopes
- Ws - Water, saline

0 0.1 0.2 Miles
0 0.1 0.2 Kilometers

N

Figure 2-4, Sheet 5. Soils
Midway,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

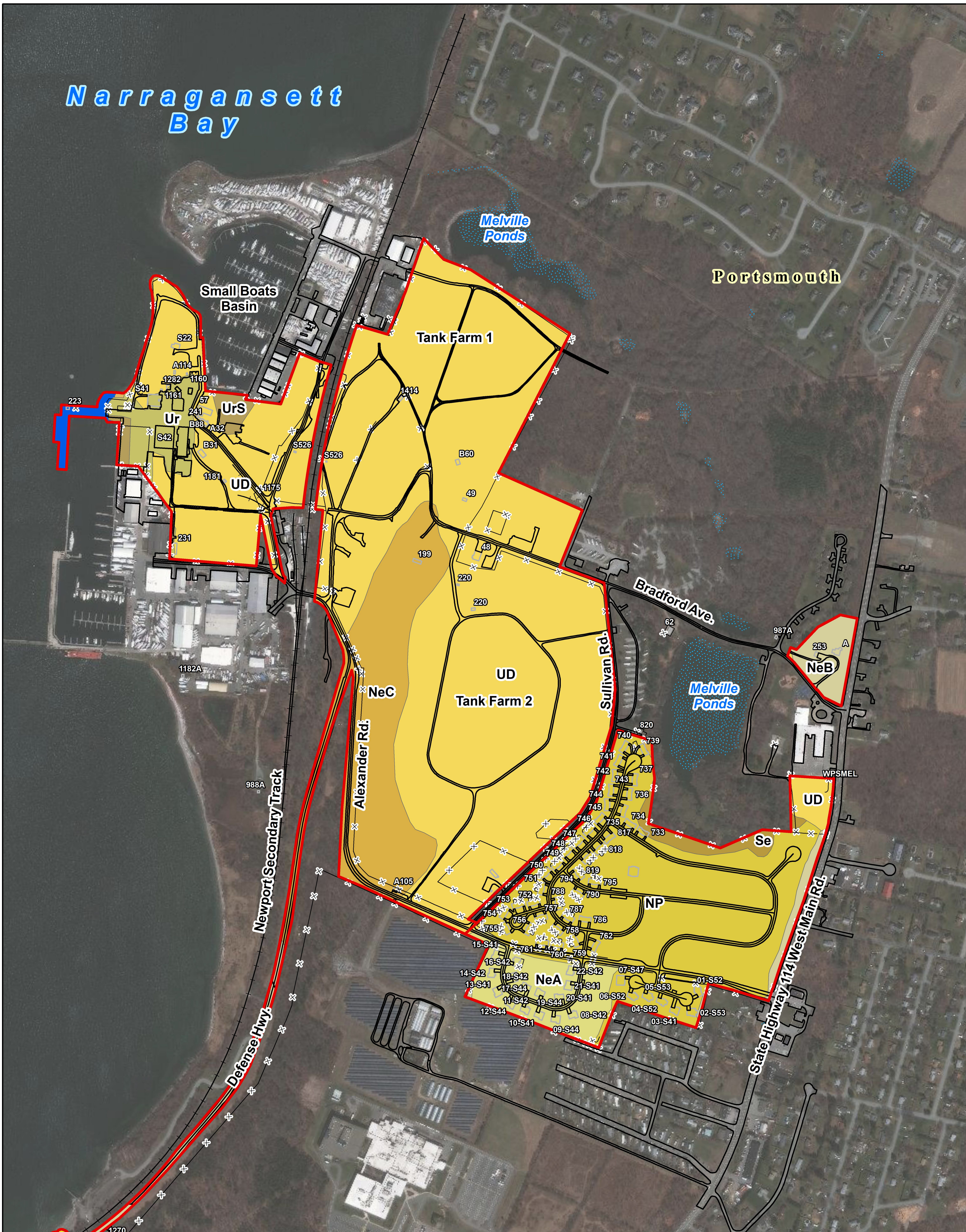
Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

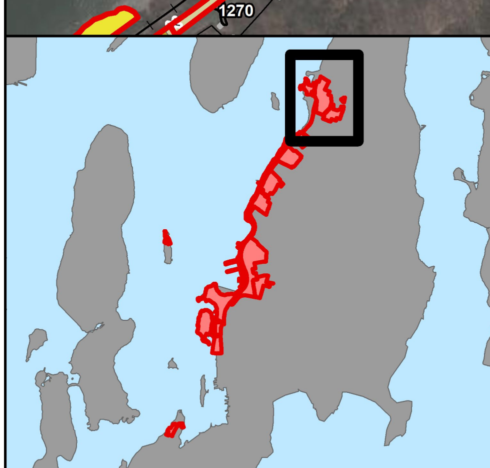
Figure 2-4, Sheet 6. Soils
Melville South,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:

Date:
August 2020





Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- Bax - Beaches, Boulders
- Baz - Beaches, cobble
- Ma - Mansfield mucky silt loam
- NP - Newport-Urban land complex
- NeA - Newport silt loam, 0 to 3 percent slopes
- NeB - Newport silt loam, 3 to 8 percent slopes
- NeC - Newport silt loam, 8 to 15 percent slopes
- Sa - Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
- Se - Stissing silt loam
- UD - Udorthents-Urban land complex
- Ur - Urban land
- UrS - Urban land, 0 to 3 percent slopes, sandy substratum
- W - Water
- Ws - Water, saline

0 0.12 0.24 Miles

0 0.12 0.24 Kilometers

N

Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 2-4, Sheet 7. Installation Areas Melville North, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

NAVAL STATION NEWPORT

Prepared By:

GSRC

Date:
August 2020

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- CC - Canton-Urban land complex, very rocky
- CeC - Canton and Charlton fine sandy loams, 3 to 15 percent slopes, very rocky
- Rk - Rock outcrop
- UD - Udorthents-Urban land complex

Source:
Navy 2019, USDA NRCS 2020, RIGIS
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

0 0.06 0.12 Miles
0 0.06 0.12 Kilometers

N

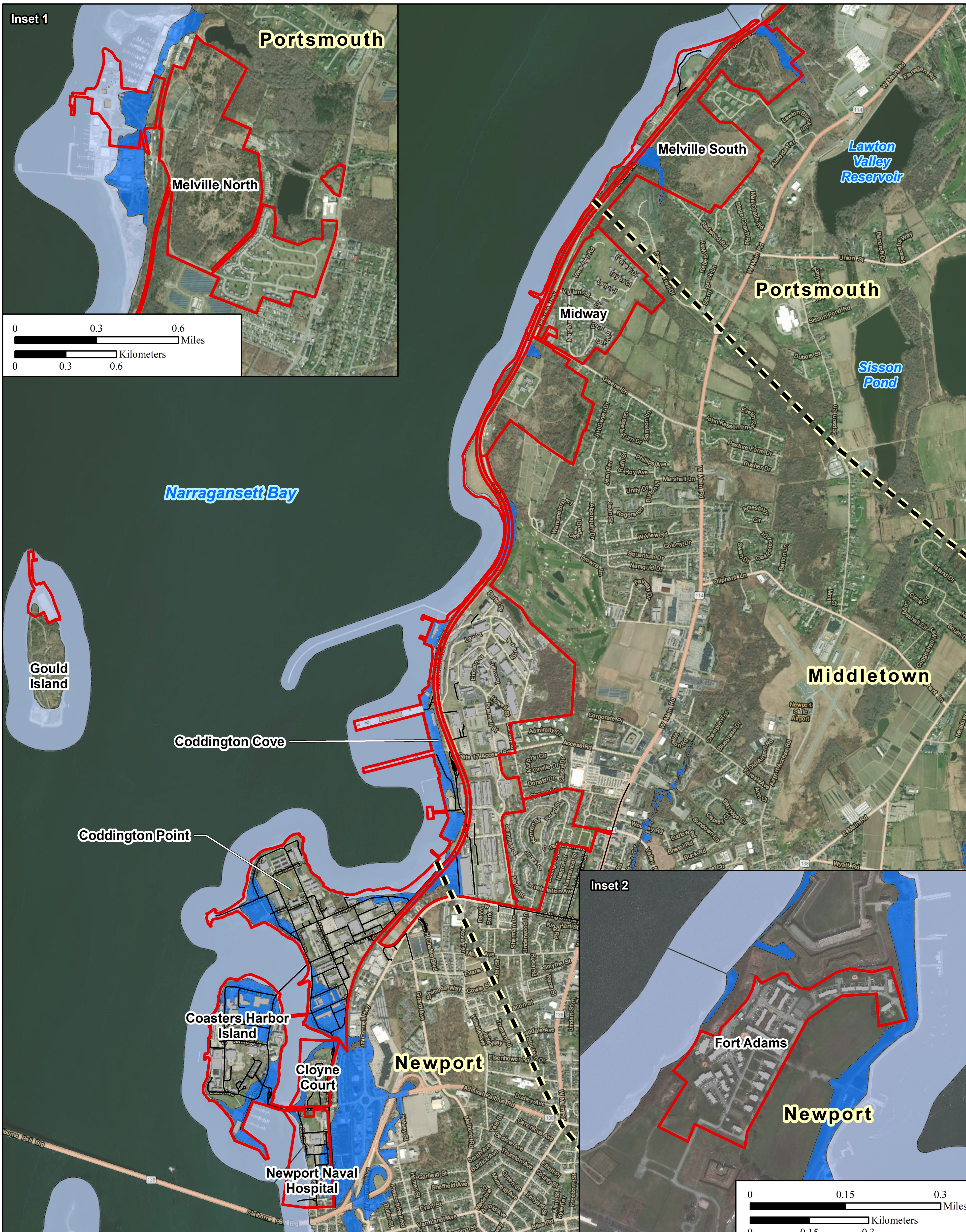
Figure 2-4, Sheet 8. Soils
Fort Adams,
Newport County, Rhode Island.

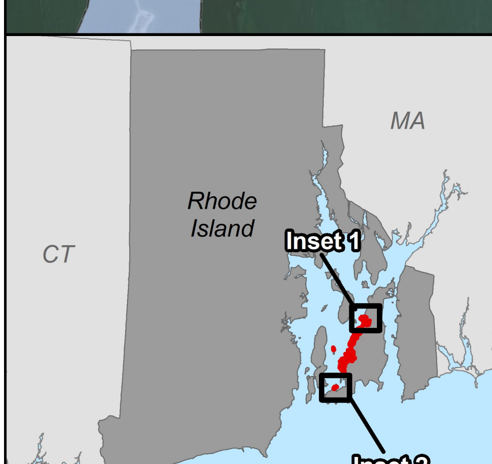
Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Figure 2-5. Surface Waters at NAVSTA Newport, Newport County, Rhode Island.





Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend
- Installation Boundary
- Road/Paved Area
- Building
- Municipal Boundary
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.5 1 Miles
Kilometers
0 0.5 1

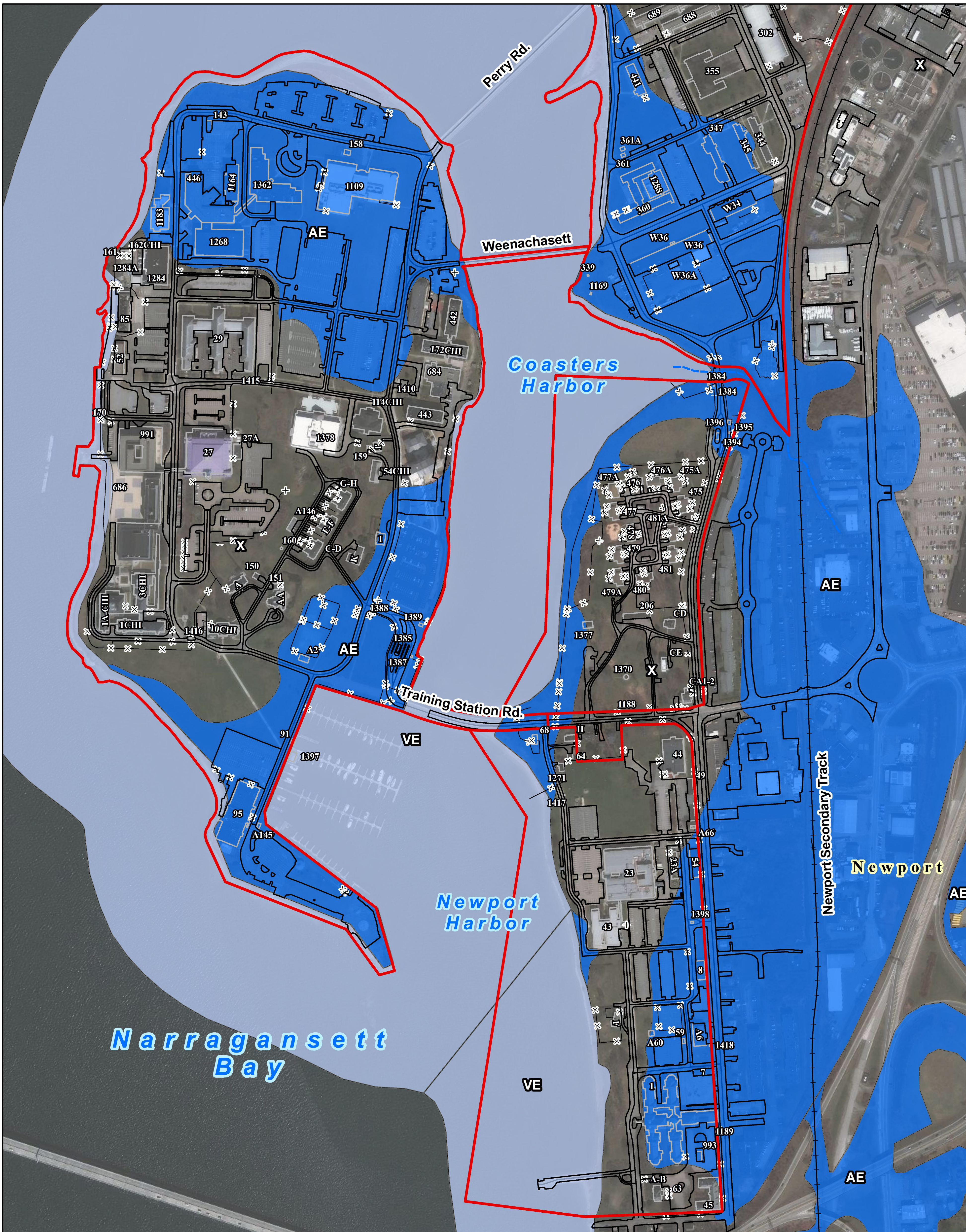
N

Figure 2-6, Sheet 1.
100-Year Flood Zone
NAVSTA Newport,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020



Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

0 0.08 0.16 Miles
0 0.08 0.16 Kilometers

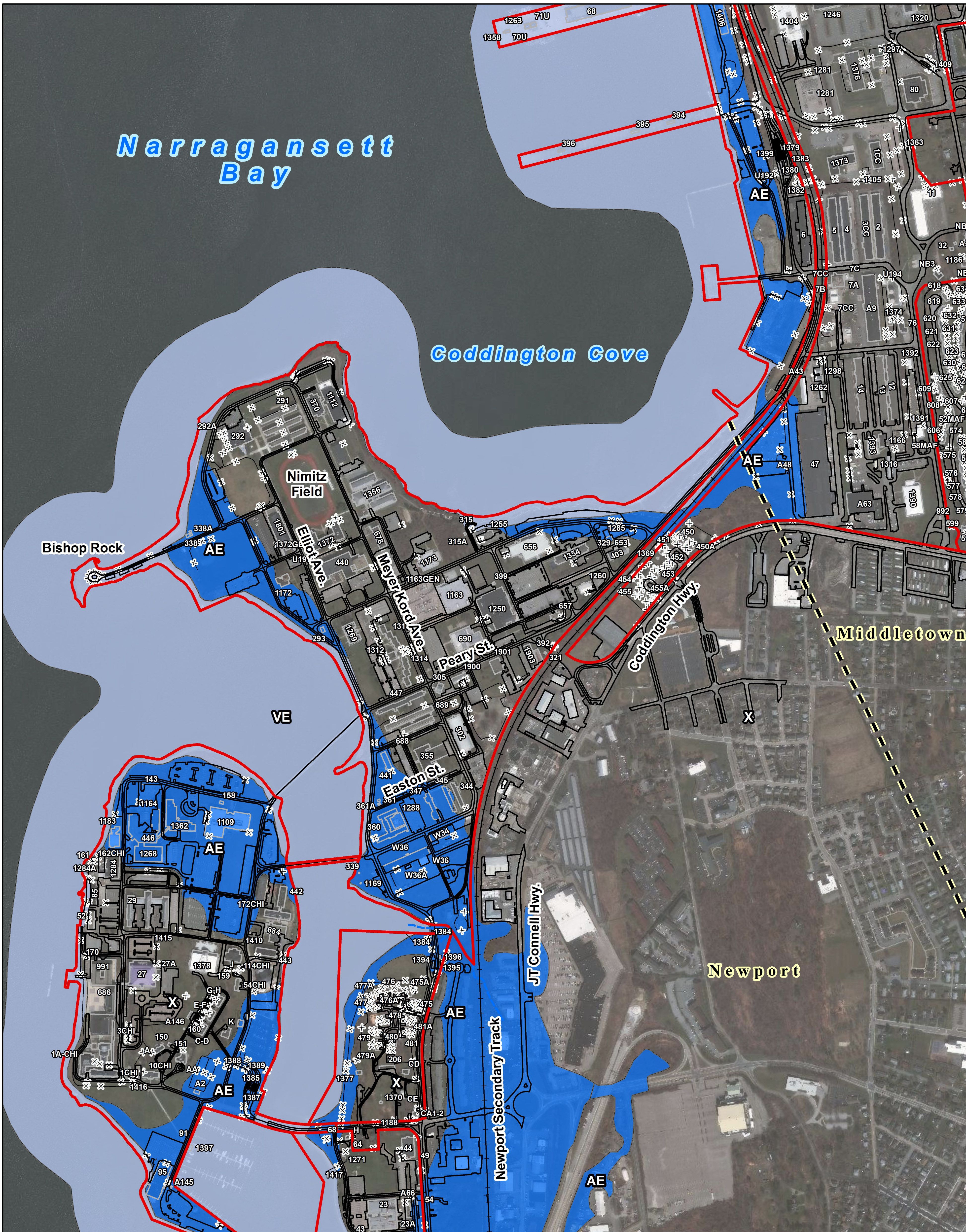
N

Figure 2-6, Sheet 2.
100-Year Flood Zone
Coasters Harbor Island,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020



Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

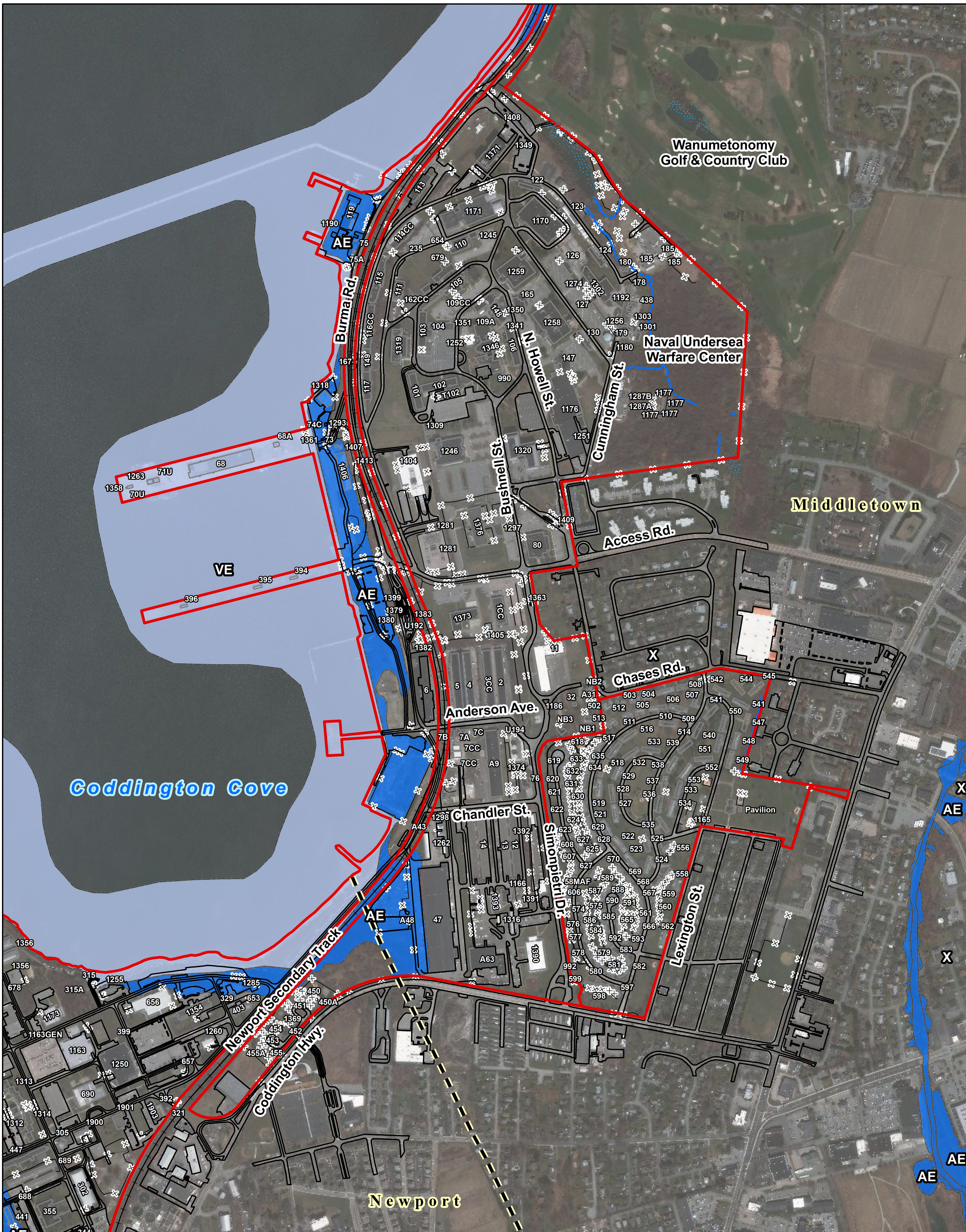
N

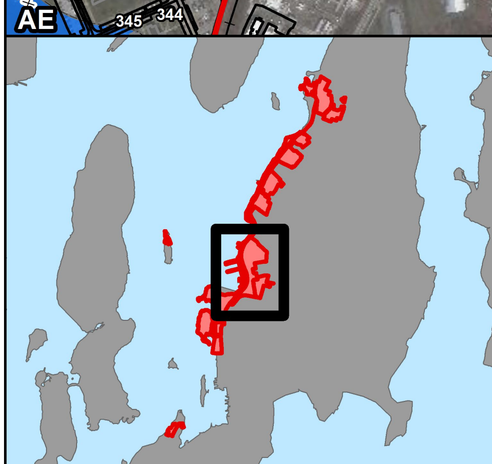
Figure 2-6, Sheet 3.
100-Year Flood Zone
Coddington Point,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020





Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.15 0.3 Miles
0 0.15 0.3 Kilometers

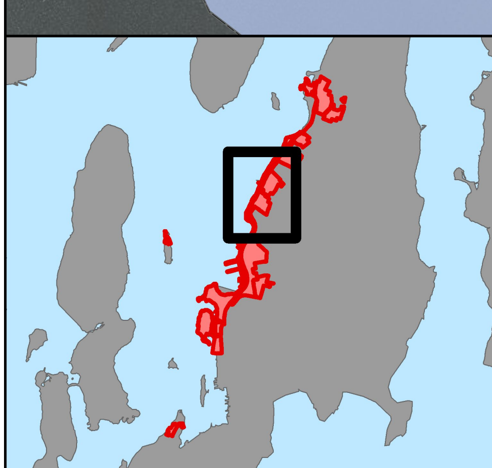
N

Figure 2-6, Sheet 4.
100-Year Flood Zone
Coddington Cove,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020



Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.1 0.2 Miles
0 0.1 0.2 Kilometers

N

Figure 2-6, Sheet 5.
100-Year Flood Zone
Midway,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Legend
- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.1 0.2 Miles
0 0.1 0.2 Kilometers

N

Figure 2-6, Sheet 6.
100-Year Flood Zone
Melville South,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.12 0.24 Miles

0 0.12 0.24 Kilometers

N

Figure 2-6, Sheet 7.
100-Year Flood Zone
Melville North,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Fence
- Railroad
- Stream
- Municipal Boundary
- Building
- Road/Paved Area
- Lake/Pond
- 100-Year Flood Zone - AE Without Velocity
- 100-Year Flood Zone - VE With Velocity

0 0.06 0.12 Miles

0 0.06 0.12 Kilometers

N

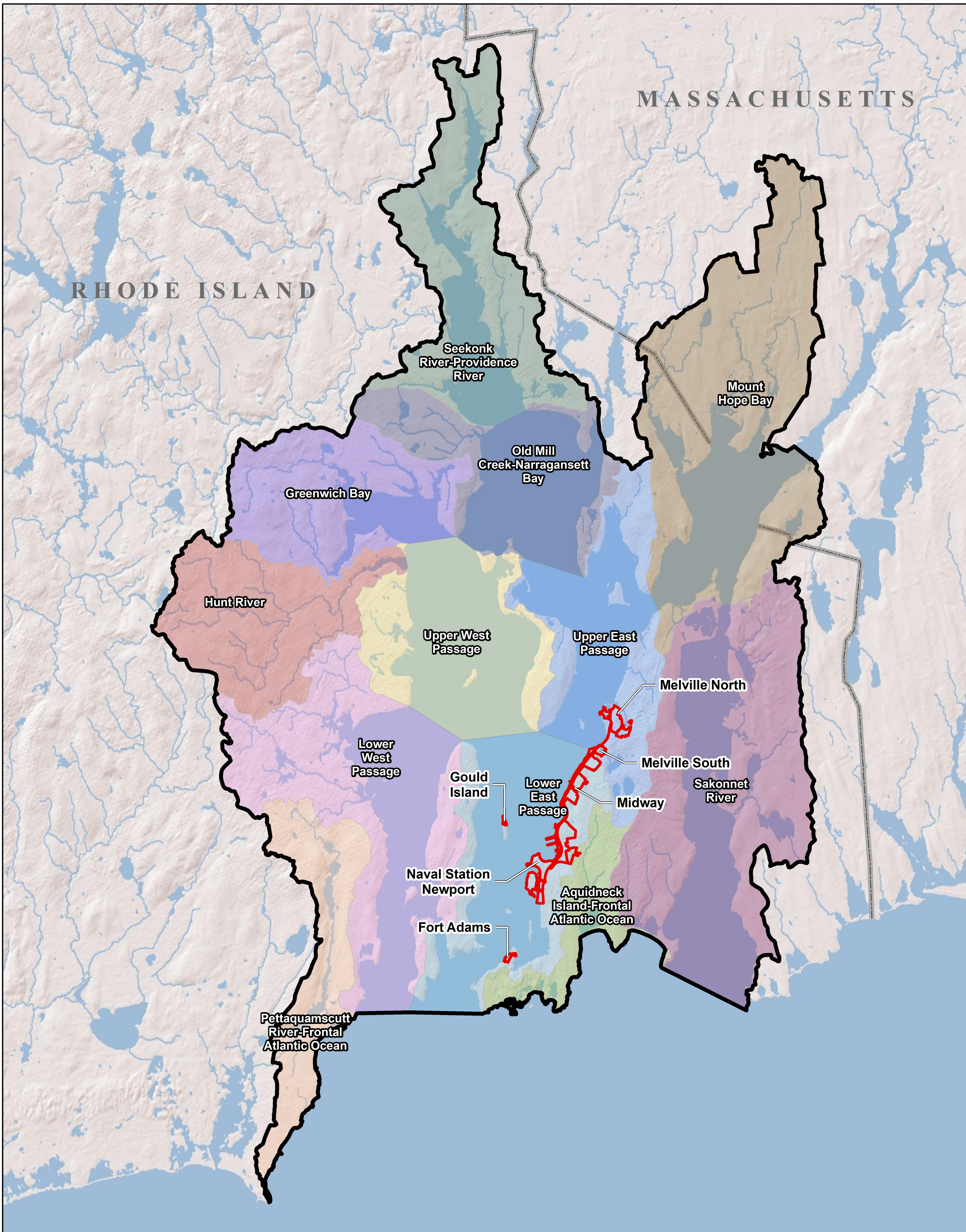
Source:
Navy 2019, RIGIS (DFIRM 2015)
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

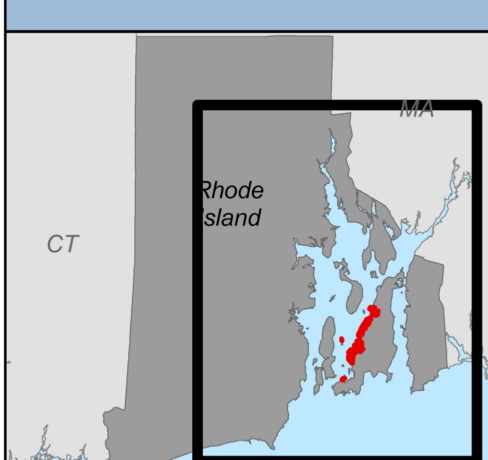
Figure 2-6, Sheet 8.
100-Year Flood Zone
Fort Adams,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020





Source:
Navy 2019, USGS 2020,
World Shaded Relief Basemap
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Narragansett Bay Watershed
- Aquidneck Island-Frontal Atlantic Ocean
- Greenwich Bay
- Hunt River
- Lower East Passage
- Lower West Passage
- Mount Hope Bay
- Old Mill Creek-Narragansett Bay
- Pettaquamscutt River-Frontal Atlantic Ocean
- Sakonnet River
- Seekonk River-Providence River
- Upper East Passage
- Upper West Passage

0 3 6 Miles
0 3 6 Kilometers

N

Figure 2-7. Narragansett Bay Watershed NAVSTA Newport, Newport County, Rhode Island.

Prepared For: **Naval Station Newport**

Prepared By: GSRC

Date: August 2020

Source:
Navy GRC 2011, RIGIS 2010 - 2012,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Major External Road
- Installation Road
- Municipal Boundary
- Special Resource Protection Waters

Water Quality Standard Class

- Class A
- Class AA
- Class B
- Class B1
- N/A

0 0.5 1 Miles

Kilometers 0 0.5 1

N

Figure 2-8. Rhode Island Water Quality Standard Classifications at NAVSTA Newport, Newport County, Rhode Island

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Source: RIGIS, NAVSTA Newport, ESRI 2012, Tetra Tech Inc. 2013, The Environmental Company, Inc. 2003

Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Area
- Previously Delineated Wetland (Digitized Boundary)
- Approximate Stream Location
- Approximate Wetland Boundary
- Road
- Stream
- RIGIS Wetland Area
- Field Observation

0 300 600 Feet

0 50 100 Meters

N

Figure 2-9, Sheet 1. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport, Rhode Island.

Prepared For: **Naval Station Newport**

Prepared By: TETRA TECH

Date: June 2014

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Source: RIGIS, NAVSTA Newport, ESRI 2012, Tetra Tech Inc. 2013, The Environmental Company, Inc. 2003

Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Area
- Previously Delineated Wetland (Digitized Boundary)
- Stream
- Road
- RIGIS Wetland Area

0 300 600 Feet

0 50 100 Meters

N

Figure 2-9, Sheet 2. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: TETRA TECH

Date: June 2014

Source: RIGIS, NAVSTA Newport, ESRI 2012, Tetra Tech Inc. 2013, The Environmental Company, Inc. 2003

Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Area
- Previously Delineated Wetland (Digitized Boundary)
- Approximate Stream Location
- Approximate Wetland Boundary
- Stream
- Road
- RIGIS Wetland Area

0 300 600 Feet

0 50 100 Meters

N

Figure 2-9, Sheet 3. Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: TETRA TECH

Date: June 2014

Source: RIGIS, NAVSTA Newport, ESRI 2012, Tetra Tech Inc. 2013, The Environmental Company, Inc. 2003

Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Area
- Previously Delineated Wetland (Digitized Boundary)
- Approximate Stream Location
- Approximate Wetland Boundary
- Road
- Stream
- RIGIS Wetland Area

0 300 600 Feet

0 50 100 Meters

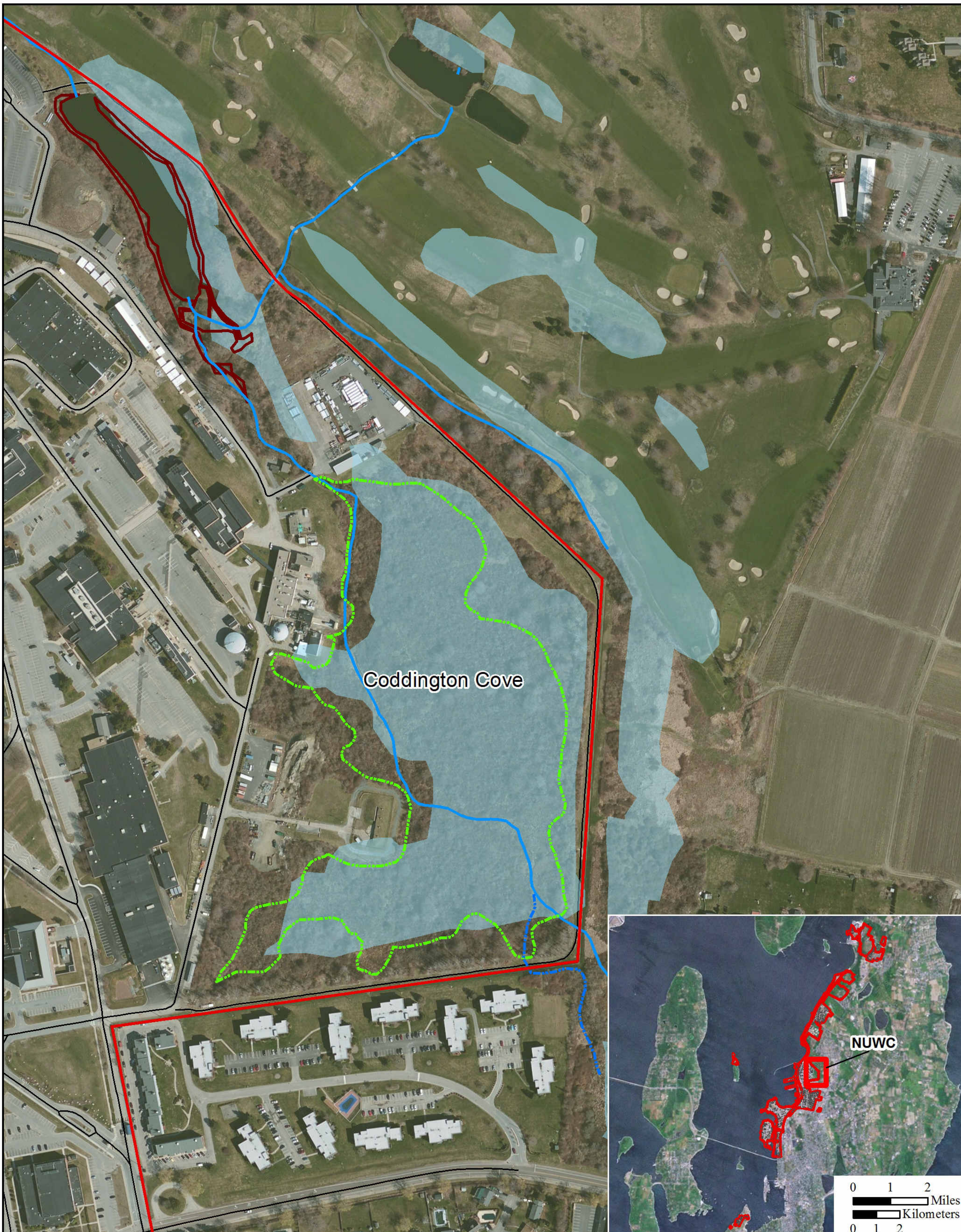
N

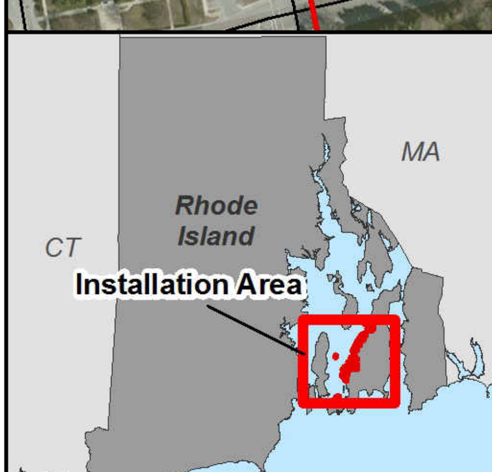
Figure 2-9, Sheet 4.
Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: TETRA TECH

Date: June 2014





Source: RIGIS, NAVSTA Newport, ESRI 2012, Tetra Tech Inc. 2008, Tetra Tech Inc. 2013
The Environmental Company, Inc. 2003
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Area
- Approximate Stream Location
- Approximate Wetland Boundary
- Wetland Area - 2008 Delineation
- Stream
- Road
- RIGIS Wetland Area

0 310 620 Feet
0 50 100 Meters

N

**Figure 2-9, Sheet 5.
Approximate Locations of Wetlands and Waterbodies at NAVSTA Newport, Newport, Rhode Island.**

Prepared For: Naval Station Newport

Prepared By: TETRA TECH

Date: June 2014

Z:\projects\NAVFAC\100_NRS_T23330_WE10_NEWPORT\GIS\MXD\FIGURES\V931\WETLANDS\VERSION01\TTP20140130N3_WL_FIGURE_1.mxd

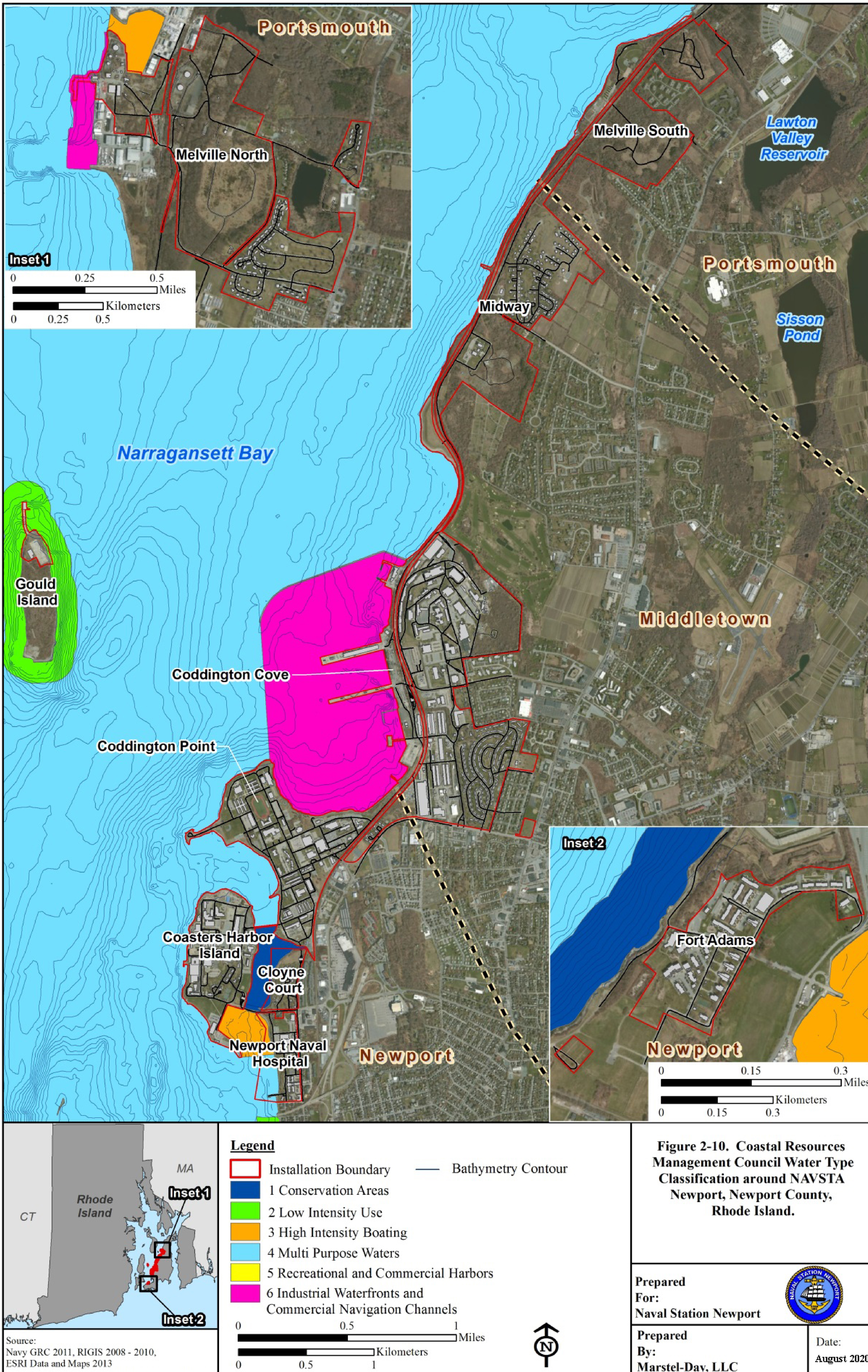


Figure 2-10. Coastal Resources Management Council Water Type Classification around NAVSTA Newport, Newport County, Rhode Island.

Legend

Installation Boundary	Freshwater Lakes/Rivers
Road/Paved Area	Sand
Municipal Boundary	Upland Forest Coniferous
Estuarine and Marine Deepwater	Upland Forest Deciduous
Estuarine and Marine Wetland	Upland Forest Mixed
Freshwater Emergent Wetland	Upland Shrubland
Freshwater Forested/Shrub Wetland	Wetland Freshwater Emergent
Freshwater Pond	Wetland Marine/Esturarine
Developed Land	Wetland Shrubland
Agriculture	

0 0.25 0.5 Miles

0 0.25 0.5 Kilometers

N

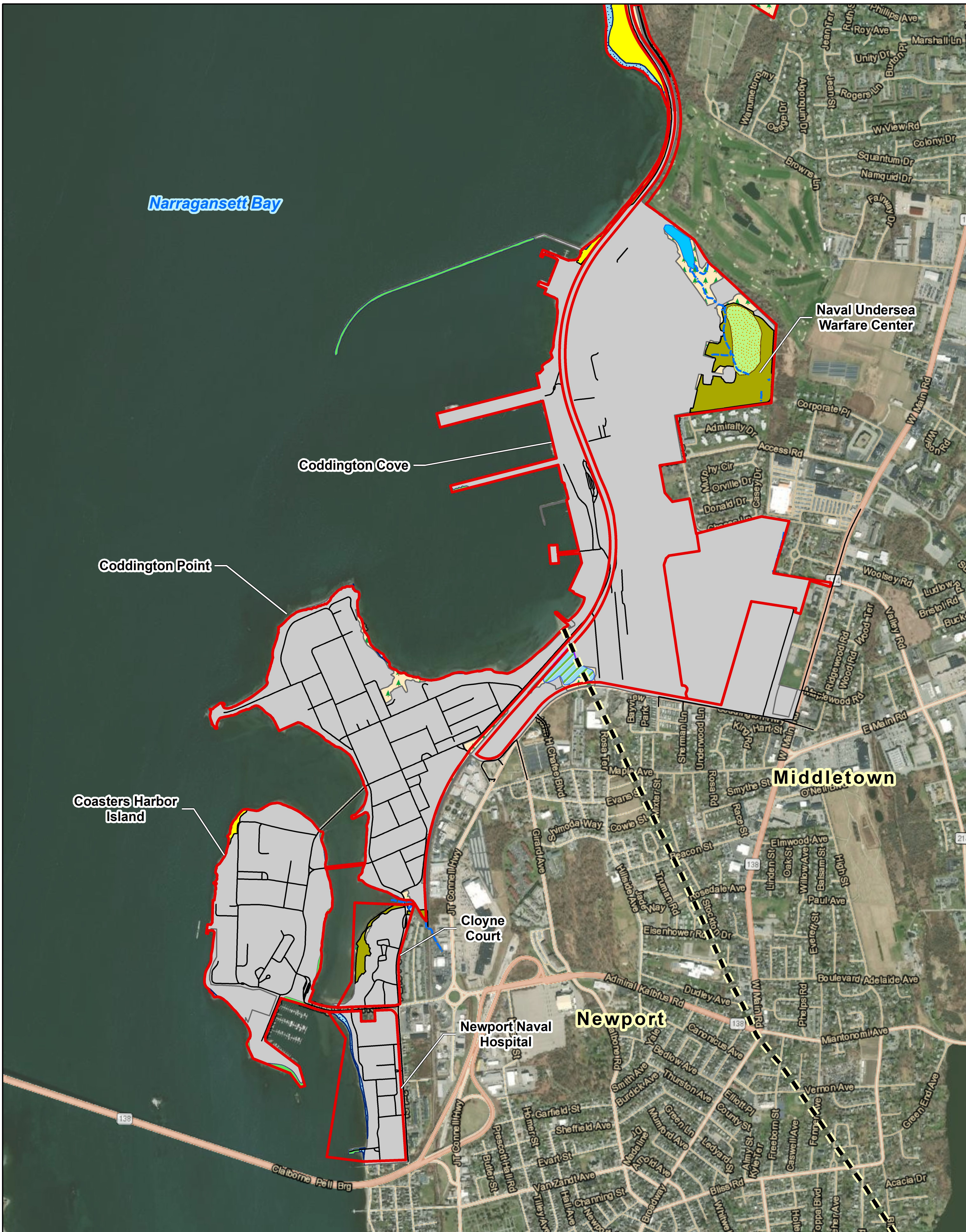
Figure 2-11, Sheet1.
Ecological Communities
Midway, Melville South, Melville North,
Newport County, Rhode Island.

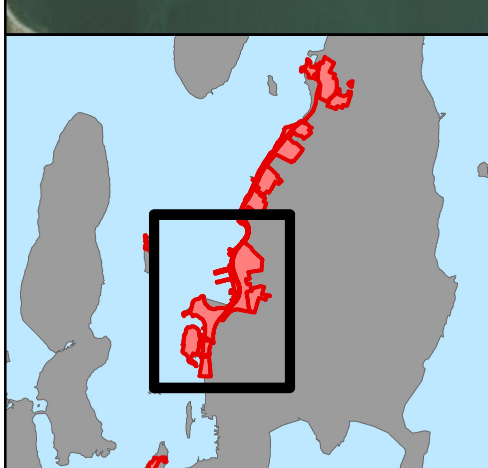
Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

Source:
Navy 2019, USFWS 2010-2019
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters





Legend

Installation Boundary	Freshwater Lakes/Rivers
Road/Paved Area	Sand
Municipal Boundary	Upland Forest Coniferous
Estuarine and Marine Deepwater	Upland Forest Deciduous
Estuarine and Marine Wetland	Upland Forest Mixed
Freshwater Emergent Wetland	Upland Shrubland
Freshwater Forested/Shrub Wetland	Wetland Freshwater Emergent
Freshwater Pond	Wetland Marine/Esturarine
Developed Land	Wetland Shrubland
Agriculture	

0 0.25 0.5 Miles

0 0.25 0.5 Kilometers

N

Source:
Navy 2019, USFWS 2010-2019
ESRI World Transportation and Imagery
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 2-11, Sheet2.
Ecological Communities
Coasters Harbor Island, Coddington Point,
Coddington Cove,
Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
GSRC

Date:
August 2020

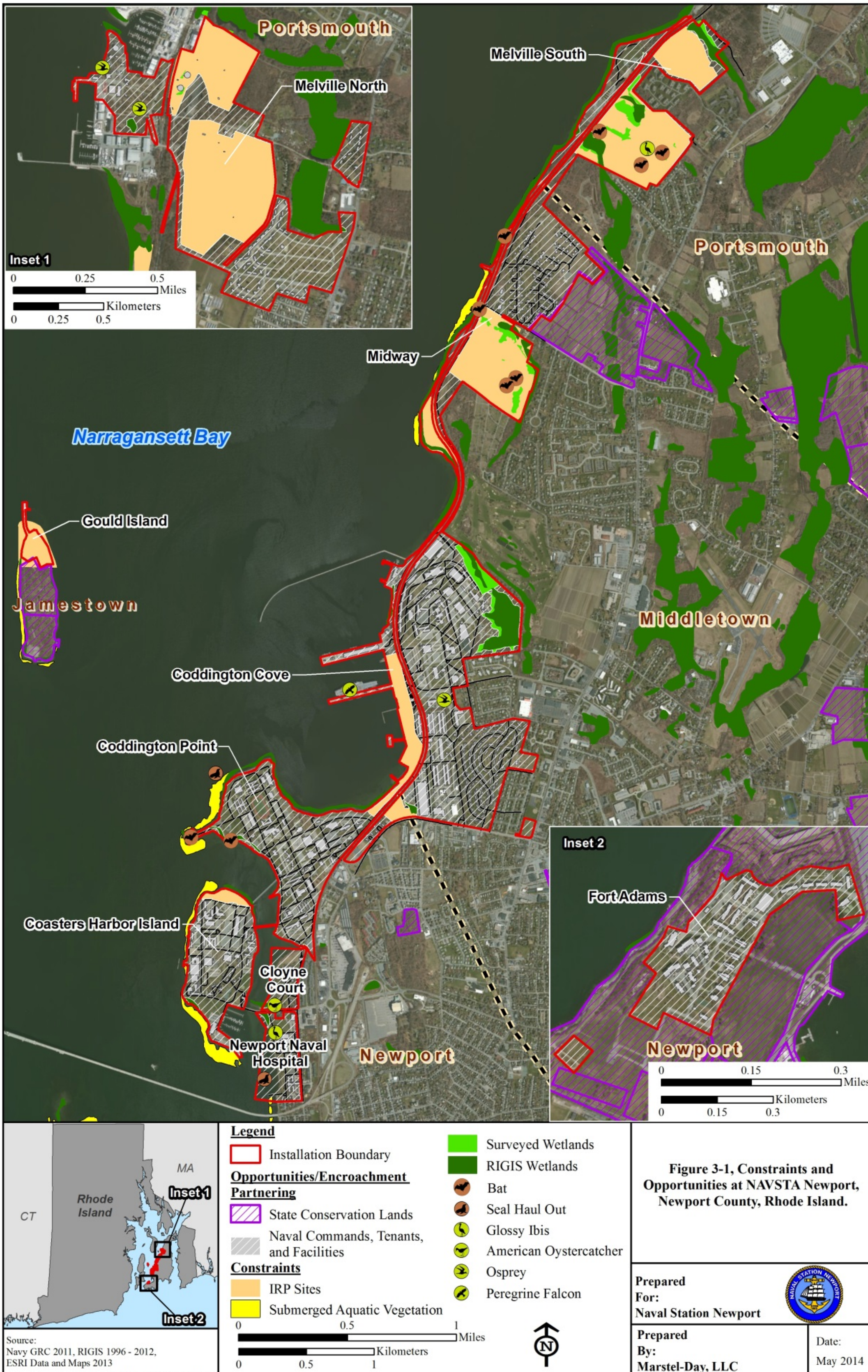


Figure 3-1, Constraints and Opportunities at NAVSTA Newport, Newport County, Rhode Island.

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.5 1 Miles
0 0.5 1 Kilometers

N

Figure 3-2, Sheet 1. Sea Level Rise and Storm Surge Projections at NAVSTA Newport, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: Marstel-Day, LLC

Date: May 2014

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.1 0.2 Miles

0 0.1 0.2 Kilometers

N

Figure 3-2, Sheet 2. Sea Level Rise and Storm Surge Projections around Coasters Harbor Island, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

N

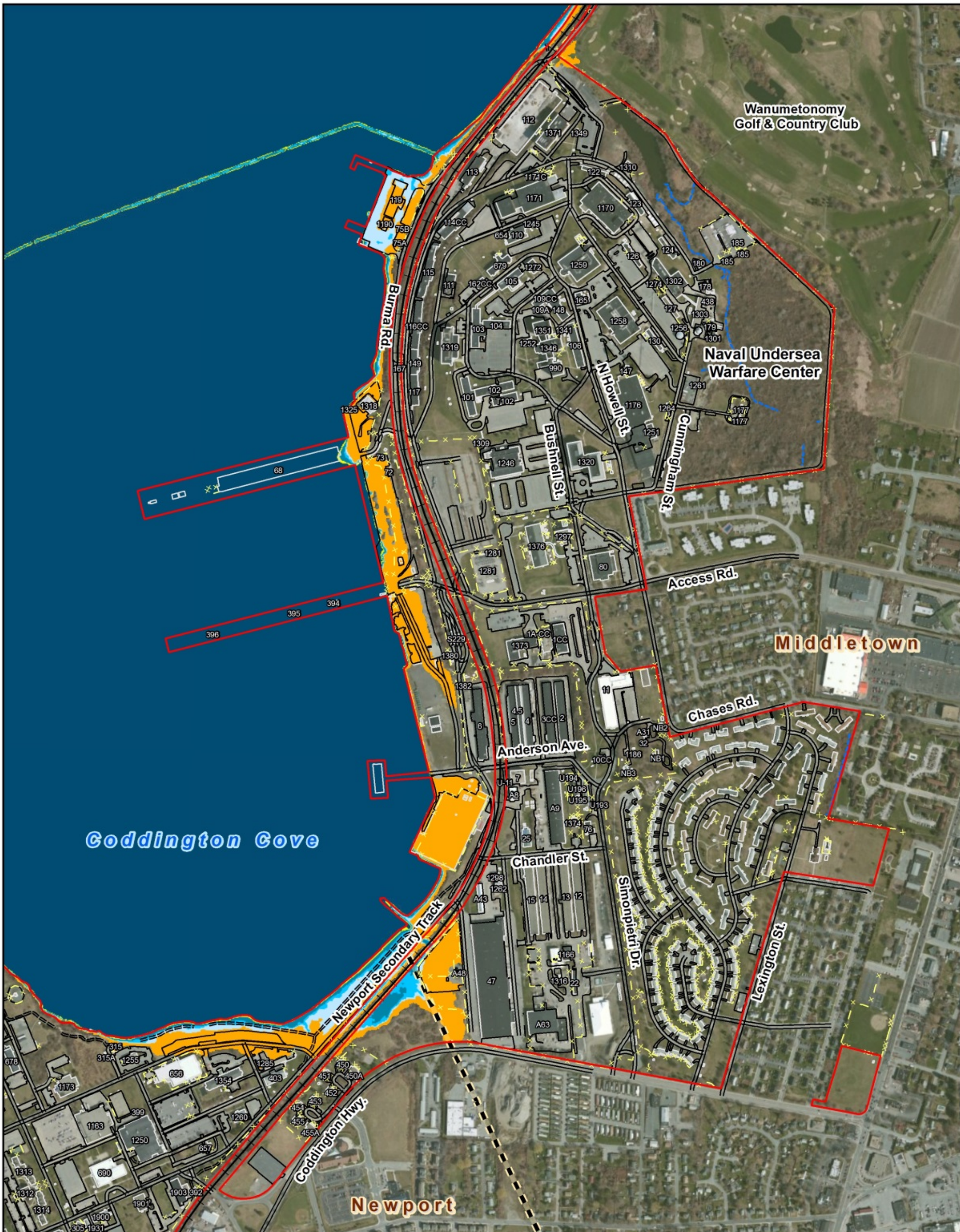
Figure 3-2, Sheet 3. Sea Level Rise and Storm Surge Projections around Coddington Point, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: Marstel-Day, LLC

Date: May 2014

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters



Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.15 0.3 Miles

0 0.15 0.3 Kilometers

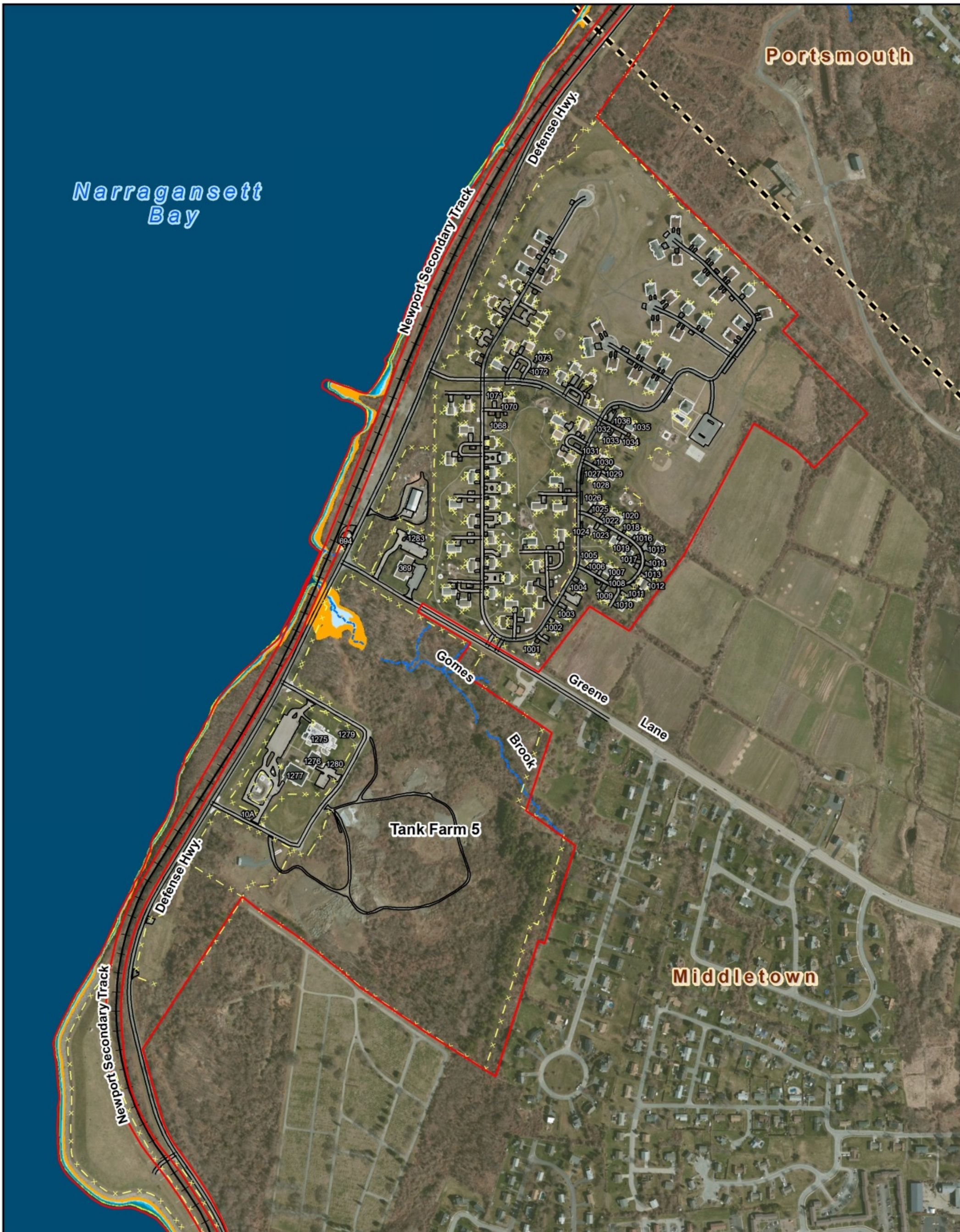
Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 3-2, Sheet 4. Sea Level Rise and Storm Surge Projections around Coddington Cove, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: Marstel-Day, LLC

Date: May 2014



Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.125 0.25 Miles

0 0.125 0.25 Kilometers

N

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 3-2, Sheet 5. Sea Level Rise and Storm Surge Projections around Midway, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.1 0.2 Miles

0 0.1 0.2 Kilometers

N

Figure 3-2, Sheet 6. Sea Level Rise and Storm Surge Projections around Melville South, Newport County, Rhode Island.

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.125 0.25 Miles

0 0.125 0.25 Kilometers

N

Figure 3-2, Sheet 7. Sea Level Rise and Storm Surge Projections around Melville North, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.125 0.25 Miles

0 0.125 0.25 Kilometers

N

Figure 3-2, Sheet 7. Sea Level Rise and Storm Surge Projections around Melville North, Newport County, Rhode Island.

Source:
Navy GRC 2011, RIGIS 2010 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Legend

- Installation Boundary
- Mean Higher High Water (MHHW)
- MHHW plus 1' SLR
- MHHW plus 3' SLR
- MHHW plus 1' SLR and 3' Surge
- MHHW plus 5' SLR
- Hurricane of 1983 Surge Height

0 0.075 0.15 Miles

0 0.075 0.15 Kilometers

N

Figure 3-2, Sheet 8. Sea Level Rise and Storm Surge Projections around Fort Adams, Newport County, Rhode Island.

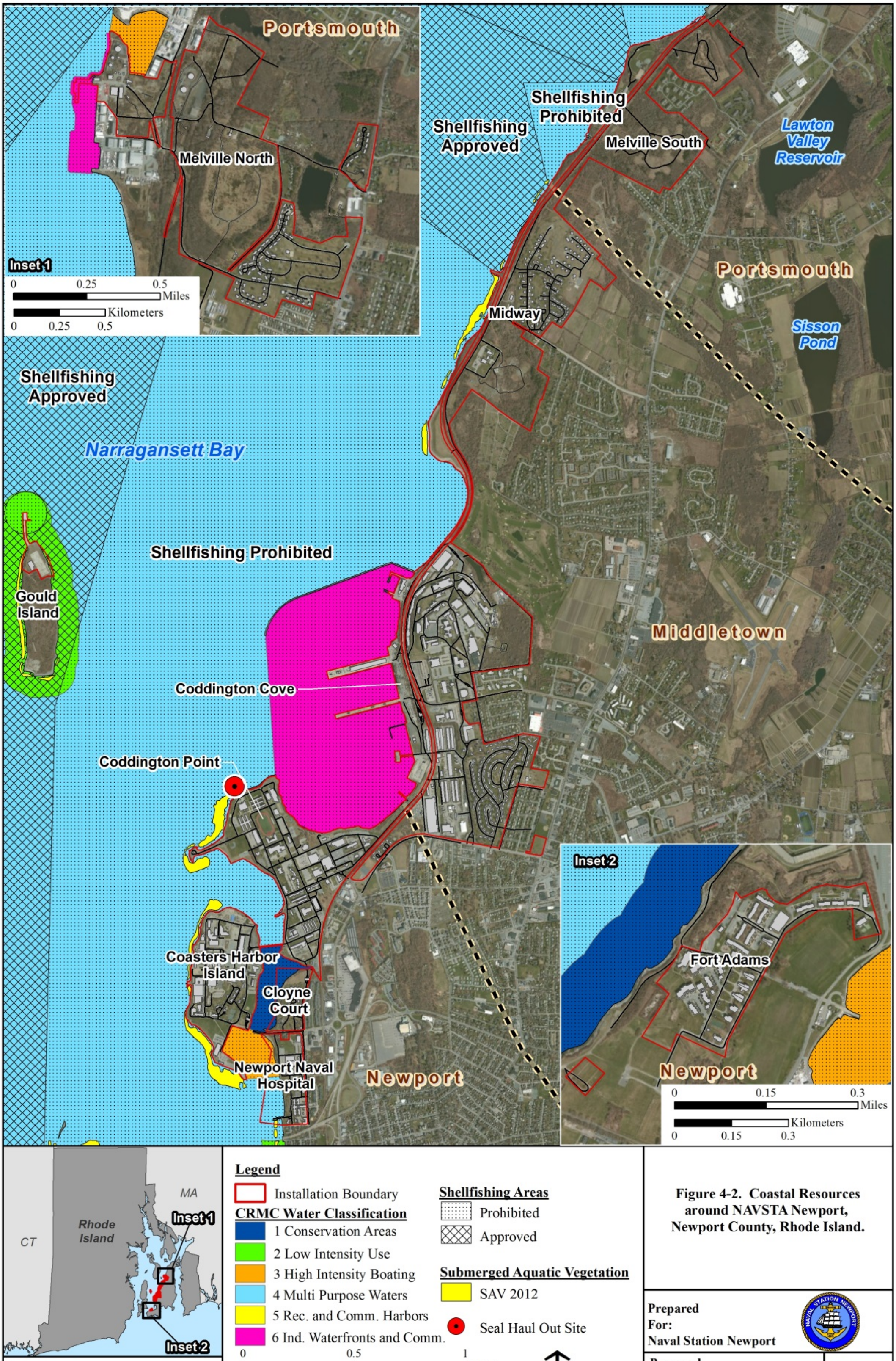
Source:
Navy GRC 2011, RIGIS 2010 - 2013, ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

Figure 4-1. Clean Water Act Section 303(d) Impaired Waters around NAVSTA Newport, Newport County, Rhode Island.



Source:
Navy GRC 2011, RIGIS 2008 - 2013,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 4-2. Coastal Resources around NAVSTA Newport, Newport County, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: Marstel-Day, LLC

Date: May 2014

Source:
Navy GRC 2011, RIGIS 2010,
ESRI Data and Maps 2013
Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 4-3. No Maintenance Areas at NAVSTA Newport, Newport County, Rhode Island.

Prepared For:
Naval Station Newport

Prepared By:
Marstel-Day, LLC

Date:
May 2014

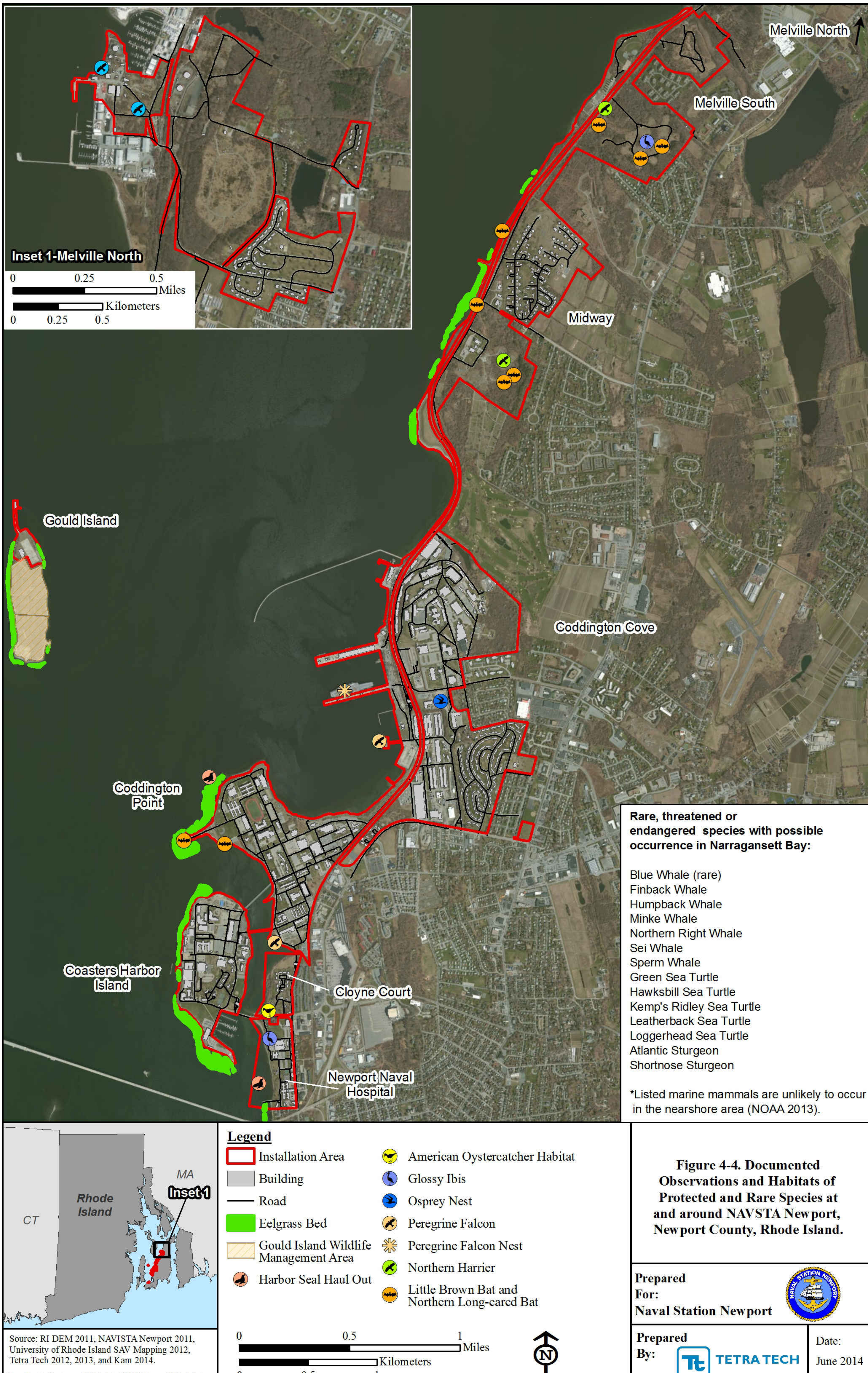


Figure 4-4. Documented Observations and Habitats of Protected and Rare Species at and around NAVSTA Newport, Newport County, Rhode Island.

Figure 4-5. Installation Restoration Program Sites at NAVSTA Newport, Newport County, Rhode Island.

Sources: NOAA ESI 2001, ESRI 2013, and Navy 2013.

Coordinate System: WGS 84, UTM, Zone 19N, Meters

Figure 4-6, Sheet 1. Environmental Sensitivity Index Map, Narragansett Bay, Rhode Island.

Prepared For: Naval Station Newport

Prepared By: TETRA TECH

Date: June 2014

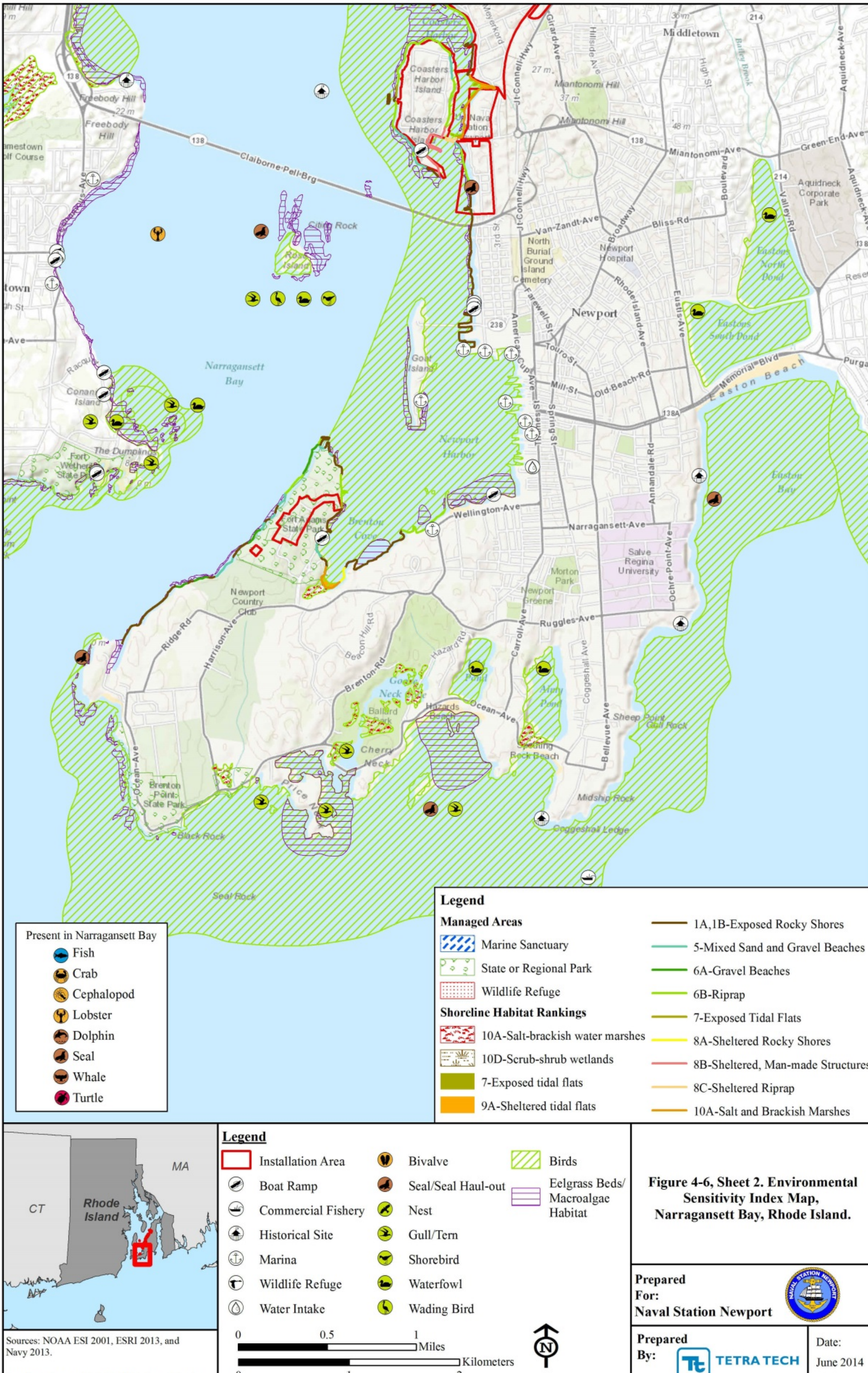


Figure 4-6, Sheet 2. Environmental Sensitivity Index Map, Narragansett Bay, Rhode Island.

Figure 4-7. Outdoor Recreation Opportunities at NAVSTA Newport, Newport County, Rhode Island.

APPENDIX G

NAVSTA NEWPORT WILDLIFE BROCHURES

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Tips for Happy Indoor Cats

Kittens that are kept indoors from birth usually show no desire to go outside as adults. With patience and time, outdoor pet cats can become happy indoor pets. The following tips will help:

- Play with your cat for at least 10 minutes each day.
- Provide plenty of toys for your cat to stalk, chase, and pounce on to fulfill its hunting instinct.
- Give your cat paper bags or cardboard boxes to play with when it is alone.
- Provide window shelves or high stands near windows so your cat can bask in the sun or watch birds and animals outside.
- Provide cat trees or kitty jungle gyms that your cat can climb so it can observe its surroundings from above.
- Plant kitty grass in indoor pots so your cat can graze without ingesting lawn chemicals.
- Feed your cat a balanced and nutritious diet, and make sure it always has access to clean water.
- Provide routine veterinary care, including an annual checkup and vaccinations.
- Keep the litter box clean.

Outdoor cats can kill rare species such as this piping plover chick.

An indoor cat is a safe and happy cat.

For the Sake of People, Cats, and Wildlife:

- Keep your cat indoors. It's better for the environment and better for your cat.
- *Never* abandon cats. If you are transferred and can't take your cat with you, find a good home or contact a veterinarian or local humane society for help.
- Do not feed stray cats – this only increases the cat overpopulation problem. Take stray and abandoned cats to a local shelter or call your base animal control officer for help.

Cat ownership is a responsibility, so please do your part.

Indoor Cats Can Slip Out, So Remember To:

- Spay or neuter your kitten as early as eight weeks old, *before* it can breed. Your cat will be healthier and won't contribute to the overpopulation problem.
- Ensure your cat has an ID tag attached to its collar and/or has an embedded microchip containing your contact information.

U.S. Department of Defense Natural Resources Conservation Compliance Program

For more information, please visit:

www.DoDNaturalResources.net

www.DENIX.osd.mil/NR

DoDNRConservation@bah.com

follow us on twitter @DoDNatRes

For more information on cats and the military, see www.defense.gov/specials/cats/index.html

For more information on Cats Indoors, see www.abcbirds.org/abcprograms/policy/cats/index.html

For information on pet adoption, contact your base veterinarian, local humane society, or see if there's a local group that can help, such as http://pactforanimals.org/military-foster-program.php

For some quick cat facts, visit http://animal.discovery.com/healthy-pets/cat-health-101

Don't Let Your Cat Go AWOL!

Indoor Cats Are Safe Cats

Cat Populations on Military Bases

Military bases struggle with how to successfully manage domestic cat populations. Frequent personnel transfers mean cats are often left behind, abandoned to fend for themselves. Lucky cats find a new home, but most are not so fortunate. Abandoned cats face many dangers including being hit by cars, starving, freezing, and catching diseases.

Base commanders must deal with how to humanely resolve the issue of too many free-roaming cats with limited available resources. Free-roaming cats kill native wildlife, including many rare and endangered species, and can also threaten the health and safety of military personnel and their families. ***As a cat owner, you are an important part of the solution.***

Cat killing a yellow-rumped warbler at a bird bath.

The Skinny on Cats

Domesticated in the Middle East over 8,000 years ago, house cats (*Felis catus*) are descendants of the Middle Eastern wild cat. European explorers and settlers first introduced these cats around the world. The Humane Society estimates the U.S. pet cat population at approximately 85 million, compared to approximately 78 million dogs. No one knows how many stray or feral cats are out there—the Humane Society estimates around 50 million.

Keeping Cats Indoors is Good for People

Stray cats often congregate around a food source, such as garbage dumps and mess halls, or where people leave food out for them. Outdoor cats are exposed to many diseases and parasites, some of which are harmful and can be transmitted to humans, including the following:

- ***Rabies*** is a deadly virus that can infect cats, wildlife, and humans. Outdoor cats are more likely to contract rabies than any other domestic animal.
- ***Cat-scratch Disease*** is a bacterial infection that cats can transmit to other cats by fleas, and to humans by a scratch or bite. While cats show no symptoms of the disease, it can cause severe illness in people. Symptoms include swollen lymph nodes, headache, fever, sore muscles and joints, fatigue, and poor appetite.
- ***Toxoplasmosis*** is an infection caused by tiny parasites found in the intestines of cats and in the tissues of many animals. People can contract this disease by not washing their hands after coming into contact with cat litter or soil contaminated with cat feces, such as in gardens and sand boxes. If contracted by a pregnant woman, the baby may develop learning, visual, and hearing disabilities.
- ***Salmonellosis*** is a bacterial infection that can cause diarrhea, fever, and stomach pain. Humans can contract this disease when they come into contact with cat feces. People can avoid infection by wearing gloves and washing their hands after cleaning out litter boxes. To prevent feline infection, keep cats indoors and feed them cooked or commercially processed food.
- Outdoor cats also can contract and transmit ***fleas, ticks, roundworm, tapeworm, and hookworm*** to humans.

Staying Indoors is Good for Cats

Many people don't realize the daily hazards that outdoor pet cats face. The average life expectancy of an outdoor, free-roaming cat is less than five years, while indoor cats commonly live 12 to 15 years. Cats that roam are in danger from:

- **Cars:** Millions of cats are run over by cars every year. In colder climates, cats may crawl into car engines to get warm, and be killed or maimed when the car is started.
- **Disease:** Outdoor cats can be exposed to several fatal diseases such as feline leukemia and feline immunodeficiency virus (FIV). Although there are vaccines for both of these diseases, not all FIV vaccinated cats will be protected because of the high number and variations of the virus strains.
- **Parasites:** Outdoor cats can suffer from debilitating parasites, such as ear mites, fleas, ticks, and worms.
- **Injuries:** Cats may experience abscesses, broken limbs, torn ears, scratched eyes, internal injuries, parasites, and death resulting from encounters with dogs, other cats, coyotes, raccoons, foxes, hawks, and owls.
- **Bad Weather:** Outdoor cats can suffer from extreme weather conditions and natural disasters, such as hurricanes, floods, fires, snow storms, and tornadoes.
- **Poisons and Traps:** The ASPCA's Animal Poison Control Center receives thousands of calls each year related to pet exposures to pesticides, rodenticides, antifreeze, and other toxic chemicals.
- **Human Cruelty:** Unfortunately, it is not uncommon for cats to be horribly abused, including being shot, stabbed, and even set on fire.

Keeping Cats Indoors is Good for Wildlife

Cats are not native to North America. Our wildlife did not evolve with this abundant and efficient predator, and thus have few defenses against it. The National Audubon Society reported that when outdoors, cats kill over 3.7 billion birds and other small animals in the U.S. every year.

- *Stray cats* are domestic animals that have been lost or abandoned by their owners.
- Truly *feral cats* are born wild and live entirely on their own without any human assistance.
- A female cat can have two to three litters per year, with four to eight kittens per litter.

Cats are not wildlife and struggle to a survive outdoors.

The Truth About Cats and Wildlife

- Even well-fed cats kill wildlife. Cats are born predators; different parts of their brain control the urge to hunt and the need to eat.
- Putting a bell on a cat's collar does not prevent it from killing because wild animals do not necessarily know that a ringing bell means danger.
- Once caught by a cat, few small animals survive. Even if the animal escapes, internal injury or infection from a cat's teeth or claws usually causes death.

Living Safely with Coyotes

Never feed coyotes or leave out food that might attract them. Don't feed their puppies. Secure trash. Coyotes eat everything: fruit, cereals, meats, small animals, and garbage.

Never feed pets outside.

Bring your small pets inside at night or accompany them in heavily used coyote areas Any pet spaniel size or smaller is at risk.

A safe cat is an indoor cat. Outdoor cats or cat colonies are a magnet for coyotes.

If coyotes are staring at you, or following you, they probably think you are going to feed them. Remember many coyotes are trained to expect food from people.

If you are uncomfortable with coyotes near you, act big, mean, and loud. A soda can full of pennies makes a good noisy shaker and should scare them away. If noise alone does not work throw something. Coyotes are very nervous animals and should leave especially if it looks like you are going to approach them.

If you feed them you are part of the "coyote problem." Remember: fat coyotes are fertile coyotes. They have plenty of natural foods here - including mice, rats, woodchucks, rabbits, geese and deer - they don't need more.

Habituated coyotes are dangerous because they are apt to approach people and may become aggressive. Problem individuals will need to be removed and euthanized. You are not doing a coyote any favor by feeding it: a fed coyote is a dead coyote.

Management and Coexistence

The NBCS is working with local and state government and the public to develop viable management and coexistence strategies for the eastern coyote in RI. We are addressing the issue of coyote subsidization and population growth by creating a unified plan to reduce coyote numbers to a level sustainable by the natural environment.

The Narragansett Bay Coyote Study (NBCS) is a project of The Conservation Agency. NBCS is committed to conducting cutting-edge research on coyote populations in Rhode Island and sharing its findings with the local communities.

Google "Narragansett Bay Coyote Study" or visit www.theconservationagency.org/coyote.htm to find regional information on coyotes in the Narragansett Bay area. The site features images of study coyotes, the **NBCS Map Gallery** containing maps identifying the territories and habits of resident coyote packs, and the interactive **Coyote Mapper** which allows you to see and zoom in on coyote action in your neighborhood.

The Conservation Agency
67 Howland Avenue
Jamestown, Rhode Island 02835
(401) 423-0866

www.theconservationagency.org/coyote.htm

Coyote Coexistence Guide

for Naval Station Newport

Prepared by

The Narragansett Bay Coyote Study

a project of The Conservation Agency

The Conservation Agency is a scientific, non-profit, 501(c)(3) organization dedicated to the conservation of natural biodiversity through exploration and discovery as well as conservation and preservation. I.R.S. 05-0392995

Coyotes on Naval Station Newport

Beginning in 2005 coyotes became a regular sight on Naval Station Newport even during the day. The base CO, responding to a clear increase in community concern about coyotes, and apparent increases in their numbers on the Base, contracted The Narragansett Bay Coyote Study (NBCS) to conduct a sub-study on the base.

The NBCS is currently working on Jamestown and Aquidneck Island to develop regionally tailored management and coexistence strategies. NBCS research indicates that throughout the Islands increasingly noticeable coyote presence has a lot to do with food.

Coyote Biology Relates to Management

Coyotes are different from deer, which depend on predators to control their population size. Since coyotes are top predators they have to control their own numbers – nothing eats them to bring their numbers down.

Coyotes regulate population size by varying the number of offspring each pack produces. More food resources mean more puppies and higher coyote population density.

With less food both coyote numbers and population density decrease.

It follows that if we can identify and control the availability the food resources the coyotes are using, coyotes will bring their own numbers down. NBCS calls this "Passive Management."

Why not shoot them?

Nationwide lethal control methods have proved futile. Trying to get rid of coyotes by killing them is a logistically impossible task since most of them are discrete, shy, and virtually invisible. Inevitably, the ones that are missed sense the increase in available food, produce more pups, and rapidly restore the population to former levels. Killing coyotes to control them is like bailing a boat with a sieve.

How does NBCS Science Help?

The NBCS has designed and deployed a novel study methodology that reveals resources that might be contributing to coyote abundance. Our team is capturing representative coyotes from each of 10 packs currently occupying Jamestown and Aquidneck Islands. NBCS uses unique tracking collars that transmit the hourly GPS coordinates of each tagged coyote to special telemetry receivers. When the GPS location data are overlaid on GIS digital map layers (orthophotos, landuse, etc.), they reveal information about movement and resource use in a detail never before possible.

When GIS maps reveal that coyotes are regularly visiting a location, scientists "ground-truth" the spot and figure out what resources are attracting them

People Cause Coyote Problems

Using GPS tracking, NBCS has found that coyotes on both islands are being heavily subsidized by humans who directly and indirectly provide thousands of pounds of food to them each year.

Human Handouts

Intentional and unintentional coyote subsidies:

- Road-killed animals, especially deer, are dumped not properly disposed of
- Deer shot but not recovered, gut piles
- Dead farm-livestock dumping
- People feeding feral cats or wildlife foods coyotes eat
- People Intentionally feeding coyotes

Problem:

- Fat coyotes are fertile coyotes
- Coyotes respond to abundant food resources by producing more offspring.
- Coyote populations are increasing
- Coyotes are getting bold – they expect food from people and may get aggressive

The coyotes on the Navy Base flow onto the base from all over Aquidneck Island. Excessive coyote reproduction occurs wherever coyotes are being subsidized significantly by people. Coyotes can produce many more offspring than they need to replace pack members. The young spread out and fill any available habitat on the island. For that reason there is no such thing as an isolated coyote problem on Aquidneck Island. Aquidneck Island's problem is the Navy Base's problem and visa versa.

Solution

We can manage coyotes - get them to drop their own numbers - if we aggressively manage ourselves and decrease the food subsidies we are providing to them.

Native Snakes of Rhode Island

Although many cultures around the world respect snakes and revere them as symbols of renewal and fertility, in our society the relationship between humans and snakes consists of apprehension. Unfortunately, the fear that many people have for these leg-less members of the reptile family is based largely on learned behavior and misinformation. This pamphlet was therefore created to educate people about the species of snakes, including the behavior and preferred habitats, they might encounter here in Rhode Island, and to suggest how to handle unexpected encounters. Although some species appear menacing and may bite when threatened, snakes are generally much more afraid of you then you are of them, and no native Rhode Island snake poses any threat to life, limb, or property. These native non-poisonous snakes are a natural and important part of healthy ecosystems here in the northeast, and are fascinating creatures worth understanding more fully.

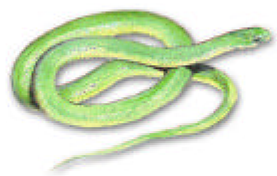
It is important to note that **NO SPECIES OF NATIVE RHODE ISLAND SNAKE IS VENOMOUS**. Timber Rattlesnakes (*Crotalus horridus*) were once found in Rhode Island, but disappeared over thirty years ago. There are still rattlesnake populations in Connecticut and Massachusetts. Copperheads (*Agkistrodon contortrix*) are also found in southern New England but have never occurred in Rhode Island. Lastly, although there are many stories about water moccasins in Rhode Island, these tales obviously refer to common Water Snakes, because the real water moccasin, or cottonmouth as it is sometimes known (*Agkistrodon piscivorus*), is a southern species found no further north than the state of Virginia.

Northern Black Racer (*Coluber constrictor constrictor*)

Description: The Black Racer is a large, shiny black snake with a silky appearance due to it's smooth scales. At maturity, Racers are generally 36-60 long, but they can reach up to 73 (more than 6 feet). The throat of the Black Racer is light and the belly is an unmarked grayish blue color. While in the juvenile stage, the Black Racer is grayish with a series of dark ovals along the back, an appearance that changes as the snake matures.

Life History: Black Racers can be found in a wide variety of dry terrestrial habitats They are territorial and maintain discrete home ranges. They usually emerge from hibernation in April, and breed from May through early June. This snake has a varied diet, with prey including small mammals, birds and frogs. Appropriate to its name, the Black Racer can move very quickly, and will typically flee from danger. If cornered, however, it may respond by rearing up and striking. When agitated, these snakes often vibrate their tail rapidly, which creates a buzzing noise. This behavior leads many people to mistake them for rattlesnakes before further investigation.

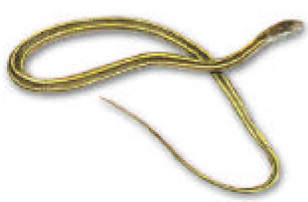
Eastern Smooth Green Snake (*Liochlorophis vernalis*)



Description: The Green Snake has a bright lime-green green back without a pattern and a white or yellow underbelly. At maturity, they are generally 12-20 long, but they can grow up to 26 .

Life History: With a coloration promoting concealment in green vegetation, the Green Snake is most commonly found in habitats like grassy meadows or open woodlands. In Rhode Island, Green Snakes are more common in coastal regions than in the interior, and can also be found in weedy vacant lots within urban areas. This species breeds through the spring and late summer, depositing clutches of 3-12 eggs in nesting sites under debris or within rotten logs. The Green Snake feeds primarily on insects, although it occasionally will also prey upon snails and salamanders.

Eastern Ribbon Snake (*Thamnophis sauritus sauritus)*



Description: The Ribbon Snake is a slender, long tailed snake that is boldly patterned with three yellow stripes on a darker, brown background. Their belly is pale yellow or white, and is separated from the side stripes by a dark brownish band. At maturity, they are generally 18-26 long, but they can grow to 38 .

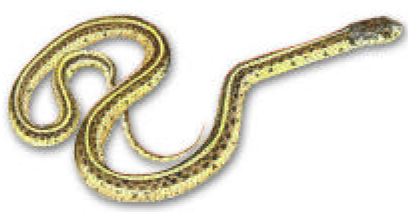
Life History: Ribbon Snakes are adept at moving both on land and in the water, and this species is typically found near wetlands, streams and pond margins. Most active in the spring, which is also when they mate, they may become dormant if rainfall is not abundant enough to provide favorable habitat. They rarely bite, although they will secrete a foul smelling musk if handled.

<u>Eastern Milk Snake</u> (*Lampropeltis triangulum triangulum*)

<u>Description</u>: The Milk Snake is boldly patterned, with darkly outlined reddish brown blotches on a light gray background. The belly has a checkered pattern of dark squares on a light background, and the snake has an overall glossy appearance. This species of snake generally reaches 24-36" at maturity, although they can grow to 52" in length.

<u>Life History</u>: Milk snakes are so named because they are often found around barns, houses, and other man-made structures. Contrary to the popular myth that they feed on cow's milk, this species of snake instead prefers to prey upon small mammals. Milk Snakes inhabit a wide variety of natural habitats; including woodlands, fields, and the outskirts of wetland areas. They are primarily nocturnal but are seen more often during the day in spring and fall, when they are basking more. If threatened or cornered, Milk Snakes assume an impressive but harmless display. They will coil in an S-shaped striking position and will vibrate their tails rapidly to make a whirring noise. Because of this behavior and their bold patterning, Milk Snakes are frequently mistaken for Copperheads, which do not occur in Rhode Island.

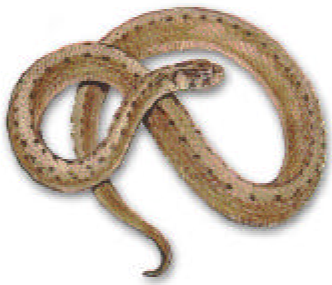
<u>Eastern Garter Snake</u> (*Thamnophis sirtalis sirtalis*)



<u>Description</u>: The Garter Snake is the most common and widespread of all New England snakes. These snakes are highly variable in coloration but are usually recognizable by having a narrow tan or yellow stripe down the middle of the back, with broader stripes on either side. Between the stripes is usually a spotted black or brown pattern. The belly of the Garter Snake is generally a pale yellow or green. When mature, these snakes are generally 18-26", although they can reach up to 48" in length. Garter Snakes are similar to but chunkier and drabber than the closely related Ribbon Snake.

<u>Life History</u>: Garter snakes inhabit almost any type of habitat; from wetlands to rocky hillsides and residential areas, and are often spotted basking in the sun on rocks, hedges, and concrete surfaces around houses. They enter water freely and can feed on fish or tadpoles. In spring and autumn, garter snakes often find their way into basements. These snakes primarily prey upon earthworms and amphibians. Although not particularly aggressive, their saliva seems to be toxic to the small animals upon which they prey, and some people may develop a rash if bitten.

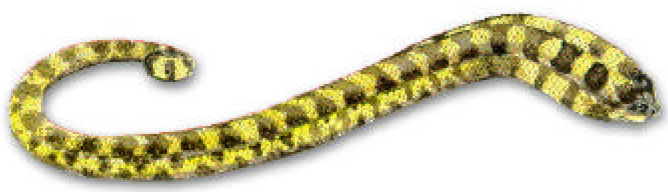
Northern Brown Snake (*Storeria dekayi dekayi*)



Description: The Brown Snake is pinkish tan in color. It has a broad lighter colored stripe down its back, bordered by darker spots. The belly of the snake is usually a buff or pinkish color. These snakes are small, generally 9-13" at maturity, with some individuals growing to 20".

Life History: Brown snakes emerge from hibernation and mate after the ground thaws in the spring months. They can be found in a wide variety of natural habitats, but are most commonly encountered in developed or residential areas. They prefer to feed upon earthworms and slugs, and it is not uncommon to find a number of these snakes grouped together under piles of debris. Brown snakes rarely bite, but will release musk if threatened.

Eastern Hognose Snake (*Heterodon platirhinos*)



Description: The Eastern Hognose Snake is characterized by its thick body and upturned snout (pictured above at right). The patterning on this species is highly variable, from the light yellowish background with dark checks pictured above to a completely black coloration. Hognose snakes are generally 20-33" long when mature, but some individuals can grow to 45".

Life History: The defining feature of Hognose Snake habitat is sandy soil. They may be found in sandy woodland and grasslands. In Rhode Island, these snakes are more common in interior areas than along the coast. Toads appear to be their prey of choice, but various other small animals may be taken as well. Hognose Snakes have large teeth in the back of their mouths to aid in swallowing resistant toads. When threatened, they can perform an impressive display by puffing up, flattening their head, and hissing loudly. This display has earned them the colloquial name of "puff-adder". Since they can assume this cobra-like appearance, these snakes often fall victim to people who are convinced they are poisonous, although they pose no threat at all and in fact are among the most docile of Rhode Island's local snake species.

Northern Water Snake (*Nerodia sipedon sipedon*)

Description: The Northern Water Snake is a thick bodied snake with a highly variable pattern. As depicted above, they often have reddish brown cross-bands closer to the head, with similar colored blotches closer to the tail. Larger snakes are darker above and the bands are less obvious. These snakes are generally 24-42" long when mature, although they can grow up to 55" in length.

Life History: As indicated by it's name, the water snake is usually found in and around wetland, lake and stream habitats. Very capable swimmers, these snakes can move quickly on and beneath the surface of water. They are often observed around the edges of bodies of water, searching for prey or basking. Their preferred foods include fish, frogs, tadpoles and salamanders, although small mammals, birds and insects are also taken. In the spring months, it is not uncommon for landowners to find these snakes in yard areas away from water. Water snakes are territorial and curious animals - they sometimes approach bathers and fishermen. Their first instinct is to retreat quickly to water when confronted, but if they are cornered, they will not hesitate to bite.

Black Rat Snake (*Elaphe obsoleta obsoleta*)

Description: Appropriately named, the Black Rat Snake is a black color, with light areas often apparent between the scales. This snake does not have the same glossy appearance as the Black Racer because it s scales are roughly keeled, rather than smooth. The belly of the snake is a mottled dark and light pattern. The Black Rat Snake is the largest snake found in Rhode Island, about 42-72" at maturity, although they can grow to 8 ft. in length. Juvenile snakes are light gray with a row of darker rectangular blotches along their back. These blotches darken and merge as the snake matures until the dark adult pattern is achieved.

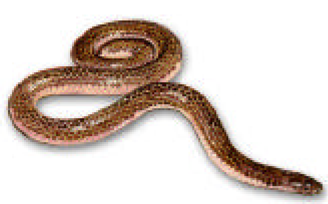
Life History: Rat Snakes are more common in the southern United States. In Rhode Island they are only found in the extreme southwestern portion of the State, primarily within the towns of Hopkinton and Exeter. These snakes can be found in a variety of habitats, from woodlands and fields to river bottoms. Black Rat Snakes are muscular and readily climb. They may reside in hollow trees, outbuildings and old barns. Their diet mainly consists of small mammals and birds, which they subdue by constriction. They also eat bird eggs. Despite their size, Black Rat Snakes are not particularly aggressive, but they may bite if threatened. Like many local species, they can vibrate their tail rapidly when frightened, a behavior that may contribute to their being mistaken for rattlesnakes.

Northern Ringneck Snake (*Diadophis punctatus edwardsii*)

Description: The Ringneck Snake derives its name from the golden yellow collar just behind it's head. The body of the snake is a darker bluish gray color. The belly is colored uniform yellow, unmarked or sometimes having a row of small black dots. Smooth scales give the Ringneck Snake a satiny appearance. At maturity, Ringneck snakes are 10-15", sometimes reaching up to 25" in length.

Life History: The Ringneck Snake is a secretive species that tends to reside in moist woodland areas where there is an abundance of cover. Typical habitats include ledges and piles of debris, where they find their favored prey species, including salamanders, earthworms and frogs. These snakes are generally nocturnal, but are sometimes active during the day during spring or fall. These snakes often find their way into the basements of homes, especially older homes that have rough stone foundations. Northern Ringneck Snakes are docile and rarely bite, but they can release a foul-smelling musk when handled.

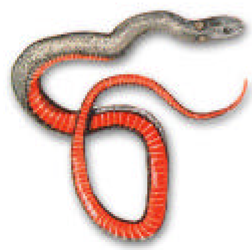
Eastern Worm Snake (*Carphophis amoenus amoenus*)



Description: The Worm Snake, appropriately, has an appearance that closely mimics that of an earthworm. The dorsal surface is plain brown, and the belly is a pinkish color. Smooth scales give the snake a shiny appearance. Worm snakes are generally 7-11" at maturity, although they can reach 13" in length.

Life History: Worm snakes are most commonly found in moist woodland habitats with sandy substrates. These snakes are very rarely found in the open, but are usually uncovered under stones or boards or in rotting logs. They feed primarily upon earthworms and soft-bodied insects. Worm Snakes rarely bite, but they can release a strong odor when threatened.

Northern Redbelly Snake (*Storeria occipitomaculata occipitomaculata*)



Description: Besides their characteristic red belly, this snake is distinguishable by the 3 pale-colored spots oriented around the neck just behind the head. The dorsal surface is generally a plain brown or gray color. At maturity these snakes are generally 8-10", occasionally reaching 16" in length.

Life History: Woodlands are the preferred habitat of Redbellied snakes, but they can be found in a wide variety of habitats, most notably near bog or marsh areas. These snakes are more common in rural western Rhode Island than elsewhere in the state, and are completely unknown from coastal areas. They are secretive, and usually hide under rocks, logs, or in rotted stumps. These snakes may release musk when handled, but they rarely bite.

Snake Encounters

In the State of Rhode Island, it is not uncommon to encounter a snake. Every part of the state harbors one species or another, and they are often found in residential and urban areas. Therefore, snakes may be observed as they bask on patios and doorsteps, seek refuge within tool sheds, or explore a cool basement during the heat of summer. When a snake is seen, the most important thing to keep in mind is not to overreact. Remember that there are no poisonous snakes currently inhabiting Rhode Island's woodlands and fields. Snakes are a natural and important part of ecosystems here in the northeast, and it is very possible for them to peaceably coexist with their human neighbors.

If at all possible, the best thing to do when a snake is found on your property is to leave it alone. Because snakes are cold blooded, they most often come out into the open to regulate their body temperature by sunning themselves. If this is the case, they will eventually leave the area of their own accord. If for some reason it is not possible to allow the snake to remain where it is; perhaps because it is in a high traffic area or within a dwelling, there are several simple, humane, non-lethal methods of relocation that one might use. If you are not at all comfortable around snakes, to the point where you cannot perform these types of removal tasks, call a pest removal professional.

Out-of-doors Encounters

- Good snake habitat consists of exposed, rocky areas surrounded by thick vegetation, precisely the condition that homeowners try to cultivate around their decks and gardens. Removing all potential to attract snakes is therefore not a practical or desirable option for most landowners.

- For snakes found outside, on doorsteps, driveways, etc., a gentle spray from a garden hose or a squirt bottle will often work quite well to encourage them to move on.

- If these are not readily available, a gentle prodding or a broom will also do the job.

Indoors Encounters

- If a snake is found in a basement, the prescribed method of removal is to use a broom to sweep it into a garbage can large enough to prevent it from crawling out. Then relocate it outside.

- Keep in mind that snakes are more likely to feel threatened and act aggressively when they are cornered.

- For a more persistent and less urgent situation, another method is to place piles of damp burlap bags or cloth in spots where snakes are likely to be found. Cover each pile with a dry burlap bag to slow evaporation, and leave the piles for 1-2 weeks. After this time, pick up the piles with a large shovel in the middle of the day, when the snakes are most likely to be underneath, and relocate them.

- Once the snake is removed, determine the point of entry and seal it to prevent future trespass. Snakes cannot bore through wood and cannot create their own holes to access buildings. All openings to the outside larger than ¼ inch should be sealed. Corners of doors and windows, especially in window wells, as well as plumbing and electrical entrances are often problem areas. Access points such as bulkheads and ground-level doors can be sealed with weather-stripping. Holes in concrete foundations should be patched with mortar. For holes in wooden buildings, a fine mesh hardware cloth or sheet metal will work well. Smaller holes can be filled with putty or sealer. In instances where complete sealing is not an option, such as a dryer vent, constructing a cage or lid of fine wire mesh to enclose the opening will be the best solution.

Repellents, Fumigants, Toxicants and Traps

- A number of snake repellants have been recommended over the years, but none has been consistently effective and we do not recommend their use. Unless the questions of access and habitat are addressed, removing or killing an individual snake does not preclude another from taking its place. In Rhode Island, no action is nearly always the best course of action.

- There are no registered toxicants for repelling snakes and there are currently no legal fumigants for killing snakes. Beyond this, such products would be excessively expensive, impractical and unnecessary, considering that these snakes are completely harmless.

- One method used by researchers to capture snakes is a funnel trap with drift fences. A funnel trap is cylindrical wire mesh structure, using the same basic concept as a lobster pot. One or both ends of the cylinder are fitted with entrance funnels, with the narrow end located within the body of the trap. Because such traps are not available commercially, they must be hand-fabricated, a process which makes their use unappealing and time-consuming. Traps are therefore impractical for indoor use.

- Some sources recommend using glue boards to capture snakes. Because this process can become a very messy and inhumane method of snake capture, we encourage the use of alternate methods. Glue boards can be hazardous to pets, non-target wildlife and small children, as well as being traumatic for the snake. Removing a snake from a glue board can be a difficult and messy task, and will require closer personal contact with the snake than most people who would resort to this method are comfortable with.

There is no situation that would necessitate the wounding or death of a native Rhode Island snake. Indiscriminant killing of snakes and other native wildlife is illegal and unethical. Local snakes are never aggressive unless threatened, and they are not a problem for people if given the proper respect and space.

Conclusion

Rhode Island has a wide and colorful variety of native snakes. These species are interesting and valuable components of ecosystems throughout the Northeast. Their adaptation to different habitats and locales, along with increasing development of their habitat, occasionally puts them in contact with people. Despite the inborn and learned phobias that many people possess towards snakes, these encounters need not be overly dramatic or tragic to any party involved. This publication seeks to educate the public about the types of snakes one might encounter in Rhode Island, and where they are most commonly found. Additionally, people should take note of the simple, humane methods of dealing with snake encounters. In this way, we should be able to coexist with our native snake species peacefully and without incident.

"It is the policy of the Rhode Island Department of Environmental Management to offer its services and accommodations to all orderly persons, and, as required, to all properly licensed persons, without regard to race, religion, color, national origin, ancestry, sex, age, or handicap. If you believe you have been discriminated against in any program, activity, facility, or if you desire further information, please write to the Office for Equal Opportunity, US Department of the Interior, Office of the Secretary, Washington, DC 20240."

Sources :

http://www.umass.edu/umext/nrec/snake_pit/index.html

Conant, R. and J. T. Collins. 1991. A field guide to reptiles and amphibians of eastern and central North America. Houghton Mifflin Company. 450 p.

DeGraaf, R. M. and D. D. Rudis. 1983. Amphibians and reptiles of New England: habits and natural history. The University of Massachusetts Press, Amherst. 85 p.

Klemens, M.W. 2000. Amphibians and Reptiles in Connecticut: A Checklist with Notes on Conservation Status, Identification and Distribution. State Geological and Natural History Survey of Connecticut. Bulletin 32. 96 p.

APPENDIX H

ESSENTIAL FISH HABITAT WORKSHEET

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NOAA Fisheries Greater Atlantic Regional Fisheries Office
Essential Fish Habitat (EFH) Assessment & Fish and Wildlife Coordination Act (FWCA) Worksheet

This worksheet is your essential fish habitat (EFH) assessment. It provides us with the information necessary to assess the effects of your action on EFH under the Magnuson Stevens Fishery Conservation and Management Act and on NOAA trust resources under the Fish and Wildlife Coordination Act (FWCA). Consultation is not required if:

1. there is no adverse effect on EFH or NOAA trust resources (see page 10 for more info).
2. no EFH is designated and no trust resources may be present at the project site.

Instructions

Federal agencies or their non-federal designated lead agency should email the completed worksheet and necessary attachments to nmfs.gar.efh.consultation@noaa.gov. Include the public notice (if applicable) or project application and project plans showing:

- location map of the project site with area of impact.
- existing and proposed conditions.
- all waters of the U.S. on the project site with mean low water (MLW), mean high water (MHW), high tide line (HTL), and water depths clearly marked.
- sensitive habitats mapped, including special aquatic sites (submerged aquatic vegetation, saltmarsh, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges), hard bottom or natural rocky habitat areas, and shellfish beds.
- site photographs, if available.

We will provide our EFH conservation recommendations and recommendations under the FWCA, as appropriate, within 30 days of receipt of a complete EFH assessment (60 days if an expanded consultation is necessary). Please submit complete information to minimize delays in completing the consultation.

This worksheet provides us with the information required[1] in an EFH assessment:

1. A description of the proposed action.
2. An analysis of the potential adverse effects on EFH and the federally managed species.
3. The federal agency's conclusions regarding the effects of the action on EFH.
4. Proposed mitigation, if applicable.

Your analysis **should focus on impacts that reduce the quality and/or quantity of the habitat or result in conversion to a different habitat type** for all life stages of species with designated EFH within the action area.

Use the information on the HCD website and NOAA's EFH Mapper to complete this worksheet. If you have questions, please contact the appropriate HCD staff member to assist you.

[1] The EFH consultation process is guided by the requirements of our EFH regulation at 50 CFR 600.905.

EFH ASSESSMENT WORKSHEET

General Project Information

Date Submitted:

Project/Application Number:

Project Name:

Project Sponsor/Applicant:

Federal Action Agency (if state agency acting as delegated):

Fast-41 or One Federal Decision Project: Yes No

Action Agency Contact Name:

Contact Phone: Contact Email:

Latitude: Longitude:

Address, City/Town, State:

Body of Water:

Project Purpose:

Project Description:

Anticipated Duration of In-Water Work or Start/End Dates:

Habitat Description

EFH includes the biological, chemical, and physical components of the habitat. This includes the substrate and associated biological resources (e.g., benthic organisms, submerged aquatic vegetation, shellfish beds, salt marsh wetlands), the water column, and prey species.

Is the project in designated EFH[2]? Yes No

Is the project in designated HAPC[2]? Yes No

Is this coordination under FWCA only? Yes No

Total area of impact to EFH (indicate sq ft or acres):

Total area of impact to HAPC (indicate sq ft or acres):

Current water depths: Salinity: Water temperature range:

Sediment characteristics[3]:

What habitat types are in or adjacent to the project area and will they be permanently impacted? Select all that apply. Indicate if impacts will be temporary, if site will be restored, or if permanent conversion of habitat will occur. A project may occur in overlapping habitat types.

	Habitat Type	**Total impact (sq ft/acres)**	**Impacts are temporary**	**Restored to pre-existing conditions**	**Permanent conversion of all or part of habitat**
	Marine				
	Estuarine				
	Riverine (tidal)				
	Riverine (non-tidal)				
	Intertidal				
	Subtidal				
	Water column				
	Salt marsh/ Wetland (tidal)				
	Wetland (non-tidal)				

[2] Use the tables on pages 7-9 to list species with designated EFH or the type of designated HAPC present.
[3] The level of detail is dependent on your project – e.g., a grain size analysis may be necessary for dredging.

	Habitat Type	Total impact (sq ft/acres)	Impacts are temporary	Restored to pre-existing conditions	Permanent conversion of all or part of habitat
	Rocky/hard bottom[4]:				
	Sand				
	Shellfish beds or oyster reefs				
	Mudflats				
	Submerged aquatic vegetation (SAV)[5], macroalgae, epifauna				
	Diadromous fish (migratory or spawning habitat)				

Indicate type(s) of rocky/hard bottom habitat (pebble, cobble, boulder, bedrock outcrop/ledge) and species of SAV:

Project Effects

Select all that apply	Project Type/Category
	Hatchery or Aquaculture
	Agriculture
	Forestry
	Military (e.g., acoustic testing, training exercises)
	Mining (e.g., sand, gravel)
	Restoration or fish/wildlife enhancement (e.g., fish passage, wetlands, beach renourishment, mitigation bank/ILF creation)

[4] Indicate type(s). The type(s) of rocky habitat will help you determine if the area is cod HAPC.
[5] Indicate species. Provide a copy of the SAV report and survey conducted at the site, if applicable.

Select all that apply	**Project Type/Category**
	Infrastructure/transportation (e.g., culvert construction, bridge repair, highway, port)
	Energy development/use
	Water quality (e.g., TMDL, wastewater, sediment remediation)
	Dredging/excavation and disposal
	Piers, ramps, floats, and other structures
	Bank/shoreline stabilization (e.g., living shoreline, groin, breakwater, bulkhead)
	Survey (e.g., geotechnical, geophysical, habitat, fisheries)
	Other

Select all that apply	**Potential Stressors Caused by the Activity**
	Underwater noise
	Water quality/turbidity/ contaminant release
	Vessel traffic/barge grounding
	Impingement/entrainment[6]
	Prevent fish passage/spawning
	Benthic community disturbance
	Impacts to prey species

Select all that apply and if temporary or permanent		**Habitat alterations caused by the activity**
Temp	Perm	
		Water depth change
		Tidal flow change
		Fill
		Habitat type conversion
		Other:
		Other:

[6] Entrainment is the voluntary or involuntary movement of aquatic organisms from a water body into a surface diversion or through, under, or around screens and results in the loss of the organisms from the population. Impingement is the involuntary contact and entrapment of aquatic organisms on the surface of intake screens caused when the approach velocity exceeds the swimming capability of the organism.

Details: project impacts and mitigation

The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. Attach supplemental information if necessary.

Describe how the project would impact each of the habitat types selected above. Include temporary and permanent impact descriptions and direct and indirect impacts.

What specific measures will be used to avoid impacts, including project design, turbidity controls, acoustic controls, and time of year restrictions? If impacts cannot be avoided, why not?

What specific measures will be used to minimize impacts?

Is compensatory mitigation proposed? Yes No

If no, why not? If yes, describe plans for mitigation and how this will offset impacts to EFH. Include a conceptual compensatory mitigation and monitoring plan, if applicable.

Federal Action Agency's EFH determination (select one)	
	There is no adverse effect[7] on EFH or EFH is not designated at the project site. EFH Consultation is not required. This is a FWCA-only request.
	The adverse effect[7] on EFH is not substantial. This means that the adverse effects are no more than minimal, temporary, or can be alleviated with minor project modifications or conservation recommendations. This is a request for an abbreviated EFH consultation.
	The adverse effect[7] on EFH is substantial. This is a request for an expanded EFH consultation. We will provide more detailed information, including an alternatives analysis and NEPA document, if applicable.

EFH and HAPC designations[8]

Use the EFH mapper to determine if EFH may be present in the project area and enter all species and lifestages that have designated EFH. Optionally, you may review the EFH text descriptions linked to each species in the EFH mapper and use them to determine if the described habitat is present. We recommend this for larger projects to help you determine what your impacts are.

Species	EFH is designated/mapped for:				Habitat present based on text description (optional)
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/ spawning adults	

[7] An **adverse effect** is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

[8] Within the Greater Atlantic Region, EFH has been designated by the New England, Mid-Atlantic, and South Atlantic Fisheries Management Councils and NOAA Fisheries.

Species	EFH is designated/mapped for:				Habitat present based on text description (optional)
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/ spawning adults	

HAPCs

Select all that are in your action area.

	Summer flounder: SAV[9]		Alvin & Atlantis Canyons
	Sandbar shark		Baltimore Canyon
	Sand Tiger Shark (Delaware Bay)		Bear Seamount
	Sand Tiger Shark (Plymouth-Duxbury-Kingston Bay)		Heezen Canyon
	Inshore 20m Juvenile Cod		Hudson Canyon
	Great South Channel Juvenile Cod		Hydrographer Canyon
	Northern Edge Juvenile Cod		Jeffreys & Stellwagen
	Lydonia Canyon		Lydonia, Gilbert & Oceanographer Canyons
	Norfolk Canyon (Mid-Atlantic)		Norfolk Canyon (New England)
	Oceanographer Canyon		Retriever Seamount
	Veatch Canyon (Mid-Atlantic)		Toms, Middle Toms & Hendrickson Canyons
	Veatch Canyon (New England)		Washington Canyon
	Cashes Ledge		Wilmington Canyon

[9] Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species have been eliminated from an area, then exotic species are included. Use local information to determine the locations of HAPC.

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APPENDIX I

FEDERAL AND STATE MUTUAL AGREEMENT LETTERS

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-----Original Message-----
From: Warner, John [mailto:john_warner@fws.gov]
Sent: Friday, May 09, 2014 8:36 AM
To: Kam, Shannon B CIV NAVFAC MIDLANT, PWD Newport
Subject: Re: Request for Comments

Shannon - As you know, due to staff limitations we have been unable provide review Naval Station Newprt's IMRMP. However, based on the e-mail from Jay Osenkowski of Rhode Island DEM, dated April 29, 2014, we anticipate that the INRMP sufficiently addresses natural resource issues at the Station. We have no further comment on the INRMP.

Let me know if you have any questions - John Warner

On Mon, May 5, 2014 at 1:33 PM, Kam, Shannon B CIV NAVFAC MIDLANT, PWD Newport <shannon.kam@navy.mil> wrote:

Good Afternoon Mr. Warner,

I am following up one last time on a letter that was sent to your office on March 17, 2014 requesting your review and comments on an Integrated Natural Resources Management Plan (INRMP) for Naval Station Newport in Newport, RI. I have attached a copy of the letter for your information; and I have also attached an email that was sent on 21 April 2014 to follow up on this letter.

The Navy is preparing the final INRMP which we will provide for your review and concurrence. We were hoping to receive your comments in advance of this document. We will be moving forward with the final revisions to the document and have received comments from both the National Marine Fisheries Service and the Rhode Island Department of Environmental Management, Division of Fish and Wildlife. This will be the final request for comments from your agency. I am hopeful that you can provide any comments or a negative response to this request by close of business on Friday, May 9, 2014. Please advise if you have any questions. Thank you for your continued support with this plan.

Respectfully,
Shannon Kam

____

John P. Warner
Assistant Supervisor, Conservation Planning Assistance and Endangered Species New England Field Office, U.S. Fish and Wildlife Service
70 Commercial Street, Suite 300
Concord, NH 0330-5087
phone: 603-223-2541, Ext 15
fax: 603-223-0104

From:	Osenkowski, Jay (DEM)
To:	Kam, Shannon B CIV NAVFAC MIDLANT, PWD Newport; John_Warner@fws.gov; Mary.A.Colligan@noaa.gov
Cc:	Buchanan, Susan; Carawan, Emmett CIV NAVFAC MIDLANT, EV; Dorocz, David D CIV NAVFAC MIDLANT, PWD Newport; Raithel, Christopher (DEM)
Subject:	RE: Comments on Naval Station Newport''s INRMP
Date:	Tuesday, April 29, 2014 8:39:58 AM

Shannon-

The staff of the RI Division of Fish and Wildlife have reviewed the draft Integrated Natural Resources Management Plan for Naval Station Newport and have no substantial objection or changes to offer at this time. Naturally, we may assume that additional biological inventory may produce records of additional species on the Naval Base. However, given the past land-use of the base and its juxtaposition on Aquidneck Island, it is not expected to harbor species that are locally or regionally rare.

We would like to offer a point of clarification in that the available narratives for the Rhode Island Natural Heritage Program (RINHP) files of rare species are not explicit enough with respect to birds. The RINHP files were designed to track only nesting locations for rare birds. Even though some listed species occur on the Navy Base and are mentioned in the management plan, these occur only as transients during migration (e.g., Northern Harrier, Sharp-shinned Hawk) and are not rare or vulnerable during that season.

We appreciate the opportunity for comment. If you have any questions please do not hesitate to contact Chris Raithel of my staff either by email (Christopher.raithel@dem.ri.gov) or phone 401-789-0281.

Sincerely,

Jay Osenkowski

Jay Osenkowski - Deputy Chief
Rhode Island Department of Environmental Management
Division of Fish and Wildlife
277 Great Neck Rd
West Kingston, RI 02892
P: 401-789-0281
F: 401-783-7490

-----Original Message-----
From: Kam, Shannon B CIV NAVFAC MIDLANT, PWD Newport
[mailto:shannon.kam@navy.mil]
Sent: Monday, April 21, 2014 2:12 PM
To: John_Warner@fws.gov; Osenkowski, Jay (DEM); Mary.A.Colligan@noaa.gov
Cc: Buchanan, Susan; Carawan, Emmett CIV NAVFAC MIDLANT, EV; Dorocz, David D CIV NAVFAC MIDLANT, PWD Newport

Subject: Comments on Naval Station Newport's INRMP

Good Afternoon,

I am following up on a letter you should have received from my office dated March 17, 2014. The Navy has requested your assistance to provide comments on our draft Integrated Natural Resources Management Plan. We will be finalizing this plan and requesting your concurrence on the plan. It has been just over one month since you should have received the request for comments and the document. Can you please advise on whether or not you have the ability to provide comments on the plan in order to assist the Navy; and if so, please provide a timeline of when we can expect to receive your comments. Thank you for your continued support with this project. Please advise if you have any questions or if I can be of assistance in any way.

Thank you.
Shannon Kam

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JUN 28 2013

Shannon Kam
Naval Station Newport
Environmental Division
Building 1CC
1 Simonpietri Drive
Newport, RI 02841

Re: Information on Species Listed Under the Endangered Species Act at Naval Station Newport, Newport, Rhode Island

Dear Ms. Kam,

This is in response to your e-mail dated June 14, 2013 regarding the United States Navy's Integrated Natural Resources Management Plan at Naval Station (NAVSTA) Newport in Newport, Rhode Island. The project site is located along the west side of Aquidneck Island in Narragansett Bay at NAVSTA Newport. The proposed project will consist of identifying and providing management strategies for the natural resources of this station.

Several listed species of whales occur seasonally in the waters off of Rhode Island. Federally endangered North Atlantic right whales (*Eubalaena glacialis*) are found off the coast of Rhode Island from December 1 – June 30. Federally endangered humpback whales (*Megaptera novaeangliae*) are found off the coast of Rhode Island from March 15 – November 30. Fin (*Balaenoptera physalus*), Sei (*Balaenoptera borealis*) and Sperm (*Physter macrocephalus*) whales are also seasonally present in New England, however, due to the depths and near shore location, listed marine mammals are unlikely to occur in the action area.

Several species of threatened and endangered sea turtles occur seasonally in New England waters. The sea turtles in northeastern nearshore waters are typically small juveniles with the most abundant being the federally threatened Northwest Atlantic Distinct Population Segment (DPS) of loggerhead (*Caretta caretta*) followed by the federally endangered Kemp's ridley (*Lepidochelys kempi*). Loggerhead turtles have been found to be relatively abundant off the Northeast coast (from near Nova Scotia, Canada to Cape Hatteras, North Carolina). Loggerheads and Kemp's ridleys have been documented in waters as cold as 11°C, but generally migrate northward when water temperatures exceed 16°C. Federally endangered leatherback sea turtles (*Dermochelys coriacea*) are located in New England waters during the warmer months as well. While leatherbacks are predominantly pelagic, they may occur close to shore, especially when pursuing their preferred jellyfish prey. These species are typically present in New England waters from June 1 – November 1. Green sea turtles *(Chelonia mydas)* may also occur sporadically in New England waters, but those instances would be rare.

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All species of sea turtles noted above are typically present in New England waters from June 1 – November 1. You can find more information on listed sea turtle species at: http://www.nmfs.noaa.gov/pr/species/turtles/.

Atlantic sturgeon occur in estuarine and marine waters along the U.S. Atlantic coast and may be present in Narragansett Bay. The New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs of Atlantic sturgeon are endangered; the Gulf of Maine DPS is threatened. Individuals originating from any of these DPSs could occur in the project area. You can find more information on sturgeon species at: http://www.nero.noaa.gov/prot_res/esp/index.html.

Candidate Species
Candidate species are those petitioned species that we are actively considering for listing as endangered or threatened under the ESA, as well as those species for which we has initiated an ESA status review that it has announced in the *Federal Register*. "Candidate" status does not carry any procedural or substantive protections under the ESA. Two candidate species, alewife and blueback herring, can occur in the project area. You can find more information on these species in the Federal Register notice that announced this decision: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr76-67652.pdf.

As listed species are likely to be present in the vicinity of the proposed project, a consultation, pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, may be necessary. As project plans develop, we recommend you consider the following effects of the project on sea turtles and sturgeon:

- Effects of increased suspended sediment;
- Suspension of contaminated sediments;
- Discharge of any other pollutant;
- Loss of prey;
- Any impacts to habitat or conditions that make affected water bodies suitable for these species and,
- Effects of underwater sound pressure waves.

The Navy will be responsible for determining whether the proposed action is likely to affect listed species. When project plans are complete, the Navy should submit their determination of effects, along with justification for the determination, and a request for concurrence to the attention of the Section 7 Coordinator, NMFS, Northeast Regional Office, Protected Resources Division (PRD), 55 Great Republic Drive, Gloucester, MA 01930. After reviewing this information, NMFS would then be able to conduct a consultation under section 7 of the ESA.

Should you have any questions about these comments or about the section 7 consultation process in general, please contact Dan Marrone at (978)282-8465 or by e-mail (Daniel.Marrone@noaa.gov).

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

Ec: Marrone, NER/PRD
File Code: Sec 7 Tech Assist 2013-Navy Integrated Natural Resources Management Plan

APPENDIX J

ENVIRONMENTAL ASSESSMENT (EA) AND FONSI

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ENVIRONMENTAL ASSESSMENT FOR IMPLEMENTATION OF THE INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Naval Station Newport
Newport, Rhode Island

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1.0 INTRODUCTION

The Environmental Assessment (EA) of the Integrated Natural Resources Management Plan (INRMP) is developed to ensure that implementation of the INRMP for Naval Station (NAVSTA) Newport will be consistent with all sections of the National Environmental Policy Act (NEPA), Executive Orders and other Laws and Regulations related to environmental protection and coordination. The purpose of the INRMP is to provide cooperative and complementary management of the land, fish and wildlife resources on the installation. The overall goal of integrated natural resource management is to protect, conserve, and preserve natural resources while providing a safe and useful environment for the military mission and allowing public use of renewable natural resources in an environmentally sound manner. NAVSTA Newport encourages public use in less sensitive areas.

1.1 PROPOSED ACTION, PURPOSE, AND NEED

1.1.1 Proposed Action

This EA focuses on the proposed implementation of the natural resource management and protection strategies as presented in the Final Draft of the INRMP, dated September 2001. The Navy is required to develop and implement an INRMP for all facilities under its jurisdiction. This assessment focuses on NAVSTA lands and facilities in Newport, Middletown and Portsmouth, Rhode Island, including the Naval Undersea Warfare Center (NUWC) in Middletown, Gould Island in Jamestown and Fort Adams in Newport. More detailed information for the area and site locations is presented within Section 1.2 of this report.

This report focuses primarily on the implementation of the INRMP, and does not address any other potential impacts from specific operations or construction activities on NAVSTA property. One alternative, "no implementation of the INRMP," has been examined in this EA. Analysis of other alternative actions to implementation of the INRMP has been limited due to the non-invasive nature of the INRMP and land use characteristics. Natural resources on NAVSTA lands have been intensely modified by major construction activities and operations for many years, and in fact, there are very few areas of natural undisturbed or unmodified lands and habitats existing in the area. Most strategies and practices recommended within the INRMP are protective in nature and focused primarily on impact avoidance and monitoring, rather than intense management practices. Unlike other larger military facilities, NAVSTA properties are small in size with an intense history of development and little or no unaltered natural resources. The major land use category and cover is industrial, military support and operations, and administration.

1.1.2 Military Purpose

The Secretary of Defense, through 32 CFR 190, Integrated Natural Resources Management Program, and DODDIR 4715.DD-R of April 1996, has established a program for integrated natural resources management. OPNAV Instruction 5090.1B, the Navy's Environmental and Natural Resources

Program Manual, implements these provisions. The purpose of the OPNAVINST 5090.1B is to set detailed requirements and procedures to be followed by shore activities to ensure compliance with a wide variety of state and federal laws, regulations, and Executive Orders concerning use, management, and protection of natural resources. The INRMP provides practicable, technical and administrative guidelines for managing the natural resources at NAVSTA. Project plans are conducted in accordance with the Navy's OPNAVINST 5090.1B Environmental and Natural Resources Program Manual and the Sikes Act.

The goal of natural resource management at NAVSTA Newport is to preserve and enhance ecosystem integrity, and to sustain both biological diversity and continued availability of those resources for military and other human uses. The goal of the INRMP is to survey, evaluate conditions, and identify natural resources at NAVSTA sites that fall within the purview of laws, regulations, and Navy policy. The INRMP will also evaluate how NAVSTA Newport's activities affect natural resources, both with respect to direct management of the resource and consequential effects of performing the basic mission at the site. Additionally, the Sikes Act requires installations to provide for multipurpose uses and public access unless it would be inconsistent with mission requirements.

1.1.3 Summary of Major Laws Applicable to Integrated Natural Resources Management

The following is a summary of major laws that govern natural resources management. For a complete description of applicable laws, refer to OPNAVINST 5090.1B.

1.1.3.1 Environmental Policy at the Federal Level

National Environmental Policy Act of 1969 (NEPA) - This law requires preparation of comprehensive environmental documentation for construction projects, or other federal actions that may affect the environment. NEPA does not mandate results, but simply prescribes a process for decision-making. The law does not require that the most environmentally sound alternative be selected, but only that the decision be informed to assure environmental factors and other possible alternatives have been considered and that the project has been carefully thought out. Different levels of documentation are required depending on potential impact. The lowest level of documentation is a Categorical Exclusion (CATX). The CATX is used for routine activities that have been established to have no significant environmental impact. The next highest level is an Environmental Assessment (EA). The EA determines if the project will result in any significant impacts to the environment. Once it is known that impacts will result, an Environmental Impact Statement (EIS) is prepared. A list of CATXs is provided in the OPNAVINST 5090.1B. This report presents the assessment of the proposed action of implementation and alternatives to the INRMP.

1.1.3.2 Laws Governing the Protection/Management of Waters, Wetlands and Coastal Areas

Rivers and Harbor Act of 1899 - The law was established to assure that waterways of the US are properly maintained in a navigable condition. Under Section 10 of the act, any work in waters of the US, that is located in or that may interfere with navigation, is prohibited unless a permit is obtained. The Army Corp of Engineers regulates this section of the act and is responsible for issuing permits. Any project that proposes construction of a structure in the water requires a permit under this law. **Federal Water Pollution Control Act (Clean Water Act)** - Section 401 of the act requires a water quality certification, or waiver, for activities that may adversely affect the quality of any open water body. The governing state agency, the State of Rhode Island Department of Environmental Management, or RIDEM in this case, has jurisdiction for the water quality certification program. Under the state program, all water bodies of the state are rated for water quality. Proposed activities must be evaluated to ensure that the determined water quality rating will not be degraded.

Section 402 of the law also established the National Pollution Discharge Elimination System (NPDES) permitting program to control discharges from point sources. The US EPA is responsible for this program but has delegated this authority to the State of Rhode Island. Rhode Island implements this program through the Rhode Island Pollutant Discharge Elimination System (RIPDES). The Navy has a general permit under this program to discharge storm water as an industrial activity. Permits are also required for stormwater discharge associated with construction activity for projects that involve greater than 5 acres of site disturbance.

Section 404 of the Clean Water Act regulates the discharges of dredge and fill material in waters of the US, including wetlands areas. The Army Corps of Engineers has jurisdiction for reviewing dredge and fill projects and issues the permits. RIDEM also has jurisdiction for freshwater wetland areas, and a state permit is also required for any work that takes place within or near wetlands areas, whether the activity involves filling or not.

Coastal Zone Management Act of 1972 - This law was designed to protect areas in coastal zones and to reduce the impacts of coastal development. The law requires construction projects within the coastal zone area (defined differently by different states) to incorporate erosion and sediment control and to control stormwater runoff. The State of Rhode Island Coastal Resources Management Council (CRMC) issues permits for activities within the coastal zone. In Rhode Island the coastal zone is defined as any area within 200 feet of any coastal feature. Recently, through an agreement with the RIDEM, the CRMC has taken jurisdiction over some freshwater wetland areas hydrologically connected to coastal features. Federal facilities are exempt from coastal zone permits. However, the act requires review of Navy projects that might affect the coastal zone under the Federal Consistency Determination program. As allowed under the program, a General Consistency Determination can be used to facilitate maintenance and other routine projects.

1.1.3.3 Laws Governing the Protection/Management of Wildlife

Endangered Species Act of 1973 - This act provides for listing of endangered (in danger of extinction) and threatened (likely to become endangered) species of plants and animals, and designation of critical habitat for animal species. Federal agencies are prohibited from taking any action that would adversely affect any critical habitat. Coordination/consultation is required with federal and state fish and wildlife agencies for projects that may affect endangered species.

Marine Mammal Protection Act of 1972 - This act prohibits the taking (including any harm or harassment) of marine mammals in the US or the high seas without a permit. Permits can be obtained for scientific research, public display or other educational purpose, or for that which is incidental to commercial fishing activities. Prohibited activities include the taking or collecting of dead animals by negligent or intentional operation of a vessel or other means, and includes feeding or attempting to feed such animals in the wild.

Migratory Bird Treaty Act - This act prohibits taking or harming of migratory and certain other birds, their eggs, nests, or young without the appropriate permit. There are very few birds that are not covered under this law. Therefore, it should be assumed that the law applies to all bird species. This law requires permits be obtained for any takings and records of any takings must be maintained. NAVSTA applied for a depredation permit for Canada geese and gulls from the US Fish and Wildlife Service in June 2001.

Sikes Act (Conservation Programs on Military Installations) - The Sikes Act requires military installations to manage natural resources, and to provide services necessary for management of fish and wildlife resources. Installations are required to provide for multipurpose uses and public access unless it would be inconsistent with mission requirements. The act also requires that hunting, fishing and trapping be in accordance with the fish and game laws of the state in which the installation is located. Cooperative agreements are authorized with state and local governments and non-governmental organizations, and calls for each party to provide matching funds to carry out natural resource projects.

1.1.3.4 Other Natural Resources-Related Laws

Outdoor Recreation Programs Organic Act - This act defines a program for managing lands for outdoor recreation. Federal departments are required to consult with the Secretary of the Interior on plans and activities relating to outdoor recreation, and to manage outdoor recreation programs in general conformity to the nationwide plan. The law encourages public use and benefits from outdoor recreation. It also allows for cooperative agreements with state and local governments as well as private organizations, and provides for acceptance of donations of funds for recreational purposes.

1.1.4 Military Mission

NAVSTA Newport was established on 1 October 1998. It's primary mission is to maintain and operate facilities and provide services and material to support operations for tenant activities, supported activities and visiting fleet units, and to perform such other functions and tasks as may be directed by higher authority. NAVSTA Newport serves as the Navy's on-scene manager for the leased Navy properties on the east side of Narragansett Bay. NAVSTA provides logistic support for the entire Newport Naval Complex of more than ten supported activities including the Naval War College, NUWC, the Naval Health Care New England, the Naval Ambulatory Care Center, and the Naval Dental Center Northeast. In addition, NAVSTA provides support to more than 25 tenant activities including the Naval Justice School and Navy College, and several non-federal activities and home-ported ships. NAVSTA is tasked, by the Commander-in-Chief, US Atlantic Fleet, as the local area coordinator for naval activities in Rhode Island and as the Senior Officer Present Afloat in support of homeport or visiting ships.

1.1.5 Natural Resource Management Objectives

Within constraints of the military missions, within limits of available resource capabilities, and in coordination with other natural resource disciplines, objectives of the INRMP are to:

- Utilize and care for the natural resources in the combination that best serves the present and future needs of the US, the Navy community, and the public
- Comply with Department of Defense (DOD) and Navy Integrated Natural Resource Management program guidelines and satisfy mandated responsibilities

- Focus on the Narragansett Bay shoreline, marine mammals/turtles, non-point source pollution, and environmental awareness
- Conserve fish and wildlife, land, forest, and recreational resources as vital components of the natural resources program
- Protect and conserve threatened and endangered plants and animal species and their dependent habitats

1.1.6 Credit Statement for Cooperating Agencies

The following are acknowledged for their coordination and participation in the development of the EA of the INRMP:

Rhode Island Department of Environmental Management
Mr. Rick Enser, Division of Planning and Development, Natural Heritage Program
Mr. Christopher Powell, Division of Fish Wildlife & Estuarine Resources
235 Promenade Street
Providence, RI 02908

Mr. Ken Anderson, P.E.
Coastal Resources Management Council
Oliver Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879

1.2 SITE CHARACTERISTICS

1.2.1 Location

NAVSTA is located on Aquidneck Island in Narragansett Bay in the southeastern Rhode Island communities of Newport, Middletown, and Portsmouth (see Figure 1). Aquidneck Island, measuring sixteen miles from north to south and less than five miles in width, is surrounded by Narragansett Bay to the west, Rhode Island Sound to the south, the Sakonnet River to the east and Mount Hope Bay to the north. The 1,341-acre complex is situated along the west shore of the island with over ten miles of frontage on the East Passage of Narragansett Bay. The complex is located partially within the City of Newport and extends northward incorporating the entire western shoreline of the Town of Middletown and about one-fifth of the Town of Portsmouth's western shoreline. The communities of Aquidneck Island recognize the unique economic and quality-of-life contributions that NAVSTA brings to the island and consider the Navy the (unofficial) fourth island community (Newport Naval Complex, 1990).

NUWC, one of NAVSTA's more than 10 supported activities, transferred all Class 1 property (land) to NAVSTA in October 1998. NUWC's 1997 Integrated Natural Resources Management Plan was reviewed as part of this study and is included as Appendix 5.F of the INRMP.

1.2.2 Description

The NAVSTA community guide plan was prepared in 1990 to facilitate communications for infrastructure development relative to orderly growth of Aquidneck Island communities. The major goal running throughout the guide plan is achieving the orderly accomplishment of the assigned military mission, minimizing the effects on the natural and socio-economic environment and the local communities. All other goals and policies hinge upon the accomplishment of this prime objective. The Navy also has open space goals, to the extent possible, to preserve open areas along Narragansett Bay and to protect areas that serve valuable ecological and aesthetic functions. The Navy should prioritize these goals since conservation of open space and natural resources provides an important ecological function, especially where viable alternatives exist (Newport Naval Complex, 1990).

NAVSTA Newport is separated into eight distinct management areas for analysis, presented in Figure 1. Table 1.1 presents the acreage of the eight management areas including information on linear feet of shore frontage on Narragansett Bay (including Coasters Harbor and Coddington Cove). Zoning for NAVSTA is presented in the Comprehensive Plan (1990). Of the thirteen zones identified in the Comprehensive Plan, three are relevant to natural resource management: Open Space (OS), Environmentally Sensitive (ES), and Waterfront Recreational (WR).

Open Space - Permitted uses and descriptions include major lawn/park type areas, exterior recreational fields, tennis courts, basketball courts, ball fields, walking/exercise/running/biking trails, recreational vehicle storage, unimproved areas, limited camping, recreational areas, utility structures and crossings, small picnic pavilions, recreational support facilities for storage and offices, cemeteries.

Environmentally Sensitive - Permitted uses and descriptions include unimproved areas, environmentally controlled outdoor activities, and limited utility crossings where no other viable alternative exists.

Waterfront Recreation - Permitted uses and descriptions include recreational activities along the waterfront, marinas, boat ramps, recreational craft berthing, swimming (dependent on water classification), utility structures, sanitation pump-out facilities, playgrounds, small picnic pavilions, recreation support facilities for storage and offices, and associated parking areas.

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Table 1.1
NAVSTA Newport Management Areas

Sheet Number *	Management Area	Acreage	Narragansett Bay Frontage
1	Coasters Harbor Island	97	2.0 miles (10,636 linear feet, lf)
1	Naval Hospital	44	0.5 miles (2,507 lf)
2	Coddington Point	213	2.1 miles (11,282 lf)
3	Coddington Cove	351	1.8 miles (9,265 lf)
4	Midway	126	1.6 miles (8,611 lf)
5	Melville South	139	1.5 miles (8,123 lf)
6	Melville North	140	0.5 miles (2,486 lf)
7	Fort Adams	26	Adjacent to 0.2 miles (1000 lf)
8	NUWC Main Site NUWC Gould Island	190 15	0.5 miles
	TOTAL	**1341**	**10.7 miles**

* See Figure 2

Coasters Harbor Island

Coasters Harbor Island (CHI) represents the oldest established Navy representation in the Newport area. The dominant land use of this 97-acre island is training and education. The educational and administrative facilities of the Naval War College, the Surface Warfare Officers School Command, the Chaplain School and Communications Schools, as indicated in Figure 2 Sheet 1 are all located on the island. Also on the island are ten sets of family quarters including Quarters AA. Quarters AA is the official residence of the President of the Naval War College and has been nominated for inclusion on the National Register of Historical Places. Other historically significant buildings on the island listed on the Register are Buildings 1, 1A, and 10 of the Naval War College. The Bachelor Officer Quarters (BOQ), a fire station, the Marine Detachment administrative office, a childcare center, the Commissioned Officers Club, and a gym are located within this site. A helicopter landing pad and marina used by recreational boaters is located at the southern end of Coasters Harbor Island (Newport Naval Complex, 1990). Zoning on Coasters Harbor Island relevant to natural resource management includes open space at Katy Field, Lawrence Field and Dewey Field. The marina located at the southern peninsula of Coasters Harbor Island is zoned waterfront recreation. The eastern shoreline of Coasters Harbor Island, south of Gate 2 is zoned as environmentally sensitive and open space.

Naval Hospital

The Naval Hospital, located on 44 acres at the southern end of the contiguous portion of the NAVSTA property line as indicated in Figure 2 Sheet 1, provides inpatient and outpatient care respectively for military and other authorized personnel in the geographical region. A stone pier is located on the shoreline at Biello Road. The shoreline south of the Gate 1 access road is zoned an environmentally sensitive area.

Coddington Point

The Coddington Point area is a campus style setting which has student dorms, dining halls, academic facilities, and enlisted housing units, as indicated in Figure 2 Sheet 2. Personnel Support and Training are the dominant land uses. Hart Field and Connell Manor, two family housing developments on either side of Coddington Highway, are outside the secured perimeter. These areas contain 140 enlisted housing units. Coddington Park Housing contains 6 duplex units and 6 garages. Two family housing areas, Cloyne Court and Farragut Field, located north of the Naval Hospital, contain 10 officer and 40 enlisted family units.

Bishops Rock and the adjacent peninsula is zoned as open space. The shoreline between Bishops Rock and the bulkhead in Coddington Cove is zoned as an environmentally sensitive area.

Coddington Cove

The Coddington Cove area is the location of NAVSTA's waterfront operations, public works functions, and supply and storage facilities, which make up the industrial area, as indicated in Figure 2 Sheet 3. Approximately 41 acres of the waterfront area was previously leased to the Rhode Island Port Authority and Economic Development Corporation who, in turn, subleased the property to Derecktor Shipyard, a commercial privately owned shipyard. The Derecktor Shipyard portion of Coddington Cove was placed in the Installation Restoration Program when environmentally degraded soil, groundwater and marine sediments where identified when the Derecktor Shipyard ceased to operate.

The Coddington Cove beach shoreline and the adjacent palustrine emergent wetland is zoned environmentally sensitive. Prichard Field and tennis courts, east of Gate 11, are zoned open space.

The Newport Secondary rail line, owned by the Rhode Island Department of Transportation, parallels the shoreline between Melville and Coddington Cove. With limited exceptions, the tracks effectively separate Navy-owned frontage on Narragansett Bay from more extensive Navy-owned property along the Defense Highway.

Midway

The Midway area extends north along the coastline of Aquidneck Island from Coddington Cove to Melville and includes four areas: Greene Lane housing, Fire Fighting Training at the former Tank Farm 5, the Town of Middletown transfer facility, and the former McAllister landfill, as indicated in Figure 2 Sheet 4. The 105+ acre housing area contains 600 family housing units for an average density of five units/acre. A ball field, recreation center, and convenience store are located within this area. An overflow parking area used to store abandoned vehicles is located in the southwest corner of Greene Lane housing.

The Midway area includes the area west of Defense Highway along the shoreline and is primarily open space. The Middletown Comprehensive Plan identifies land use in this area as forest and brushland (1992). The Fire Fighting Training Center and McAllister Point, a former Navy landfill, are two of eight NAVSTA Newport Installation Restoration (IR) program sites. Former Tank Farm 5 is now a fire fighting training facility. This area contained eleven underground fuel tanks. These tanks have been imploded and backfilled, thus they are no longer intact.

The former McAllister Point Landfill located on the western shore of Aquidneck Island adjacent to Narragansett Bay is approximately 10.8 acres. Its proximity to the bay provides the potential for various chemicals and debris previously disposed in the landfill to migrate to the bay. The site has been capped and a revetment of 1 to 4 foot diameter stones has been placed over the liner on the seaward landfill slope. The purpose of the revetment is to stabilize the slope and protect it against wave action. Dredging is underway offshore to remove contaminated sediments.

McAllister Point is zoned environmentally sensitive. The property west of Defense Highway, from the Coddington Cove breakwater north to Greene Lane, including shoreline north and south of McAllister Point, is zoned open space. Gomes Brook, north of the Fire Fighting Training Center, is an environmentally sensitive area. The shoreline north of the Midway pier is open space.

Melville-South

Former Tank Farms 3 and 4, and the Carr Point recreation area are located in Melville-South, as indicated in Figure 2 Sheet 5. Former Tank Farm 3 was operated by the Defense Fuel Support Point (DFSP). Tank Farm 3 contains seven underground fuel tanks; Tank Farm 4 is an abandoned fuel farm that contained twelve underground fuel tanks. All tanks have been imploded and backfilled. Former Tank Farm 3 is undergoing a site investigation and former Tank Farm 4 is currently undergoing remediation.

The entire shoreline, including Carr Point and east to Defense Highway, is zoned open space. Lawton Brook, north of former Tank Farm 3, is an environmentally sensitive area.

Melville-North

The Melville-North area, includes 200 units of family housing, a 40 unit mobile home park, Tank Farms 1 and 2 and the DFSP north fueling pier (see Figure 2 Sheet 6). The recreation area south of the Melville housing area is zoned open space.

Fort Adams

Approximately 26 acres of land at Fort Adams have been developed for 110 family housing units, as indicated in Figure 2 Sheet 7. This area, located southwest of Newport Harbor, is not contiguous with NAVSTA. The Fort Adams State Park bounds the Navy property on the north, east and south; Narragansett Bay is located to the west. In addition the Fort Adams area includes a childcare center, a Navy recreational building, a fire station, and a historic Army cemetery. Eight of the active Navy houses at Fort Adams, which in total include fifteen units, are on the National Register of Historic Places. The southern area of Jackson Road is in an historic district.
The historic Army cemetery at Fort Adams is zoned open space.

Main Site (NUWC)

The NUWC site lies entirely within the town of Middletown, Rhode Island, in Newport County. It is located on the western coast of Aquidneck Island, approximately four miles north of the City of Newport. This island, measuring sixteen miles from north to south, is less than five miles in width. The East Passage of Narragansett Bay is located to the west, Rhode Island Sound to the south, the Sakonnet River to the east and Mount Hope Bay to the north (see Figure 1).

The NUWC area consists of approximately 190 acres contiguous to the northeast edge of Coddington Cove, and has approximately 2,500 linear feet of pier frontage on Narragansett Bay; (Stillwater Basin occupies approximately 1000 linear feet of Coddington Cove shoreline); the remainder of Navy shoreline is NAVSTA owned and managed. The site is intensely developed as a campus-style Research and Development office park with labs and offices ranging from multi-story structures to single-story buildings up to fifty years in age. See Figure 2 Sheet 8.

Operations extend through approximately 150 of the 190-acre parcel. The central area consists of research, and development buildings, and administrative buildings. There are older lab buildings, as well as parking areas along the periphery of the site. The area between buildings consists of roads, parking, and mechanical and other support equipment. Lawns and ornamental shrubs dominate the landscaped areas associated with these buildings. The Deerfield area, an undeveloped buffer along the northern and eastern boundaries of the site, surrounds a wetland area. Land use/cover in this area is predominated by scrub/shrub vegetation. NUWC maintains the frontage on Stillwater Basin, a protected pier system located within Coddington Cove on Narragansett Bay.

Gould Island (NUWC)

The Gould Island area is located approximately one and one-half miles west of Aquidneck Island and approximately one mile east of Conanicut Island (Jamestown) in the East Passage of Narragansett Bay. Gould Island is approximately one-half mile long by one-quarter mile wide, and is approximately fifty-two acres in size. See Figures 1 and 2 Sheet 9. NUWC owns and maintains the northern end of the island; the southern end of the island is owned by RIDEM and designated as a Formerly Utilized Defense Site (FUDS).

Description

The majority of the NUWC, Gould Island property is located on 14.5 acres on the northern end of Gould Island. The primary use of the property is for occasional torpedo testing. NUWC weapons systems testing area is located in the East Passage immediately north of Gould Island and is a potential site for testing of countermeasures. No personnel are permanently based on the island. All buildings on Gould Island have been demolished with the exception of Building 35. This building is located on the northern manmade "arm" of the island. Building 35 contains two torpedo elevators, a firing pier, three diesel-powered generators, storage space, and office space. Test activities and recurring pier and piling maintenance activities take place in the area around the active portion of Building 35 at the northernmost tip of the island. Building 35 has a footprint of approximately 10,000 square feet. See Figure 2 Sheet 9.

The shoreline at Gould Island is man-made. The shoreline of the northern "arm" containing Building 35, is deteriorated sheet piling. The sheet piling has rusted away and backfill has slumped through, causing sink-holes on the surface at numerous locations. A granite block revetment was observed along the east shoreline; a concrete block revetment was observed along the west shore.

Paved areas include streets (A, C, D, and E) and an extensive area north of former Building 32. The building foundation of the south end of Building 35 is still in place. Sufficient deterioration of the pavement has enabled extensive scrub and shrub vegetation to grow up on these streets, virtually impeding passage.

RIDEM maintains most of the remaining land, the southern end, of the island. Their portion is a FUDS.

1.2.3 Adjacent Land Use

Waters of the East Passage of Narragansett Bay bound all eight NAVSTA Newport management areas on the west. The land areas adjacent to NAVSTA consist of more densely developed municipal, commercial, and recreational land to the south, in Newport, with lower density residential, recreational, and agricultural land use to the north in Middletown and Portsmouth.

In Newport, mixed commercial and residential land uses abut the Naval Hospital, Coddington Point, and Coddington Cove project areas along Connell Highway. Commercial, Industrial and Residential zoning abuts this area (City of Newport, 1991). Fort Adams is zoned Residential by the City of Newport (City of Newport, 1991). Fort Adams State Park, owned and operated by RIDEM, abuts Navy property.

According to the Middletown Comprehensive Plan, land adjacent to NAVSTA Newport is developed for high-density residential, agricultural and recreational use (1992). Property adjacent to NAVSTA Newport in Middletown is zoned Limited Business and Residential along Coddington Highway; General Business, Limited Business, Office Business, and Residential along Route 114 in the vicinity of Gate 17; and Open Space and Residential adjacent to the Midway area of the complex (Town of Middletown, 1992).

In Portsmouth, abutting land is zoned for Residential, Waterfront District, Heavy Industrial, and Open Space with a wetland overlay district along the shoreline and in the vicinity of streams (Town of Portsmouth, 1992). Land use in this area is developed at a lower density than in more southerly sections of NAVSTA Newport.

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1.3 EXISTING ENVIRONMENTAL CONDITIONS

1.3.1 Topography

The Narragansett Basin, composed of sedimentary rock, covers most of eastern Rhode Island including Aquidneck Island, and was formed some 300 million years ago. Weathering and erosion of the rock from the leveling effect of glaciation have resulted in the gently rolling terrain and rich soil ideally suited for agriculture. Farming began in the seventeenth century and has prospered through history, primarily in more rural areas of Middletown and Portsmouth. As a result, a large portion of the land was cleared and few wooded areas remain.

The topography was created through Wisconsin glaciation. Movement of glaciers gave Aquidneck Island its elongated north/south shape. As the glaciers receded they deposited silt, sand, gravel, and boulders over the existing bedrock. NAVSTA is located in the Narragansett Till Plains. Due to geologic features, the New England region has been affected by earthquakes originating in the St. Lawrence Valley. The Newport area is shown as being in a zone having a moderate probability of earthquake activity (Town of Middletown, 1992).

Bedrock under the site is known as the Rhode Island Formation, consisting of meta-sandstone, meta-conglomerate, schist, carbonaceous schist, and graphite, deposited during the Pennsylvanian era (Hermes et. al., 1994). The Narragansett Basin is an ancient north/south trending structural basin with a major axis of approximately 50 miles and a maximum width of approximately 30 miles. The basin extends approximately 10 miles into Rhode Island Sound. It is a topographic depression consisting of Pennsylvanian Sedimentary Facies, underlain and surrounded by pre-Pennsylvanian, igneous, and metamorphic rocks. Overlaying the Pennsylvanian sediments are glacial deposits which are the parent material for the area soils.

The strata of Narragansett Bay are approximately 12,000 feet in thickness and consist of carboniferous series that have been deformed into a series of folds. The greater part of NAVSTA consists of a series of shale and slate coal-bearing beds separated by sandstones and conglomerates.

Land at NAVSTA ranges from sea level to 175 feet in elevation as indicated in Figure 1 and Figure 2. The existing topography consists of gentle to moderate sloping terrain from the shoreline of Narragansett Bay up to the middle of Aquidneck Island. Drainage from the watershed area flows to the bay via three major streams (Gomes, Normans, and Lawton Brooks), two smaller unnamed streams both (between Normans and Lawton Brook), and a number of other small streams and/or drainage courses which are subject to stormwater discharge. These streams and drainage courses flow through culverts under Defense Highway. NAVSTA is located along the west shore of Aquidneck Island; a north-south ridge along Route 138 defines the drainage basins of Aquidneck Island; drainage west of Route 138, including drainage for NAVSTA, discharges to the East Passage of Narragansett Bay, while drainage east of Route 138 discharges to the Sakonnet River.

1.3.2 Soils

The soils in the area were formed by glacial deposits of till and outwash. Glacial till consists of a mixture of unsorted particles ranging in size from large boulders to clay particles. Glacial outwash consists of stratified sand, gravel, and cobbles deposited during glacial melting. Glacial deposits, derived mainly from shale, sandstone, and conglomerates, overlay the bedrock anywhere between 1 to 150 feet. Most local soils are subject to a high seasonal water table that presents certain problems for community development. This is generally true of all of the Bay Island communities (Conanicut and Aquidneck Islands) whose geologic history is similar. The land is generally rocky and covered by a relatively thin layer of soil.

Historically, forest cover evolved from the glacial tills consisting of chestnut, white and pitch pines, cedar, white, red, scarlet, chestnut and black oak, walnut, hickory, beech, birch, and maple. According to the USDA Forest Services, southern Rhode Island lies within the Eastern Broadleaf forest oceanic province and the oak-chestnut-yellow poplar subregion (Bailey, 1995). The major soils formed under this forest cover are the Newport, Narragansett, and Pittstown silt loams and loams, and the Merrimac, Birchwood and Windsor sandy loam series.

Udorthents-Urban Land (UD) and Urban Land (UR) - The UD soil series consists of moderately well drained to excessively drained soils comprised of fill material and are covered by buildings and pavement. Soils were filled or leveled for construction of buildings, recreational facilities, and paved roads. The permeability and stability of this series is variable. UR consists mostly of sites for buildings, paved roads, and parking lots. Extensive areas of NAVSTA are mapped UD or UR as indicated below:

- Land east of Piers 1 and 2 at Coddington Cove (UR), see Figure 2 Sheet 3
- Majority of Coasters Harbor Island (UR, UD), see Figure 2 Sheet 1
- The entire peninsula of Coddington Point (UD), see Figure 2 Sheet 2
- North and east of the Defense Highway in the Coddington Cove area (UD), see Figure 2 Sheet 3
- Midway area (including former McAllister Point landfill) along the Narragansett Bay shoreline south of Gomes Brook (UD), see Figure 2 Sheet 4
- In the area developed for Greene Lane Housing, Tank Farms 1 and 2, former Tank Farms 3, 4, and 5, and the DFSP in Melville (UD), see Figure 2 Sheets 5 and 6

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Table 1.2
Soil Association Locations

Soil Series	**Drainage Description**	**Map Location** Figure 2 Sheets 1-9
Beaches (Ba)	well drained	Melville, Midway
Canton (CC)	well drained	Fort Adams
Merrimac (MmA)	somewhat excessively drained	Melville, Midway
Newport (NeA, NeB, NeC)	well drained	Coddington Cove, Midway, Melville
Newport (NP)	well drained	Coddington Point, Naval Hospital, Melville
Pittstown (PmA, PmB)	moderately well drained	Coddington Cove, Midway, Melville
Stissing (Se)	poorly drained (hydric)	Melville, Midway, Coddington Cove, NUWC Main Site (Deerfield area)
Udorthents-Urban Land (UD, UR)	moderately to excessively well drained	Coasters Harbor Island, NUWC Main Site and Gould Island, Coddington Point, Coddington Cove, Midway, Melville North and South.

Source: United States Department of Agriculture, Soil Conservation Service, *Soil Survey of Rhode Island, 1981*, Table 23. Wildlife Habitat Potentials

Newport Silt Loam (NeA, NeB, NeC) - NeA is found on the crests of drumlins with slopes up to 3 percent. NeB and NeC are found on the sideslopes. NeB has slopes of 3 to 8 percent and NeC has slopes of 8 to 15 percent. The Newport soil series is well drained. Permeability is moderate or moderately rapid in the surface layer and subsoil and slow or very slow in the substratum. Runoff is medium, and the available water capacity is moderate. This soil series is suitable for community development but limited mainly by the slow or very slow permeability of the substratum. Roads and streets need careful design to prevent frost heaving. The hazard of erosion is severe for NeC. Use of straw bale sediment barriers, temporary diversion and siltation basins, and quick establishment of vegetation help to control erosion of NeB soils during construction.

Newport silt loams soils are found in the Midway and Melville areas of NAVSTA as indicated below:

- The upland area between Gomes Brook and Normans Brook, along Defense Highway (mapped NeB), see Figure 2 Sheets 4 and 5
- The Lawton Brook area north of former Tank Farm 3 (NeB), see Figure 2 Sheet 5
- Steep slopes between Tank Farm 2 and the Defense Highway in Melville (NeC), see Figure 2 Sheet 6
- The Melville trailer park south of Stringham Road (NeA), see Figure 2 Sheet 6

Newport-Urban Land Complex (NP) - This Newport soil series drainage class is well drained and consists of urban land areas covered by streets, parking lots, buildings, and other urban structures. The soil texture consists of silt loam and permeability is moderate or moderately rapid in the surface layer and subsoil and slow or very slow in the substratum. Available water capacity is moderate, and runoff is medium to rapid. Areas of this series are used mainly for industrial and other urban purposes. There are limitations to community development because of the slow or very slow permeability in the substratum. Roads and streets require careful design to prevent frost heaving.

Newport-Urban Land series soils are found in the vicinity of the Naval Hospital (see Figure 2 Sheet 2), along the Ranger Road housing area, the Read Street/Jones Street housing area near Coddington Cove (see Figure 2 Sheet 3), and at the Melville housing area (see Figure 2 Sheet 6).

Beaches (Ba) - Beaches range in slope from gentle to moderate, not exceeding 15 percent slopes, and are found along the shore of estuarine systems such as Narragansett Bay. The texture of this series consists of sand, gravel, cobbles, stones, boulders, and rocks. Areas are prone to exposure during low water. Included in this soil map unit are rock outcrops and revetments.

Beaches are mapped along Narragansett Bay from the vicinity of the Normans Brook north to Melville (see Figure 2 Sheets 4, 5, and 6).

Canton-Urban Land Complex, Very Rocky (CC) - The Canton complex drainage class consists of well-drained soils and areas of urban land. This unit is usually on crests of glacial hills. Slopes range up to 15 percent. This complex is comprised of approximately 40% Canton soils, 30% urban land, and 30% rock outcrops. Typically the Canton series texture is sandy loam. The permeability is moderately rapid and available water capacity is moderate. Runoff is medium and limitations to community development are the associated rock outcrops.

NAVSTA Newport property at Fort Adams is mapped CC (see Figure 2 Sheet 7).

Merrimac Sandy Loam (MmA) - Merrimac soil drainage class is somewhat excessively drained, and slopes associated with this soil are typically less than 3 percent. Permeability of this soil is moderately rapid, runoff slow, and available water capacity moderate.

MmA is found in the higher ground east of the beach at Carr Point (see Figure 2 Sheet 5).

Pittstown Silt Loam (PmA and PmB) - PmA, with slopes up to 3 percent, is found on the crest of glacial upland hills and drumlins. PmB, with slopes between 3 and 8 percent, is found on side slopes of these hills. This soil series drainage class is moderately well drained. Permeability is moderate in the surface layer and subsoil and slow in the substratum. Available water capacity is moderate and runoff is slow. This soil series has a high seasonal water table from late fall through mid spring. This soil is suitable for community development but is limited by the high water table and slow permeability of the substratum. Roads and streets require careful design to prevent frost heaving. Poorly drained Stissing soils may be found in association with Pittstown silt loam.

Extensive areas mapped PmB are located between the Newport Secondary rail line and Connell Highway, in the Coddington Cove area (Figure 2 Sheet 3). The area incorporating Gomes Brook north of former Tank Farm 5 and south of Greene Lane (Figure 2 Sheet 4), a small area of poorly drained soil on the Portsmouth-Middletown line north of the Greene Lane Housing area, and an isolated wetland north of former Tank Farm 4 and adjacent to Carr Point (Figure 2 Sheet 5), are all mapped PmA.

Stissing Silt Loam (Se) - Stissing soils are nearly level, poorly drained (hydric), with slope range up to 3 percent. Permeability is moderate in the surface layer and subsoil and slow in the subsurface. Available water capacity is moderate and runoff is slow. This soil has a high seasonal water table near the surface from late fall through spring. The seasonal high water table and the slow permeability in the substratum make this soil poorly suited to community development.

Stissing series soils are located within the wetland adjacent to Defense Highway, southwest of Building 47 along Coddington Cove (Figure 2 Sheet 3) along Normans Brook, and south of former Tank Farm 4 (Figure 2 Sheet 5). The wetland located between the upper Melville Pond and the Melville Housing area (outside of NAVSTA property) is also mapped Se (Figure 2 Sheet 6).

1.3.3 Marine Conditions

Narragansett Bay has a water area of approximately 155 square miles and occupies an irregular series of glacially carved depressions in the sedimentary and meta-sedimentary rocks underlying the coast. The bay is a series of interconnected channels that form an estuary. Tidally driven circulation continuously mixes the south coastal saltwater with the fresh rivers entering from the north. The freshwater wedge associated with the inflow from the upper bay river gradually becomes mixed as it moves down the bay. Depending on the time of year and the phase of the tides, the freshwater runoff of Narragansett Bay has a flushing time of ten to forty days. Drainage into the bay includes the southern one-third of Rhode Island and adjacent areas of Massachusetts. Twenty-three communities lie within the basin (Shonting et. al., 1995).

Narragansett Bay has a mean depth of 27 feet. The East Passage is the primary shipping channel and has an average depth of 35 feet. It has a maximum depth of 213 feet off Castle Hill and is one of the deepest tidally scoured depressions along the north Atlantic coast (Shonting et. al., 1995). As indicated in Table 1.3, mean tidal range at Newport is 3.5 feet with extremes as high as 7.5 feet.

The winter water temperature of Narragansett Bay's East Passage approximately isothermal from the surface to the bottom, is between 41°F and 43°F. A real vertical gradient is maintained in summer with surface temperatures reaching 68°F and bottom temperatures of 59°F to 61°F. The salinity density is less seasonally dependent than temperature. The mean values over the water column range from 21 to 29 percent at the head of the bay from 29 to 30 percent at the mouth. Because of river inflow, surface water tends to be fresher than bottom water. Vertical gradients decrease toward the mouth of the bay from tidal mixing (Shonting et. al., 1995).

Table 1.3

Tidal Information at Newport, Rhode Island

	Height at Datum of Soundings Mean Lower Low Water (ft)
Mean Higher High Water	3.9
Mean High Water	3.6
Mean Low Water	0.1
Extreme Low Water	-3.6

Source: NOAA, 1995

Figure 3 presents nautical conditions identified on the NOAA chart 13221 (NOAA, 1995).

Coasters Harbor Island

Seawalls and revetment protect the shoreline of Coasters Harbor Island. The western shore is exposed to wind and fetch from the open waters of Narragansett Bay to the southwest and northwest; Conanicut Island protects Coasters Harbor Island from direct westerly winds. Island water depth immediately off-shore is approximately ten feet at mean lower low water (mllw) to the north. To the west, the shoreline drops sharply to 30 to 40 feet mllw and a gradual shoal limits water depths to 5 feet mllw to the south (NOAA, 1995). Water depths east of the island range between 2 to 10 feet mllw. A federal dredging project conducted by the Corps of Engineers in 1892 involved deepening the channel leading from Newport Harbor into the Coasters Harbor to nine feet. It also provided for cutting additional openings in the southernmost causeway located immediately north of Coasters Harbor (USACOE, 1993).

Two fixed bridges provide access to Coasters Harbor Island. Horizontal clearance is 31 feet; vertical clearance at mllw is 3 feet. At mllw, shallow water and/or exposed mud flats would limit navigation beneath the more southerly bridge.

Tidal flow west of Coasters Harbor Island ranges from 0.1 to 0.4 knots per hour and travels south at ebb flow from about one hour after high water to six hours after high water and then reverses flow up Narragansett Bay until the 12th hour after high water or low tide, respectively (RI Sea Grant, undated).

Naval Hospital

The Naval Hospital shoreline is comprised of a seawall and revetment that extends along the cobble/gravel beach bar adjacent to Newport Harbor. The shoreline is exposed during tidal fluctuation. Open water, south of Gate 10, is a subtidal dredged channel. Depth to bottom ranges between 10 and 20 feet. Tide flow ranges between 0.1 to 0.4 knots per hour and travels south at ebb flow from about one hour after high water to six hours after high water and then reverses to a northerly flow up Narragansett Bay until the 12th hour after high water respectively (RI Sea Grant, undated).

Coddington Point

The Coddington Point shoreline is a cobble/gravel beach with steep-sided slopes to upper ground. Water depth off Coddington Point shoreward of red nun buoy N "2" is less than 18 feet at mllw. West of the point red nun buoy N "16" marks “The Sisters”, a rock outcrop exposed at mean lower low water. Depths between The Sisters and Bishop Rock are typically less than 10 feet at mllw. Bishops Rock Shoal is marked by red R "14", a flashing buoy with a bell. Water depths from Bishops Rock south to Coasters Harbor Island are six feet or less at mllw.

Currents off Coddington Point generally ebb south from one to six hours after high tide, then reverse north from seven hours after high tide to low tide (12 hours after high tide). The tidal flow rate is 0.2 knots per hour on the north of Coddington Point, 0.4 knots west off the point, 0.4 to 0.6 knots west in Narragansett Bay, and 0.1 knots per hour south into Coasters Harbor (RI Sea Grant, undated).

Coddington Cove

Coddington Cove is a protected embankment formed by Coddington Point to the south and a 4000-foot rubble-mound breakwater to the north. Water depths within Coddington Cove range up to 50 feet with a reported depth of 30 feet in 1986 in the vicinity of Piers 1 and 2 (NOAA, 1995). This depth has been compromised by deposition of materials during operation of a private shipyard at Pier 1 in the 1980s. A bluff east of the point overlooks the southwest shore of Coddington Cove. Rock outcrops and steep embankments mark this thickly vegetated shoreline. A gravel/cobble beach extends from Coddington Point eastward to the industrial shorefront. The industrial shorefront is flanked by concrete and steel cofferdam seawalls, concrete block riprap, Piers 1 and 2, and breakwaters extending north to Stillwater Basin.

A predominant counterclockwise circulation pattern has been observed during all tidal stages (Brown & Root Environmental, 1996). Tidal current flow in Coddington Cove is at a maximum approximately one hour after high water at 0.3 knots per hour. Tidal flow ebbs south from zero hours to about six hours after high water and reverses north from seven hours to 12 hours after high water (RI Sea Grant, undated).

Midway

Depths between McAllister Point and the Coddington Cover breakwater are less than 18 feet mllw. Tidal flats are located immediately north of the breakwater and along the shoreline (NOAA, 1995). A gravel/cobble beach with a steeply-banked naturally-vegetated shoreline flanks the Newport Secondary rail line along the entire length of Midway with the exception of McAllister Point. The former McAllister Point landfill, an Installation Restoration (IR) site, was recently capped and riprap was placed along the shoreline. The site is currently fenced to prevent access to the steeply sloped grassed shoreline. Midway Pier, an abandoned rock-faced bulkhead, is located in the vicinity of Greene Lane. Depths north of McAllister Point are fairly uniform, dropping to a depth of 18 feet within 300 feet of shoreline.

Tidal current flow along Midway and Melville is approximately 0.5 knots per hour at the maximum, two hours after high water. A southerly ebbing flow continues from high tide to approximately six hours after high water, reversing direction to a northerly flow from seven hours to 12 hours after high water (RI Sea Grant, undated).

Melville-South

Carr Point is a landmark along the Melville-south shoreline. A gravel/cobble beach with a steeply-banked naturally-vegetated shoreline continues to flank the Newport Secondary rail line in this area with the exception of Carr Point where a recreation area is located west of the rail line. Although depths of up to 50 feet mllw are identified west of Carr Point and Weaver Cove, a shoal extends from south of Carr Point northwest to Dyer Island, limiting depths to 18 feet or less at mllw.

Melville-North

The Melville-North shoreline is limited to a concrete seawall, north fueling pier, and riprapped shoreline of the DFSP. A depth of 16 feet was reported in 1981 in the area inside the north fueling pier. Depths of 18 feet mllw were identified within the small boat basin formed by Coggeshall Point and DFSP (NOAA, 1995).

Fort Adams

The Fort Adams shoreline has fairly steep slopes with bedrock outcrops and a rocky shore with depths of 60 feet mllw within 200 yards of shore. Tidal currents vary dramatically when compared to other NAVSTA management areas. Currents flow west-northwest between one and three hours after high water, south-southeast from three to six hours after high water, and then north and northeast from seven to 12 hours after high water. The tidal current flow rates range from 0.2 to 0.6 knots per hour (RI Sea Grant, undated).

1.3.4 Climate

Because of NAVSTA's location along the coastline of the Atlantic Ocean, climate is affected by the ocean's thermal qualities. Warm gulf currents provide winters, which are milder than inland areas. Annual precipitation averages 42.75 inches and there are 125 mean days with at least 0.01 inches fall. Snowfall averages around 20 inches a year and rarely remains on the ground for more than four days. The cooling ocean breezes in the summer tend to keep the average summer temperature in the low seventies.

Predominant summer winds are from the southwest while predominant winter winds are from the northwest. Fort Adams is exposed to southwest winds from Rhode Island Bay. Coasters Harbor Island, Coddington Point, and Coddington Cove are protected from west winds by the Conanicut Island land mass and from winter storms from the north-northeast by the Aquidneck Island land mass. Winds along the East Passage of Narragansett Bay in the Midway and Melville areas could be affected by Prudence Island and Conanicut Island (Jamestown) land masses.

Based upon five years of data from the State of Rhode Island T.F. Green Airport, winds above 17 knots (19.6 mph) are most frequently recorded from the northwest, west-northwest, north-northwest, southwest, and north-northeast. The mean windspeed is 10.8 mph with the greatest windspeeds occurring in December and January. There is less than a one in five chance that hurricane-force winds, or those greater than 73 mph, will occur at NAVSTA. Heavy fog (visibility of one quarter mile or less) occurs on an average of 26 days per year (RIDOT, 1995).

1.3.5 Hydrology

Site hydrology is dominated by freshwater flow from upland areas into Narragansett Bay. Surface runoff is directed either to one of the three freshwater stream tributaries discharging into Narragansett Bay or flow is directly discharged via overland runoff to drainage area outfalls directly released to the bay.

1.3.5.1 Groundwater

Groundwater supplies in the east bay section of Rhode Island are generally provided by aquifers in till and bedrock (bedrock constitutes one third of the groundwater resources in the state). The average depth to groundwater is approximately 5-12 feet. The water is soft and generally of good quality, but may contain excess concentrations of iron and manganese in some areas. All groundwater and surface water flows into Narragansett Bay. Groundwater within NAVSTA is relatively shallow due to the proximity to sea level. Any wells that are developed may have salt intrusion. Deeper artesian wells capture water that is trapped between bedrock and is replenished where the aquifer is near or at surface level. No wells, shallow or artesian, presently exist at NAVSTA for consumption; potable water is supplied by the City of Newport (Newport Naval Complex, 1991).

Groundwater in the vicinity of NAVSTA is classified as GB south of the Coddington Cove breakwater including Coddington Cove, Coddington Point, Coasters Harbor Island, and the Naval Hospital by RIDEM. Groundwater at Melville-North and Melville-South is also classified as GB. Groundwater classified as GB may not be suitable for drinking water use without treatment and is within areas served by public water systems. Groundwater in the vicinity of Midway and Fort Adams is classified GA. This classification determines these areas as groundwater resources suitable for public and private drinking water without treatment.

1.3.5.2 Marine Water Quality Classification

All surface waters of the state have been categorized by RIDEM according to water use classifications based on considerations of public health, recreation, propagation and protection of fish, shellfish and wildlife, and economic and social benefit. Each class is identified by the most sensitive water uses to be achieved and protected. Although surface waters are regulated to enhance and protect uses designated by the Clean Water Act, they may be suitable for additional beneficial uses. RIDEM's designated uses include the following for seawater as presented in Rule 8.B.2 of the RIDEM Water Quality Regulations, 1997:

- Class SA surface waters are designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. These waters shall have good aesthetic value

- Class SB waters are designated for primary and secondary contact recreational activities, fish and wildlife habitat, and good aesthetic value

- Class SB(1) waters are marine waters designated for primary and secondary contact recreational activities, fish and wildlife habitat, and having good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharge. Therefore primary contact recreational activities, shellfishing, and fish and wildlife habitat will likely be restricted

RIDEM surface water classifications for marine and fresh waterbodies are presented in Figure 2 Sheets 1 through 9. With the exception of Class SB1 waters within 500 feet of the Newport Wastewater Treatment Facility outfall located 750 feet west of Bishop Rock, all marine surface waters between the Newport-Pell Bridge north to the breakwater at Coddington Cove are classified as SB waters. Marine surface waters from the Coddington Cove breakwater north to Carr Point are classified SA. Between Carr Point and Coggeshall Point (north of Melville-North), marine surface waters are classified as SB1. Surface waters west of Fort Adams are classified as SA with the exception of waters within 500 feet of the Navy sewer outfall that are mapped SB and SB1 (RIDEM, 1997).

1.3.5.3 Freshwater Water Quality Classification

Surface waters of the State of Rhode Island are classified in Appendix A of the 1997 *Water Quality Regulations.* The RIDEM classification of freshwater bodies is presented in Figure 2 Sheets 1-7. Normans Brook in Melville-South is identified as an unnamed brook classified as a Class B1 waterbody between Redwood Road, Portsmouth and the East Passage of Narragansett Bay (see Figure 2 Sheet 5). Class B1 waters are designated for primary and secondary contact recreational activities, fish and wildlife habitat, and have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges. RIDEM Rule 8.B.3 outlines partial use designations that denote specific restrictions of use that may affect the application of the water quality criteria. It is likely that recreational activities and fish and wildlife habitat will be restricted on the NAVSTA segment of Normans Brook. The cause of this partial use designation is likely failed ISDS systems in the Redwood Road neighborhood, east of NAVSTA.

For waterbodies not listed in RIDEM Appendix A of the 1997 *Water Quality Regulations*, all freshwaters hydrologically connected by surface waters and upstream of Class SB waters shall be Class B (RIDEM Rule 8.C.2). Therefore two unnamed streams discharging into Class SB waters in Coasters Harbor and Coddington Cove are Class B waterbodies. Lawton Brook in Melville-South, downstream of the Lawton Valley Reservoir (a Class A drinking water supply, located upgradient of NAVSTA), is a designated Class B waterbody as it discharges into the Class SB section of Narragansett Bay north of Carr Point (see Figure 2 Sheet 5). RIDEM defines Class B waters as waters designated for fish and wildlife habitat and primary and secondary contact recreational activities. These waters shall have good aesthetic value.

All other fresh waters not listed in Appendix A of the 1997 *Water Quality Regulations* shall be considered to be Class A. Gomes Brook in Midway (see Figure 2 Sheet 4) and two small unnamed streams to the north in Melville-South (see Figure 2 Sheet 5) outfall into Class SA waters south of Carr Point, and are therefore considered Class A waterbodies. Any drainage from former Tank Farm 5 in Midway is directed to Gomes Brook prior to discharge into Narragansett Bay (see Section 8.2 Photo M-2 in the INRMP). RIDEM Class A waters are waters designated as a source of public drinking water supply, for primary and secondary contact recreational activities and for fish and wildlife habitat. These waters shall have good aesthetic value.

1.3.6 100-Year Flood Zone

Figure 2 indicates NAVSTA Newport areas subject to flooding during a storm with a likelihood of occurrence once within a 100-year period. With over ten miles of frontage on the west shore of Aquidneck Island, low-lying natural resources at NAVSTA Newport are especially vulnerable to flood damage from waves with velocity. During a 100-year storm, flooding may be expected to inundate extensive areas between the Newport-Pell Bridge and upland areas on Coddington Point, leaving only isolated upland areas on Coasters Harbor Island and areas along Third Street north of Gate 10 unflooded (Figure 2 Sheet 1). Zone VE, coastal flooding with velocity hazard (wave action) and a base flow elevation of 15 feet (the height of the 100-year flood from National Geodetic Vertical Datum of 1929 [NGVD]) could be expected along the north and south shores of CHI and along the immediate shore of Coasters Harbor. Areas subject to flooding without velocity extend and base flow elevation or height of 13 feet NGVD, eastward beyond NAVSTA property to Connell Highway (Federal Emergency Management Agency, 1984).

Flooding during a 100-year storm would inundate the industrial and storage area north of Gate 2 (see Figure 2 Sheet 2) on Weenachasett Street, adjacent to the Coasters Harbor estuary. Buildings 346, 347, 348, 1288, 360, W34, W-36, and 354 would be subject to flooding; hazardous storage areas south of W36 and west of Building 354 would be subject to wave action as well. In the vicinity of Bishops Rock, flooding would be anticipated inland to Donovan Avenue.

Flooding during a 100-year storm would be limited to the base of the bluff east of Coddington Point. Along Coddington Cove, land westward of Defense Highway may be inundated by 100-year floods. Areas south of the breakwater would be subject to coastal flooding with velocity (wave action) up to an elevation or height of 15 feet NGVD. Piers 1 and 2 and Stillwater Basin would be subject to coastal flooding with velocity (wave action) up to a base flow elevation or height of 17 feet NGVD. The open storage areas west of Building 47 in Coddington Cove (Figure 2 Sheet 3), adjacent to the palustrine wetland, would also be subject to flooding (no wave action anticipated).

Midway's Defense Highway would be slightly inundated by flooding from a 100-year storm event. Valleys of Normans and Lawton Brooks would store freshwater flood volumes during such a storm. Coastal flooding with velocity (wave action) up to a base flow elevation or height of 17 feet NGVD would be expected along the Midway coast of Narragansett Bay. The Melville-North DFSP refueling area would receive 100 year flooding up to 14 feet NGVD elevation; a velocity zone with a base flow elevation or height of 17 feet NGVD is located west and north of the north fueling pier and includes the tank area (Tank Farms 1 and 2).

Although the shoreline would be exposed to flooding with velocity, upland areas of Fort Adams would not experience 100-year flooding action because of the steep topography surrounding this site.

2.0 ALTERNATIVES

This EA evaluates only two alternatives for the NAVSTA Newport INRMP: implementation or non-implementation. The INRMP focuses primarily on protecting and conserving NAVSTA's natural resources. Due to the intensive land use and the military mission, the management recommendations place a priority on natural resource protection, rather than intensive management and use. With the major focus on the military mission of this relatively small base, there are few benefits to exploring intermediate management alternatives.

The INRMP has five major management areas: Fish and Wildlife, Pest Management, Land Management, Forestry Management, and Outdoor Recreation. Environmental restoration, an ongoing effort at NAVSTA, is also addressed in the INRMP.

This section presents a comparison of the management recommendations presented in the 1985 and 1992 Natural Resource Management Plans (NRMPs) and the recommended management (preferred) alternatives in the INRMP completed in 2001.

2.1 FISH AND WILDLIFE

2.1.1 No-Action Alternative

The No-Action Alternative is continued implementation of the objectives and practices outlined in the existing Natural Resources Management Plan (1992). On-going practices used for management of natural resources at NAVSTA would continue and there would be no change to the objectives outlined in the 1992 plan.

The 1992 Natural Resources Management Plan makes the following recommendations regarding fish and wildlife:

Due to the highly developed nature of habitat resources, limited diversified and available habitat resources, relatively low priority within mission activities and absence of qualified manpower, there were few opportunities identified for effective and practicable fish and wildlife management. However, it is recognized that those natural habitat resources which provide food, cover, water and space for fish and wildlife should be conserved as a vital component of the overall natural environment at NAVSTA, and thereby add to the quality of life within and around NAVSTA.

Although fishing has provided limited recreation along Narragansett Bay in the waterfront industrial areas at NAVSTA, this activity should not be encouraged through expansion at Coddington Cove area because of security reasons in this area. Should potential conflicts continue between recreational fishing and lobster harvesting, a NAVSTA instruction may be required to restrict these activities, along with appropriate signage and patrolling, to minimize or eliminate interference with military operations.

Since there is an extensive shoreline interface of NAVSTA with Narragansett Bay in the Melville North, Melville South and Midway areas, continued beach and shore fishing in these "open space" areas could be encouraged by the Navy community and the public through appropriate signage. This could attract fisherman to areas not previously fished and provide added recreational opportunities. In order to maintain a clean appearance and contribute to the health of Narragansett Bay water quality, all areas fished may require administrative controls and would need to be visited periodically for policing of any trash and debris.

Under given limitations of resource abundance and mission requirements, the best practicable use of wildlife would be for non-consumptive purposes. The practicable mechanism to serve this function would be maintenance of existing habitats with limited human interference on resources, especially in less developed portions of NAVSTA property.

Promote protection of fish and wildlife species and their natural habitats on NAVSTA property by preventing indiscriminant alteration to the physical and biological habitat components. Any proposed projects, particularly at the less developed areas of the northern portions should be carefully scrutinized for anticipated impacts to the NAVSTA fish and wildlife resources early in the project development, and through application of the NEPA process.

NAVSTA personnel should be encouraged to report unusual or unique sightings of wildlife, particularly large bird nests (osprey, bald eagle, glossy ibis, heron, etc.) to maintain known databases. Special conservation efforts may be required for such occurrences, depending on nest locations, time of year, and species represented.

In an effort to participate with the RIDEM Division of Fish and Wildlife to perpetuate and conserve osprey populations in the State of Rhode Island, consideration should be made for construction of osprey platforms in the tank farm areas. Coordination has been made to integrate this potential need.

Continue to protect and maintain water quality of all point sources of water which can effect marine and estuarine organisms of Narragansett Bay; prevent intentional and accidental discharges of any contaminants which may enter Narragansett Bay. Assistance may be offered by Engineering Field Activity (EFA) Northeast for instituting these endeavors.

The 1992 NRMP also recommended the commencement of yearly banding of Canada Geese by the RIDEM Division of Fish and Wildlife in order to increase the amount of data on the east bay flock and recommended the placement of osprey nesting platforms in three areas on the NAVSTA property.

Since no threatened, endangered, sensitive, or rare species were found or known to occur on the property in 1992, no management recommendations were offered.

Recommendations from the 1992 plan for the protection of wetlands are as follows:

Assure that assertive measures are made to avoid, minimize, reduce, eliminate, and/or mitigate wetland losses; prevent unnecessary adverse impacts to ecological values, uses, and functions of this important habitat type. Project locations should continue to avoid secondary adverse impacts to wetlands or suspected wetlands. Comply with any applicable Federal, state and local rules and regulations governing the protection of wetlands.

The 1992 NRMP recommended that the Pest Management Plan for NAVSTA be updated and that cooperation between NAVSTA and NUWC continue to accomplish pest management services at NUWC. The 1992 plan also made several recommendations in regard to rabies.

2.1.2 INRMP Implementation (Preferred Action)

Management recommendations for fish and wildlife are focused on resource protection. The "edge" between intertidal beach and landscaped lawns provides diverse options for food and cover. Proper care and maintenance of these plantings is important for protecting these resources. Lawns in the shoreline areas of Coasters Harbor Island are mowed directly to the edge of the fringed rock or gravel terrace adjacent to the beach. By allowing a five to ten foot swath to revegetate with native salt-tolerant species such as *Rosa rugosa*, the value of this "edge" to wildlife would be increased.

Freshwater wetlands are present on NAVSTA and are protected under the Rhode Island Freshwater Wetlands Protection Act and the Clean Water Act. The areas protected by the state act include the "perimeter wetland" which extends 50 feet from the delineated edge of freshwater wetlands and "riverbank wetlands", the area within 100 feet of watercourses less than ten feet in width, and the area within 200 feet of rivers greater than 10 feet in width. Any alterations within the wetland or the perimeter wetland are subject to the jurisdiction of the act. Any proposed projects adjacent to or within the drainage basin should be carefully scrutinized for anticipated impacts to fish and wildlife resources early in project development and through application of the site review and NEPA processes.

For activities that could impact marine resources such as pier and bulkhead repair, pile driving, and maintenance dredging, mitigation is recommended to minimize impacts from these activities. Construction may be limited to seasons of the year when fish are not spawning in the area. Construction methods may be selected to minimize impacts (i.e. pile driving, not augering). Placement of silt curtains around marine sites and placement of hay bales on land may be used to confine sedimentation to the immediate project site.

Management objectives for endangered and threatened species and marine mammals at NAVSTA consist of habitat preservation, avoiding species disturbance to the greatest possible extent, and educating military personnel through environmental awareness.

Subtidal and benthic areas offshore provide suitable foraging habitat for all species of marine turtles including the threatened loggerhead, and the endangered green and Kemp's Ridley sea turtles. These habitats, however, are at the northernmost limits of their extensive ranges, and the occurrence of individuals would be considered very rare and unusual. Any incidental sightings of harbor porpoises should be reported as well. Offshore naval operations should make appropriate provisions for the possible presence of these species, including visual observations before and during operations.

Naval proposals and plans for non-routine maintenance, repairs, and expansion of shoreline and offshore facilities should make provisions to ensure that the National Marine Fisheries Service (NMFS) is consulted prior to commencement of activities. Requirements of the Endangered Species Act and the Magnuson-Stevens Act include provisions for consultation with the NMFS and may require additional studies to mitigate potential adverse affects to protected habitats species.

Update surveys of rare species only if there is a massive or significant change in land use (RIDEM, 1989a).

Harbor seals are periodic visitors to Coddington Cove and are protected under the Marine Mammals Protection Act. By prohibiting access to the breakwater, enforcing the Security Zone within Coddington Cove thereby limiting marine traffic, and continuing best management practices relating to stormwater management, the habitat of these marine mammals will be protected.

The US Navy is required to obtain a depredation permit from the USFWS for the removal of nuisance migratory bird species protected under the Migratory Bird Treaty Act (MBTA). If a federal agency is acting in its official capacity, USFWS recommends the agency, NAVSTA in this case, keep a record of activities covered under this act. This record is required in the event that USFWS ever requests an annual report of activities. No permit or record of activity is required to actively discourage land use by waterfowl through an Integrated Management Plan (IMP), however a permit is required to eliminate animals. Both Canada geese and gulls have become nuisance species at NAVSTA.

Flocks of Canada geese are a problem within many areas of NAVSTA property where large openland grass habitat areas provide preferred foraging and resting habitats for this species. Geese require openland habitat and will continue to increase in population as long as no threat exists from human activity and habitat is not degraded.

Recommendations for deterring Canada geese include placement of "noisemakers". These noisemakers are sometimes successful, although some species adapt physiologically. In those instances, noisemakers are less effective. Noisemakers are but one method available to reduce species complacency. They have the potential to deter geese from staying for long periods of time in one area and becoming permanent residents. Noisemakers are used by sounding off a loud bang that almost sounds like a gunshot, at a frequency associated with geese sensitive receptors. They are placed within in open areas where geese visit frequently. They are triggered and set to sound at certain time intervals. Noisemakers are of potential nuisance in urban areas and may present a noise ordinance violation. The use of border collies for controlling nuisance Canada geese should be investigated. Border collies have been shown to be an effective deterrent in controlling geese on golf courses.

Additionally, allowing native plant-life to grow into a dense vegetative buffer between shoreline and upland grassy areas has also been shown to be an effective goose deterrent. Incorporation of new grounds maintenance practices to allow 25 foot wide buffers of shrubs and dense herbaceous vegetation will not only deter geese in preferred shoreline landing areas, but can also help to protect water quality from surface runoff during storm events.

Gulls are also protected under the MBTA. Federal permits are required to kill gulls. However, a permit is not required to actively discourage land use by gulls. This species becomes acclimated to any single control method, thereby requiring a diverse, site-specific approach to control. Grid wires suspended on rooftops, audio and visual frightening, and pesticides may be used to deter gulls.

In accordance with the MBTA, trees should be inspected prior to felling in order to determine if active nests are present. Any nests disturbed by routine operations should be reported to the Natural Resources Manager, NAVSTA Newport, Code N8N, for documentation in accordance with USFWS requirements. Backhoe operators should be alert for potential presence of nesting migratory birds and other species of concern prior to demolition activities. Landscaping crews should also report nests observed to Code N8N prior to hedge trimming and pruning activities.

A Pest Management Plan (PMP) has been prepared for NAVSTA (Northern Division, 2001). The objective of the PMP is to provide guidance for the maintenance of an effective and environmentally sound pest management program. The principles of Integrated Pest Management, IPM, are based on the notion that control is only required if a population will surpass an economic or aesthetic injury threshold. Many of the IPM strategies involve clearing brush, draining standing water used as breeding areas, and applying pesticides. As indicated in the PMP, such procedures should be implemented only when warranted to avoid adversely impacting habitat areas for beneficial species of wildlife, adversely affecting wetland functions and values, and causing adverse effects to beneficial insects such as bees. Outdoor pesticide applications must be carefully planned to prevent introduction of pesticide materials into the estuarine and freshwater habitats in and around NAVSTA. Measures to minimize drift and prevent runoff will be implemented whenever outdoor applications are conducted.

2.2 LAND MANAGEMENT

2.2.1 No-Action Alternative

Under the current 1992 plan the grounds are classified into improved, semi-improved, and unimproved areas. The plan recommends recurring maintenance practices such as lawn mowing and fertilizing as well as offering suggestions for improving land use and appearance. In addition to the above, the 1985 plan recommends the following for erosion control. Temporary and permanent measures should be taken to prevent soil erosion on new construction sites. These measures could be temporary vegetative cover, permanent cover, staked hay bales in waterways and mulch netting. Extra care should be taken to insure that natural and manmade watercourses, and roadside ditches remain in stable condition. These areas should be limed, fertilized and mowed where possible to maintain a good vigorous sod. Those areas subject to road salt damage should be reseeded as necessary.

2.2.2 INRMP Implementation (Preferred Alternative)

Coastal wetlands are environmentally sensitive areas that provide food and shelter for large populations of juvenile fish and are nurseries for several species of fish and invertebrates. Flats and brooks associated with many coastal wetlands are rich in shellfish. Coastal wetlands provide important habitat for shore birds and waterfowl, and are among the most scenic features of the Rhode Island and NAVSTA Newport shoreline. Coastal wetlands are effective in slowing erosion along protected shores. Avoidance and minimization of impacts and compensation for unavoidable losses are necessary tools for retaining and restoring Rhode Island's coastal wetlands.

Land uses and activities abutting coastal wetlands may have a strong impact on the wetland itself. Nearby drainage patterns may affect sedimentation processes and the salinity of waters may be altered. Wildlife utilizing wetlands habitat should be protected from harassment. Recommended management methods include habitat verification/mapping, zoning changes, stormwater management practices, and oil and hazardous materials emergency spill and leak response.

Habitat Verification

Recently delineated freshwater wetlands should be included on NAVSTA Newport Conditions Maps. If and when a new bridge to CHI is programmed through a military construction project (MILCON), an inventory of possible eelgrass beds should be made as part of the planning process. Freshwater wetlands and eelgrass should be integrated into condition management. Potential eelgrass beds have been identified by RIDEM in offshore areas south of Coddington Point. The presence of these beds should be verified during the growing season. The extent of eelgrass beds should be identified using Global Positioning System (GPS), and the locations should be included on NAVSTA Newport Conditions Maps to coordinate with eelgrass mapping project currently underway by the Narragansett Bay Project.

Zoning

Environmentally sensitive resources at NAVSTA Newport include the following:

CRMC's Type 1 Conservation Waters; waters classified RIDEM as Class SA or A by RIDEM; areas currently zoned Environmentally Sensitive by NAVSTA Newport; potential eelgrass beds (and other sites protected by the Clean Water Act); and wetlands mapped either by the National Wetlands Inventory (including marine, estuarine, and palustrine wetlands) and freshwater wetlands mapped by NAVSTA Newport.

Changed since the 1985 Natural Resource Management Plan is the Newport Naval Complex Comprehensive Plan (November, 1990). The comprehensive plan has two zoning designations to protect critical natural resources: Environmentally Sensitive (ES) zoning and Open Space (OS) zoning. ES zoning permits the uses of unimproved areas, environmentally controlled outdoor activities, and limited utility crossings where no other viable alternatives exist. OS zoned areas are set aside to control development in floodplains, wetlands, and other environmentally sensitive areas. OS zones permit major lawn/park type areas, exterior recreation fields, playgrounds, associated parking areas, recreational vehicle storage, unimproved areas, limited camping, recreational areas, utility structures and crossings, small picnic pavilions, recreation support facilities for storage and offices, and cemeteries.

Recommended management changes from the 1985 NRMP include the following:

Revise Newport Naval Complex Comprehensive Plan (1990) to zone environmentally sensitive areas subject to 100-year flooding as ES and not OS. Change zoning to ES for shoreline adjacent to CRMC Type 1 waters, eelgrass beds, and along RIDEM Class SA or A waters. Change zoning to ES for areas subject to 100-year flooding and adjacent to wetlands (including the area adjacent to Gate 2 and west of Building 47). NAVSTA should prohibit stockpiling of soil and debris within current and proposed ES zones without adequate provision for stormwater management n order to maintain compliance with the state Non-Point Source Pollution Prevention Plan (RIDEM, 1995). All stockpiled material (regardless of zoning) should be covered and surrounded with hay bales. Storage of hazardous materials within 100-year flood zones (regardless of zoning designation) should be prohibited unless contained within flood proof structures.

Oil and Hazardous Material Handling

A release of oil or hazardous materials at any site within NAVSTA has the potential to adversely affect the quality of Narragansett Bay, therefore a Spill Prevention Control and Countermeasures Plan for Oil has been implemented (Naval Station Newport, 1996). Appropriate storage, handling, and spill responses are required to protect the waters of the bay and adjacent environmentally sensitive resource areas.

Recommended management includes the following:

Bring DFSP into compliance with National Oil Contingency Act, 40CFR 112.

Investigate and permit the outfall east of the northern fueling pier.

Implement tank and pipe testing programs for USTs and determine compliance with RIDEM Underground Storage Tank (UST) regulations.

Replace the 3,000-gallon #2 fuel oil underground storage tank at Building W-34 (the SPCC indicates that the tank was installed in 1941). This tank is located within the drainage area of the estuarine wetland adjacent to Gate 2.

Obtain an Order of Approval from RIDEM in accordance with the Underground Injection Control Program, authorized under the Clean Drinking Water Act if the storm water drainage system includes drywells or sumps (with no connections to receiving waters). The quality of sensitive resources including groundwater-fed wetlands will be assured by protecting the groundwater at NAVSTA.

Investigate catch basins with unknown discharge points, especially those within the drainage areas of sensitive environmental resources.

Replace two PCB transformers at Building 72 at the Naval Hospital located within 200 feet of the coastal zone. Replacement would reduce the potential for an emergency release to cause significant impacts to surrounding marine ecosystems of Narragansett Bay.

Floodproof any hazardous materials storage areas located within the 100-year flood zone.

Complete and implement Spill Prevention Control and Countermeasures Plan (similar to the one completed for oil) for hazardous materials storage areas (including chlorine).

Erosion and Sedimentation Control

NAVSTA Newport is currently in compliance with the Best Management Practices (BMPs) recommended in the Rhode Island Soil Erosion and Sediment Control Handbook. Site-specific erosion control recommendations at NAVSTA Newport include the following:

Enforce BMPs at construction areas including utility installations and IR sites. Specific recommendations include a weekly inspection by Natural Resource Manager, Code N8N, to ensure that graded areas are quickly stabilized with grass seeding or planting, stockpiled soil is covered, dust is suppressed through application of calcium chloride or water, and hay bales are replaced when fouled with sediment. Appropriate decontamination procedures must be followed at IR sites to confine the area of contamination to the hot zone.

Leave a five to ten foot vegetated buffer between mowed lawn and intertidal beach to stabilize the shoreline. This is especially important along the north side of Coasters Harbor Island and along the west shore of Coddington Point (north of Bishops Rock). Vegetation should be kept at three to four feet to avoid blocking views. Plantings should mimic natural shoreline species such as the north coast of Coddington Point. Retaining leaf litter in natural areas along the shoreline slows runoff waters to allow infiltration and absorption of pollutants such as fertilizers and herbicides.

Repair bulkheads and seawalls to maintain serviceable condition in accordance with US Army Corps of Engineers requirements for Section 404 permitting (if constructed after implementation of the Clean Water Act in 1972). Erosion of backfilled material through the bulkhead or wall has the potential to increase turbidity, thereby reducing photosynthesis, and reducing depths in adjacent waterways. Backfill eroded areas behind seawalls and bulkheads with gravel or other large-grained material to minimize erosion.

Storm Water Management

Non-point source discharges, including stormwater flow, have the potential to adversely affect natural resources areas through erosion, scouring, or deposition along the shoreline. Non-point source discharges can also degrade water quality with potential pollutants including total suspended solids, fecal coliform, volatile organic compounds, and hydrocarbons.

Recommendations for storm water management include the following:

Provide secondary containment in the form of an elevated berm for all loading docks and adjacent to building doors where handling and loading of liquid material occurs regularly. In all cases, the potential exists for a spill to occur in these areas that may result in an impact to natural resources if not contained.

Establish and implement an annual maintenance program for existing oil/grit separator storm drainage structures. Implement a testing program to verify the efficacy of these structures.

Implement an annual catchbasin maintenance program including the cleanup of sumps and drainage of oil from oil/water separators. Dispose of removed waste in accordance with RIDEM regulations.

Repair or replace drainage outfalls, as necessary, to minimize scouring and undermining of the shoreline.

In industrial areas where the outlet for the stormdrain system is unknown but potentially within the drainage areas of a sensitive resource, verify through dye tests or similar means the outlet location. In the event that underground injection is occurring, appropriately address as regulated under the state UIC program.

Non-Point Source Pollution

NAVSTA Newport is currently in compliance with the Rhode Island Community Non-Point Source Pollution Management Guide (RIDEM, 1995). The guide outlines the following BMPs to minimize non-point source pollution of sensitive resources for fertilizing and pesticide application:

Minimize lawn areas adjacent to surface waters. Leave a zone of undisturbed natural vegetation as a buffer to help prevent fertilizer contamination of surface waters. Existing lawns should only be fertilized when a soil test indicates the need for a particular nutrient. When using fertilizers, choose "slow release" varieties that release nutrients at a rate where they are more easily absorbed by plants. Calibrate lawn spreaders to avoid over fertilizing. Do not over water, too much water can leach nutrients through the soil into groundwater or wash them overland into nearby surface waters.

The INRMP also recommends the following:

Grasses tend to be very effective in reducing overland flow, as well as being effective nutrient and sediment removers. Nitrogen removal rates increase in areas vegetated in the transitional zone (between land and marine environment). Thickly planted, clipped grasses provide a dense, obstructive barrier to the coastline. Leave an adequate buffer width for the highest overall removal efficiencies and for shoreline stabilization and erosion control when mowing. Although grasses are effective as vegetated buffer species, they should also be incorporated with other species of vegetation (wood-stemmed species).

2.3 FOREST MANAGEMENT

2.3.1 No-Action Alternative

There are no recommendations for Forest Management in the 1985 or 1992 NRMPs.

2.3.2 INRMP Implementation (Preferred Alternative)

A volumetric determination of forest stands within NAVSTA Newport property was conducted and it was concluded that stands occur in sparse, isolated areas, species contained in stands are undesirable for harvest, and existing tree species in forest stands are relatively small in acreage and have low basal area. Management for future harvestable production of upland forests is not recommended. Forest management will not be addressed because of stand density inconsistency and the small acreage of these forest stands. Silvicultural practices have been determined to be impractical and not recommended because any type of management would not be economically viable.

2.4 OUTDOOR RECREATION

2.4.1 No-Action Alternative

The 1985 NRMP recommends leasing areas to state or towns where boat ramps could be established. It also discusses the possibility of opening the skeet shooting range to the public.

The 1985 plan also recommends using the idle field that runs adjacent to the east side of Greene Lane housing area for community garden plots.

No other recommendations for outdoor recreation were made in either the 1985 or 1992 NRMPs.

2.4.2 INRMP Implementation (Preferred Alternative)

A key component of recreation options at NAVSTA Newport is appreciation of the natural environment, including the benefits afforded by its shoreline location on Narragansett Bay. Protection of the shoreline, a valuable natural resource, is important to providing recreational opportunities for Navy personnel and their families.

The following recommendations are made to increase recreational benefit while protecting natural resources:

Install fitness/jogging trail signs as information for users and to promote use among others. Signs should indicate the types of resources to be found and explain protective measures that have been put in place. To protect jogger safety and eroding slopes, post signs for steep drop-offs and road crossings, as necessary. Include trail conditions on base mapping.

Post shellfish closure signs along NAVSTA Newport shoreline south of Midway Pier near Greene Lane and north of Carr Point to alert recreational fisherman that taking of shellfish is illegal. Shellfishing is permitted between the Midway Pier and Carr Point.

Cooperate with the Town of Portsmouth in its efforts to maintain the water quality of the Melville Ponds, including the upper pond, located adjacent to the Melville and Rainbow Heights housing area. This area is used for fishing, canoeing, and model yacht racing by the general public.

Opportunities may exist for developing public information points at the Naval Hospital stone pier including natural resources and historic/cultural resources at that location. Coordination would be required between the Naval War College Museum and the RI Historical Preservation and Heritage Commission for planning and developing tasks.

Expand recreational opportunities for the general public in a manner consistent with the NAVSTA mission as funding for planning and implementation becomes available.

2.5 ENVIRONMENTAL RESTORATION

2.5.1 No-Action Alternative

No recommendations for Environmental Restoration were made in the 1985 or 1992 NRMPs.

2.5.2 INRMP Implementation (Preferred Alternative)

It is recommended that the CERCLA process be fully implemented to restore natural resources at and adjacent to NAVSTA Newport.

Short-term restoration activities at Coasters Harbor Island include the following to protect water quality and sediments near a potential eelgrass bed at the north end of Coasters Harbor:

Stabilize the shoreline of Katy Field, site of the Former Firefighting Training Area, from further erosion to limit migration of contaminated material. Degradation of this material, including asphalt debris, could contribute to the release of polyaromatic hydrocarbons (PAHs) to Narragansett Bay.

Assess impacts to marine resources prior to underwater site remediation or dredging at McAllister Point and/or Derecktor Shipyard.

3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

The purpose of this section is to present information on the environment that will be affected by implementation of the INRMP and the specific consequences for each major management objective from implementation of the INRMP (the preferred alternative) and the alternative of no action, which is to continue operating under the older NRMP. Section 2, Alternatives, has already examined some of the anticipated impacts that may result from either course of action. This section will examine those in greater detail. This section of the EA is organized by the four major management priorities, presenting the existing environmental conditions and the environmental consequences.

The INRMP presents recommendations, policies and procedures for natural resource management related to Fish and Wildlife, Forestry, Land Management and Outdoor Recreation. The INRMP also presents the status of environmental restoration activities and procedures for ensuring continued protection of the environment. The Plan does address the need to coordinate with adjacent communities and the State of Rhode Island on management objectives.

NAVSTA Newport is in an air quality non-attainment area. Implementation of the recommendations within the INRMP is not expected to have any detrimental impact on air quality in the area. In fact, some of the practices proposed would actually result in less air pollution. For example, the Plan preferred alternative of implementation recommends not mowing lawns and grounds that are adjacent to shorelines and waterways, which would result in a reduction of hydrocarbon emissions. The recommended practice of allowing vegetation to grow in five to ten foot vegetated buffers would create transitional areas adjacent to natural habitats and increase habitat edges. Much of the land use recommendations within the INRMP relate to water quality and fish and wildlife habitat protection.

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3.1 FISH AND WILDLIFE

3.1.1 Marine & Freshwater Fish & Wildlife

Both marine and freshwater habitat areas have been identified at NAVSTA Newport. Habitat mapping is presented in the INRMP, Figure 2 Sheets 1 through 9. This information is based on mapping completed by the Narragansett Bay Project and has recently been updated from true color aerial photography taken in 1996 at a scale of 1:12,000 and 1:40,000. This data has been incorporated into the RIDEM Geographic Information System (GIS) (French et. al., 1992).

Subtidal Areas

Open Water - Saltwater open water bodies are defined as areas where the salinity range is above 0.5 parts per thousand and surface water is permanent and not dominated by persistent vegetation (Cowardin et. al., 1979). Subtidal (open water) habitats in Narragansett Bay are located adjacent to NAVSTA Newport property. These areas consist of sites that are classified as subtidal sand (depositional and dynamic). Subtidal dredged channels are also located offshore.

Vegetated Aquatic Beds - Vegetated aquatic beds are considered Special Aquatic Sites. Special aquatic sites, as defined in the federal 40 CFR Part 230 (Section 404(b)(1) Guidelines), Subpart E (230.40 through 230.45), include freshwater and tidal wetlands, sanctuaries and refuges, mudflats, vegetated shallows, and coral reefs. Aquatic beds include wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years (Cowardin et. al., 1979). Macroalgae, or seaweed, together with microscopic phytoplankton, form the base of the marine food chain, feeding huge populations of crustaceans, mollusks, and small fish, upon which the larger fish and wading/shore birds depend. Macroalgal beds within this subtidal zone typically include red algae such as *Chondrus,* brown algae such as rockweeds (*Fucus* and *Ascophyllum*) and kelp (*Laminaria),* and green algae such as sea lettuce (*Ulva).* These species were reported at a broadscale macrophyte sampling station north of Bishops Rock, conducted as part of the Narragansett Bay Project Habitat Inventory (French et. al., 1992). Macroalgal beds on cobble substrate, macroalgal bedrock, and macroalgal beds on sand were identified in the subtidal zone off shore.

Eelgrass Beds

Eelgrass beds provide valuable habitat for many species of fish in the Bay both as a source of food and cover. Green turtles (*Chelonia mydas*), an endangered species, reportedly graze on eelgrass, but are very infrequent visitors this far north in Rhode Island waters. These important habitats have been greatly reduced over the years from pollution and uncontrolled development and use of the subtidal areas in the Bay. The State of Rhode Island with support from federal agencies, nonprofit groups, and other sources has recently engaged in an eelgrass restoration initiative.

In July 1999, the US Navy and the US Army Corps of Engineers jointly conducted eelgrass bed mapping activities as part of the data collection for the NAVSTA Integrated Natural Resources Management Plan work. The mapping team utilized divers and sophisticated marine aquatic vegetation detection instruments to map locations and coverage in areas of NAVSTA where eelgrass was most likely to occur. These maps and the data are presented the Appendix Section of the INRMP. Similar eelgrass mapping has been completed more recently as a joint effort between the US Navy and RIDEM (US Navy, 2000).

Eelgrass beds are considered special aquatic sites. Plant surveys were conducted in harbor locations at NAVSTA during July 1999 (Louis Berger, 2001). The purpose of these studies was to determine the presence of eelgrass (*Zostera marina*) stands, their coverage, and distribution. Surveys were conducted by the U.S. Army Engineer Research and Development Center Environmental Laboratory (ERDC-EL) using the Submersed Aquatic Vegetation Early Warning System (SAVEWS). NUWC and Seaward Services, Inc. assisted with the surveys. Ground truth measurements were obtained by NUWC scuba divers at selected locations along transects to confirm eelgrass presence or absence.

Intertidal Areas

Rocky Shores - Intertidal rocky shorelines are determined by the size of material present. Rocky shorelines are areas where the diameter of particles is greater than ten inches and vegetation is not persistent (Cowardin et. al., 1979). Rocky shores are generally high-energy habitats that lie exposed as a result of continuous erosion by wind driven waves or strong currents.

Beaches - Beaches are classified as areas that are not dominated by persistent vegetation and are susceptible to tidal fluctuation. Areas where the diameter of particles is between three and ten inches are classified as cobbles. Intertidal gravel beaches are defined as areas where the diameter of parent material is between two millimeters and seven point sixty-two centimeters (2 mm - 7.62 cm). Gravel and cobble beachfronts are most commonly associated with the coastline of NAVSTA Newport property. These areas are generally sparsely vegetated except at the upper edges where little tidal influence is received. The upper fringes are vegetated with a variety of herbaceous plants, many of which are not native species. Intertidal sand beaches are areas where the diameter of particle is less than 2 mm. Most beaches are important primarily as feeding areas for migratory shorebirds. The piping plover (*Charadrius melodus*), a federally listed, endangered species which utilizes large, expansive sandy beaches that front the ocean, is not present on NAVSTA properties (personal communication with R. Enser, RIDEM Natural Heritage Program, 6/00). Fox, raccoon, skunk, and smaller mammals such as voles and mice also scavenge and feed along intertidal beach areas. Intertidal rock outcrops are defined as bare, hard rock areas consisting of stones or boulders, that occur along the shoreline exposed to intertidal forces. Back beach areas are intertidal zones where irregular tidal inundation occurs.

Flats and Terraces - Tidal flats are intertidal zones that have sand or mud substrate, lack vegetation, and are exposed during tidal fluctuation (Cowardin et. al., 1979). Intertidal fringing sand flats are special aquatic sites protected by the Clean Water Act. These feeding areas are utilized by a variety of species throughout the tidal cycle. Fish can be found in intertidal areas during high tide and a large variety of benthic fauna may be found in the sediment. Tidal flats are essential to shorebirds, herons, and egrets that feed on invertebrates and small fish migrating onto these areas during high tides. Grazers, such as swans, brant, and widgeons utilize algae and eelgrass in the aquatic beds. Raptors, such as the osprey, bald eagle, and northern harrier, may be found on intertidal flats, feeding on fish and birds. Exposed flats are an important winter food source and provide feeding areas for various types of gulls. These areas can provide habitat for macroalgal and eelgrass beds (Golet, 1976). Fringe rock and gravel terraces are areas located within the intertidal zone along the shoreline of NAVSTA property. These sites are irregularly flooded and are typically above the mean high water boundary. These areas provide shelter and resting areas for shore birds and marine mammals.

Saltmarsh - Saltmarshes are areas defined by tidal fluctuation causing substrate to become inundated and exposed. Plants and animals adapt to the environmental stresses of salinity, periodic inundation, and temperature extremes (Cowardin et. al., 1979). These tidal, estuarine, and emergent wetlands are dominated by salt tolerant plants including cordgrass (*Spartina*), saltwort *(Salicornia),* and sea blight (*Suaeda*). Best examples are generally found today in limited patches near Naval facilities called "fringe" marshes.

Wildlife species that use saltmarsh for breeding habitat include mute swan, mallard, American black duck, willet, herring gull, great black-backed gull, clapper rail, killdeer, common tern, least tern, marsh wren, savannah sparrow, sharp tailed sparrow, seaside sparrow, eastern meadowlark, and red-winged blackbird. Saltmarsh areas also provide habitat and breeding areas for softshell clams, crabs, and several species of fish and invertebrates. Small mammals, such as raccoons, striped skunks, foxes, and opossums, also utilize the salt marsh for hunting and scavenging. Field observations at NAVSTA confirmed that raccoon and skunk were actively foraging in salt marsh areas. Edge areas or habitat interfaces with field successional communities and forested areas enhance the value of salt marshes by providing cover for many species. Species such as swallows, kingbirds, sparrows, warblers, wading birds, and shorebirds all use this productive resource for feeding.

3.1.2 Upland/Freshwater Wildlife Areas

Freshwater Marsh - Freshwater marshes are wetland areas where an emergent herbaceous vegetation community exists in either standing water or intermittently exposed substrate adapted to saturated soil conditions.

Open Water - Freshwater open water bodies are defined as areas less than 20 acres in size with an average depth less than seven feet (between three and ten feet). These areas contain permanent surface water not dominated by persistent vegetation. Less than 50 percent of the water body surface is dominated by persistent emergent shrub or tree vegetation. Maximum salinity is below 0.5 parts per thousand (Cowardin et. al, 1979).

Upland - Upland areas are the limit to where hydrophytic vegetation and hydric soils occur. Soils directly affect the kind and amount of vegetation available to wildlife as food and cover. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. These are the three basic natural resource requirements needed for wildlife survival. If any one of these elements is missing, inadequate, or inaccessible, wildlife will be scarce or absent. If the upland soils have the potential, these habitats can be utilized by certain species. Upland areas serve as buffers, nesting areas, or food resources for wildlife.

Openland - The openland wildlife habitat areas support species that do not require protected areas of cover. The wildlife species that use this habitat consist of open space areas that are not overgrown with grasses, herbs, shrubs, or vines. The low interspersion of available cover is suitable to attract wildlife species that include quail, pheasant, sparrows, cotton tail rabbit, and fox (USDA, 1981).

Woodland Scrub-shrub - The woodland wildlife habitat areas support wildlife species that require protected areas of cover. Woodland habitat consists of areas of hardwoods or conifers, and associated grasses, and shrubs. Wildlife attracted to these areas includes ruffed grouse, woodcock, woodpeckers, squirrels, raccoons, and deer.

Wetland - Wetland wildlife habitat areas support wildlife species that require wetter conditions and dense protected areas of cover found in this habitat. Wetland wildlife habitat consists of open, marshy, or swampy, shallow areas where water-tolerant plants grow. Species that utilize this habitat are ducks, geese, herons, and shore birds.

3.1.3 NAVSTA Newport Management Area Wildlife Habitat Types

Field inspections of wildlife resources and habitats were conducted on 11 November 1997 by personnel of the Louis Berger Group, Inc. Additional observations were made and recorded during coastal investigations in August 1999 as part of the INRMP development. The primary focus of attention was the diverse wildlife habitat and land use. Field investigations were conducted in October 2000 as part of this Environmental Assessment to verify habitat map accuracy.

Marine habitats for fish and wildlife on NAVSTA property consist of extensive shoreline, adjacent to the East Passage of Narragansett Bay, and the open waters within the Bay. The shoreline of NAVSTA is an important ecological resource for a variety of fish and wildlife species. Habitat associated with each management area site has been inventoried for potential habitat resource areas (French et. al., 1992). The 11 November 1997 site inspection was conducted to corroborate information on shoreline habitat presented in the Narragansett Bay Project's bay-wide inventory of habitats. The mapping for the Bay Projects inventory has been updated recently and is now being incorporated into the Rhode Island GIS system. Information on subtidal habitats including macroalgae and eelgrass beds has been verified. See Figure 2 Sheets 1 through 9.
NAVSTA's inland habitat consists of, but is not limited to, upland areas of openland, woodland, and wetlands. Although most areas of NAVSTA Newport are intensively developed, wildlife may utilize habitats as described below. Land use/cover types are presented in Figure 2.

Coasters Harbor Island

Human activity has altered the shoreline of Coasters Harbor Island. Habitats include intertidal gravel beach, subtidal sand, human altered shoreline at the marina, and a fringe gravel terrace. The southern shore is mapped as a vegetated macroalgal bed-sand and eelgrass bed. A dredged channel was also inventoried on the west side of Coasters Harbor Island. Rock revetment and seawalls minimize damage from erosion along the shoreline (see Figure 2 Sheet 1).

The inland area of Coasters Harbor Island is a highly developed urban area where human influence has degraded natural habitat. The landscape of Coasters Harbor Island is altered and remaining upland open space is limited. This site has poor vegetative cover to support wildlife species requiring woodland habitats. Some portions, i.e. Dewey Field to the south and Katy Field to the north, are mainly open space with lawns and shrubs. Low edge interspersion, low habitat suitability, and poor cover type vegetation determines that Coasters Harbor Island represents poor wildlife habitat. Katy Field and Dewey Field are both zoned open space areas.

Naval Hospital and Coasters Harbor

A variety of subtidal and intertidal habitats along the east shore of Coasters Harbor, east of Coasters Harbor Island, make this a dynamic and valuable area for diverse wildlife species. Intertidal gravel beach shoreline with rock outcrops near the Naval Hospital provide habitat for wildlife. The east shoreline of Coasters Harbor, north of the Gate 10 access road, is mapped intertidal gravel beach shoreline. An estuarine emergent fringe saltmarsh extends north along the shoreline, north of the Gate 1 access bridge to Coasters Harbor Island and west of Farragut housing to the outlet stream, adjacent to Gate 2. The wetland area in the vicinity of Gate 2, along the east shore of Coasters Harbor, represents one of the few areas exhibiting potential cover, nesting, and feeding opportunities for wildlife.

The tidal flat area located on the eastern landward shore of Coasters Harbor Island provides a rich and diversified habitat with an abundance of *Spartina* and other tidal vegetation. Hundreds of small crabs, observed in this area during field reconnaissance in August 1999, serve as food for herons, mammals, and other wildlife. Evidence of use by skunks and raccoons was observed during field visits. Also, green herons, snowy egrets, and kingfishers were observed feeding in this area.

The open water habitat in Coasters Harbor is subtidal sand with the benthos defined as a dredged channel. The open water area south of Coddington Point is mapped as a macroalgal bed. The open waters of Narragansett Bay, west of the hospital, are mapped subtidal sand. Bedrock or an intertidal rock outcrop is mapped south of the Gate 10 access road to the Naval Hospital.

The inland area of the Naval Hospital is urbanized and developed consisting of building structures and pavement. Open space areas are limited and vegetative cover consists of grasses and shrubs with low edge interspersion and poor cover type vegetation, indicating poor suitability for woodland wildlife habitat. These open space grass areas are adjacent to Gate 10 along the shoreline.

Coddington Point

The southern coast of Coddington Point is intertidal gravel beach (see Figure 2 Sheet 2). Habitats along the Bishops Rock peninsula include an intertidal rock outcrop, intertidal gravel beach, and fringe gravel terrace. The shore extending north from Bishops Rock is intertidal gravel beach with a fringe gravel terrace and vegetated macroalgal bed-cobble. A vegetated macroalgal bed with a sand substrate has been mapped in the open water off Coddington Point. East of the point, towards Coddington Cove, the shoreline is mapped as an intertidal rock outcrop and fringing rock terrace. The open water area to the north of Coddington Point is mapped as a vegetated aquatic macroalgal bed with a cobble substrate.

The inland area of Coddington Point is highly developed and urbanized. This site consists of buildings and parking lots with limited lawns and hedges. Woodland wildlife habitat is limited and open space areas of vegetation are composed of grasses and shrubs. This area of NAVSTA is highly influenced by human activity and the suitability for wildlife habitat is poor.

Coddington Cove

Much of the shoreline of Coddington Cove is human altered with limited potential for wildlife habitat (see Figure 2 Sheet 3). Habitat types range from intertidal gravel beach with associations of subtidal sand (dynamic and depositional) directly offshore in the cove to fringe gravel terrace.

The inland area of Coddington Cove is highly developed with buildings and other structures for industrial uses. Wetland wildlife habitat south of Building 47 is dominated by *Phragmites*, an emergent wetland plant of low habitat value for wildlife.

Midway

The shoreline area north of the Coddington Cove breakwater is mapped intertidal gravel beach and subtidal sand (depositional) (see Figure 2 Sheet 4). Extensive vegetated macroalgal bed on both sand and cobble substrata are located off shore between the Coddington Cove breakwater and Carr Point. The upper intertidal zone is marked with a fringe rock terrace between McAllister Point and Gomes Brook. An intertidal gravel beach extends from the vicinity of Greene Lane north to a point south of Carr Point.

The inland area of Midway is useful and beneficial to support various types of wildlife species. This site has interspersed vegetated cover types promoting diversification of wildlife species. The increase in habitat edge and patchiness of this site includes openland, woodland, and wetland wildlife habitats. Woodland wildlife habitat is adjacent to McAllister Point, east of Defense Highway.

Melville-South and Melville-North

An intertidal gravel and sand beach extends north from Carr Point to Lawton Brook (see Figure 2 Sheet 5). Subtidal sand (depositional) is found offshore in this same area. Three macroalgal beds on sand substrate are located offshore in the Normans Brook, Carr Point, and Lawton Brook areas. A fringe gravel terrace and fringing sand flat are located adjacent to the discharge area of Normans Brook. The shoreline associated with Carr Point, extending north to Melville-North, is mapped as an intertidal sand beach with limited area of back beach. The shoreline north of Lawton Brook is mapped as an intertidal gravel beach. The Weaver Cove area is mapped as an emergent saltmarsh. This habitat has ecological significance.

The Melville-North area including DFSP north fueling pier and wharf is highly altered by human activity (see Figure 2 Sheet 6). Macroalgal beds extend offshore north of the fueling pier, along an intertidal gravel beach and a fringing gravel terrace.

The inland area of Melville-North is influenced by human activity and is highly disturbed. The upland area consists mainly of open space areas with grasses and shrubs, low edge interspersion, and poor cover type vegetation in the vicinity of Tank Farms l and 2. Woodland wildlife habitat is present adjacent to Tank Farm 1. Residential areas offer limited wildlife habitat.

Wetlands associated with the upper Melville Pond, owned by the Town of Portsmouth, offer more diverse and valuable habitat than found on adjacent Navy property. The upper Melville Pond is stocked with rainbow, brown, and brook trout by the RIDEM Fish and Wildlife Department each spring and fall. Annually, 1600 to 1800 trout are stocked on a "put and take" basis in the upper pond and in a lower Melville Pond. Stocking is conducted the third week of March and continues every two or three weeks into May when water temperatures rise. An additional stocking the second week of October is usually conducted. It is not anticipated that any trout will become resident species. According to the Portsmouth Town Manager, the upper Melville Pond is a popular recreation area for fisherman and includes facilities consistent with the Americans with Disabilities Act (ADA), providing handicapped accessible fishing.

Fort Adams

The west shoreline is mapped as a fringing rock terrace exposed to deep tidal currents and wave activity (see Figure 2 Sheet 7). A 40 to 90 foot deep channel located directly offshore is an important fish habitat. The northern end of Fort Adams is mapped intertidal gravel beach and fringe gravel terrace.

Fort Adams is a developed residential area. Limited open space areas have vegetation consisting of grasses and shrubs with low edge interspersion and poor cover type vegetation. Adjacent land within the Fort Adams State Park offers more wildlife habitat.

NUWC

Most land and water resources of the 190-acre NUWC area serve as habitat for some form of wildlife. Approximately 150 acres of the site are developed. Buildings, structures, and associated landscape areas (lawns, shrubs, and trees) in developed portions generally support tree squirrels, songbirds, and raptors, while less developed areas (such as the Deerfield area) generally provide "undisturbed" vegetative habitat for species less tolerant of human activity. The primary wildlife resource concerns at NUWC focus on the latter area. In addition, NUWC maintains limited frontage on Stillwater Basin, a protected pier system located within Coddington Cove on Narragansett Bay. This habitat is important for fish and wildlife. See Figure 2 Sheet 8.

Occurrence of species at NUWC is dictated largely by available habitat and by degree of past land use activities. Widespread alteration over the last several hundred years has caused emigration or elimination of many original species, particularly reptiles and mammals. As a result, the present fauna consist of species that have a relatively wide geographical distribution and ecological tolerance, moderate to high habitat and environmental adaptability, and minimal habitat requirements.

Field inspections of wildlife resources and habitats were conducted on 24 and 29 May 1996 by Louis Berger & Associates, Inc. The primary focus of attention was the Stillwater Basin area on Narragansett Bay and the Deerfield wetland area.

The undeveloped Deerfield area provides a range of habitats for vertebrate species. Freshwater wetland and facultative wetland vegetation occur in the lower areas, surrounded by dense scrub-shrub vegetation. These habitats are bordered by NUWC lawns and the adjacent non-Navy golf course. This variety provides a range of niches for feeding, breeding, and nesting. The edge between the dense scrub/shrub vegetation and open mowed lawns provides a rich and diverse habitat for songbirds and mammals. This site is also directly accessible to coastal shoreline as evidenced by shellfish debris.

Gould Island

The majority of the property is located on 15 acres on the northern end of Gould Island (see Figure 2 Sheet 9). The primary use of the annex is for occasional torpedo testing. A weapons systems testing area is located in the East Passage immediately north of Gould Island and is a potential site for testing of countermeasures. No personnel are permanently based on the island. All buildings at Gould Island have been demolished with the exception of Building 35 on the northern manmade "arm" of the island. Building 35 contains two torpedo elevators, a firing pier, three diesel-powered generators, storage, and office space. Test activities and recurring pier and piling maintenance activities take place in the area around the active portion of Building 35 at the northernmost tip of the island. Building 35 has a footprint of approximately 10,000 square feet.

The shoreline of Gould Island is man-made. The man-made shoreline of the northern "arm" containing Building 35 is deteriorated sheet piling. At numerous locations the sheet piling has rusted away and backfill has slumped through, causing sink holes on the surface. Granite block revetment was observed along the east shoreline; concrete block revetment was observed along the west shore.

Paved areas include former streets (A, C, D, and E) and an extensive paved area north of former Building 32. The building foundation of the south end of Building 35 is still in place. Sufficient deterioration of the pavement has enabled extensive scrub and shrub vegetation to grow up on these streets, virtually impeding passage.

RIDEM maintains most of the remaining land on the island. It is a designated FUDS awaiting study and/or remediation.

3.1.4 Special Aquatic Sites

Special aquatic sites, as defined in 40 CFR Part 230 (Section 404(b)(1) Guidelines), Subpart E (230.40 through 230.45), include freshwater and tidal wetlands, sanctuaries and refuges, mudflats, vegetated shallows, and coral reefs. Mudflats are intertidal areas that not only provide habitat for mollusks and polychaetes, but also provide feeding habitat to wading and shore birds. Vegetated shallows include eelgrass *(Zostera marina)* and widgeon grass *(Ruppia maritima).* Mudflats and eelgrass beds are located offshore at Coasters Harbor Island, Coddington Point, and Fort Adams as indicated in Section 2.1.1 above.

Eelgrass beds are located within the waters of Narragansett Bay adjacent to the NAVSTA property. RIDEM has identified an eelgrass bed north of Coasters Harbor in an area identified on the nautical chart (Figure 3) as "ruins" and "platforms" (RIDEM, 1989a). The Narragansett Bay Project has identified vegetated shallows as macroalegal beds and eelgrass beds (French et. al., 1992). See Figure 2 Sheets 1-7 in the INRMP. Although this information is subject to periodic field verification, the potential for protected habitats exists at the following locations:

- Southwest end of Coasters Harbor Island (eelgrass)
- North of the stone breakwater on the west side of Coasters Harbor Island (macroalgal bed, soft [sand or silt] substrate)
- North side of Coasters Harbor Island (macroalgal bed, soft substrate), extending to Bishops Rock
- West of the Naval Hospital (macroalgal bed, soft and cobble substrate)
- North shore of Bishops Rock (eelgrass) and west of short of Coddington Point (macroalgal bed, soft substrate)
- At shores north and south of Coddington Point (macroalgal bed, cobble substrate)
- Limited beds between Coddington Cove breakwater and McAllister Point (macroalgal bed, soft substrate)
- North of McAllister Point to Carr Point (macroalgal bed, soft and cobble substrate)
- West of the DFSP Tank Farms 1 and 2 (macroalgal bed, cobble substrate)
- West of Fort Adams (macroalgal bed, cobble substrate)

Narragansett Bay Habitat Mapping has recently been revised and updated by the Narragansett Bay Estuary Program. Mapped resources include coastal marshes, eelgrass beds and special aquatic sites and other coastal features. This data was collected using 1996 true color aerial photography (transparencies) at 1:12,000 and 1:40,000 scales taken in the summer of 1996. The data has been incorporated into the state GIS database.

3.1.5 Habitats of Concern

Habitat within the Coasters Harbor saltmarsh, near Gate 2, has been impacted in the past (probably prior to enactment of the Clean Water Act in 1972) through filling along the north and south edges. Although limited in extent compared to the original saltmarsh footprint, this habitat includes mudflats exposed at low tide, fringing saltmarsh, and freshwater inflow from upland areas outside of NAVSTA. A wetland in the vicinity of Connell Highway rotary that likely receives highway runoff from local roads and the approach to the Newport-Pell Bridge, is connected hydraulically via a stream to the NAVSTA saltmarsh. Headwaters of this wetland/stream are located in a residential area southeast of the Jai-Alai stadium and may include parking lot runoff and storm drain discharge from the residential area as well. Additional adjacent off-site land usage includes commercial uses along the west side of Connell Highway, the Newport Secondary rail line, and a Newport Electric substation. Land uses on NAVSTA include a low-lying area to the south where demolition debris and other stockpiled material have been observed and fenced storage and stockpile areas along the north. These storage areas are paved and associated drainage is discharged via overland flow to a wetland.

Eelgrass beds are protected as Special Aquatic Sites under the Clean Water Act. Waters off the Coasters Harbor shoreline north of the Coasters Harbor Island bridge and south of Bishops Rock have been identified as eelgrass beds. These resource areas have been mapped, and are depicted in Section 8.3 of the INRMP. Other eelgrass habitats have been identified along the southwest shores of Coasters Harbor Island. These areas were identified by the Narragansett Bay Project and field verified by the Navy/Army Research team during inventory activities in July 1999.

Macroalgal beds are prolific along the NAVSTA Newport according to the Narragansett Bay Project habitat mapping (French et. al., 1992). Macroalgal or seaweed beds are also protected as Special Aquatic Sites by the Clean Water Act. Beds on sand and gravel substrate have been identified off the naval hospital, north of Coasters Harbor Island and south of Bishops Rock, along Coddington Point, between the Coddington Cove breakwater north to Carr Point (with the exception of McAllister Point), along the DFSP Tank Farms 1 and 2 at Melville, and west of Fort Adams. The presence and health of these beds must be field verified during the growing season.

The west shore of Fort Adams has been identified as Type 1, Conservation Water by the RI Coastal Resources Management Council. The rocky shores of Fort Adams limit human use. Human presence does not diminish use of this shoreline for feeding, nesting or resting habitat for shorebirds. Although some rocks on shore may be used as haul-outs for harbor seals, the availability of this habitat further south at Brenton Point State Park limits the desirability of such use along the shoreline at Fort Adams.

3.1.6 Fish and Wildlife Recommendations

Management recommendations for fish and wildlife are focused on natural resource and habitat protection. This is due to the intensive, historical industrial and support land use that has significantly converted and altered the natural habitats of NAVSTA. The following recommendations are excerpted from the INRMP:

- The "edge" between intertidal beach and landscaped lawns provides diverse options for food and cover. Proper care and maintenance of these plantings is important for protecting these resources. Lawn is mowed directly to the edge of the fringed rock or gravel terrace adjacent to the beach in many areas of Coasters Harbor Island. By allowing a five to ten foot swath to revegetate with native salt-tolerant species such as *Rosa rugosa*, the value of this "edge" to wildlife would be increased.

- Freshwater wetlands are present on NAVSTA. These wetlands are protected under the Rhode Island Freshwater Wetlands Protection Act and the Clean Water Act. The areas protected by the state include the "perimeter wetland" which extends 50 feet from the delineated edge of freshwater wetlands and "riverbank wetland", the area within 100 feet of watercourses less than ten feet in width and within 200 feet of rivers greater than 10 feet in width. Any alterations within the wetland or the perimeter wetland are subject to the jurisdiction of the RI Wetlands Act. Any proposed projects adjacent to or within the drainage basin should be carefully evaluated for anticipated impacts to fish and wildlife resources early in project development and through application of the site review and NEPA process.

- Mitigation is recommended to avoid or minimize impacts from activities that could affect marine resources such as pier and bulkhead repair, pile driving, and maintenance dredging. Construction may be limited to seasons of the year when fish are not spawning in the area. Construction methods may be selected to minimize impacts (i.e. pile driving, not augering). Placement of silt curtains around marine sites and placement of haybales on land may be used to confine sedimentation to the immediate project site.

Species Protection

Management objectives for endangered and threatened species and marine mammals at NAVSTA consist of habitat preservation, avoid disturbance of individuals, and educate military personnel through environmental awareness.

INRMP recommendations for species protection are listed below:

- Subtidal and benthic areas offshore provide suitable foraging habitat for all species of marine turtles including the threatened loggerhead and the endangered green and Kemp's Ridley turtles. These habitats, however, are at the northernmost limits of their extensive ranges, and the occurrence of individuals would be considered rare and unusual. Any incidental sightings of harbor porpoises or other marine mammals should be reported to the Natural Resources Manager, Code N8N. Offshore naval operations should make appropriate provisions for the possible presence of marine aquatic species, including visual observations before and during operations.

- Naval proposals and plans for non-routine maintenance, repairs, and expansion of shoreline and offshore facilities should make provisions to ensure that the National Marine Fisheries Service (NMFS) is consulted prior to commencement of activities. Requirements of the Endangered Species Act and the Magnuson-Stevens Act include provisions for consultation with the NMFS, and may require additional studies to mitigate potential adverse affects to protected habitats, including Essential Fisheries Habitats (EFH).

- Update surveys of rare species only if a significant change in land use occurs (RIDEM, 1997).

- Harbor seals, periodic visitors to Coddington Cove, are protected by the Marine Mammals Protection Act. By prohibiting access to the breakwater, enforcing the Security Zone within Coddington Cove thereby limiting marine traffic, and continuing best management practices relating to stormwater management, the habitat of these marine mammals will be protected.

Pest Management

The US Navy is required to obtain a depredation permit from the USFWS for the removal of nuisance migratory bird species protected under the Migratory Bird Treaty Act (MBTA). If a federal agency is acting in its official capacity, USFWS recommends the agency, NAVSTA in this case, keep a record of activities covered by this act. This record is required in the event that USFWS ever requests an annual report of activities. No permit or record of activity is required to actively discourage waterfowl from land use through an Integrated Management Plan (IMP), however a permit is required to eliminate animals. Both Canada Geese and gulls have become nuisance species at NAVSTA Newport.

Flocks of Canada Geese are a problem within many areas of NAVSTA Newport property where large open grassland habitat areas provide preferable foraging and resting habitats for this species. Geese require grassland habitat and will continue to increase in population as long as no threat exists from human activity and habitat is not degraded.

INRMP recommendations for pest management are listed below:

- Utilize noisemakers to discourage goose populations from establishing themselves. They should be placed within areas the geese utilize. Noisemakers are triggered to sound off at certain time intervals. Noisemakers can be a nuisance in urban areas and may present a noise ordinance violation.

- Allowing native vegetation to grown into a dense buffer between the water and upland grassy areas has been shown to be a deterrent to geese. Incorporation of new grounds maintenance practices to allow 25 foot wide buffers of shrubs and dense herbaceous vegetation will not only deter geese in preferred shoreline landing areas, but can also help to protect water quality from surface runoff during storm events.

- Gulls are protected under the MBTA. Federal permits are required when gulls must be killed, but permits are not required to actively discourage land use. This species becomes acclimated to any single control method, thereby requiring a diverse and site-specific approach to control. Grid wires suspended on rooftops, audio and visual frightening, and pesticides may be used to discourage nesting or landing of gulls.

- In accordance with the MBTA, trees should be inspected prior to felling in order to determine if active nests are present. Any nests disturbed by routine naval operations should be reported to the Natural Resources Manager, NAVSTA Newport, Code N8N, for documentation in accordance with USFWS requirements. Backhoe operators should be alert for potential presence of nesting migratory birds and other species of concern prior to demolition activities. Landscaping crews should also report nests observed to Code N8N prior to hedge trimming and pruning activities.

3.1.7 Environmental Consequences

There are no intensive wildlife management practices that have been recommended within the INRMP. Instead the focus has been more on strengthening the protection and improving the quality of existing habitats by implementing best management practices (BMPs) to reduce and eliminate erosion and sedimentation problems, and nonpoint source pollution from run-off. Implementation of the use of buffer strips of vegetation will also enhance the wildlife value of habitats.

The INRMP recommends strict adherence and coordination with state wetlands laws and regulations, which facilitate the protection of wetlands and buffer areas around them for wildlife functions and values. Coordination with the National Marine Fisheries Service (NMFS) is addressed to ensure protection of marine wildlife and fisheries, including EFH, for operational and construction activities by the Navy and its tenants.

Opportunities may exist for developing a wildlife habitat improvement and management plan in the Gould Island area due to the recent environmental restoration and clean-up activities there. Several structures have been torn down and pavement removed. This represents a good proactive opportunity to coordinate wildlife management on NAVSTA lands, since RIDEM is the other landowner.

3.2 LAND USE

Most land and water resources at NAVSTA (approximately 1,341 acres) serve as habitat for some form of wildlife. Buildings, structures, and associated landscape areas (lawns, shrubs and trees) generally support the following species: tree (grey) squirrel, song birds, raccoon, opossum, skunk, American robin, cardinal, starling, crow, sparrow, mourning dove, and raptors. Less developed areas generally provide "undisturbed" vegetative habitat for species less tolerant of human activity.

Due to the intensive development and industrial nature, wildlife habitat is limited. Occurrence of species is dictated largely by available habitat and past land use. Widespread habitat alteration and conversion has caused elimination of many original species, particularly reptiles and mammals. Wildlife is typical of urbanized areas where species have become adapted to limited habitat requirements.

Large contiguous habitat areas are absent from the NAVSTA property. The resultant smaller habitat areas create a large amount of lower value edge or ecotonal areas (areas where two or more habitats interface) which meet the habitat requirements of species adapted to the food and cover resources of such areas.

Human use of land resources dominates upland areas of NAVSTA property. Land management, including wetlands and stormwater management are key factors in maintaining adequate feeding, resting, breeding, and nesting habitat for fish and wildlife species. Environmental restoration and issues relating to the past release of hazardous materials (or potential pathways identified in the *Spill Prevention Control and Countermeasure Plan)* are also critical for the success of these species.

Dense scrub/shrub undergrowth dominates upland areas between the shoreline and Defense Highway north of the Coddington Cove breakwater. This undergrowth serves as a vegetated buffer strip and provides sufficient nesting and resting habitat for many species, including those protected by the Migratory Bird Treaty Act. This, combined with the mowed "edge" along the perimeter shoreline east of Coddington Point, provides a diverse selection of food sources for wildlife. Maintenance of the dense undergrowth and mowed lawns are important to maintaining habitat in all NAVSTA areas.

Habitats with limited human access are potentially more valuable to wildlife than those frequented by man. Although NAVSTA has over ten miles of shoreline on Narragansett Bay, access by military personnel and their families is not encouraged along much of this frontage. Access along the 3.5 miles between the Coddington Cove breakwater and the DFSP at Melville is limited to 1900 linear feet at the Carr Point recreation area. A fence along the thickly vegetated back beach limits access between the ballfields, picnic areas, and trailer hookups and the undeveloped gravel and sand beach. Access from the remaining northern section of NAVSTA is limited by a lack of parking opportunities along the Defense Highway, the Newport Secondary rail line, and utility lines. Access is controlled to the DFSP waterfront in Melville and to the former McAllister Point landfill. With the exception of these two sites which have limited potential for use by fish and wildlife based on current and past use, natural habitat including intertidal gravel beaches and fringing rock terraces abound for the remaining 2.9 miles between the Coddington Cove breakwater and the DFSP in Melville. Although the shoreline is relatively undisturbed, wildlife usage of both upland and shoreline habitats may be limited by the rail line and Defense Highway.

Approximately 3.8 miles on Narragansett Bay is available from the Coddington Cove breakwater south to the Newport-Pell Bridge (including Coasters Harbor Island). Approximately 3,700 feet (includes approximately 1,000 linear feet at Stillwater Basin) are developed with piers and bulkheads. Of the remaining frontage, intertidal gravel beach and fringe gravel/rock terrace dominate the shoreline. Much of this shoreline is readily accessible to NAVSTA personnel and their families (the rock bluff east of Coddington Point within Coddington Cove is not accessible). Recreation facilities including ballfields, picnic areas, and jogging trails provide direct access to the shoreline.

Several manmade features limit access to the shoreline and limit use by wildlife traveling between habitats. Roads such as Riggs Road at the Naval Hospital, Cushing Road and access roads behind Buildings 991, 686 and 683 at Coasters Harbor Island, and Donovan/Elliott Avenue, Cappodanno Drive, and Whipple Street in the Coddington Point area all parallel the shoreline. Proximity of roads and utility lines also limits access of wildlife from the waterfront to upland areas. Limited human access to the shoreline helps protect this habitat for nesting birds.

3.2.1 Land Use Recommendations

Specific recommendations for land use management have been made within the INRMP for NAVSTA properties. Management and protection recommendations include the following: verifying and mapping wildlife habitat, changing to be more inclusive of sensitive areas, implementing storm water maintenance practices, responding to oil and hazardous material spills and leaks, and implementing storm water BMPs.

Specific recommendations for species protection are listed below:

- Include recently delineated freshwater wetlands on NAVSTA Newport Conditions Maps
- Inventory of eelgrass as part of the planning process, if and when a new bridge to CHI is programmed by MILCON
- Integrate freshwater wetlands and eelgrass beds on condition maps
- Potential eelgrass beds have been identified by RIDEM in offshore areas south of Coddington Point. Verify the presence of these beds during the growing season. Verify the extent of these beds and include the locations on the NAVSTA Conditions Maps

Environmentally sensitive resources at NAVSTA Newport include CRMC's Type 1 Conservation Waters, waters classified by RIDEM as Class SA or A, areas currently zoned by NAVSTA as ES, potential eelgrass beds (and other sites protected by the Clean Water Act), and wetlands mapped either by the National Wetlands Inventory (including marine, estuarine and palustrine wetlands) or NAVSTA (freshwater wetlands).

According to the Comprehensive Plan (Newport Naval Complex, 1990), two zoning designations protect critical natural resources:

- ES permits the following uses: unimproved areas, environmentally controlled outdoor activities and limited utility crossings where no other viable alternatives exist
- OS, areas are set aside to control development in floodplain, wetlands, and other environmentally sensitive areas. Open Space permits the following uses: major lawn/park type areas, exterior recreation fields (tennis courts, basketball courts, ball fields, walking/exercise/running/biking trails), playgrounds, associated parking areas, recreational vehicle storage, unimproved areas, limited camping, recreational areas, utility structures and crossings, small picnic pavilions, recreation support facilities for storage and offices, and cemeteries

INRMP recommendations for zoning are listed below:

- Revise Comprehensive Plan to zone environmentally sensitive areas subject to 100-year flooding as Environmentally Sensitive and not Open Space
- Change zoning to ES for shoreline adjacent to CRMC Type 1 waters, eelgrass beds (once confirmed), and along RIDEM Class SA and A waters
- Change zoning to ES for areas subject to 100-year flooding and adjacent to wetlands (including the area adjacent to Gate 2 and west of Building 47)

Soil and debris are currently stockpiled within the 200-foot jurisdictional zone of CRMC south of Gate 2 (north of Farragut housing area). There is the potential for runoff to discharge directly into CRMC Type 1 conservation waters within Coasters Harbor. Increased sediment loading could increase turbidity and adversely impact the photic zone. The photic zone is the area where plants (macroalgal and eelgrass) intake sunlight necessary in photosynthesis. This area, currently zoned OS, should be re-zoned ES, as described above.

A hazardous materials storage area and scrap yard at Buildings 47 and 48A abut a freshwater emergent wetland discharging to Coddington Cove. This area is within the 50-foot perimeter wetland classified by RIDEM, within the 200-foot CRMC area of jurisdiction, within a 100-year flood zone, and is adjacent to an area zoned ES.

INRMP recommendations for soils and hazardous materials:

- Prohibit stockpiling of soil and debris within current and proposed ES zones without adequate provision for stormwater management. All stockpiled material (regardless of site zoning) should be covered and surrounded with hay bales
- Prohibit storage of hazardous materials within 100-year flood zones (regardless of zoning designation) unless contained within flood-proofed structures

3.2.2 Environmental Consequences

The consequences of not implementing the recommended strategies and practices contained within the INRMP 2001 would result in greater risk of degradation to coastal wetland resources and habitats from land use impacts. Degradation from land use would result in a loss of quality habitat, poor water quality, and violations of state and federal environmental laws and regulations. The previous NRMP did not contain such comprehensive management and protection practices and strategies.

3.2.3 Oil and Hazardous Material Handling

A release of oil or hazardous materials at any site within NAVSTA has the potential to adversely affect the quality of Narragansett Bay and the associated smaller coastal marshes. Appropriate storage, handling, and spill response is required to protect the waters of the bay and adjacent environmentally sensitive resource areas.

INRMP recommendations for oil and hazardous material handling are listed below:

- Bring DFSP into compliance with National Oil Contingency Act, 40 CFR 112. Investigate and permit the outfall east of the north fueling pier
- Implement tank and pipe testing program for Underground Storage Tanks (USTs) and determine compliance with RIDEM UST regulations
- Replace the 3,000 gallon #2 fuel oil underground storage tank at Building W-34. According to the SPCC, this tank was installed in 1941. This tank is located within the drainage area of the estuarine wetland adjacent to Gate 2

- If the storm water drainage system includes dry wells or sumps (with no connection to receiving waters), an Order of Approval must be obtained from RIDEM in accordance with the Underground Injection Control Program, authorized under the Clean Drinking Water Act. By protecting the groundwater at NAVSTA, the quality of sensitive resources including groundwater-fed wetlands will be assured
- Investigate catchbasins with unknown discharge points, especially those within the drainage areas of sensitive environmental resources. Obtain an Order of Approval from RIDEM in accordance with the Underground Injection Control Program if the stormwater drainage system includes dry wells or sumps with no connection to receiving waters
- Replace two PCB transformers at Building 72 at the Naval Hospital, located within 200 feet of the coastal zone. Replacement would reduce the potential for an emergency release to cause significant impacts to surrounding marine ecosystems of Narragansett Bay
- Floodproof any hazardous materials storage areas located within the 100-year flood zone
- Complete and implement a Spill Prevention Control and Countermeasures Plan (similar to the one completed for oil) for hazardous materials storage areas (including chlorine).

3.2.4 Environmental Consequences

As the previous NRMP did not contain many of these recommended strategies and practices, failure to implement the INRMP 2001 would result in reduced environmental controls and practices with impacts of environmental degradation of water quality and wildlife habitat on NAVSTA and surrounding environs.

3.2.5 Erosion and Sedimentation Control

The following are recommendations made within the INRMP 2001 to reduce the potential of water quality degradation on NAVSTA properties. These were selected measures to meet the objectives of the Rhode Island Department of Environmental Management, as excerpted from the *Rhode Island Soil Erosion and Sediment Control Handbook* (1989b):

- ***Fit Development to the Terrain -*** Areas should be tailored to the existing site conditions in order to avoid unnecessary land disturbance, minimizing the erosion hazards and costs. Limit areas of clearing and grading by concentrating construction activities on the least critical or sensitive areas. Align roads on the contour and consider using them to divert surface water
- ***Divide the Site into Drainage Areas -*** Consider how erosion and sedimentation can be controlled in each small drainage area before looking at the entire site
- ***Cluster Buildings Together -*** Cluster development lessens the erodible area, reduces runoff, and generally reduces development costs
- ***Minimize Impervious Areas*** - Keep paved areas such as parking lots and roads to a minimum. The more land that is kept in vegetative cover, the more water will infiltrate into the soil minimizing runoff and erosion
- ***Minimize Disturbance of the Natural Drainage -*** Maintain, where possible, the natural drainage system of a site instead of replacing it with storm sewers or concrete channels. Sediment basins should be located so they will intercept runoff prior to its entry into the wetland or watercourse. Avoid diverting one drainage system into another without closely investigating whether the receiving system will be overtaxed and create downstream flooding or erode the natural streambank vegetation
- ***Keep Land Disturbances to a Minimum -*** Plans the stages of development so that only the areas that are actively being developed are exposed. All other areas should have natural vegetation preserved, have a good cover of temporary or permanent vegetation established, or be heavily mulched
- ***Stabilize Disturbed Areas -*** Permanent structures, temporary or permanent vegetation and mulch, or a combination of these measure, should be employed as quickly as possible after the land is disturbed. Stabilization measures should be applied within 30 days after final grading. Stockpiles, spoil areas, borrow areas, and other disturbed areas should be protected by mulch or temporary vegetation if they will be idle for more than 30 days
- ***Keep Run-off Velocities Low*** - Keep slope lengths short, gradients low, and preserve natural vegetative cover to help keep stormwater velocities low. Keeping runoff velocities low will reduce soil erosion
- ***Minimize the Grades of Slopes*** - Attempt to keep slopes at 10:1 or flatter. Cut and fill slopes should not be steeper than 2:1. If slopes are to be mowed, the slope should not be steeper than 3:1
- ***Protect Disturbed Areas from Stormwater Runoff*** - Install erosion control or stormwater management measures to minimize water entering and running over disturbed areas. Drainage facilities should be installed as early as feasible during construction, prior to site clearance, if possible. Surface water should be diverted from the face of all cut and/or fill slopes by the use of diversions, ditches, and swales or conveyed downslope by using appropriate measures

- ***Install Perimeter Sediment Control Practices*** - Two methods are most often used to retain sediment: 1. Filter runoff as it flows through an area or, 2. Impound the sediment-laden runoff for a period so the soil particles settle out

Site-specific erosion control INRMP recommendations for NAVSTA include the following:

- Enforce Best Management Practices (BMPs) at construction areas including during the installation of utilities and at IR sites. Specific recommendations include a weekly inspections by the Natural Resource Manager, Code N8N, to ensure that graded areas are stabilized quickly with grass seeding or planting, stockpiled soil is covered, dust is suppressed through application of calcium chloride or water, and haybales are replaced when fouled with sediment. Appropriate decontamination procedures must be followed at IR sites to confine the area of contamination to the hot zone
- Leave a five to ten foot vegetated buffer between mowed lawn and intertidal beach to stabilize the shoreline. This is especially important along the north side of Coasters Harbor Island and along the west shore of Coddington Point (north of Bishops Rock). Vegetation should be kept at three to four feet to avoid blocking views. Planting should mimic natural shorelines such as the north coast of Coddington Point. Plantings could include salt-tolerant species such as a limited number of Japanese black pine *(Pinus thunbergii)* to frame views, and beach plum *(Pyrunus maritima),* bayberry *(Myrica pennsylvanica)*, Rugosa rose *(Rosa rugosa),* and Virginia creeper *(Parthenocissus quinquefolia).* Retain leaf litter in natural areas along the shoreline slows runoff waters to allow for infiltration and absorption of pollutants such as fertilizers and herbicides
- Repair bulkheads and seawalls to maintain serviceable condition, in accordance with US Army Corps of Engineers requirements for Section 404 permitting (if constructed after implementation of the Clean Water Act in 1972). Erosion of backfilled material through the bulkhead or wall has the potential to increase turbidity, thereby reducing aquatic photosynthesis, and reducing depths in adjacent waterways
- Backfill eroded areas behind seawalls and bulkheads with gravel or other large-grained material to minimize continued erosion

Best Management Practices - The most recent version of the *Rhode Island Stormwater Design and Installation Standards Manual* provides appropriate methods for the treatment of stormwater with "Best Management Practices" (RIDEM, 1993). An additional source that provides guidance and supplemental information for management and treatment of stormwater is the most recent version of the *Rhode Island Soil Erosion and Sediment Control Handbook*, including amendments (RIDEM, 1989b). The *Rhode Island Community Nonpoint Source Pollution Management Guide* (RIDEM, 1995) also provides information for decision-makers in preventing impacts to natural resources.

An erosion and sediment control plan should be prepared for any on-site construction activities. The plan should include operation and maintenance requirements for both temporary and permanent control measures and identify responsible parties. The erosion and sediment control plan should contain sufficient information to satisfy regulatory requirements and ensure that problems of erosion and sedimentation for a given project are adequately addressed. The length and complexity of the plan should be commensurate with the size of the project, the severity of site conditions, and the potential for off-site damage, especially to sensitive resource areas such as CRMC Type 1 waters, RIDEM Class SA and A waterbodies, NAVSTA-zoned ES areas, potential eelgrass beds, and wetlands.

During construction, weekly inspections will conducted by the Natural Resource Manager, NAVSTA Newport, Code N8N, to determine compliance with construction specifications relating to sediment control. Inspections should be conducted immediately following rain or more frequently during prolonged storm events. A report should be required at each inspection to assure compliance.

3.2.6 Environmental Consequences

Many of these recommendations are not found within the previous NRMP. The consequences resulting from failure to implement these strategies will result in potential environmental impacts from operations and construction on NAVSTA lands, causing degradation to water quality and wildlife habitats. Failure to implement the practices and recommendations would also result in violations of state and federal environmental regulations and laws.

3.2.7 Stormwater Management

The INRMP 2001 makes very specific recommendations on storm water management and they are listed here. Non-point source discharges, including stormwater flow, have the potential to adversely affect natural resource areas through erosion, scouring, or deposition along the shoreline and through degradation of water quality with potential pollutants including total suspended solids, fecal coliform, volatile organic compounds, and hydrocarbons.

INRMP recommendations for storm water management include the following:

- Provide secondary containment, in form of elevated berm, in all loading docks or adjacent to building doors where handling and loading of liquid materials regularly occurs. In all cases, the potential exists for a spill to occur in these areas that may result in an impact to natural resources if not contained
- Establish and implement an annual maintenance program for existing oil/grit separator storm drainage structures. Implement a testing program to verify the efficacy of these structures
- Implement an annual catchbasin maintenance program including cleaning of sumps and drainage of oil from oil/water separators. Dispose of removed wastes in accordance with RIDEM regulations
- Repair or replace drainage outfalls, as necessary, to minimize scouring, undermining, etc. on shoreline
- In industrial use areas where the outlet for the storm drain system is unknown but potentially within the drainage area of a sensitive resource, verify through dye tests or similar means the outlet location. In the event that underground injection is occurring, appropriately address as regulated under the state UIC program

Coasters Harbor Island

- Provide spill equipment at the Building 170 Solid Waste Dumpster, located at the Coasters Harbor Island shoreline
- Stabilize the Building A138 storm drain

Naval Hospital

- Install and maintain adequate erosion control measures (silt fence, hay bales) throughout the construction period at the sewer construction site (adjacent to Building 50 reservoir)
- Provide spill control equipment at Building 1296 and 68 water and wastewater pumping stations

Coddington Point

- Maintain spill control equipment at the gasoline station, Building 1285. Cover storm system inlets during fuel delivery. Repair or replace crushed storm drain outlet adjacent to this site in a manner to be resistant to future erosion or wave action
- Install an oil/grit separator stormwater management unit on the main discharge line to capture and remove regulated contaminants at the Building 354 Industrial Area. Surface runoff from this hazardous material storage area has the potential to discharge to the saltmarsh at Gate 2 (located within CRMC Type 1 conservation waters). Institute a management program for the hazardous waste storage area. Maintain adequate erosion control measures around soil stockpiles.

Coddington Cove

- Provide positive roadside drainage in the Anderson Avenue area. Maintain the existing stormdrain system in a functional condition
- Cover the Secure Storage Area (adjacent to Building A48) to prevent the transport of pollutants into storm runoff. Install outlet protection such as riprap stabilization, at stormdrain outlet in Coddington Cove
- Install oil/grit separator stormwater management units on main discharge lines in the Coddington Cove industrial area to protect waters of Coddington Cove as follows:

    1. 33-inch outfall north of Building 234
    2. 33-inch outfall near intersection of Chandler Street and Defense Highway
    3. 24-inch outfall adjacent to Secure Storage Area (northwest corner of Building 47).
    4. 60-inch outfall adjacent to southwest corner of Building 47

Melville-North

- Install secondary containment throughout the fuel loading area, with oil/water separator units placed on outlet pipes. Prepare a site-specific SPCC plan, with personnel training and provision of spill control equipment in a readily accessible location

- Maintain the separation unit on a tight schedule, to prevent an unforeseen overflow of oil or fuel within the chamber. Add a filtration unit to capture volatile organic compounds present in the discharge
- Complete the containment for the North Fueling Pier piping at the ends to provide spill control
- Empty the secondary containment basin at the rear of Building S42 periodically of precipitation (after verified uncontaminated) to maintain capacity for potential spills; or cover drums to reduce stormwater collection

3.2.8 Environmental Consequences

These recommendations are not found in the previous NRMP. Failure to adopt and implement the practices and strategies within the INRMP 2001 would result in environmental degradation of important natural resources on and around NAVSTA properties. Surface and groundwater quality of both marine and freshwater resources would be negatively impacted as well as wildlife habitats.

3.3 FOREST RESOURCES

3.3.1 NAVSTA Forest Recommendations

Most of Aquidneck Island including NAVSTA Newport was cleared in colonial times and divided into small agricultural farms. As farms have been abandoned, successional growth has dominated former fields, creating small woodland areas on the island. Successional tree species including but not limited to gray birch *(Betula populifolia*), black cherry (*Prunus serotina*), black locust (*Robinia pseudoacacia*), red maple (*Acer rubrum*), eastern red cedar (*Juniperus virginiana),* and mixed varieties of oaks (*Quercus sp.)* and pines (*Pinus sp.)* have all colonized this area.

Virtually all of the forests within a 10-mile radius of NAVSTA Newport are hardwoods. The two main hardwood forest community types are mesic lowland mixed forests dominated by red maple (*Acer rubrum*), and xeric upland mixed forests dominated by white and red oaks (*Quercus alba* and *Q. rubra*). An ad hoc community group in Portsmouth has been involved with the town nature preserve in the Melville Ponds area, north of NAVSTA property. This group is concerned with preserving the woodland in this area because this habitat type has become so rare on Aquidneck Island.

The majority of NAVSTA property consists of land uses related to human activity. There are no wooded forest areas within the developed portion of Coasters Harbor Island, Naval Hospital, Coddington Point, Coddington Cove, and Fort Adams. Although scrub/shrub habitat is common in the northern portion of NAVSTA, successional processes have not yielded mature specimens of hardwood or softwood trees. Most growth is less than 20 feet in height. Several limited wooded areas have been identified at former Tank Farm 4 and along Lawton Brook, north of former Tank Farm 3. Former Tank Farm 4 was leased for agricultural use until remediation of the area was initiated.

There is little opportunity for potential timber harvest to exist and resource outgrants are limited and likely not viable. The dominant species, hardwoods, are not suitable for commercial development and silviculture management because of the relatively undeveloped crowns, low numbers of merchantable logs, and low basal area. Silviculture is the science and art of growing and tending forest crops and the practice of controlling the establishment, composition, stocking density, and growth of forests for future harvesting. Merchantability clearly defines the standards used for volume determination for harvest suitability. Merchantable hardwood logs are sawlogs not less than eight feet in length with a ten-inch diameter inside the bark at the small end. A merchantable sawtimber tree is defined as containing at least one merchantable sawlog. Basal area is the cross sectional area in square feet of a single tree or stand that is used for volume determination.

Volume determination of forest stands within NAVSTA was conducted and it was concluded that sparse, isolated stands occur, species contained in stands are undesirable for sawtimber harvest suitability, and existing tree species in forest stands are relatively small in acreage, have minimal numbers of merchantable logs, and have low basal area. The wooded areas within NAVSTA have no potential for sawtimber harvest. Management (silviculture) for future harvestable sawtimber production of upland forests is not recommended. Forest management will not be addressed because of stand density inconsistency and the small acreage of these forest stands. Silvicultural practices have been determined to be impractical and are not recommended because any type of management would not be economically viable.

NUWC

The approximately 190-acre NUWC site consists primarily of buildings, roads, and improved grounds such as lawns. The remaining undeveloped areas contribute to the mission primarily as required uninhabited zones around propulsion test facilities and explosive storage magazines. Physically, the undeveloped areas include wetlands, streams, and ponds that contribute to wildlife habitat and water quality without any conflict with NUWC's mission and with minimal management effort. Little opportunity for forest, farming, and agricultural management activities exist, due both to the highly specialized use of the site to support the Navy's mission and the regulatory status of the unimproved areas. Diversion of additional areas of the site for potential use for forest farming, and agriculture is not compatible with safety and security concerns and is not desired.

Forest, farming, and agricultural management activities do not occur at Gould Island. Due to the island's location, the minimum size of Navy-owned land, and security concerns, there is little potential for forest, farming, and agricultural management. Moreover, the State of Rhode Island has elected to use the majority of the island, once owned by the Navy, as a wildlife management area with no active management measures. Implementation of active forest, farming, and agricultural management on the remaining Navy owned parcel has no economic viability and is not consistent with the state's planned management and will not be undertaken.

3.3.2 Environmental Consequences

There are no specific recommendations for forest management practices within the INRMP 2001, and this is consistent with the previous NRMP. As NAVSTA has very little forest resources due to the urban landscape and significant long-term conversion and use of lands for industrial and military operations and support purposes, it was determined that it would not be cost-effective or beneficial to manage the small stands of trees. These areas do, however, provide value as wildlife habitat and for recreational and landscape purposes, and that is covered within the INRMP 2001. Recommendations for forest management on NUWC lands are not presented within the INRMP 2001, for many of the same reasons as presented for the other NAVSTA land holdings. There are no anticipated negative environmental consequences for this action.

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3.4 NAVSTA NEWPORT/NUWC RECREATION RESOURCES

3.4.1 Recreational Facilities and Locations

Coasters Harbor Island

A wide range of sports related outdoor activities are available on Coasters Harbor Island. A fitness/jogging trail encompasses the perimeter along the coastline of the island. Opportunities for saltwater fishing are to be found along the seawalls, piers, and beaches along the entire coastline, (with the exception of the pier at the north end of Taylor Drive, Coasters Harbor Island, that is considered un-safe). Bird watching is possible throughout the NAVSTA shoreline. A dinghy ramp for small boats is adjacent to this pier. A mooring field is located offshore in Coasters Harbor.

Katy Field, located on the north shoreline and zoned OS, once used for recreation, is now fenced and closed. Lawrence Field, north of Gate 1 on the shoreline of Coasters Harbor, is a multipurpose area that supports baseball, softball, football, and soccer. NAVSTA zoning within this area is OS. This site, utilized daily from March 15 to October 15, is in fair overall condition with holes and manhole covers in the outfield. Dewey Field, zoned OS, is open lawn providing passive recreation along the south shore of the island. Sections of Dewey Field have been disturbed by construction.

Tennis courts are provided at two locations on the island, both OS zoned. Five clay courts located outside of Gym 109 are in good overall condition, as determined by the NAVSTA Morale, Welfare, and Recreation (MWR). Five hard courts are located south of Gate 1 at Building 676 and are in very good overall condition.

A recreational marina for privately-owned sail and power boats is located within the southern peninsula of Coasters Harbor Island, south of Gate 1. This area is zoned for WR. The marina is used by military personnel (retired or enlisted), families of military personnel, and DoD civilian personnel. MWR has indicated that overall condition of the marina is good. The Coastal Resources Management Council (CRMC) concurs with the determination that the Coasters Harbor Island marina certification/perimeter establishment is consistent with the federally approved Rhode Island Coastal Management Program (CRMC, 1997).

The existing marina contains 125 berthing slips and 34 mooring balls, a parking area which meets CRMC's parking standard for marinas, and a launching ramp. No dry rack storage of private boats is provided by the Navy marina. Dry rack storage for approximately 37 Navy-owned recreational boats (28 sailboats and 9 row boats) is located in a yard adjacent to Navy building W34. Currently an additional 11 service sailboats are also located at W34. Storage for approximately eight Navy-owned power boats is provided at nearby Building 303. Currently there are no fueling stations located at the marina. Electrical and water service extend along the main dock areas and service is provided for each slip. A marine sanitary pump-out facility is available.

Table 3.1
MWR Outdoor Recreational Facilities

Map Location Facility Name	Baseball	Softball	Football	Soccer	Tennis Courts	Notes
Coasters Harbor Island						
Lawrence Field	*	*	*	*		Military dog training area
Dewey Field						Open space
Fac. No. 674					5	Hard courts
Fac. No. 675					2	Clay courts
Marina						Sail & power boats
Fitness/Jogging Trail						Coastline
Naval Hospital						
Naval Hospital Field		*		*		
Fac. No. 1291					2	
Coddington Point						

Map Location Facility Name	Baseball	Softball	Football	Soccer	Tennis Courts	Notes
Ave J.			1			
Basketball Court						One court, two baskets
Fitness/Jogging Trail						Coastline
Coddington Cove						
Prichard Field	*	*	*	*		Lacrosse field
Fac. No. 664					2	
Fac. No. 677		2				
Fitness/Jogging Trail						Coastline
Melville South						
Carr Point	2					Campsites, picnic areas, playing fields
Fort Adams						
Courts					*	Basketball

* = Multiple Use Facility

Naval Hospital

Recreational opportunities at the Naval Hospital consist of one multipurpose recreation field, the Naval Hospital Field, and two tennis courts. A stone pier located on the shoreline at Biello Road can be used for recreational saltwater fishing, but is not open to the public for security reasons.

Coddington Point

Many recreational opportunities are provided in the Coddington Point area. A fitness/jogging trail encompasses the entire perimeter shoreline of Coddington Point and can be utilized by all Navy personnel. Bishops Rock is developed as a general-use recreational park and picnic area offering expansive views north and south of Narragansett Bay. This area is used year-round by Navy personnel. MWR Branch has indicated that overall condition of this site is good. The picnic shelter and tables need repair. Bishops Rock is zoned for open space.

A recreational playground, tot lot, and picnic pavilion are located on a bluff overlooking Coddington Cove in an area east of Meyerkord Avenue and north of Whipple Street. This site provides scenic vistas of adjacent Narragansett Bay and the cove. MWR has indicated that condition of this facility is good. See Photo CC-1 in the appendix of the INRMP. A grassy open space lot supports multipurpose activities such as football and is located south of Building 291 on Hollmeyer Street. A basketball court located on the west of Meyerkord Avenue, east of Building 1269 also promotes recreational activities within Coddington Point. None of these facilities are zoned for open space or waterfront recreation.

Coddington Cove

Various types of outdoor recreational facilities including the fitness/jogging trail are located at Coddington Cove. Prichard Field, the Naval Academy Prep School multipurpose field, supports baseball, softball, football, soccer, and lacrosse. This NAVSTA field is within NUWC, but is incorporated in this management plan because of its importance in promoting recreational activities. Two tennis courts, Facilities 664 and 677, are located west of Gate 16A adjacent to the Coddington Cove housing area. A play area is located south of Read Street within the Coddington Cove housing area. Prichard Field and the tennis courts are zoned for open space.

Midway

Midway's recreational opportunities are directly related to the Navy housing area. The Greene Lane housing area has a tot lot and multipurpose field for soccer, football, and baseball, west of Mayflower Drive.

Melville-South

Carr Point, located along the west shoreline adjacent to the East Passage of Narragansett Bay, is an important area for MWR recreational activity during the summer months. Carr Point has a combination field used for baseball/softball and also supports two baseball fields, a general recreation area which incorporates tot lots used as a play area, picnic area and camping sites. MWR has indicated that overall condition of the ballfields is fair; the campsites, picnic areas, and play area are good. Fences and lights are damaged at the ballfield and no bathroom facilities are provided. Grills are damaged at the picnic and camping area. Trees and shrubs along the waterfront fence are overgrown. Lighting is poor, sites need rock or paving, and there is no provision for emergency phone calls to 911 at the recreational vehicle camping area. Carr Point is zoned OS.

A public boat launch constructed by the Town of Portsmouth at Weaver Cove is adjacent to but not on NAVSTA property. This area is noted because the boat launch is available to Navy personnel and their families.

Melville-North

A playground is located on NAVSTA property east of the Melville housing area on Stringham Road. This area is zoned for OS.

The Town of Portsmouth has developed extensive recreational areas on property adjacent to NAVSTA in Melville. Upper Melville Pond, located between the Melville and Rainbow Heights housing areas, is stocked with trout by RIDEM Fish and Wildlife and is a popular fishing area; a fishing dock is ADA-accessible. The Thumbs Up Yacht Club conducts model yacht racing for participants of the Shake-a-Leg program for handicapped sailors.

Upper Melville Pond drains through a series of ponds located within a town nature preserve before discharging to Narragansett Bay north of NAVSTA. A campground and extensive trail network are located within this property, owned by the Town of Portsmouth. Rainbow Heights and Melville housing areas and Tank Farm 1 are located within the Melville Ponds watershed.

Fort Adams

Recreational opportunities at the Fort Adams housing area consist of tennis/basketball courts north of Building 10 on Monroe Road. Two open space areas are located west of the fire station, Building 86, and adjacent to the preschool, Building T-381. RIDEM-owned Fort Adams State Park, located adjacent to NAVSTA, provides extensive recreational opportunities with beaches, boating, playing fields, and picnic facilities.

NUWC Main Site and Gould Island

Because of NUWC's sensitive and classified mission, little or no public access to the site for recreational activities is allowed. Outdoor recreation is limited to softball fields, a fitness trail, and de facto walking routes for employees and military personnel already with security access to the site. The fitness trail is used predominantly during lunchtime hours. This trail, with fitness stations, is located along the property perimeter, northwest of the Deerfield wetland.

NUWC's mission is limited to research, development, testing, and evaluation performed almost entirely by civilian staff on an approximately 190-acre site. All military family housing, recreational areas, and community facilities for military personnel are provided by the NAVSTA, which has recently undergone substantial reductions in assigned military personnel. The existing recreational resources on the NUWC premises represent an insignificant fraction of the Navy-owned recreational resources on NAVSTA and are wholly adequate to support the limited needs of employees with security access to the site. Expansion of the physical extent of recreational resources or expansion of access to non-NUWC personnel is not compatible with the sensitive, military mission of the command. Continued use and maintenance of resources at the existing level is recommended as desirable and consistent with safety, security, and mission concerns.

3.4.2 Environmental Consequences

Very few recommendations were made for providing new recreational opportunities or enhancing existing ones in the 1985 and 1992 NRMPs. The INRMP 2001 includes new strategies and developments for enhancing recreational facilities and for cooperation and coordination with the Town of Portsmouth and the RI Historical Preservation Commission. The recommendations made within the INRMP were made within the context of the military mission and the availability of funding for such initiatives. Failure to implement the recreation strategies within the INRMP 2001 could result in loss of the value to public access and use by military personnel and families.

The activities of NUWC appear to have little, if any, impact on outdoor recreation that takes place on adjacent areas outside the Naval property. Recent remediation and clean-up efforts on Gould Island have modified the environment there considerably since the INRMP was prepared for that facility.

4.0 APPENDIX

4.1 REFERENCES

Brown & Root Environmental, 1996. *Marine Ecological Risk Assessment, Former Derecktor Shipyard & Training Center, Newport Rhode Island,* Interim Data Deliverable.

Coastal Resources Management Council. As amended June, 1996 with 1999 revisions, *State of Rhode Island Coastal Resources Management Program.*

Coastal Resources Management Council. 1996. Communication with Ken Anderson, P.E.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deep-Water Habitats of the United States*.

French, D. and twelve others, 1992. *Habitat Inventory / Resource Mapping for Narragansett Bay and Associated Coastline*. Narragansett Bay Project.

Golet, C. Francis. 1976*. Wildlife Wetland Evaluation Model.*

Hermes, O.D., L.P. Gromet, and D.P.Murray. 1994. *Bedrock Geologic Map of Rhode Island.* Office of the Rhode Island State Geologist.

Middletown, Town of. 1992. *Town of Middletown Comprehensive Community Plan*.

National Oceanic and Atmospheric Administration. 1995. *Narragansett Bay (Including Newport Harbor) Navigational Chart 13223,* 34th Edition, January 28, 1995. Washington, DC: U.S. Department of Commerce.

National Oceanic and Atmospheric Administration. 1995. *Narragansett Bay (Including Newport Harbor) Navigational Chart 13221, 51*st Edition, September 20, 1997. Washington, DC: U.S. Department of Commerce.

Newport, City of. 1991. *Comprehensive Land Use Plan*. Adopted by the Council December 11, 1991.

Newport Naval Complex 1990. *Comprehensive Plan*, November 1990.

Northern Division, Naval Facilities Engineering Command Environmental Department Biological Sciences Branch. 1997. *Pest Management Plan for Naval Education and Training Center, Newport, Rhode Island.*

Northern Division, Naval Facilities Engineering Command. 1985. *Natural Resources Management Plan: Naval Complex, Newport, RI. August 1985.*

Portsmouth, Town of. September 1992. *Town of Portsmouth Comprehensive Community Plan.*

Rhode Island Department of Environmental Management. 1997. *Water Quality Regulations.*

Rhode Island Department of Environmental Management Division of Planning and Development Natural Heritage Program. October 6, 1989a. *Results of Endangered Species Surveys on U.S. Navy Installations in Rhode Island.*

Rhode Island Department of Environmental Management, USDA Soil Conservation Service, and the Rhode Island State Conservation Committee. 1989b. *Rhode Island Soil Erosion and Sediment Control Handbook.*

Rhode Island Department of Environmental Management. 1991 *Groundwater Classification.*

Rhode Island Department of Environmental Management, Nonpoint Source Pollution Management Program, Office of Environmental Coordination and Rhode Island Department of Administration, Division of Planning. 1995. *Rhode Island Nonpoint Source Pollution Management Plan.* State Guide Plan Element 731, Report Number 87.

Rhode Island Department of Environmental Management, Division of Water Resources, *The State of the State's Waters - Rhode Island a Report to Congress (PL 94-500,305b),* October 1994

Rhode Island Department of Environmental Management, Office of Environmental Coordination, Rhode Island Community Nonpoint Source Pollution Management Guide, 1995.

Rhode Island Department of Transportation. 1995. *Newport Marine Facilities US Army Corps Highway Methodology Phase I Constraints Analysis*.

Rhode Island Sea Grant/Ocean Engineering. Undated. *The New Tides and Tidal Currents of Narragansett Bay 1990-1999.* University of Rhode Island Marine Technical Report.

Shonting, D.H., D.N. Connors, and E.R. DeBlois. 1995. *The Physical and Chemical Oceanography of Navy Test Sites at Narragansett Bay, RI; Seneca Lake, NY; and Lake Pond Oreille, ID: Effects and Rates of Small-scale Pollutant Releases.* Naval Undersea Warfare Center Division: Newport, RI.

Tiner, Ralph W., Jr. 1987. *A Field Guide to Coastal Wetland Plants of the Northeastern United States.* The University of Massachusetts Press.

U.S. Army Corps of Engineers, New England Division. 1993. *Water Resources Development, Rhode Island, 1993.*

U.S. Department of Agriculture, Soil Conservation Service. July 1981. *Soil Survey of Rhode Island.*

U.S. Department of the Interior. U.S. Fish and Wildlife Service. 1975. *National Wetlands Inventory,* Prudence Island Quadrangle, aerial photography.

U.S. Department of the Navy, Naval Undersea Warfare Center Division. 1996. *Spill Prevention Control and Countermeasures Plan. Newport, Rhode Island.*

U.S. Fish and Wildlife Service, Division of Endangered Species. 1996. *Section 7 Consultation*. [On-Line]. Available: http://www.fws.gov/~r9endspp/sec7.html.

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APPENDIX K

INRMP BENEFITS FOR ENDANGERED SPECIES, CRITICAL HABITAT, AND MIGRATORY BIRDS

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INRMP BENEFITS FOR ENDANGERED SPECIES, CRITICAL HABITAT, AND MIGRATORY BIRDS

Section 4(a)(3)(B)(i) of the ESA of 1973 prohibits the Secretaries of the Departments of Interior and Commerce from designating as critical habitat any lands or other geographical areas owned or controlled by DOD, or designated for its use, that are subject to an INRMP prepared pursuant to Section 670a of the Sikes Act (DODM 4715.03). This restriction applies if either Secretary determines that a given INRMP provides a benefit to the species for which critical habitat is proposed for designation.

The USFWS uses three criteria to determine if an INRMP provides adequate special management or protection to obviate the need for critical habitat designation:

(1) The INRMP provides a conservation benefit to the listed species.

(2) The INRMP provides certainty that relevant agreed-on actions will be implemented.

(3) The INRMP provides certainty that the conservation effort will be effective.

Currently, no federally listed species have been observed on NAVSTA Newport (see Section 2.3.7, *Threatened and Endangered Species and Species of Concern*). However, the northern long-eared bat has recently been proposed for listing as endangered by the USFWS, and has been confirmed on NAVSTA Newport. Also, the USFWS currently is conducting a candidate assessment for the little brown bat, which also has been observed on the installation. This INRMP provides several projects (#'s 3–9; see Chapter 5 and Appendix C) focused on providing a conservation benefit to these two bat species. Four of these seven projects are focused on survey work, two projects direct habitat restoration actions, and an additional project outlines the development of a detailed Bat and Bird Conservation Strategy for the installation. As implemented, these projects will provide key data, information and habitat restoration activities to maintain and potentially increase bat populations and their habitats on NAVSTA Newport (criterion 1). Appendix C includes the implementation schedule for these conservation efforts (criterion 2). Projects #'s 4–7 outline annual monitoring to both assess bat population numbers and to provide data for adaptive management of project implementation (criterion 3).

No other species with federal ESA protection status have been observed on the installation. The New England cottontail rabbit is a federal candidate species that may be present in the region; a survey on NAVSTA Newport for this species is a project defined by this INRMP. The piping plover, listed as federally threatened, has been reported as nesting in a nearby location to the installation. Federally endangered Atlantic sturgeon from the New York Bight, Chesapeake Bay, South Atlantic, and Carolina DPS, as well as threatened Atlantic sturgeon from the Gulf of Maine DPS, could all potentially occur in Narragansett Bay.

No critical habitat has been proposed or designated for the lands or nearshore waters owned or controlled by NAVSTA Newport, relative to any federally listed or candidate species with potential occurrence at NAVSTA Newport (described above). Measures included in the INRMP (e.g., to address water quality and soil erosion) will indirectly benefit protected species that occur in the Narragansett Bay and the waters immediately surrounding the area. In the event that future federal listed species occur on NAVSTA Newport, the installation might be able to avoid USFWS or NOAA Fisheries designation of critical habitat by implementing its INRMP through the execution of appropriate projects and activities, in accordance with the specific timeframes identified in this INRMP.

Federal trust species also include migratory birds. This NAVSTA Newport INRMP includes several projects to benefit the conservation and management of migratory birds, including avian surveys (Project #1), data reporting (#2), a Bat and Bird Conservation Strategy (#3), and bluebird and bat boxes (#8). Additional habitat restoration activities also will provide migratory bird breeding, wintering, and/or stopover habitats (e.g., Projects #9, 13, 17, 19, and 29).

APPENDIX L

NAVSTA NEWPORT BAT SURVEY REPORT

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NAVFAC Atlantic Biological Resource Services

Baseline Bat Acoustic Survey Report

Naval Station Newport
Newport, Rhode Island

Bat acoustic detector station at Tank Farm 3

Prepared for:
NAVFAC Mid-Atlantic
9742 Maryland Avenue
Norfolk, VA 23511

Contract: N69450-16-D-0112
Task Order: TOF5521

August 2019

TETRA TECH

Baseline Bat Acoustic Survey Report:
Naval Station Newport
Newport, Rhode Island.

Prepared for:
NAVFAC Mid-Atlantic
9742 Maryland Avenue
Norfolk, VA 23511

Contract: N69450-16-D-0112
Task Order: TOF5521

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Recommended citation:
Tetra Tech. 2019. Baseline Bat Acoustic Survey Report: Naval Station Newport, Rhode Island. NAVFAC Atlantic Biological Resource Services. Contract: N69450-16-D-0112; Task Order: TOF5521, Task Option 3.

Executive Summary

To address the growing concerns over declining bat populations caused by white-nose syndrome, Naval Station Newport initiated acoustic bat surveys in compliance with the Sikes Act, Endangered Species Act, and a commitment to restore, improve, and preserve natural resources. The objective was to perform a baseline survey to determine species composition and bat activity levels in resident and migratory bat species using acoustic methods. During the 2018 survey, 877 detector-nights were sampled over the course of 215 calendar nights between 09 May and 10 December 2018. A total of 40,169 bat passes were recorded and identified to the species level or frequency group, resulting in an overall activity rate of 47.4 bat passes/detector-night. Presence of six of the eight species of bats known to occur in Rhode Island were detected (big brown bat [*Eptesicus fuscus*], eastern red bat [*Lasiurus borealis*], hoary bat [*L. cinereus*], silver-haired bat [*Lasionycteris noctivagans*], little brown bat [*Myotis lucifugus*], and tri-colored bat [*Perimyotis subflavus*]). Northern long-eared bat (*M. septentrionalis*) was not detected. Activity was dominated by big brown bat, eastern red bat, and unidentified high frequency species. Combined, these three groups accounted for 88 percent of all recorded bat activity. It is possible that bat passes included in the unidentified high frequency species group were made by *Myotis*, including Northern long-eared bat and therefore presence of the species cannot be ruled out as a possibility. The detectors recorded bat activity for nearly the entire survey period, with the highest activity rates detected during late August, with no major pulses in activity observed in September and October, suggestive of migratory movements. Bat activity varied among stations with the highest rates recorded at stations within or adjacent to a closed canopy.

Based on the survey results, recommendations for additional conservation efforts and monitoring include:

1. Following best management practices under U.S. Fish and Wildlife Service's northern long-eared bat 4(d) rule for all projects that involve tree removal;
2. Conducting active acoustic monitoring in conjunction with emergence counts at structures potentially utilized by bats as roosting locations;
3. Conducting active acoustic monitoring to identify areas at Naval Station Newport that have the highest utilization by bats prior to passive acoustic monitoring or mist-nettings; and
4. Partnering with the State of Rhode Island to expand surveys on Gould Island to understand how bats utilize the island and if old buildings or cisterns serve as hibernacula.

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1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was contracted to collect baseline information on bats at Naval Station Newport (NS Newport or Installation) located in Newport County, Rhode Island (Figure 1). There has been growing concern for the health of bat populations in recent years due to precipitous population declines caused by white-nose syndrome (WNS; USFWS 2012). Cave roosting bat species, particularly the genus *Myotis*, have been particularly hard hit, leading to the listing of the northern long-eared bat (*Myotis septentrionalis*; MYSE) as threatened by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) on 02 April 2015 (USFWS 2016a). However, this species is not currently listed as endangered or threatened in Rhode Island (DEM 2015).

In compliance with the Sikes Act and the ESA, and in support of a commitment to restore, improve, and preserve natural resources (USFWS 2001), the United States Department of the Navy (Navy) initiated acoustic bat surveys within habitats suspected to serve as important resources for bats (i.e., roosting or foraging habitat), as well as areas that may undergo development in the future. Acoustic monitoring can provide information on species composition, overall bat activity levels and temporal changes in activity. This information may be used by natural resources managers to make informed land-use decisions for the Installation.

In accordance with the Scope of Work prepared for this project, the objective was to perform a high-level, extended survey to determine species composition and activity levels of resident and migratory bat species using acoustic methods. MYSE presence/absence surveys (Tetra Tech 2019) were completed following protocols established by the USFWS and detailed in the *2018 Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines; USFWS 2018a), concurrently with the baseline bat survey effort in the summer of 2018. The presence/absence survey confirmed the presence of eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and little brown bat (*M. lucifugus*; Tetra Tech 2019). This report provides a summary of data collected at the long-term sites.

The following eight bat species have the potential to occur at the Installation based on habitat and range: MYSE, eastern small-footed bat (*M. leibii*), little brown bat, tri-colored bat (*Perimyotis subflavus*), eastern red bat, hoary bat, big brown bat, and silver-haired bat (Table 1; Kays and Wilson 2009, Harvey et al. 2011, DEM 2015, Solari 2018). All of these species are listed as Species of Greatest Conservation Need in the Rhode Island Wildlife Action Plan, although they have differing Natural Heritage Program State Rank levels depending on known threats and distributions within the State (DEM 2015). Bat surveys have been conducted on the Installation in the past, with the most recent surveys conducted from 09 April to 09 October 2013, which detected more than 5,000 call sequences from seven bat species, including the little brown bat and MYSE (Tetra Tech 2014).

MYSE can be found throughout forested portions of the northeastern U.S. and in eastern, central, and northern Canada (USFWS 2016a). Historically, the species had patchy distribution, and was less common in the southern and western portions of its range (Barbour and Davis 1969). Population density seems to have been highest in the northern portion of the species’ range, which includes much of the eastern U.S. (Harvey et al. 2011). MYSE are an obligate forest-dwelling species, adapted to gleaning and hawking for insects in the sub-canopy of deciduous and mixed forests. MYSE forage primarily below the canopy in the understory, or in sub-canopy shrub layers. Foraging is often concentrated in forested upland areas, but also may occur in forest clearings, above roadways and trails, or near water (USFWS 2016a). These habitat requirements and behavioral patterns relate directly to the potential for the Installation to support MYSE.

Little brown, eastern small-footed, and tri-colored bats are resident, short distance migrants that hibernate in caves or mines and are associated with forested habitats. Little brown bats were widespread throughout Rhode Island pre-WNS, but are currently uncommon, occurring in low numbers. Rhode Island is on the fringe of the range for the eastern small-footed bat, which is associated with rocky areas for roosting, and the species has not been documented in the State. Tri-colored bat is known to occur in the State, though not in high numbers and the distribution is not well understood (DEM 2015).

Big brown bats also are hibernators and have been found with WNS, but their survival rate is higher than *Myotis* species (Frank et al. 2014). There may be two reasons for this; the first being that big brown bats select areas within caves that are colder and with less humidity, which inhibits the fungus' growth (Hayman et al. 2016); and the second being that their size allows for a greater amount of body fat during hibernation, which potentially mitigates the effects of WNS (Hayman et al. 2016).

Long distance migrators or tree-roosting bats include the hoary bat, silver-haired bat, and eastern red bat. These bats migrate south during the fall to southern states or Mexico to find areas that support insects year-round. They return to the northern portion of their range in the spring. Because tree roosting bats do not enter hibernation they are not susceptible to WNS, however, the group is exposed to other risks such as being struck by wind turbines, which is greatest during fall migration (Cryan 2003).

Figure 1. Regional Setting of 2018 Baseline Bat Acoustic Survey Locations, Naval Station Newport, Rhode Island.

Table 1. Bat Species and Likelihood of Occurrence, 2018, Naval Station Newport, Rhode Island.

Common Name	Scientific Name	Frequency Group	Likelihood of Occurrence	Reason for Likelihood	State Status[1]	Federal Status[2]	Habitat Association
Big brown bat	*Eptesicus fuscus*	Low	High	Suitable habitat within Installation, species range includes entire state including larger Islands of Narragansett Bay	SGCN SRANK: S5	NL	Habitat generalist found in a variety of habitats including buildings and urban areas; females congregate in maternal colonies, often in barns or attics
Eastern red bat	*Lasiurus borealis*	High	High	Suitable habitat within Installation, species range includes entire state and known occurrences in counties adjacent to Installation	SGCN SRANK:S?	NL	Found in hardwood deciduous forests; commonly utilize forest roads and openings when foraging insects
Hoary bat	*Lasiurus cinereus*	Low	Moderate	Suitable habitat within Installation, but little known about summer distribution	SGCN SRANK: S1	NL	Found in a variety of forest types, often foraging over roads or openings
Silver-haired bat	*Lasionycteris noctivagans*	Low	Moderate	Suitable habitat within Installation, but little known about summer distribution; known to overwinter in Rhode Island	SGCN SRANK: SU	NL	Found in a variety of forest types, often associated with water
Eastern small-footed bat	*Myotis leibii*	High	Low	May be suitable habitat within Installation, but there are currently no records in Rhode Island; International Union for Conservation of Nature range extends into neighboring states	SGCN SRANK: SU	NL	Associated with exposed rock habitats and adjacent forest
Little brown bat	*Myotis lucifugus*	High	Moderate	Suitable habitat within Installation and was widespread in Rhode Island prior to White Nose Syndrome	SGCN SRANK: S5	NL	Found in proximity to a water source for foraging and may be associated man-made structures for roosting
Northern long-eared bat	*Myotis septentrionalis*	High	Moderate	Suitable habitat within Installation, but distribution in Rhode Island is not well understood	SGCN SRANK: S2	T	Found in dense forest areas and forages in a variety of habitats; known to hibernate in small numbers in bunkers along south coast of the United States.
Tri-colored bat	*Perimyotis subflavus*	High	Moderate	Suitable habitat within Installation, but distribution in Rhode Island is not well understood	SGCN SRANK: S4	NL	Found in a variety of forest types and may be associated man-made structures for roosting

Sources: Kays and Wilson 2009, Harvey et al. 2011, Rhode Island Department of Environmental Management, Division of Wildlife 2015, and Solari 2018

[1] SGCN = Species of Greatest Conservation Need; SRANK = Natural Heritage Program Species Rank; and S1 = Unrankable, S2 = Imperiled, S4 = Apparently Secure, S5 = Secure, SU = Unrankable (lacking information or conflicting trends), S? = Inexact or Uncertain rank

[2] T = Threatened; NL = Not Listed

2.0 SURVEY AREA

NS Newport is located on the west coast of Aquidneck Island in southeastern Rhode Island. The 562-hectare (1,388-acre) Installation complex comprises more than 16 kilometers (10 miles) of shorefront on Aquidneck Island on Narragansett Bay (Figure 1). The land area adjacent to NS Newport consists of densely developed municipal, commercial, and recreational land use to the south in Newport, with lower-density residential and agricultural land uses to the north and east in Middletown and Portsmouth, Rhode Island.

The Installation is developed at medium to high intensity with the majority of open space (i.e. forest, mixed forest, shrub/scrub, fields) occurring on the north end of the Installation in Melville South and North. Melville North is approximately 8 kilometers (5 miles) north of the main installation and consists of a landfill site, Tank Farms 1 and 2, the Melville Housing Area, and Defense Fuel Support Depot. Tank Farms 3 and 4 are in Melville South. Gould Island, a 20-hectare (50-acre) island located in Narragansett Bay, approximately 1.6 kilometer (1.0 mile) offshore of Aquidneck Island and the main Installation area, was formally developed, but has become overgrown and revegetated after decades without use. The Navy currently controls 5 hectares (13 acres) at the northern tip of the island and the remaining area to the south is managed as a bird sanctuary by the State of Rhode Island. Surveys focused on these areas as well as the former Navy Hospital located on the southern end of the Installation because of the potential use of these areas as foraging and roosting locations for bats. Additionally, these parcels have been flagged for decommissioning in The Naval Station Newport Vision 2035 Master Plan (NAVFAC 2008).

3.0 METHODS

3.1 BAT DETECTORS

Tetra Tech used Wildlife Acoustics® Song Meter SM3 BAT Monitoring Systems (bat detectors) for the duration of the acoustic monitoring survey, which occurred between 09 May and 10 December 2018. Four ground-based bat detectors were originally deployed, and each bat detector station consisted of a 25-watt solar panel, a 12-volt DC battery encased in a waterproof housing, and the acoustic detector. Each detector was equipped with new SMM-U2 microphones for the duration of the survey. One SM4 BAT detector deployed for the MYSE presence/absence surveys conducted in July 2018 was left in place and added to the baseline survey effort beginning on 15 August 2018.

Detectors and microphones were tested prior to deployment with a Wildlife Acoustics Ultrasonic Calibrator to ensure equipment was functioning properly and device sensitivity was within the manufacturer's suggested thresholds. A "chirp test" with the Ultrasonic Calibrator was used to confirm all connections were sound, and that the microphones registered high frequency noise once the detectors were set. Tetra Tech performed this test again at demobilization to ensure microphones were still functioning.

Tetra Tech programmed each bat detector to record bat echolocation files using the following settings: trigger window = 2 seconds, sampling rate = 256 kilohertz, gain = 12 decibels, and minimum trigger frequency = 16 kilohertz. To ensure that the greatest period of bat activity was surveyed, bat detectors were programmed to begin recording 1 hour before sunset and to stop recording approximately 1 hour after sunrise each day to account for deployment in darker canopied areas. Data was recorded in full spectrum mode and files were saved in .WAV format on internal SD cards.

Tetra Tech implemented quality assurance and quality control measures during all stages of data collection, analysis, and report preparation. Bat detector data were downloaded monthly when access was possible. Data from SD storage cards were then downloaded to a server where a Tetra Tech biologist reviewed the files to confirm the operational status of the bat detectors.

Sampling locations were based on representative habitats within the Installation, areas with potential for high bat activity, and areas that may undergo future development (Figure 2). Microphones were mounted at a minimum height of 2.7 meters (8.9 feet) to avoid ground vegetation and to elevate the cone of detection. SMM-U2 omnidirectional microphones were oriented at the sky within suspected flight paths to increase the number of call pulses and quality of recordings.

Station RINP-1 was located on the north side of Gould Island on the edge of an open field. An old, overgrown concrete area associated with former infrastructure was present 60 meters (197 feet) east of the station and is utilized by a large nesting colony of gulls; the area extended to the north amid old buildings and docks. Active dredging and sediment removal were underway at the dock location approximately 300 meters (984 feet) to the north from the start of the survey through July 2018. State land to the south of the station was characterized by dense vegetation, overgrown roadways and infrastructure.

RINP-2 was located at the southern extent of the Installation at the Naval Heath Clinic New England outside of the former Navy Hospital last used in 1998, where buildings may now serve as potential roost locations for bats. Mature trees and parking lights surrounding the complex also may serve as roosting locations for bats and attract insects and foraging bats.

RINP-3 was located on the north side of the 17-hectare (41-acre) Tank Farm 3 along a road corridor leading from a forested canopy to an opening. Mature trees flanked the perimeter of the Tank Farm with the interior consisting of a network of old roads and dense shrubs. A dump area for vegetation covered with plastic for solarization was present 100 meters (328 feet) southwest of this station.

RINP-4 was located near the northern extent of the Installation in the 14-hectare (35-acre) Melville Backyard. The area is predominately vegetated with low trees and dense shrubs and flanked by non-Navy developed marinas to the north and south. The parcel is intersected with old roads, contains an active well house, and has an old warehouse located 100 meters (328 feet) to the west of the station, which may serve as a potential roost location for bats. A street light adjacent to the well house at this station also may serve as an attractant for insects and foraging bats.

Figure 2. Baseline Survey 2018 Acoustic Detector Stations, Naval Station Newport, Rhode Island.

RINP-9[1] was located on a two-track road within a closed canopy and mature forest (Figure 3). The two-track road provided a potential flyway and foraging corridor. This station was added to the baseline survey due to high levels of bat activity recorded at this location in the 2018 presence/absence survey. The addition of this station also increased sampling effort to compensate for downtime at other stations that occurred due to microphone failures. Appendix A includes station conditions and photographs illustrating detector orientation.

[1] Note that station numbering was discontinuous because stations RINP-5, RINP-6, RINP-7, and RINP-8 were part of the 2018 presence/absence survey (see Tetra Tech 2019), but only RINP-9 was used for this baseline survey.

Figure 3. Additional Presence/Absence Survey Detector Added to Baseline Survey Effort on 15 August 2018, Naval Station Newport, Rhode Island.

3.2 BAT PASS ANALYSIS

Bats emit pulses of high frequency sound to navigate in their environment and search for prey. A single pulse (or call), is generally not helpful for identifying species; however, a series of pulses (also known as an echolocation sequence or bat pass) can more reliably be used to assign a species classification. Tetra Tech defines a bat pass as an echolocation sequence with two or more call pulses separated by two or more seconds (Loeb et al. 2015).

Tetra Tech analyzed bat acoustic data using two software programs, which provides three benefits: 1) allows for comparison of software outputs and assessment of discrepancies in auto-classification, and highlight species that will require more attention in manual review; 2) enables a large volume of files to be quickly reviewed for non-bat recordings (i.e., noise files from insects, wind, etc.) in zero-cross format; and 3) provides latitude to work with the dataset that was most accurate based on preliminary manual review. Tetra Tech first analyzed the recorded data using Kaleidoscope Pro version 4.2.0, using the classifier “Bats of North America 4.2” at the 0 Balanced “Neutral” sensitivity level for species of bats in Rhode Island and the eastern small-footed bat based on the proximity of the species range to Newport County, Rhode Island (Solari 2018). Signals of interest ranged from 16–120 kilohertz, lasting 2–500 milliseconds, with a minimum of two call pulses.

Full spectrum .WAV files were converted to zero-crossing using a division ratio of eight. Zero-crossing extracts the basic time-frequency content of a signal and produces a simplified version of a sound wave represented by a series of points. While multiple frequency content of the full spectrum call is lost with zero-cross data, it greatly reduces file size and enables faster processing. Zero cross format outputs were assessed to ensure that noise files were effectively filtered from the dataset during analysis. Select files auto-classified as *Myotis* species were manually reviewed to assess the prevalence of false-positive classifications in the data set.

Tetra Tech then analyzed the data set using SonoBat 4.2.0 (SonoBat, Inc.) north-northeastern package with the following settings: max of 15 pulses per file for consideration, 5 kilohertz auto-filter, acceptable call quality 0.80, and sequence decision threshold 0.90. SonoBat outputs were evaluated for accuracy and it was determined that SonoBat generated fewer false positive classifications, particularly for little brown bat, which was misclassified as eastern red bat far more often than by Kaleidoscope Pro. SonoBat outputs were then reviewed using its extensive reference library of known echolocation sequences and superior spectrogram platform for reviewing full spectrum calls. During manual review, Tetra Tech considered a recording as suitable for species level identification if the individual call pulses within the bat pass were not truncated and exhibited the full spectrum of frequency modulation produced by a bat species, preferably including the presence of harmonics.

All files auto-classified as MYSE, tri-colored bat, and eastern small-footed bat were manually reviewed to ensure that all potential MYSE passes were correctly identified. Over 15 percent of the files auto-classified as little brown bat were reviewed to confirm species presence at stations that generated little brown bat auto-classifications. A subset of all bat species' call files was manually reviewed to confirm presence. Passes classified as "High Frequency" (frequency center above 35 kilohertz) or "Low Frequency" (frequency center below 35 kilohertz) during manual review lacked detail to be identified at the species level (e.g., too far from the microphone or noise interference) or were auto-classified as "High or Low" and reclassified to one of these groups based on frequency. To positively confirm a MYSE call there must be 3–5 call pulses that exceed 110 kilohertz that are not broken in the middle or oversaturated. Following manual review, data was analyzed using the program R to summarize total passes and mean activity rates by station and species (R Core Team 2019). Figures were generated using the R package "lattice" (Sarkar 2008).

4.0 RESULTS

During the 2018 survey, 877 detector-nights were sampled over the course of 215 calendar nights between 09 May and 10 December 2018. Bat detectors were operational for the duration of the survey with no downtime caused by power outages. However, the microphone membrane degraded on three of the new SMM-U2 microphones, resulting in a partial or total loss of sensitivity. Microphones were not operational at RINP-3 from 15 August–11 September 2018; at RINP-4 from 5 August–11 September 2018; and at RINP-1 from 15 August–25 October 2018. The downtime was prolonged at RINP-1 because the monthly check was missed on 11 September when a transport was not available, and another monthly check was missed on 27 September due to a small craft advisory. RINP-9 was added to the baseline survey on 15 August 2018 and the detector and microphone were fully operational through the end of the survey. Of the 977 available detector-nights during the survey, detectors and microphones were fully operational for 877 detector-nights or 89.8 percent of the time.

A total of 40,169 bat passes were recorded and identified to the species level or frequency group, resulting in an overall activity rate of 47.4 bat passes/detector-night (Table 2). Few noise files (non-bat recordings, i.e., wind, bird song, insects) were identified during manual review of recordings and six species and two groups were confirmed as present. Mean activity rates across all detectors ranged from 2.2 bat passes/detector-night at RINP-1 to 107 bat passes/detector-night at RINP-9 (Table 2).

Table 2. Summary of Bat Passes Recorded During 2018 Acoustic Bat Monitoring Surveys, Naval Station Newport, Rhode Island.

Station	Number of Bat Passes			Mean Activity Rate (bat passes/detector-night)	Standard Error
	Total	Nightly Minimum	Nightly Maximum		
RINP-1	317	0	28	2.2	0.4
RINP-2	8,735	0	344	40.6	4.3
RINP-3	17,825	0	913	82.9	11.6
RINP-4	775	0	29	4.1	0.4
RINP-9	12,517	0	626	107.0	13.3
Overall[1]	**40,169**	**0**	**1,940**	**47.4**	**6.0**

[1] Represents cumulative values for detector-nights and total number of bat passes, and the overall mean activity rate across all detectors at the Installation.

Big brown bat was the most commonly recorded (44 percent of total passes recorded) followed by eastern red bat (28 percent), unknown high frequency bat (16 percent), unknown low frequency bat (7 percent), silver-haired bat (2 percent), little brown bat (1 percent), and hoary bat and tri-colored bat (both less than one percent; Table 3). Average species activity rates follow the same pattern (Table 4).

Twelve (12) bat passes were auto-classified as MYSE by SonoBat. However, manual vetting determined that they did not meet the standards to definitively classify the bat passes as MYSE and that they were predominantly feeding buzzes from other species (Figure 4). Three bat passes were auto-classified as eastern small-footed bat by SonoBat but lacked detail to be identified to the species level. Nearly 15 percent of the 732 passes auto-classified as little brown bat were manually reviewed, and the majority were false positives and identified as eastern red bat or high frequency species; however, little brown bat presence was confirmed at RINP-2, RINP-3, and RINP-4. All passes auto-classified as tri-colored bat were manually reviewed and four passes were confirmed.

The detectors recorded bat activity for nearly the entire survey period, with the highest activity rates detected during late August, despite RINP-1 and RINP-3 being down due to microphone failures during this time (Figure 5). Migratory tree bats accounted for over 31 percent of all bat activity (Table 3) and were recorded throughout the entire survey period, although activity levels varied by species throughout the season (Figure 6). Hoary bat was most active from late spring through the summer, while silver-haired bat activity remained constant throughout the season. Eastern red bat activity peaked in mid-August with two additional spikes observed in late September and early October. The initial increase in eastern red bat activity on 15 August 2018 was due to the addition of station RINP-9 to the survey.

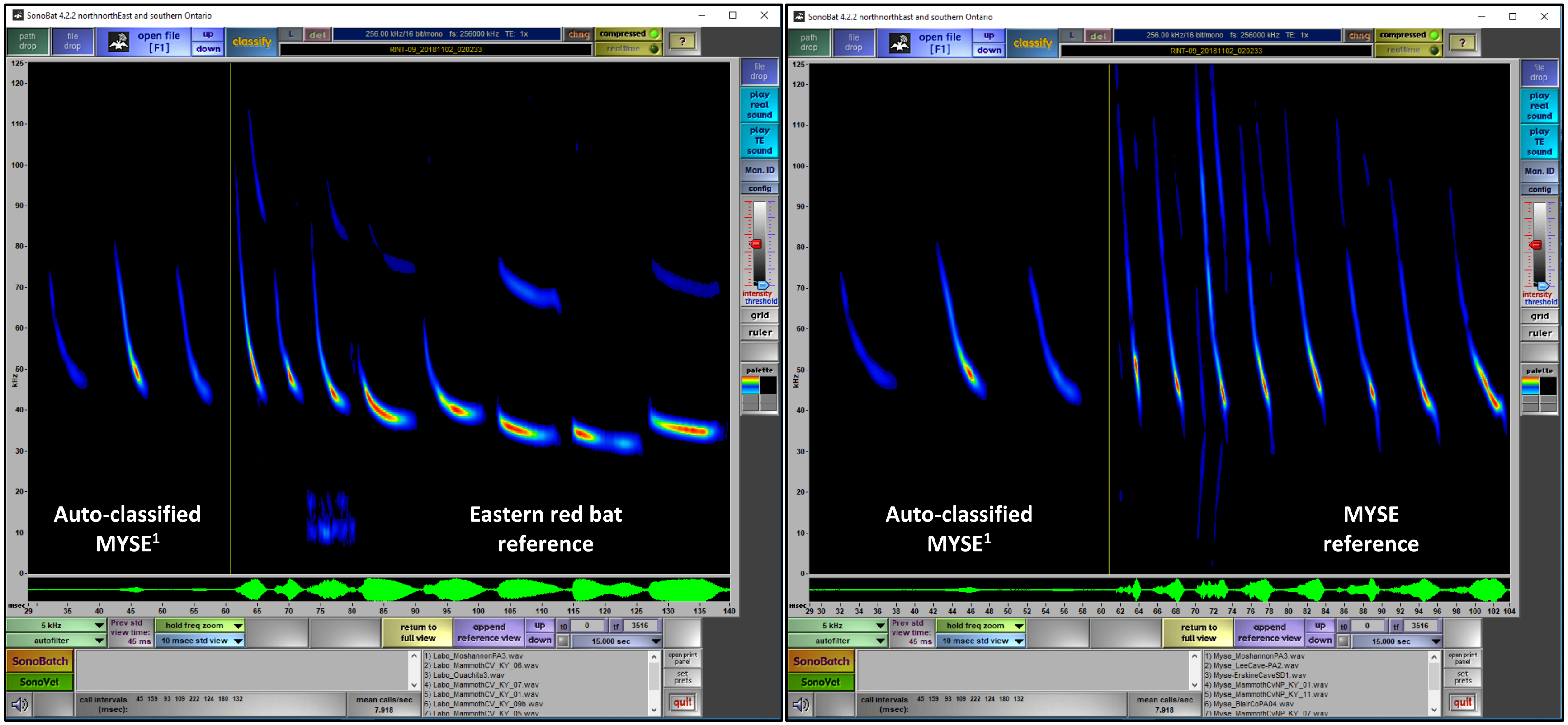
Table 3. Summary of Bat Passes by Species Recorded During 2018 Acoustic Bat Monitoring Surveys, Naval Station Newport, Rhode Island.

Station	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Little brown bat	Tri-colored bat	Unidentified high frequency bat	Unidentified low frequency bat
RINP-1	42	74	46	20	0	1	91	43
RINP-2	5,714	456	162	545	7	3	543	1,305
RINP-3	6,627	7,706	27	177	162	0	2,383	743
RINP-4	337	90	39	88	1	0	89	131
RINP-9	4,819	3,030	22	57	460	0	3,446	683
Total Passes	**17,539**	**11,356**	**296**	**887**	**630**	**4**	**6,552**	**2,905**

Table 4. Average Activity Rates (Bat Passes/Detector-Night) Recorded per Species in 2018 at each Detector, Naval Station Newport, Rhode Island.

Station	Big brown bat	Eastern red bat[1]	Hoary bat[1]	Silver-haired bat[1]	Little brown bat	Tri-colored bat	Unidentified high frequency bat	Unidentified low frequency bat
RINP-1	0.29	0.52	0.32	0.14	0.00	0.01	0.64	0.30
RINP-2	26.58	2.12	0.75	2.54	0.03	0.01	2.53	6.07
RINP-3	30.82	35.84	0.13	0.82	0.75	0.00	11.08	3.46
RINP-4	1.80	0.48	0.21	0.47	0.01	0.00	0.48	0.70
RINP-9	41.19	25.90	0.19	0.49	3.93	0.00	29.45	5.84
Overall Mean	**20.00**	**12.95**	**0.34**	**1.01**	**0.72**	**0.00**	**7.47**	**3.31**
Standard Error	**2.20**	**2.31**	**0.05**	**0.13**	**0.24**	**0.00**	**1.00**	**0.33**

[1] Migratory tree bats.



[1] Although the file in question was auto-classified as MYSE, the structure aligns more closely with eastern red bat. It is common for higher amplitude eastern red bat pulses to be misclassified as *Myotis* species by software due to frequency overlap and pulse structure.

Figure 4. Comparison of 2018 Bat Pass Auto-classified as MYSE by SonoBat to Known Reference Files for Eastern Red Bat and MYSE, Naval Station Newport, Rhode Island.

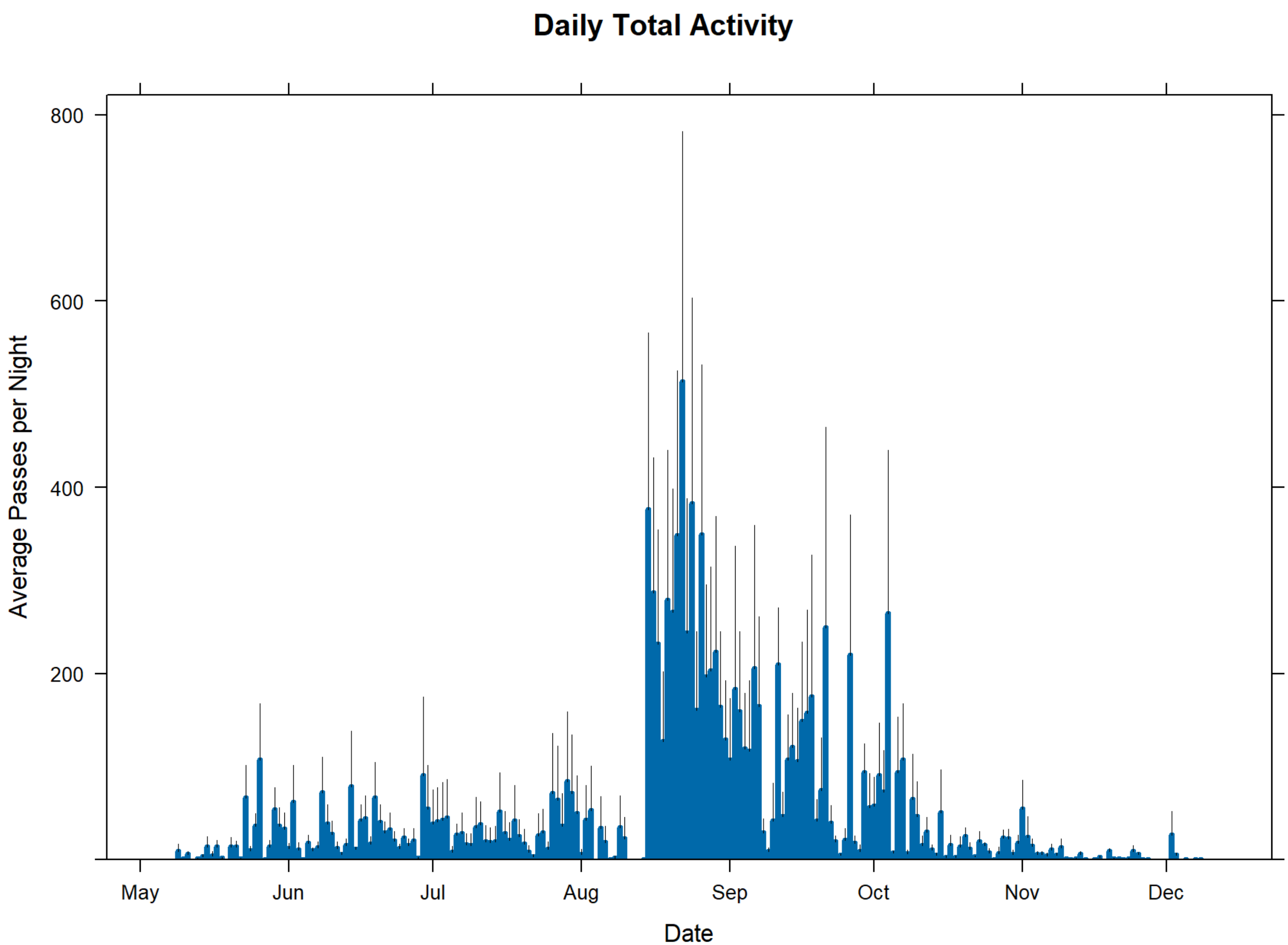


Figure 5. Average Number of Bat Passes with Standard Error per Detector-Night by Date in 2018 at all Detectors, Naval Station Newport, Rhode Island.

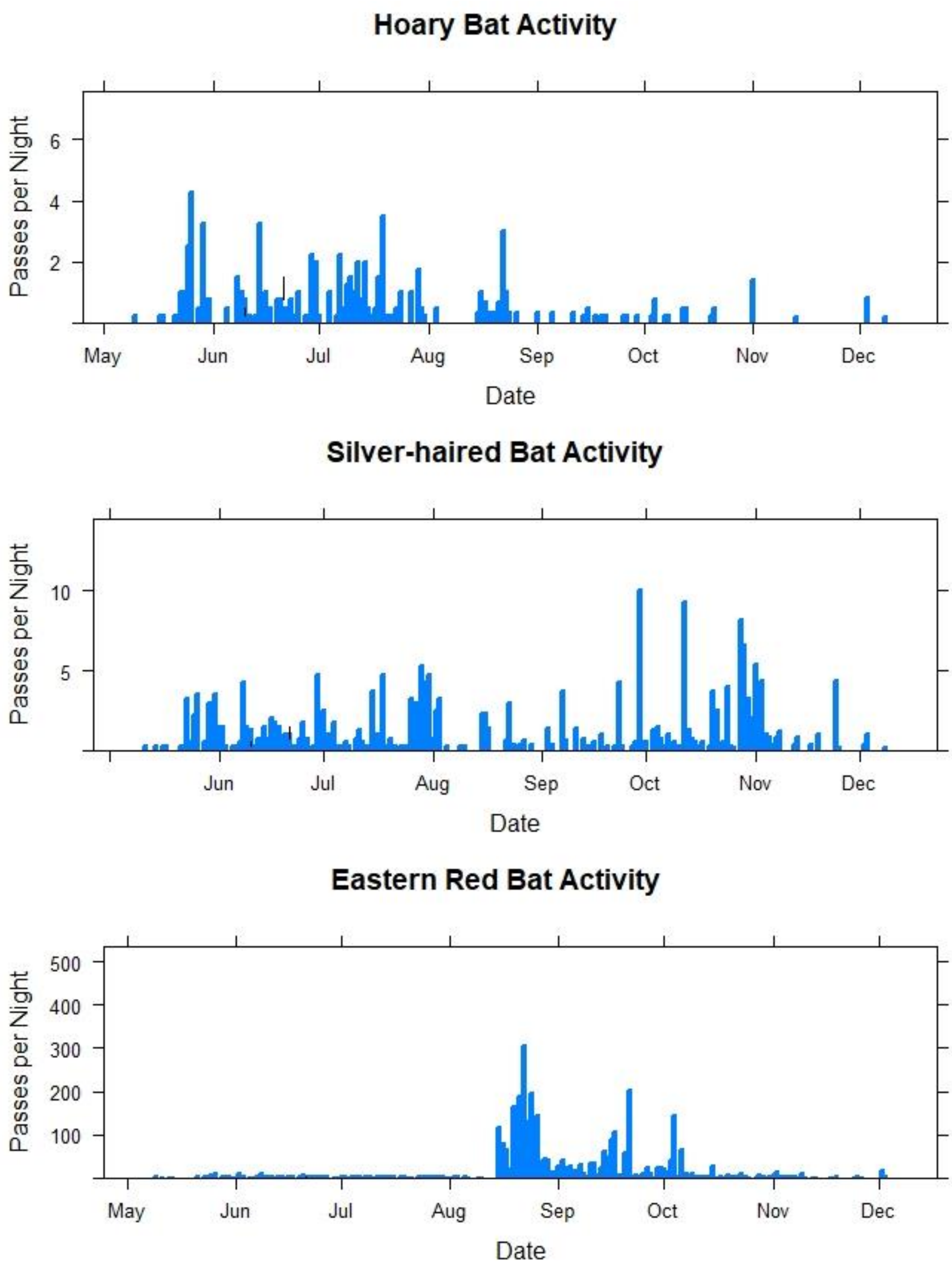


Figure 6. Number of Migratory Bat Passes per Detector-Night by Date in 2018 at all Detectors, Naval Station Newport, Rhode Island.

5.0 DISCUSSION

The 2018 baseline bat acoustic survey confirmed the presence of six of the eight species of bats known to occur in Rhode Island. Activity was dominated by big brown bat, eastern red bat, and unidentified high frequency species, which were likely eastern red bat passes that did not contain characteristics allowing identification to the genus or species level (i.e., approach phase calls). However, it is possible that the unidentified high frequency species could be *Myotis* bats, including MYSE. Combined, these three groups accounted for 88 percent of all recorded bat activity. According to the Rhode Island Wildlife Action Plan (DEM 2015), big brown bat, eastern red bat, and little brown bat are the only three species known to occur throughout the entirety of the State. Although, ubiquitous throughout much of the country and the eastern U.S., the hoary bat and silver-haired bat are described as uncommon in Rhode Island during the summer breeding season (Cryan 2003, DEM 2015). Survey results corroborated this trend as hoary and silver-haired bat were present throughout the survey, but far less common than eastern red bat.

Little is known about the populations and distributions of tri-colored bat, eastern small-footed bat, and MYSE within Rhode Island (DEM 2015) and the presence of MYSE and eastern small-footed bat was not confirmed during the survey. Little brown bat and tri-colored bat were confirmed as present, albeit at very low numbers, which is likely attributed to significant decreases as a result of WNS (USFWS 2015). Status review of the little brown bat suggests that listing under the ESA is warranted (Kunz and Reichard 2012), and this species will remain under review until 2023 (USFWS 2016b). Currently there are no federal protections in place for little brown bat; however, the species has been granted elevated conservation status at state levels. Pennsylvania recently added little brown bat, tri-colored bat, and MYSE to the state endangered species list (PA.gov 2019). The tri-colored bat is currently under status review to determine if listing under the ESA is warranted. Although the species is under a status review, no legal protections at the federal level are in place until a final rule is released, which will likely take a minimum of 2 years after the review began (20 December 2017; Center for Biological Diversity and Defenders of Wildlife 2016). Recent research has identified remaining populations of little brown bat have demonstrated some resiliency to WNS with survival rates of 41–87 percent (Dobony and Johnson 2018). This trend provides hope that declines may have stabilized, considering it is predicted that population recovery will take a long-period of time (United States Geological Survey 2015).

Bat activity varied among stations and habitat type did not always correlate with observed activity levels. In general, habitats on the Installation could be described as developed, residential, or wooded and bats appeared to utilize all habitats, but at varying intensity depending on needs (i.e., roosting, foraging, travel; Brigham 1991, Amelon et al. 2014). The lowest activity rates were recorded on the north side of Gould Island on the field edge adjacent to continuous scrub-shrub. While this appeared likely to be foraging habitat for bats, insect abundance may have been low at this locale because of the presence of the expansive concrete area associated with old infrastructure 60 meters (197 feet) to the east consisting of non-vegetated groundcover. It is possible that overgrown roads not far to the south on State land would have served as flyways and foraging areas and yielded higher activity levels. In addition, a microphone failure occurred on 15 August during peak bat activity and remained out into October, which further contributed to lower activity rates. Low activity levels were recorded at RINP-4, which was in a similar habitat. Station RINP-4 was positioned in an approximately 14-ha (35-ac) partially wooded/scrub-shrub Melville backyard, flanked by two marinas to the north and south and Narragansett Bay to the west. Formerly a Defense Fuel support depot, the area is no longer in use and is a wooded area intersected with old roads. Several old warehouses were nearby as well as an active wellhouse. Although bats were recorded at RINP-4, it is unlikely that nearby features (i.e., warehouse, streetlights) attracted bats for roosting or foraging.

Moderate activity rates were observed at RINP-2, which was in a residential setting. The detector was in a parking lot surrounded by mature deciduous trees and the former and unused Navy Hospital complex. Unused buildings or features such as cupolas (see Photo #2 of RINP-2, Appendix A) may serve as roost locations. Street lights present in the parking area also may have attracted insects and foraging bats. Markedly higher activity rates were recorded at RINP-3 and RINP-9, both of which were located in flyways adjacent to or within mature canopies. Both stations were located within an approximately 202-hectare (500-acre) area dominated by fragmented woodlands interspersed with residential areas and Lawton Reservoir. Lawton Brook and a 2-hectare (5-acre) wetland area were located just north of these stations. Survey results suggest that bat activity is greatest in contiguous, lesser developed areas with ample resources for foraging and roosting. Dramatic differences in activity levels between stations in similar habitats illustrates the importance of how micro-siting detectors can influence the volume of bats recorded in a given locale. It also illustrates the importance of deploying multiple units to provide an overall assessment of bat activity across the landscape of interest and the intensity of use within specific areas.

Detector location and habitat appeared to influence species composition. Eastern red bat, little brown bat, and unidentified high frequency species were most closely associated with stations located in forested settings. The most dramatic example of species dominance at any station was big brown bat at RINP-2, which accounted for 65 percent of all passes at this station. Although silver-haired bat was not common overall, 61 percent were recorded at RINP-2. Big brown bat commonly roost and form maternity colonies in buildings with multiple entry and exit locations (Agosta 2002) and silver-haired bat have demonstrated a preference for roosting in large trees (Barclay and Kurta 2007). Big brown and silver-haired bats could be attracted to these features at RINP-2.

A spike in overall activity was seen with the addition of station RINP-9 on 15 August 2018, with two factors contributing to strong influences resulting in this overall trend. First, activity levels recorded at RINP-9 were orders of magnitude greater than at other stations. Second, mean values presented in Figure 5 and Figure 6 are corrected for the number of active detectors and microphones that were not operational at stations RINP-1 or RINP-4 when RINP-9 was introduced, thereby reducing the denominator to 3 instead of 5 functional detectors. When RINP-4 was restored to service on 11 September 2018 and RINP-1 on 23 October 2018, overall activity levels dropped due to the influence of lower activity rates at these stations. Typically, when activity is more evenly distributed among stations, detector downtime or the addition of detectors to a survey do not have such a dramatic influence on overall activity rates for a given project. This example highlights the disparity of activity rates at different sites within a relatively small geographic area. The influence of eastern red bat activity at RINP-9 withstanding, no spikes in activity were observed in the spring or fall of 2018 that are indicative of migratory movements (Figure 6).

All four SM3 BAT detectors powered by solar panels and external batteries (RINP-1 through RINP-4) and the SM4 BAT detector powered by internal batteries performed flawlessly and were operational 100 percent of the survey period. The recently released SMM-U2 Wildlife Acoustics microphone was purchased specifically for this project because of advertised waterproof design and superior signal to noise ratio. However, over time the membrane over the microphone element became prone to cracking resulting in a partial or complete loss of microphone sensitivity. Microphone failure caused downtimes at several detectors over the course of the season as the microphone membrane became damaged. Although the microphones may have registered noise in a field test during checks, it wasn't until files were reviewed following each check that an issue became apparent, thus compounding the time interval before the microphones were replaced in the field. Even with the downtimes caused by microphone outages, stations RINP-1 through RINP-4 were operational for 89.8 percent of the survey period. To compensate for known microphone outages, station RINP-9 was added to the baseline survey because of a large volume of high frequency bats identified in this area during the MYSE presence/absence survey. Overall, equipment performed well over the long-term deployment and provided a seasonal assessment of bat use in multiple habitat types across the Installation.

5.1 RECOMMENDATIONS

The 2018 surveys provided valuable baseline information on bat species composition and activity levels at the Installation, but findings and observations spurred additional questions that warrant further investigation. Below are several topics and recommendations to ensure activities are compliant with ESA regulations and further the knowledge of bats on the Installation.

The baseline survey did not identify the presence of the federally listed threatened MYSE at the Installation, but it is possible the species occasionally utilizes the Installation and were simply not detected. MYSE have previously been detected on the Installation. Depending on the nature and extent of activities within the areas of interest, removing forested areas or suitable individual roost trees could impact MYSE summer habitat. According to the Rhode Island Wildlife Action Plan, the second primary threat to all bat species in the State is residential and commercial development via habitat loss of maternal roost sites or critical micro-features (RIDEM 2015). Following best management practices and ensuring activities are in compliance with the MYSE 4(d) rule will mitigate negative influence for the species as well as other bats.

1) Best management practices under the MYSE 4(d) rule suggest avoiding activity such as cutting trees during the pup season (01 June–31 July) or the breeding season (15 May–15 August) can prevent MYSE take and curtail adverse effects. However, tree removal is prohibited under the final 4(d) rule only if it occurs within 46 meters (150 feet) of a known maternity roost tree from 01 June through 31 July (USFWS 2016c). If a federal project may result in prohibited tree removal described above (or if a project is authorized, funded, or

permitted by a federal agency), the final 4(d) rule provides a programmatic biological opinion and optional framework for streamlining USFWS Section 7 consultations. However, the USFWS also may advise federal agencies when project-level consultation for MYSE is required (USFWS 2018a).

Old structures on the Installation, specifically the former Navy Hospital complex, were identified as potential roost locations during the baseline surveys and results suggest bats may be attracted to these features. However, without conducting emergence counts or active acoustic monitoring it is not possible to determine if specific features are used as roost locations by bats.

2) Active acoustic monitoring used in conjunction with emergence counts will identify which features are being utilized by bats as roosting locations.

A large disparity in activity levels was observed among sites on the Installation, highlighting the need for multiple detectors to determine areas with concentrated activity. Stationary monitoring is inherently limited in its capacity to identify areas of greatest use over a broad area.

3) Active acoustic monitoring during ideal summer conditions would allow for greater coverage and resolution to identify which areas on the Installation serve as linkages between roosting and foraging habitats and represent pathways of regular bat activity throughout the year. Identified areas could serve as locations for further investigation by passive acoustic monitoring or mist-netting surveys, as well as provide valuable information on specific resources to protect.

Information on how bats use coastal areas and islands is limited (Dowling and O'Dell 2018, Johnson and Gates 2019). Use of coastal areas and hibernacula is of current interest as a popular theory holds that bats hibernating in anthropogenic features outside of traditional inland hibernacula (i.e., caves, mines), avoid exposure to WNS and have greater survival rates (McLeish 2016). In an attempt to address this question, a detector was deployed on Gould Island (RINP-1) for the baseline surveys. However, low activity levels were observed and no *Myotis* species were recorded at this station. Results may have been confounded by the influence of the old air strip adjacent to the station (large paved area with no vegetation), thereby reducing prey base. However, this station also experienced a prolonged period of downtime due to a microphone outage. Forested areas owned by the State immediately south of RINP-1 likely provide more favorable conditions for bats and would be expected to yield higher activity levels and potentially greater species composition. Furthermore, cisterns are reportedly located on these State lands, which may serve as hibernacula.

4) Partnering with or receiving permission from the State to survey the southern portion of Gould Island would provide a valuable opportunity to investigate how bats utilize islands and if old buildings or cisterns may serve as hibernacula.

6.0 LITERATURE CITED

Amelon, S., F. Thompson, Frank, J. Millspaugh. 2014. Resource Utilization by Foraging Eastern Red Bats (*Lasiurus borealis*) in the Ozark Region of Missouri. *The Journal of Wildlife Management*. *78*. 10.1002/jwmg.685.

Agosta, S. J. 2002. Habitat use, diet and roost selection by the big brown bat (*Eptesicus fuscus*) in North America: a case for conserving an abundant species. *Mammal Review*, *32*(3), 179–198.

Barbour, R. and W. Davis. 1969. Bats of America. University Press of Kentucky, Lexington. 286 pp.

Barclay, R.M. and Kurta, A., 2007. Ecology and behavior of bats roosting in tree cavities and under bark. Bats in forests: conservation and management (M. J. Lacki, J. P. Hayes, and A. Kurta, eds.). Johns Hopkins University Press, Baltimore, Maryland, pp. 17–59.

Brigham, R. M. 1991. Flexibility in foraging and roosting behaviour by the big brown bat (*Eptesicus fuscus*). *Canadian Journal of Zoology*, *69*(1), 117–121.

Center for Biological Diversity and Defenders of Wildlife. 2016. Petition to List the Tri-colored bat *Perimyotis subflavus* as Threatened or Endangered under the Endangered Species Act. Available online at: https://ecos.fws.gov/docs/petitions/92000/885.pdf. Accessed January 2019.

Cryan, P. M. 2003. Seasonal distribution of migratory tree bats (*Lasiurus* and *Lasionycteris*) in North America. *Journal of Mammalogy*, *84*(2), 579-593.

Dobony, C. A., and J. B. Johnson. 2018. Observed resiliency of little brown myotis to long-term white-nose syndrome exposure. *Journal of Fish and Wildlife Management 9*(1):168–179; e1944-687X. doi:10.3996/102017-JFWM-080.

Dowling, Z. R. and O'Dell, D. I. 2018. Bat Use of an Island off the Coast of Massachusetts. *Northeastern Naturalist 25*(3), pp. 362–383.

Frank, C. L., A. Michalski, A. A. McDonough, M. Ragunuab, R. J. Rudd, and C. Herzog. 2014. The Resistance of a North American Bat Species (*Eptesicus fuscus*) to White-Nose Syndrome (WNS*). PLoS One 9*(12).

Harvey, M. J., J. S. Altenbach, and T. L. Best. 2011. Bats of the United States and Canada. The Johns Hopkins University Press, Baltimore, MD. USA.

Hayman, D. T. S., J. R. C. Pulliam, J. C. Marshall, P. M. Cryan, and C. T. Webb. 2016. Environment, host, and fungal traits predict continental-scale white-nose syndrome in bats. *Science Advances 2*(1).

Johnson, J. B. and J. E. Gates. 2019. Bats of the Boston Harbor Islands. *Northeastern Naturalist 25*(sp9), pp. 90–109.

Kays, R. W., and D. E. Wilson. 2009. Mammals of North America 2nd Edition. Princeton University Press: Princeton, New Jersey.

Kunz, T. H., and J. D. Reichard. 2012. Status Review of the Little Brown Myotis (*Myotis lucifugus*) and determination that immediate listing under the Endangered Species Act is scientifically and legally warranted. Boston University's Center for Ecology and Conservation Biology.

Loeb, S. C., T. J. Rodhouse, L. E. Ellison, C. L. Lausen, J. D. Reichard, K. M. Irvine, T. E. Ingersoll, J. T. H. Coleman, W. E. Thogmartin, J. R. Sauer, C. M. Francis, M. L. Bayless, T. R. Stanley, and D. H.

Johnson. 2015. A plan for the North American Bat Monitoring Program (NABat). General Technical Report SRS-208. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 112 pp.

McLeish, T. M. 2016. Wintering bats in Rhode Island: Are They Seeking Refuge from White-Nose Syndrome? ecoRI News. Available online at: https://www.ecori.org/natural-resources/2016/2/9/wintering-bats-are-they-seeking-refuge-from-white-nose-syndrome. Accessed December 2018.

NAVFAC (Naval Facilities Engineering Command). 2008. NAVSTA Newport Vision 2035, Master Plan Community Brief, 31 July 2008. Available online at: http://www.rabnewportri.org/enclosures/Sept2008Encl2.pdf. Accessed May 2019.

PA.gov. 2019. Pennsylvania Pressroom. Official News for Pennsylvania State Agencies. 1/29/2019. Highlights from Today's Commissioners Meeting. Available online at: https://www.media.pa.gov/Pages/Game-Commission-Details.aspx?newsid=281. Accessed February 2019.

R Core Team. 2019. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available online at: http://www.R-project.org/. Accessed 22 May 2019.

RIDEM (Rhode Island Department of Environmental Management, Division of Fish and Wildlife). 2015. Rhode Island Wildlife Action Plan. Rhode Island Wildlife Action Plan Species Profiles. Species of Greatest Conservation Need. Available online at: http://www.dem.ri.gov/programs/bnatres/fishwild/swap/SGCNMammals.pdf. Accessed December 2018.

Sarkar, D. 2008. Lattice: Multivariate Data Visualization with R. Springer, New York. ISBN 978-0387-75968-5.Solari, S. 2018. *Myotis leibii*. The IUCN Red List of Threatened Species 2018: e.T14172A22055716. Available online at: http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T14172A22055716.en. Accessed 21 December 2018.

Tetra Tech, Inc. 2014. Final Bat Assessment Report for Naval Station Newport. Prepared for NAVFAC Atlantic, Norfolk Virginia. Prepared by Tetra Tech, Inc., Portland, Maine. May 2014.

______. 2019. Northern Long-eared Bat Presence/Absence Survey Report for Naval Station Newport. Prepared for NAVFAC Atlantic, Norfolk Virginia. Prepared by Tetra Tech, Inc., Portland, Maine. April 2019.

United States Geological Service. 2015. Declines and Slow Recovery in Little Brown Bat Populations Predicted. Available online at: https://www.usgs.gov/news/declines-and-slow-recovery-little-brown-bat-populations-predicted. Accessed February 2018.

USFWS (United States Fish and Wildlife Service). 2001. The Military and the Endangered Species Act. Interagency Cooperation. Available online at: https://digitalmedia.fws.gov/digital/collection/document/id/1851/. Accessed February 2018.

______. 2012. North American bat death toll exceeds 5.5 million from white-nose syndrome. News Release 17 January 2012. Available online at: https://www.whitenosesyndrome.org/sites/default/files/files/wns_mortality_2012_nr_final_0.pdf. Accessed November 2018.

______. 2015. White-Nose Syndrome: The Devastating Disease of Hibernating Bats in North America. Available online at: https://www.whitenosesyndrome.org/sites/default/files/resource/white-nose_fact_sheet_11_2015.pdf. Accessed February 2019.

______. 2016a. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat With 4(d) Rule; Final Rule and Interim Rule. Federal Register 80(63): 17974-18033. Available online at: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf. Accessed January 2019.

______. 2016b. National Listing Workplan. 7–Year Workplan (September 2016 version). Available online at: https://www.fws.gov/endangered/improving_esa/pdf/Listing%207-Year%20Workplan%20Sept%202016.pdf. Accessed January 2019.

______. 2016c. Endangered and Threatened Wildlife and Plants; 4(d) Rule for the Northern Long-Eared Bat. Federal Register 81(9): 1900-1922. Available online at: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf. Accessed January 2019.

______. 2018a. 2018 Range-Wide Indiana Bat Summer Survey Guidelines April 2018. Available online at: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2018RangewideIBatSurveyGuidelines.pdf. Accessed November 2018.

______. 2018b. Northern Long-Eared Bat Final 4(d) Rule, White-Nose Syndrome Zone Around WNS/Pd Positive Counties/Districts, 01 October 2018. Available online at: https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf. Accessed 19 December 2018.

APPENDIX A. PHOTO LOG OF DETECTOR LOCATIONS AND SITE CONDITIONS

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Table A-1. 2018 Detector Station Descriptions, Naval Station Newport, Rhode Island.

Station Name	RINP-1	RINP-2	RINP-3	RINP-4	RINP-9[1]
Latitude	41.53615504	41.50089112	41.56544749	41.58726152	41.57066813
Longitude	-71.34553264	-71.32061622	-71.2892752	-71.28490563	-71.2865969
Objectid[1]	8	9	10	11	16
Photo Date	5/9/2018	5/9/2018	5/9/2018	5/9/2018	7/16/2018
Survey Start	5/9/2018	5/9/2018	5/9/2018	5/9/2018	8/15/2018
Survey End	12/10/2018	12/10/2018	12/10/2018	12/10/2018	12/10/2018
Station Description	Located on the north side of Gould Island on edge of open field; dense vegetation, overgrown old buildings and bunkers located south of station	Within a canopy gap created by a large blow down; very dense mid and understory, with ample breaks in upper canopy	On a slight hill overlooking wetland containing *Phragmites* sp.; dense locust (*Robinia* sp.) draped by bittersweet (*Celastrus* sp.) is adjacent to detector with mic; oriented in gap overlooking wetland	Located in a wetland containing *Phragmites* sp., bordered by dense, mature trees; canopy above wetland is open	Located at the top of a hill above station RINP-8 within an old road corridor between mature stands of white oak (*Quercus alba*) and beech (*Fagus* sp.)

[1] Note that station numbering was discontinuous because stations RINP-5, RINP-6, RINP-7, and RINP-8 were part of the 2018 presence/absence survey (see Tetra Tech 2019), but only RINP-9 was used for this baseline survey.

Photo #	Station	Date	Direction
1	RINP-1	09 May 2018	North

Photo #	Station	Date	Direction
2	RINP-1	09 May 2018	East

Photo #	Station	Date	Direction
3	RINP-1	09 May 2018	South

Photo #	Station	Date	Direction
4	RINP-1	09 May 2018	West

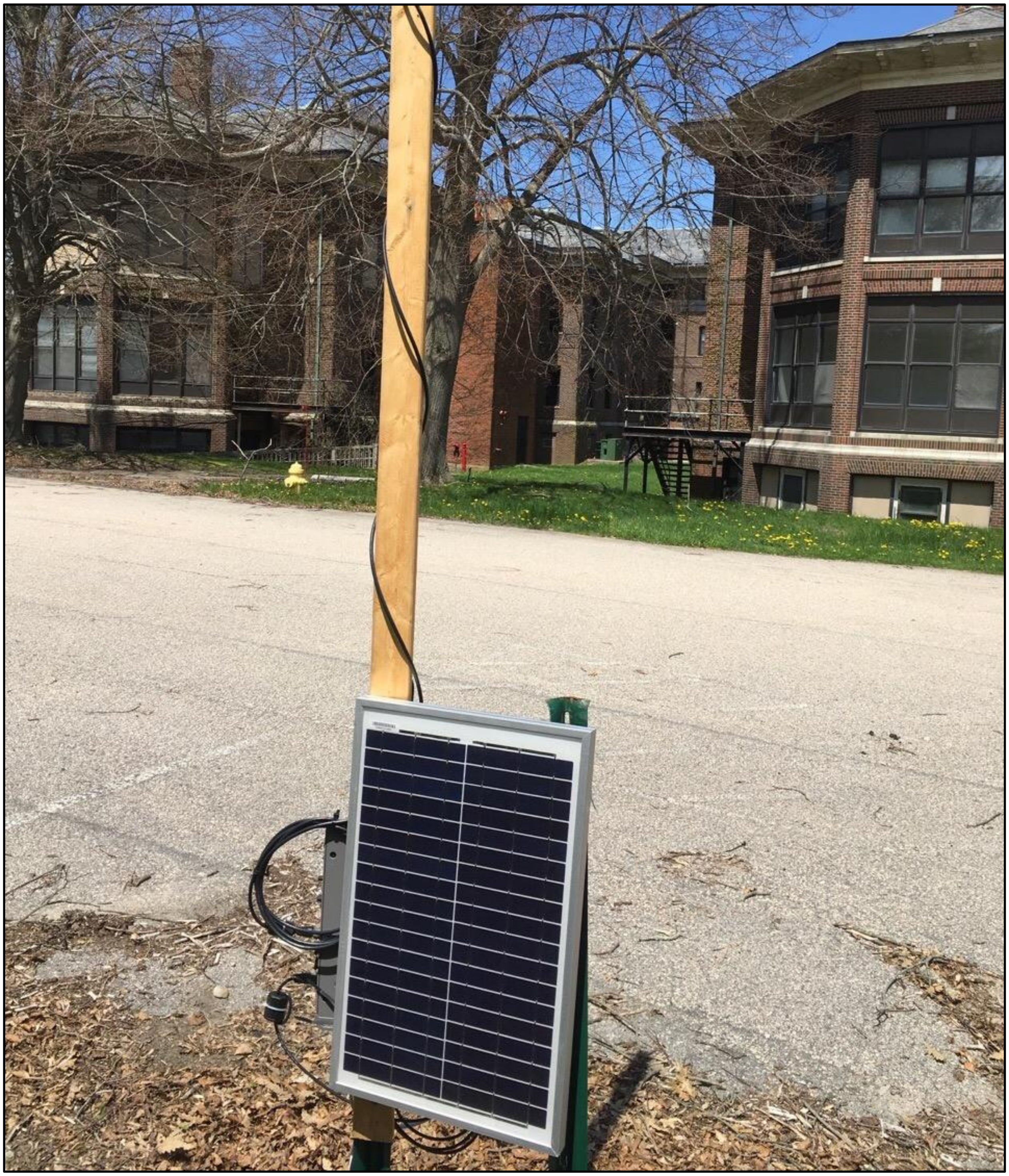


Photo #	Station	Date	Direction
1	RINP-2	09 May 2018	North

Photo #	Station	Date	Direction
2	RINP-2	09 May 2018	East

Photo #	Station	Date	Direction
3	RINP-2	09 May 2018	South

Photo #	Station	Date	Direction
4	RINP-2	09 May 2018	West

Photo #	Station	Date	Direction
5	RINP-2	09 May 2018	East

Example of Potential Bat Roost Entry/Exit Points on Buildings.

Photo #	Station	Date	Direction
1	RINP-3	09 May 2018	North

Photo #	Station	Date	Direction
2	RINP-3	09 May 2018	East

Photo #	Station	Date	Direction
3	RINP-3	09 May 2018	South

Photo #	Station	Date	Direction
4	RINP-3	09 May 2018	West

Photo #	Station	Date	Direction
1	RINP-4	09 May 2018	North

Photo #	Station	Date	Direction
2	RINP-4	09 May 2018	East

Photo #	Station	Date	Direction
3	RINP-4	09 May 2018	South

Photo #	Station	Date	Direction
4	RINP-4	09 May 2018	West

Photo #	Station	Date	Direction
1	RINP-9	09 May 2018	North

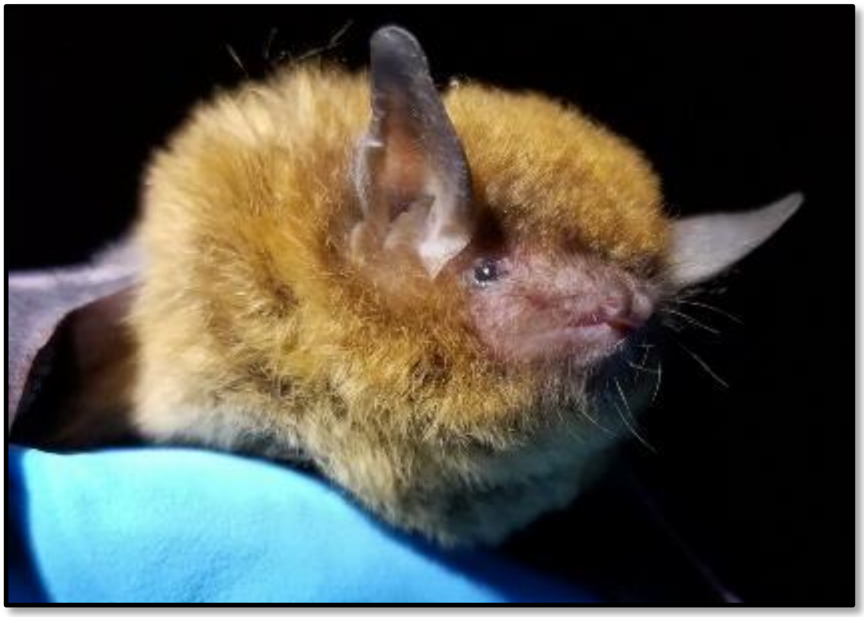
Photo #	Station	Date	Direction
2	RINP-9	09 May 2018	East

Photo #	Station	Date	Direction
3	RINP-9	09 May 2018	South

Photo #	Station	Date	Direction
4	RINP-9	09 May 2018	West

Northern Long-Eared Bat Presence/Absence Survey Report

Naval Station Newport
Newport, Rhode Island



April 2019

TETRA TECH

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Northern Long-eared Bat Presence/Absence Survey Report: Naval Station Newport

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Contract Number: N69450-16-D-0112, Task Order: N40085-18-F-5521

Recommended Citation:

Tetra Tech. 2019. Northern Long-Eared Bat Presence/Absence Survey Report: Naval Station Newport, Rhode Island. Contract: N69450-16-D-0112; Task Order: TOF5521, Task 5.

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1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was contracted to collect information on the federally threatened northern long-eared bat (*Myotis septentrionalis*; MYSEMYSE) at Naval Station Newport (NS Newport or Installation) located in Newport, Rhode Island (Figure 1). Due to declines caused by white-nose syndrome (WNS) and the continued spread of this disease, MYSE was listed as threatened by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) on 02 April 2015 (USFWS 2016a). In accordance with the Scope of Work prepared for this project, the objective was to perform a low-level short term acoustic survey during the maternity period (15 May to 15August) to determine the presence or absence of MYSE in suitable bat habitat following protocols established by the USFWS and detailed in the *2018 Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines; USFWS 2018a). Baseline acoustic surveys were conducted concurrently with the presence/absence survey efforts in the summer of 2018, but this report pertains only to data collected at the short-term sites. Acoustic surveys and habitat assessments (Appendix A) were performed by USFWS-approved qualified bat biologists (Appendix B) in suitable MYSE habitat to detect if MYSE were utilizing the Installation.

2.0 SPECIES BACKGROUND

On 02 April 2015, the USFWS announced that the MYSE was listed as threatened with an interim section 4(d) rule. The intent of the 4(d) rule was to provide the USFWS flexibility in implementing the ESA by modifying regulations necessary to provide for the conservation of the listed species while not overburdening private landowners, state agencies, and others with blanket regulations that do not further the conservation of the species. A final 4(d) rule for MYSE was released on 14 January 2016 (USFWS 2016a), which became effective 16 February 2016. USFWS determined that WNS was and continues to be the primary threat to MYSE. USFWS further determined that regulating other sources of mortality or harm, such as habitat loss, would not effectively conserve the species.

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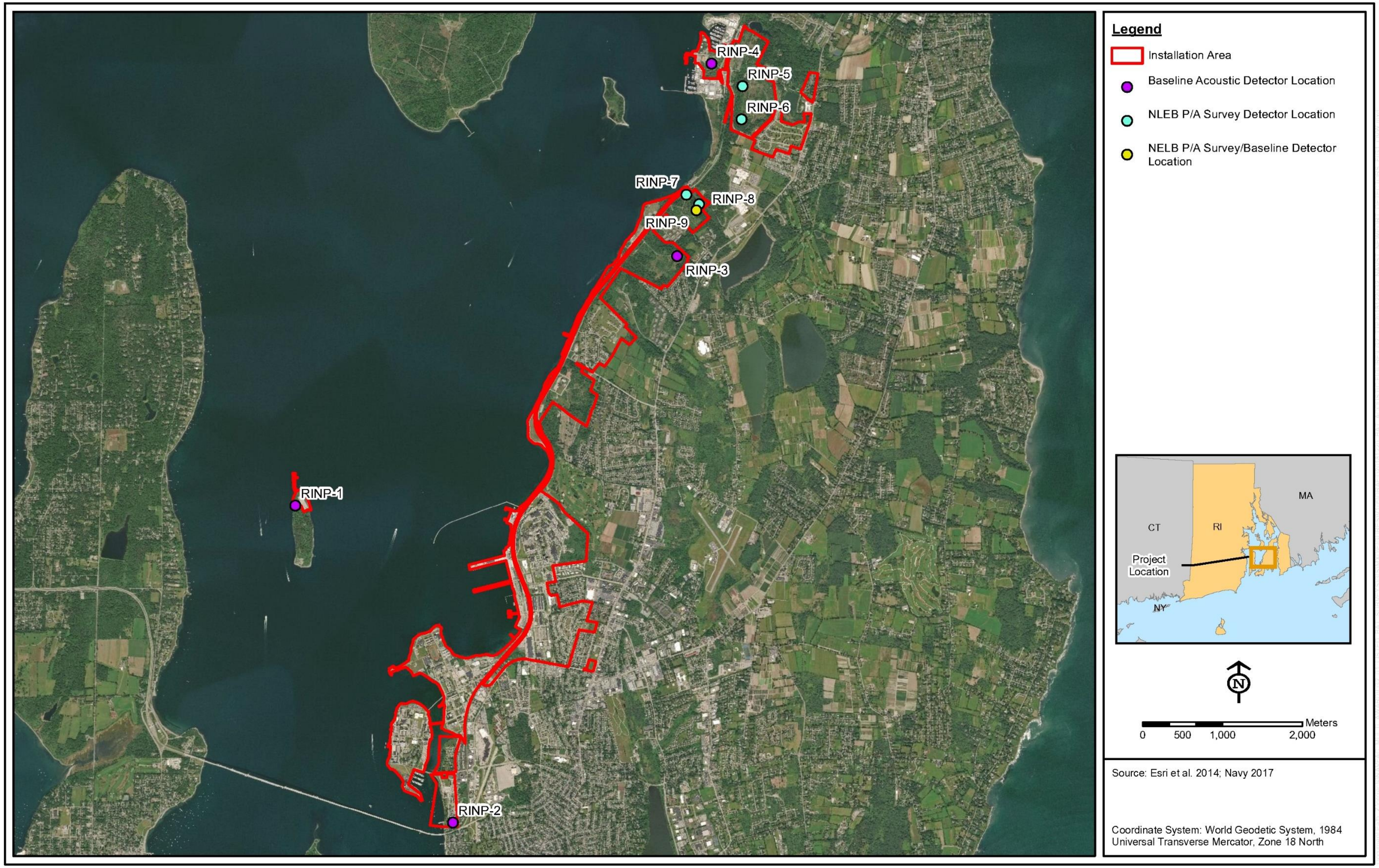

Figure 1. Regional Setting of Baseline and Presence/Absence Survey Locations at Naval Station Newport, Rhode Island, 2018.

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For areas within the WNS zone, *incidental take*[1] is prohibited only if it meets on of the following three criteria:

- If the take occurs within a hibernaculum,[2]
- if tree removal activities occur within a 0.40 kilometer (0.25-mile) of a known, occupied hibernaculum at any time of year, or
- if tree removal occurs within 46 meters (150 feet) of a known, occupied maternity roost tree from 01 June through 31 July (USFWS 2018a).

If a federal project may result in prohibited tree removal described above (or if a project is authorized, funded, or permitted by a federal agency), the final 4(d) rule provides a programmatic biological opinion and optional framework for streamlining USFWS Section 7 consultations. However, the USFWS also may advise federal agencies when project-level consultation for MYSE is required (USFWS 2018a).

MYSE occurs in all five of Rhode Island's counties (USFWS 2018c). Although there are no known caves or mines in Rhode Island, MYSE, as well as tri-colored bat (*Perimyotis subflavus*), are known to overwinter in man-made structures in the state (McLeish 2016). MYSE can be found throughout forested portions of the northeastern U.S. and in eastern, central, and northern Canada (USFWS 2015a). Historically, the species had patchy distribution, and was less common in the southern and western portions of its range (Barbour and Davis 1969). Population density seems to have been highest in the northern portion of the species' range, which includes much of the eastern U.S. (Harvey 1992). MYSE are an obligate forest-dwelling species, adapted to gleaning and hawking for insects in the sub-canopy of deciduous and mixed forests. Foraging occurs entirely within forested areas but is not restricted to mature forests. MYSE forage primarily below the canopy in the understory, or in sub-canopy shrub layers. Foraging is often concentrated in forested upland areas, but may also occur in forest clearings, above roadways and trails, or near water (USFWS 2015a). These habitat requirements and behavioral patterns relate directly to the potential for the Installation to support MYSE.

Summer roosts provide MYSE with a thermally-stable environment, as well as protection from the elements and predators (Owen et al. 2002). Day roost selection by MYSE is dependent upon the presence of suitable live or dead (snag) trees having cavities, crevices, or exfoliating bark for roosting, although man-made structures and caves may also be used for roosting. Throughout their range, MYSE roost in a variety of tree species, using specific trees based on their suitability

[1] "Incidental take is defined by the ESA as take that is incidental to, and not the purpose of carrying out an otherwise lawful activity. For example, harvesting trees can kill bats that are roosting in the trees, but the purpose of the activity is not to kill bats" (USFWS 2016b).
[2] NLEB hibernaculum include caves and abandoned mines with constant, cooler temperatures and high humidity in which they spend the winter in a state of metabolic depression (USFWS 2015a).

to retain bark or provide cavities or crevices. Isolated trees may also be used as roosts, provided they are within 305 meters (1,000 feet) of another suitable roost tree or forested area (USFWS 2018a). MYSE roost alone or in small maternity colonies and switch roosts often; on average, lactating females appear to switch roosts every 2–5 days (Menzel et al. 2002, Sasse and Perkins 1996).

Unlike true long-distance migratory bats (*Lasiurus* spp. and *Lasionycteris* spp.), MYSE do not undertake long-distance migrations between summer and winter ranges, but do make shorter distance movements between summer roosts and winter hibernacula. MYSE arrive at hibernacula in August or September, begin hibernation in October and November, and leave for summer habitats in March or April (USFWS 2015a). MYSE hibernate in caves and mines, as well as in man-made structures. The species prefers large hibernacula with large entrances and, although MYSE are often found with other *Myotis* species, they prefer cooler temperatures and higher humidity than little brown bat (*M. lucifugus*). Individuals may hibernate in cracks and crevices in hibernacula walls and may be overlooked during winter surveys. The species also has been found in less traditional hibernacula, including dams and dry wells, and may utilize man-made structures more frequently than previously thought, especially in the northeast (USFWS 2015a).

Significant decreases in populations of MYSE have occurred over the last 5 years, primarily because of WNS, a fungal pathogen responsible for unprecedented mortality of hibernating bats, with an estimated 5.7–6.7 million bats killed since the discovery of WNS in the U.S. from 2006 through 2012 (USFWS 2012). WNS was first discovered in eastern New York in the winter of 2006–2007 and has now been documented in at least 33 states and seven Canadian provinces (WNSRT 2019). Precipitous declines have been documented for the MYSE, with an estimated 99 percent decline in the northeast due to WNS (USFWS 2012). Other threats to MYSE include loss and fragmentation of forested habitat, alteration to traditional hibernacula, and anthropogenic sources of mortality including wind energy facilities (USFWS 2015b).

3.0 METHODS

3.1 ACOUSTIC SURVEYS

3.1.1 Desktop and Field Habitat Analysis

Prior to conducting field work, Tetra Tech consulted with the Installation’s natural resource specialist to identify suitable MYSE habitat that may be used by MYSE for foraging and roosting during the breeding and migration seasons. Elements such as forest patch size, proximity to closed-canopy forests, and landscape features that may be used by bats commuting between roosting and foraging habitats (e.g., forested tracts, wetlands, streams) were considered when selecting the detector locations as well as locations of baseline acoustic detectors that were concurrently operating to provide thorough coverage of suitable habitats. All open water, wetlands, and relatively contiguous forested lands not highly fragmented by residential or commercial developments were considered suitable MYSE habitat; and all densely populated or developed stretches were determined to be unsuitable.

Where possible, the following habitat types were targeted in the field in order of descending priority (i.e., detector deployment in openings within interior forests were highest priority, then within interior closed canopy forests, etc.):

- Interior forest-canopy openings;
- Closed canopy forests;
- Near water sources adjacent to forested habitat;
- Forest edges; and
- Linear forested corridors, including corridors connecting forested habitat blocks.

Field habitat assessments were completed at each station as recommended in Phase 1 of the Guidelines (USFWS 2018a), and are provided in Appendix B.

3.1.2 Bat Detectors

Tetra Tech used five Wildlife Acoustics® Song Meter SM4BAT Monitoring Systems (bat detectors) to survey five locations. Each detector was equipped with SMM-U2 microphones for the duration of the survey, which occurred between 16 July and 25 July, 2018. The detectors were fully waterproof and powered by internal D cell batteries. Each detector and microphone was tested prior to deployment with a Wildlife Acoustics Ultrasonic Calibrator to ensure equipment was functioning properly and device sensitivity was within the manufacturer's suggested thresholds. A "chirp test" with the Ultrasonic Calibrator was used to confirm all connections were sound, and that the microphones registered high frequency noise once the detectors were set. Tetra Tech performed this test again at demobilization to ensure microphones were still functioning. Log files were reviewed when units were retrieved to verify proper functioning for the duration of the survey.

Tetra Tech programmed each bat detector to record bat echolocation files using the following settings: trigger window = 2 seconds, sampling rate = 256 kilohertz, gain = 12 decibels, and minimum trigger frequency = 16 kilohertz. To ensure that the greatest period of bat activity was surveyed, bat detectors were programmed to begin recording one hour before sunset and to stop recording approximately one hour after sunrise each day to account for deployment in darker canopied areas. Data was recorded in full-spectrum mode and files were saved in .WAV format on high capacity data storage cards.

Sampling locations were based on representative habitats within the Installation, areas with potential for high bat activity, areas with potential forest clearing, and areas available for access (Figures 2 and 3, Table 1). Microphones were mounted at a minimum height of 2.7 meters (9 feet) to avoid ground vegetation and to elevate the cone of detection. Microphones were oriented in line with suspected flight paths or straight up depending on the setting, to increase the number of call pulses and quality of recordings. Therefore, specific orientation was determined by microsite conditions (arrows in Figure 3 indicate microphone direction at each station, no arrows indicate the microphone was oriented straight up). Appendix C includes station conditions and photographs illustrating detector orientation.

Figure 2. Representative Photos of Detector Placements and Potential Bat Flyways at Naval Station Newport, Rhode Island, 2018.

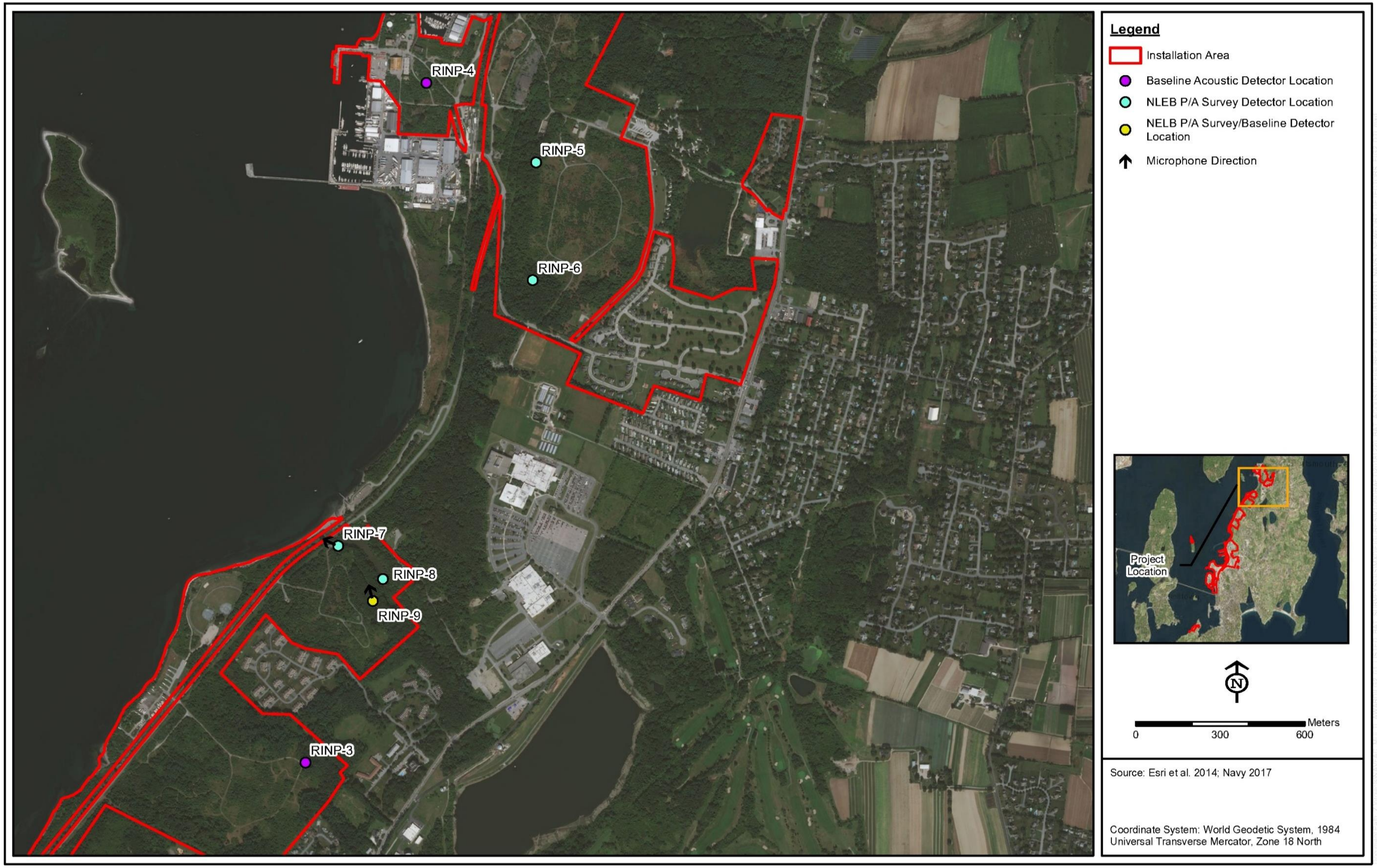

Figure 3. Detail of Detector Stations Indicating Microphone Direction at Naval Station Newport, Rhode Island, 2018.

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Table 1. Acoustic Detector Descriptions and Survey Data at Naval Station Newport, Rhode Island, 2018.

Detector Station	Suitable MYSE Habitat?	Description	GPS Coordinates	Microphone Orientation (degrees)	Survey Nights
RINP-05	Yes	Located in a utility line corridor, lined by dense vegetation, that leads to an open field.	41.58481 -71.280151	At sky	7/16–7/25
RINP-06	Yes	Within a canopy gap created by a large blow down. Very dense mid and understory, with ample breaks in upper canopy.	41.581047 -71.280162	At sky	
RINP-07	Yes	On a slight hill overlooking phragmites wetland. Dense locust draped by bittersweet is adjacent to detector with mic. oriented in gap overlooking wetland.	41.572397 -71.288136	295°	
RINP-08	Yes	Located in a phragmites wetland bordered by dense, mature trees. The canopy above wetland is open.	41.571376 -71.286189	At sky	
RINP-09	Yes	Located at the top of a hill above RINP-08 within a old road corridor between mature stands of white oak and beech	41.570668 -71.286597	345°	

3.1.3 Bat Pass Analysis

Bats emit pulses of high frequency sound to navigate in their environment and search for prey. A single pulse (or call), is generally not helpful for identifying species; however, a series of pulses (also known as an echolocation sequence or bat pass) can more reliably be used to assign a species classification. Tetra Tech defines a bat pass as an echolocation sequence with two or more call pulses separated by two or more seconds (Loeb et al. 2015). Tetra Tech analyzes bat acoustic data using a two-phased approach: 1) filter data to remove non-bat sounds and assign an initial species or group classification using a USFWS-approved software program (USFWS 2018a), and then 2) manually review and cross-validate a subset of this data using an additional, independent echolocation software program to confirm species presence.

Tetra Tech analyzed the recorded data according to the Guidelines (USFWS 2018a). Data was filtered and analyzed using Kaleidoscope Pro version 4.2.0, using the classifier “Bats of North America 4.3” at the 0 Balanced “Neutral” sensitivity level for species of bats in Rhode Island and the eastern small-footed bat (*M. leibii*) based on the proximity of the species range to Newport County (Solari 2018). Signals of interest ranged from 16–120 kilohertz, lasting 2–500 milliseconds, with a minimum of two call pulses. Full spectrum .WAV files were converted to zero-crossing using a division ratio of eight. After filtering and initial classification of the acoustic data, Tetra Tech cross-validated and manually confirmed species presence for a subset of the data using SonoBat 4.2.0 (SonoBat, Inc.) North northeastern package. SonoBat was used for this step as it contains an extensive reference library of known echolocation sequences and superior spectrogram platform for reviewing full-spectrum calls. During manual review, Tetra Tech considered a recording as suitable for species level identification if the individual call pulses within the bat pass were not truncated and exhibited the full spectrum of frequency modulation produced by a bat species, preferably including the presence of harmonics.

All files auto-classified as MYSE, tri-colored bat, eastern small-footed bat, and little brown bat (except at RINP-09) were subsequently manually reviewed to ensure that all MYSE passes were identified. In addition, all recordings were reviewed for each site-night that software indicated that MYSE was likely based on Maximum Likelihood Estimates (MLEs). Due to the high degree of false positive little brown bat auto-classifications identified during manual review of Station RINP-09, all data recorded at this station was re-processed using Sonobat to determine level of agreement between software auto-classifications. All files classified as little brown bat by both programs were reviewed and those that did not have agreement were changed to eastern red bat (*Lasiurus borealis*) or unidentified high frequency species. A subset of all bat species' call files was manually reviewed to confirm presence. Passes classified as "High Frequency" (frequency center above 35 kilohertz) or "Low Frequency" (frequency center below 35 kilohertz) during manual review lacked detail to be identified at the species level (e.g., too far from the microphone or noise interference) or were auto-classified as "No identification" and reclassified to one of these groups based on frequency. To positively confirm an MYSE call there must be 3–5 call pulses that exceed 110 kilohertz that are not broken in the middle or oversaturated. Results were summarized by detector and by night.

3.2 WEATHER REQUIREMENTS

Weather requirements outlined in the Guidelines (temperatures remain above 50 degrees Fahrenheit, no precipitation that exceeds 30 minutes, and sustained wind speed less than 9 miles per hour) must be met during the first 5 hours of the survey period for each detector-night and net-night for valid survey results. Weather history in 5-minute increments was reviewed from the closest weather station (Newport State Station, KUUU) to the Installation that had data on temperature, wind speed, wind gusts, precipitation rate, and precipitation accumulation. This ensured that the Guidelines were met for a valid survey night (Weather Underground 2018).

4.0 RESULTS

4.1 ACOUSTIC SURVEY

During the 2018 survey, 50 detector-nights were sampled over the course of 10 calendar nights between 16 July 2018 and 25 July 2018. Weather conditions during the survey period met requirements outlined in the Guidelines on 5 of the 10 nights (Table 2). Precipitation lasting for more than half an hour occurred on two nights during the survey period, disqualifying those nights. Three additional nights were disqualified by winds that exceeded 9 miles per hour. Nightly temperatures ranged from 76 degrees Fahrenheit at sunset to a low of 62 degrees Fahrenheit. Note that weather records were obtained from the Newport, Rhode Island airport and it is possible that wind speeds were actually lower at the stations because of vegetation and topography and may not have negatively influenced bat activity on those nights that were technically disqualified according to the Guidelines.

Interpreting results solely on the number of species' bat passes by software auto-classification can be misleading, as there are varying levels of confidence associated with each classification. Maximum Likelihood Estimates (MLEs) are used as a secondary measure to determine likelihood of species presence by incorporating known error rates for each species classifier within the software. In most cases, manual review of bat passes by experienced biologists serves as the most accurate method for species identification. MLE results for the acoustic survey indicate that all eight bat species occurring in Rhode Island (RIDEM 2017) are likely present at the Installation (Table 3), including big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), little brown bat, eastern small-footed bat, northern long-eared bat, and tri-colored bat. Manual review did not confirm the presence of northern long-eared bat, eastern small-footed bat and tri-colored bat (Table 5).

A total of 19,523 bat passes were detected acoustically including five species and three groups (Table 4). Twenty-one (21) bat passes were auto-classified as MYSE by Kaleidoscope Pro; however manual vetting determined that they did not meet the standards to definitively classify the bat passes as MYSE and that they were predominantly feeding buzzes from other species. All *Myotis* spp. passes were manually reviewed or re-analyzed in Sonobat for false negative MYSE passes. Of the 870 little brown bat passes auto-classified by Kaledioscope Pro, only 2 were definitively confirmed as little brown bat and one as *Myotis* spp., while 104 passes were confirmed as eastern red bat and the remainder as unidentified high frequency species.

Big brown bat (*Eptesicus fuscus*) was the most commonly recorded (63 percent of total passes recorded) followed by eastern red bat (13 percent), unknown high frequency bat (13 percent), unknown low frequency bat (5 percent), hoary bat (*Lasiurus cinereus*) and silver-haired bat (*Lasionycteris noctivagans*; 3 percent each; Table 4). All myotis passes collectively composed less than a fraction of a percent of all bat passes.

Activity rates were calculated for each detector and for each species by detector by dividing total bat passes by the number of detector nights. Average activity rates among all detectors was 390 bat passes/detector night, with the highest rate occurring at Station RINP-07, which had an average of 652 bat passes per night. Station RINP-05 had only 52 average bat passes per night, which was the station that had the lowest average (Table 4).

Table 2. Summary of Weather Information during the First 5 Hours of each Survey Night at Naval Station Newport, Rhode Island, 2018.

Survey Night	Temperature Range (degrees Fahrenheit)	Wind Speed Range (miles per hour)	Precipitation (inches)	Qualifying Night
7/16/2017	72–76	6–9	None	Yes
7/17/2017	68–70	0–5	trace, 1.5 hour	No
7/18/2017	63–74	0–7	None	Yes
7/19/2017	62–69	0–7	None	Yes
7/20/2017	60–69	0–7	None	Yes
7/21/2017	69–74	0–1	None	Yes
7/22/2017	65–67	7–10	None	No
7/23/2017	69–74	9–13	None	No
7/24/2017	72–74	9–13	None	No
7/25/2017	72–73	9–14	trace, 1.5 hour	No
Source: Weather Underground 2018				

Table 3. Summary of Species Presence at Naval Station Newport, Rhode Island, 2018.

Common Name	Scientific Name	Maximum Likelihood Estimate Prediction[1]	Qualitative Analysis	Overall Evaluation
Big brown bat	*Eptesicus fuscus*	Present	Present	**Present**
Eastern red bat	*Lasiurus borealis*	Present	Present	**Present**
Hoary bat	*Lasiurus cinereus*	Present	Present	**Present**
Silver-haired bat	*Lasionycteris noctivagans*	Present	Present	**Present**
Little Brown bat	*Myotis lucifugus*	Present	Present	**Present**
Northern long-eared bat	*Myotis septentrionalis*	Present	Absent	Absent
Unidentified Myotis sp.	*Myotis sp.*	NA	Present	**Present**
Tri-colored bat	*Perimyotis subflavus*	Present	Absent	Absent
Eastern Small-footed bat	*Myotis leibii*	Present	Absent	Absent

1. Based on probability of presence for any site on any night. See Table 4-5 for complete listing of Maximum Likelihood Estimates by site/night.

Table 4. Summary of Bat Passes at Naval Station Newport, Rhode Island, 2018.

Station	Survey Night	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Little Brown Bat	Myotis Species	Unknown high frequency bat	Unknown low frequency bat	Total
RINP-05	7/16/2018	18	3	7				3	2	**33**
	7/17/2018	3		1	1				2	**7**
	7/18/2018	27	4	4	5			2	2	**44**
	7/19/2018	13	40	15	6			29	2	**105**
	7/20/2018	3	58	1				48		**110**
	7/21/2018	7	25	1	3		1	14	3	**54**
	7/23/2018	27	9	4	4			6	5	**55**
	7/24/2018	43	7	3	2			7	3	**65**
	7/25/2018	32	2	2	2			8	1	**47**
RINP-06	7/16/2018	130	13	20	22			2	24	**211**
	7/17/2018	83	9	7	10			4	13	**126**
	7/18/2018	197	27	17	35	1		1	35	**313**
	7/19/2018	217	10	6	23			6	28	**290**
	7/20/2018	152	21		6		1	10	13	**203**
	7/21/2018	375	15	9	3			19	11	**432**
	7/23/2018	217	45	3	22			10	25	**322**
	7/24/2018	71	18		1			8	2	**100**
	7/25/2018	103	53	1	1			11	5	**174**
RINP-07	7/16/2018	815	12	10	34			9	47	**927**
	7/17/2018	474	26	10	17			6	34	**567**
	7/18/2018	149	80	9	15			55	34	**342**
	7/19/2018	162	108	4	15			115	39	**443**
	7/20/2018	106	215	7	36		1	83	61	**509**
	7/21/2018	69	26		10			12	5	**122**
	7/22/2018	492	33	4	10			33	12	**584**
	7/23/2018	784	65	1	12			26	15	**903**

Station	Survey Night	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Little Brown Bat	Myotis Species	Unknown high frequency bat	Unknown low frequency bat	Total
	7/24/2018	876	96	7	18			77	37	**1,111**
	7/25/2018	862	38	3	11			77	20	**1,011**
RINP-08	7/16/2018	860	23	78	34			2	91	**1,088**
	7/17/2018	195	3	74	43				54	**369**
	7/18/2018	184	23	44	25			3	48	**327**
	7/19/2018	144	38	61	12			1	41	**297**
	7/20/2018	104	24	33	17	1		2	22	**203**
	7/21/2018	250	32	19	13			1	29	**344**
	7/22/2018	226	23	6	7			2	18	**282**
	7/23/2018	264	49	19	27			2	29	**390**
	7/24/2018	276	89	27	33			6	34	**465**
	7/25/2018	315	64	19	12			4	31	**445**
RINP-09	7/16/2018	317	124	11	4			225	27	**708**
	7/17/2018	194	76	4	14			58	20	**366**
	7/18/2018	362	224	2	5			435	22	**1,050**
	7/19/2018	314	159	1	8			208	26	**716**
	7/20/2018	186	154	3	5			240	10	**598**
	7/21/2018	399	87	2	13			112	9	**622**
	7/22/2018	194	33		3			50	9	**289**
	7/23/2018	351	75	1	9		1	121	15	**573**
	7/24/2018	310	77	6	8			164	30	**595**
	7/25/2018	355	63	4	5		1	139	19	**586**
Grand Total		**12,307**	**2,498**	**570**	**621**	**2**	**5**	**2,456**	**1,064**	**19,523**

Table 5. Summary of Maximum Likelihood Estimates (MLEs) for species presence by Kaleidoscope Pro at Naval Station Newport, Rhode Island, 2018.

Station	Survey Night	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Eastern Small-footed bat	Little Brown bat	Northern long-eared bat	Tri-colored bat
RINP-05	16-Jul	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	0.31
	17-Jul	**0.03**	1.00	0.36	0.86	1.00	1.00	1.00	1.00
	18-Jul	**0.00**	**0.00**	0.13	0.91	1.00	1.00	1.00	1.00
	19-Jul	**0.00**	**0.00**	**0.00**	0.59	1.00	1.00	1.00	**0.00**
	20-Jul	0.16	**0.00**	0.65	1.00	1.00	1.00	1.00	**0.00**
	21-Jul	**0.00**	**0.00**	0.77	0.34	1.00	0.98	**0.01**	0.24
	22-Jul	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	23-Jul	**0.00**	**0.00**	0.13	1.00	1.00	1.00	1.00	**0.00**
	24-Jul	**0.00**	**0.00**	0.71	1.00	1.00	1.00	1.00	0.57
	25-Jul	**0.00**	**0.01**	0.86	1.00	1.00	1.00	1.00	1.00
RINP-06	16-Jul	**0.00**	**0.00**	**0.00**	0.87	1.00	1.00	1.00	1.00
	17-Jul	**0.00**	**0.00**	0.23	1.00	1.00	1.00	**0.03**	1.00
	18-Jul	**0.00**	**0.00**	**0.04**	0.45	1.00	1.00	1.00	1.00
	19-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.71
	20-Jul	**0.00**	**0.00**	1.00	1.00	1.00	0.64	0.17	1.00
	21-Jul	**0.00**	**0.00**	1.00	1.00	1.00	0.36	**0.00**	1.00
	22-Jul	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	23-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	1.00
	24-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.46
	25-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	1.00
RINP-07	16-Jul	**0.00**	**0.00**	1.00	1.00	1.00	0.70	1.00	1.00
	17-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.68
	18-Jul	**0.00**	**0.00**	0.61	1.00	1.00	1.00	1.00	1.00
	19-Jul	**0.00**	**0.00**	1.00	1.00	1.00	0.76	**0.04**	1.00
	20-Jul	**0.00**	**0.00**	0.79	**0.00**	1.00	1.00	0.10	1.00

Station	Survey Night	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Eastern Small-footed bat	Little Brown bat	Northern long-eared bat	Tri-colored bat
	21-Jul	**0.00**	**0.00**	1.00	0.97	**0.00**	0.87	1.00	1.00
	22-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	0.47
	23-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	**0.03**	0.68
	24-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	**0.04**	1.00
	25-Jul	**0.00**	**0.00**	1.00	1.00	1.00	0.90	1.00	1.00
RINP-08	16-Jul	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00
	17-Jul	**0.00**	**0.02**	**0.00**	0.50	1.00	1.00	1.00	1.00
	18-Jul	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00
	19-Jul	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00
	20-Jul	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00
	21-Jul	**0.00**	**0.00**	0.06	1.00	1.00	1.00	1.00	1.00
	22-Jul	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00	1.00
	23-Jul	**0.00**	**0.00**	0.09	1.00	1.00	1.00	1.00	1.00
	24-Jul	**0.00**	**0.00**	**0.00**	1.00	1.00	1.00	1.00	1.00
	25-Jul	**0.00**	**0.00**	0.31	1.00	1.00	1.00	1.00	1.00
RINP-09	16-Jul	**0.00**	**0.00**	1.00	1.00	**0.00**	**0.00**	1.00	1.00
	17-Jul	**0.00**	**0.00**	1.00	1.00	1.00	**0.01**	1.00	1.00
	18-Jul	**0.00**	**0.00**	1.00	1.00	1.00	**0.00**	1.00	1.00
	19-Jul	**0.00**	**0.00**	1.00	1.00	1.00	**0.00**	1.00	1.00
	20-Jul	**0.00**	**0.00**	1.00	1.00	**0.00**	**0.00**	1.00	1.00
	21-Jul	**0.00**	**0.00**	1.00	1.00	1.00	**0.00**	1.00	1.00
	22-Jul	**0.00**	**0.00**	1.00	1.00	1.00	**0.00**	1.00	1.00
	23-Jul	**0.00**	**0.00**	1.00	1.00	1.00	**0.00**	0.52	0.91
	24-Jul	**0.00**	**0.00**	1.00	1.00	**0.00**	**0.00**	0.49	1.00
	25-Jul	**0.00**	**0.00**	1.00	1.00	**0.00**	**0.00**	0.57	0.96

Note: Maximum Likelihood Estimate (MLEs) interpretation – values <0.05 indicates there is a 95 percent confidence that the species is present. **Bold** value indicates significance.

5.0 DISCUSSION

This presence/absence survey did not identify the presence of the federally threatened MYSE at the Installation. Of the passes auto-classified as MYSE there were several strong candidates but none contained the definitive characteristics to classify beyond the myotis species group. In addition, concurrent baseline acoustic surveys were conducted at four additional locations in the spring through the fall of 2018 which may provide additional evidence for the presence or absence of MYSE on the Installation. The majority of the Installation is developed, yet pockets of potentially suitable habitat do occur within the boundary. Preferred habitat of MYSE includes contiguous mature forest, and specifically wetland habitat with a closed canopy (Yates and Muzika 2006, Henderson and Broders 2008). Despite presence of suitable habitat, MYSE absence may be attributed to their precipitous decline due to WNS. Given that a MYSE has been documented over wintering in man-made structures in Rhode Island (McLeish 2016), it is possible that MYSE utilize the Installation in the spring or fall moving from or to anthropogenic winter hibernacula.

Acoustic survey results did suggest habitat differences between the detector sites influenced bat activity. Stations RINP-07, 08, and 09 had the highest activity rates and were located around the same approximately 1-acre, linear wetland. A moderate amount of activity was recorded within a canopy gap in the forest at Station RINP-06, and the lowest activity was recorded in a utility line corridor at RINP-05. It is possible that bats avoided the utility lines within this corridor which resulted in lower activity rates than recorded at other stations.

Detector location did not appear to influence species composition. The big brown bat was the most commonly recorded species at the Installation regardless of habitat type. Eastern red bat, a migratory tree bat, was the next most active species at the Installation and did not appear to be influenced by habitat type. However, habitat and structural characteristics surrounding each detector may have influenced the type of echolocation bats were emitting, thereby influencing the species classification. In cluttered environments, bats emit shorter and more frequent pulses, also known as approach phase echolocations, to better orient their flight path or hone in on prey (Fenton 2013). Approach phase pulses are steeper and less diagnostic than more common echolocations known as search phase pulses. Rapid approach phase pulses of an eastern red bat closely resemble myotis species, such as little brown bat, and are commonly misclassified by software as species with a higher characteristic frequency. For example, the majority of recordings auto-classified as little brown bat were determined to be eastern red bat or unidentified high frequency bat during manual review. In addition, over 91 percent of all bat passes classified as unidentified high frequency species were recorded at Stations RINP-07 and RINP-09, both located amid trees and in a probable foraging location. It is likely that the majority of the unidentified high frequency passes were actually eastern red bat emitting approach phase echolocations.

All eight bat species with the potential to occur in Rhode Island are listed as Species of Greatest Conservation Need, although at differing State Rank levels depending on known threats and distributions within the State. (RIDEM 2015). According to the Rhode Island Wildlife Action Plan (RIDEM 2015), big brown bat, eastern red bat, and little brown bat are the only three species known to occur throughout the State. Ubiquitous throughout much of the country and the eastern U.S., the hoary bat and silver-haired bat are described as uncommon in Rhode Island during the summer breeding season (Cryan 2003, RIDEM 2015). Less is known about the populations and distributions of tri-colored bat, eastern small-footed bat, and northern long-eared bat within Rhode Island (RIDEM 2015). In the Rhode Island Wildlife Action Plan, the number two threat for all bat species in the state is residential and commercial development via habitat loss of maternal roost sites or critical micro-features (RIDEM 2015).

6.0 RECOMMENDATIONS

Even though MYSE were not detected in this survey, the species may occasionally utilize the Installation and it is possible they were not detected by the survey and actually are present. Depending on the nature and extent of activities within the areas of interest, there is the potential to directly impact MYSE summer habitat by removing forested areas or potential individual roost trees. Below are several recommendations to protect MYSE habitat as well as suggestions of ways to gain more information about potential MYSE utilization of the Installation. These measures also would protect other bat species.

1) Best management practices under the MYSE 4(d) rule suggest avoiding activity such as cutting trees during the pup season (01 June–31 July) or the breeding season (15 May–15 August) can prevent MYSE take and curtail adverse effects. However, tree removal is prohibited under the final 4(d) rule only if it occurs within 46 meters (150 feet) of a known maternity roost tree from 01 June through 31 July (USFWS 2016a, b).
2) Tree snags should not be removed unless considered a safety concern and can be created by girdling trees if an area is lacking snags. Snags can create roosting opportunities like peeling bark and cavities for species such as MYSE. Prescribed fire may also increase the number of snags. Fire also increases the canopy gaps and therefore solar radiation reaching roosts, which can increase maximum roosting temperatures (Johnson et al. 2009). Increased roosting temperatures are associated with rapid development of young (Boyles and Aubrey 2006). However, prescribed fire may reduce roosting opportunities for foliage roosting bats such as hoary bat.
3) Construct or place bat houses around the Installation to create roosting habitat.
4) Each bat species has a preferred habitat for foraging so maintaining multiple habitats on the Installation is important. Many species prefer to feed over open water, thus protecting wetlands and both the forest around them and corridors that connect them with other forest patches is vital. The larger bat species (such as hoary bat and big brown bat) prefer to forage in open meadow areas and along forest edges that tend to collect insects. Finally, many species, such as MYSE, prefer to forage in forested areas that tend to be wetter and provide better areas for breeding insects. Forested corridors

that connect the forest patches or run along streams are important to provide a sheltered environment that bats can use to move around the landscape.

5) Conduct surveys in the spring or fall to potentially document myotis traveling to or from man-made hibernacula (buildings, cisterns, drain pipes, etc)

7.0 REFERENCES

Barbour, R. and W. Davis. 1969. Bats of America. University Press of Kentucky, Lexington. 286 pp.

Boyles, J.G., and D.P. Aubrey. 2006. Managing forests with prescribed fire: implications for a cavity dwelling bat species. Forest Ecology and Management 222: 108–115.

Brown, C. 2016. Wild Rhode Island, Vol 9. Issue 6. Summer, 2016. Available online at: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/WildRI_Summer_2016.pdf. Accessed December 2018.

Cryan, P. M. 2003. Seasonal distribution of migratory tree bats (Lasiurus and Lasionycteris) in North America. *Journal of Mammalogy*, *84*: 579–593.

Fenton, M.B., 2013. Questions, ideas and tools: lessons from bat echolocation. Animal Behaviour, 85(5), pp.869–879.

Harvey, M.J. 1992. Bats of the eastern United States. Arkansas Game and Fish Commission in cooperation with the U.S. Fish and Wildlife Service and Tennessee Technological University. Little Rock, Arkansas.

Henderson, L.E., and H.G. Broders. 2008. Movements and resource selection of the northern long-eared myotis (*Myotis septentrionalis*) in a forest-agriculture landscape. Journal of Mammalogy 89: 952–963.

Johnson, J.B., J.W. Edwards, W.M. Ford, and J.E. Gates. 2009. Roost tree selection by northern myotis (*Myotis septentrionalis*) maternity colonies following prescribed fire in a Central Appalachian Mountains hardwood forest. Forest Ecology and Management 258: 233–242.

Loeb, S.C., T.J. Rodhouse, L.E. Ellison, C.L. Lausen, J.D. Reichard, K.M. Irvine, T.E. Ingersoll, J.T.H. Coleman, W.E. Thogmartin, J.R. Sauer, C.M. Francis, M.L. Bayless, T.R. Stanley, and D.H. Johnson. 2015. A plan for the North American Bat Monitoring Program (NABat). General Technical Report SRS-208. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 112 p.

Menzel, M., S. Owen, W.M. Ford, J. Edwards, P. Wood, B. Chapman, and K. Miller. 2002. Roost tree selection by northern long-eared bat (*Myotis septentrionalis*) maternity colonies in an industrial forest of the central Appalachian Mountains. Forest Ecology and Management 155: 107–114.

McLeish, T. M. 2016. Wintering bats in Rhode Island: Are They Seeking Refuge from White-Nose Syndrome? ecoRI News. Available online at: https://www.ecori.org/natural-resources/

2016/2/9/wintering-bats-are-they-seeking-refuge-from-white-nose-syndrome. Accessed December 2018.

Owen, S. F., M.A. Menzel, W.M. Ford, J.W. Edwards, B.R. Chapman, K.V. Miller, and P.B. Wood. 2002. Roost Tree Selection by Maternal Colonies of Northern Long-Eared Myotis in an Intensively Managed Forest. Published by the United States Department of Agriculture, Forest Service, Northeastern Research Station. General Technical Report NE-292. March 2002.

RIDEM (Rhode Island Department of Environmental Management Division of Fish and Wildlife) 2015. Rhode Island Wildlife Action Plan. Rhode Island Wildlife Action Plan Species Profiles. Species of Greatest Conservation Need. Available online at: http://www.dem.ri.gov/ programs/bnatres/fishwild/swap/SGCNMammals.pdf. Accessed December 2018.

_______. 2016. New Release: DEM Confirms presence of Fungal Disease affecting bats in RI. Available online at: http://www.dem.ri.gov/news/2016/pr/0505161.htm. Accessed December 2018.

_______. 2017. Bats of Rhode Island. Available online at: http://www.dem.ri.gov/programs/ bnatres/fishwild/pdf/bat.pdf. Accessed December 2018.

Sasse, D.B., and P.J. Perkins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the White Mountains National Forest. Bats and forests symposium. British Columbia Ministry of Forests Working Paper 23: 91–101.

Solari, S. 2018. *Myotis leibii*. *The IUCN Red List of Threatened Species* 2018: e.T14172A22055716. http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T14172A22055716.en. Accessed 21 December 2018.

USFWS (U.S. Fish and Wildlife Service). 2012. USFWS. 2012. North American bat death toll exceeds 5.5 million from white-nose syndrome. News Release January 17, 2012. Available online at: https://www.whitenosesyndrome.org/sites/default/files/files/wns_mortality_2012_nr_final_0.pdf. Accessed November 2018.

_______. 2014. Northern Long-Eared Bat Interim Conference and Planning Guidance. USFWS Regions 2, 3, 4, 5, & 6. 06 January 2014. Available online at: https://www.fws.gov/ northeast/virginiafield/pdf/NLEBinterimGuidance6Jan2014.pdf. Accessed 27 November 2018.

_______. 2015a. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat with 4(d) Rule. Available at: https://www.govinfo.gov/ content/pkg/FR-2015-04-02/pdf/2015-07069.pdf. Accessed January 2019.

______. 2015b. Northern Long-Eared Bat. *Myotis septentrionalis.* Available at: https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/NLEBFactSheet01April2015.pdf. Accessed January 2019.

______. 2016a. Endangered and Threatened Wildlife and Plants; 4(d) Rule for the Northern Long-Eared Bat. Federal Register 81(9): 1900–1922. Available online at: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf. Accessed January 2019.

______. 2016b. Northern Long-Eared Bat – Final 4(d) Rule. Questions and Answers. Available at: https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FAQsFinal4dRuleNLEB.pdf. Accessed January 2019.

______. 2018a. 2018 Range-Wide Indiana Bat Summer Survey Guidelines April 2018. Available online at: https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2018RangewideIBatSurveyGuidelines.pdf. Accessed November 2018.

______. 2018b. Northern Long-Eared Bat Final 4(d) Rule, White-Nose Syndrome Zone Around WNS/Pd Positive Counties/Districts, 01 October 2018. Available online at: https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf. Accessed 19 December 2018.

______. 2018c. ECOS. Species Profile for Northern long-eared Bat (*Myotis septentrionalis*). Available online at: https://ecos.fws.gov/ecp/species/. Accessed on 19 December 2018.

Weather Underground. 2018. PWS data for Newport, RI. Available online at: https://www.wunderground.com/history/daily/us/ri/newport/KUUU/date/2018-7-26

WNSRT (White-Nose Syndrome Response Team). 2019. White-Nose Syndrome Response Team. Available at https://www.whitenosesyndrome.org/. Accessed January 2019.

Yates, M.D., and R.M. Muzika. 2006. Effect of forest structure and fragmentation on site occupancy of bat species in Missouri Ozark forests. Journal of Wildlife Management 70: 1238–1248.

APPENDIX A

HABITAT ASSESSMENTS FOR BAT DETECTOR STATIONS

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APPENDIX B

STAFF RESUMES

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APPENDIX C

PHOTO LOG OF DETECTOR LOCATION AND SITE CONDITIONS

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Photo #	Station	Date	Direction
1	RINP-05	16 July 2018	Microphone orientation: At sky

Photo #	Station	Date	Direction
2	RINP-05	16 July 2018	East

Photo #	Station	Date	Direction
3	RINP-05	16 July 2018	West

Photo #	Station	Date	Direction
4	RINP-06	16 July 2018	Microphone orientation: At Sky

Photo #	Station	Date	Direction
5	RINP-06	16 July 2018	Southeast

Photo #	Station	Date	Direction
6	RINP-06	16 July 2018	West

Photo #	Station	Date	Direction
7	RINP-07	16 July 2018	Northwest

Photo #	Station	Date	Direction
8	RINP-07	16 July 2018	Southeast

Photo #	Station	Date	Direction
9	RINP-07	16 July 2018	Northeast

Photo #	Station	Date	Direction
10	RINP-08	16 July 2018	South

Photo #	Station	Date	Direction
11	RINP-08	16 July 2018	Northeast

Photo #	Station	Date	Direction
12	RINP-08	16 July 2018	Southwest

Photo #	Station	Date	Direction
13	RINP-09	16 July 2018	South

Photo #	Station	Date	Direction
14	RINP-09	16 July 2018	Southwest

Photo #	Station	Date	Direction
15	RINP-09	16 July 2018	Northwest

Photo #	Station	Date	Description
16, 17	RINP-09	26 July 2018	Mature stand of white oak west of detector

APPENDIX M

NAVSTA NEWPORT PINNIPED SURVEY REPORT

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Haul-out Counts and Photo-Identification of Pinnipeds in Narragansett Bay, Rhode Island: 2015/16 Annual Progress Report

Prepared by

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December 2016

Suggested Citation:

Moll, T.E., J.S. Krumholz, G.H. Mitchell, C.G. Tompsett, T.E. Vars, and Z.D. Singer-Leavitt. 2016. *Haul-out Counts and Photo-Identification of Pinnipeds in Narragansett Bay, Rhode Island: 2015/16 Annual Progress Report*. Prepared for U.S. Fleet Forces Command, Norfolk, Virginia. December 2016.

Cover Photo Credit:

Harbor seal (*Phoca vitulina*) *hauled out at a survey site in Narragansett Bay, RI.* Cover photo by Glenn Mitchell, Photo taken under NMFS General Authorization Permit #19826-00.

This project is funded by U.S. Fleet Forces Command and carried out by Naval Undersea Warfare Center Division, Newport as part of the U.S. Navy's data gap program.

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Acronyms and Abbreviations

NOAA	National Oceanic and Atmospheric Administration
Photo-ID	Photo-identification
SIFT	Signal Invariant Feature Transform
U.S.	United States

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1. Introduction and Background

Harbor seals (*Phoca vitulina concolor*) and gray seals (*Halichoerus grypus*) occur along the Atlantic coast of the United States (U.S.) and are protected under the Marine Mammal Protection Act. The harbor seal is one of the most widely distributed seals, found in temperate to polar coastal waters of the northern hemisphere (Jefferson et al. 2011). Harbor and gray seal distribution appears to be shifting, and in recent years there have been an increased number of seals reported in southern New England and the mid-Atlantic region (Kenney 2014; Waring et al. 2014). Occasional sightings and strandings had been reported as far south as Florida and North Carolina for harbor and gray seals for many years (Waring et al. 2014), but more recently, small winter haul-out sites have been discovered in the lower Chesapeake Bay, Virginia and near Oregon Inlet, North Carolina (Waring et al. 2014). This study focuses on a harbor seal haul-out site near Naval Station Newport in Narragansett Bay, Rhode Island. This report presents an analysis of seal counts and environmental parameters in addition to a preliminary assessment of photo-identification (photo-ID) techniques.

An important aspect of seal physiology is the need to haul out. Harbor seals in the northeast U.S. haul out to breed and pup during the summer, but also must haul out during the winter to rest and thermoregulate, as their blubber layer is insufficiently thick to defend against colder water temperatures. Haul-out sites vary but include intertidal and subtidal rock outcrops, sandbars, sandy beaches, and even peat banks in salt marshes (Burns 2008; Gilbert and Guldager 1998; Prescott 1982; Wilson 1978). When hauled out, seals are particularly vulnerable to anthropogenic noise and disturbance, as they require this time to rest and warm up, but can easily be startled and “flush” back into the water by loud noise or close proximity of humans, boats, aircraft etc. Repeated flushing of haul-outs can have numerous deleterious effects including reduced pupping success, behavior changes, and abandoning the haul-out (Lelli and Harris 2001; Richardson et al. 2013; Terhune and Brillant 1996).

Harbor seals undertake an annual migration from summer breeding and pupping grounds in northern New England and maritime Canada, to winter feeding grounds in Southern New England and the Mid-Atlantic region in autumn and early winter. The reverse migration occurs before the pupping season, which takes place from mid-May through June (Barlas 1999; Jacobs and Terhune 2000; Rosenfeld et al. 1988; Whitman and Payne 1990).

1.1 Study Site

Narragansett Bay is a well-known winter feeding ground for harbor seals, occupied roughly from late September until early May (Raposa and Dapp 2009; Schroeder 2000). There are over 20 documented haul-out sites within the bay, mostly on rock outcrops which are away from shore and exposed at low tide, although seals do occasionally come ashore on beaches (Raposa and Dapp 2009; Schroeder 2000). The number of haul-out sites has increased in the last decade, concurrently with the general increase in the harbor seal population size throughout New England (Gilbert et al. 2005; Raposa and Dapp 2009). However, specific information on the population size and ecology of harbor seals in Narragansett Bay remains relatively sparse due to limited and sporadic volunteer monitoring efforts (Raposa and Dapp 2009). The haul-out studied in this project is on a rocky outcropping known as “The Sisters” located near Coddington

Point on Naval Station Newport (Figure 1). This haul-out has been studied by the Naval Undersea Warfare Center Division, Newport since 2011 during winter months when harbor seals are present in the bay. While completely submerged at high tide, the rocks can provide space for more than 40 seals to haul out at low tide (Figure 2).

Figure 1: Location of the haul-out study area on Naval Station Newport

Figure 2. Photo showing Naval Station Newport haul-out from typical photographic vantage point. Photos were taken adjacent to a jogging path which runs parallel to shore, approximately 150 meters from the haul-out (Photo: T. Moll, Photo taken under NMFS General Authorization Permit #19826-00)

1.2 Project Goals

The overall goal of this project is to gain an understanding of seal movement and behavior to assist the Navy in determining potential impacts from Navy training and testing. Monitoring the Naval Station Newport site will help the Navy understand trends in seasonal movements, site fidelity, and relative abundance in close proximity to Navy activity. By establishing a record of seal presence and abundance, we can further our understanding of the general ecology of the population in Narragansett Bay, and whether this population is impacted by present or future human disturbance. We also aim to pilot test several software programs designed to photo match individual animals based on pelage patterns, a process which has been used successfully with other similar marine mammal species (Bolger 2012; Hiby et al. 2007; Paterson et al. 2013), and with some limited success on harbor seals (e.g. McCormack 2015). Photo-ID methods could eventually lead to a better understanding of the movement of these animals within and between haul-out sites. Maintaining this type of long-term dataset enhances the Navy's ability to understand how this population may respond to changes in climate and other anthropogenic disturbances.

2. Methods

2.1 Field Observations

Following National Oceanic and Atmospheric Administration (NOAA) seal watching guidelines (NOAA 2015), a series of systematic, land-based counts of all seal species were conducted from a walking path in close proximity to the haul-out (Figure 2). Counts were made approximately once per week during the daytime and at low tide. An effort was made to conduct the count within one hour of peak low tide. The number of seals hauled out and observed in the water nearby was recorded three times at 10-minute intervals during each site visit throughout the season. Whenever possible, a second observer verified the count. For analysis purposes, we used the maximum observed number of seals "hauled out" and "present" (including both hauled out and in water seals) across each of these three surveys, consistent with similar studies by Grellier et al. (1996) and Pauli and Terhune (1987). Unless otherwise specified, seal count data was interpreted as the maximum number of animals counted during the survey period.

Photographs of seals were collected between counts using a Canon EOS 7D Mark II camera with a zoom lens (Canon EF 100-400mm f/4.5-5.6L IS USM) or a prime lens (Canon EF 300mm f4 L IS), sometimes combined with a 2x tele-extender (Canon Extender EF 2x III) for photo-ID and a photo-capture-recapture study. Multiple photos of each seal were taken using different zoom and exposure combinations to maximize pelage visibility. The camera settings used are shown in Table 1 and the shot sequence and guidance are shown in Table 2. When taking sequences 2 through 6 the images were overlapped so entire animals would appear in at least one frame each. In the future photographs will be used to develop a local catalog and database which can be compared to other regional catalogs.

Table 1: Custom Camera Settings

Custom Mode	Base Mode	Shut-ter Speed	Exposure Compen-sation	Bracket-ing	White Balance	Metering	Drive	Auto-focus	ISO	Auto Lighting Optimizer
C1	Tv	1/1000	+ 1/3	+/- 2/3	Auto	spot	quiet	5 point	auto	High
C2	Tv	1/800	+ 1/3	+/- 2/3	cloudy	spot	slow	5 point	auto	High
C3	M	1/640	+ 1/3	+/- 2/3	Auto	spot	slow	5 point	auto	High

Table 2: Shot Sequence

Series	Lens	Setting	Shot framing
1	100-400mm	C3	zoomed to ~200mm, 3 images of the entire haul-out
2	100-400mm	C3	Zoomed in, 3 Images in each of 5 locations, L-R
3	2x+100-400mm	C1	Zoomed in, 3 Images in each of 5 locations, L-R
4	2x+100-400mm	C2	Zoomed in, 3 Images in each of 5 locations, L-R
5	2x+300mm	C1	3 Images in each of 5 locations, L-R
6	2x+300mm	C2	3 Images in each of 5 locations, L-R

Observers also recorded weather and environmental conditions at the time of observation, as well as any potential disturbance, and how the animals reacted. These environmental data were supplemented with higher resolution, historical meteorological and oceanographic data from the nearest NOAA weather station (# 8452660) located on a boat pier at the southern end of Coasters Harbor Island, Naval Station Newport (Figure 3). These data were downloaded from https://tidesandcurrents.noaa.gov/. Additional weather data (e.g., precipitation, visibility, cloud cover) were obtained from instruments located at Newport State Airport via Weather Underground (www.wunderground.com). Environmental data were used to investigate relationships between seal presence/abundance and environmental parameters.

Figure 3: NOAA weather station located at Naval Station Newport.

Photos were sorted and processed for matching using software-aided and manual matching techniques to compare and identify individual seals. We are currently investigating the use of a large database format for managing seal images and associated environmental data.

2.2 Photo-Identification Methods

Two software packages, Wild-ID and Extract Compare, were investigated for their capability to serve as an aide to manual matching and improve our ability to recognize repeated visitors to the haul-out. For both software packages, we used a subset of the cropped photos to build a catalog of known matches (different photographs of the same seal on the same day, ideally from different angles) and known non-matches (photographs of other seals from the same day) to test the false negative and false positive identification rates across a range of similarity score thresholds (see Bendik et al., (2013). We used this analysis to determine the optimal similarity score threshold for each program, which would provide enough sensitivity to minimize false negatives, while maintaining a low false positive rate. This analysis compares the reliability of the two software programs to match individuals and maintain a low false positive rate. The similarity score threshold aids the interpretation of potential matches and determines if a true match exists. The user thus controls the outcome and can reject those images with improbable match odds.

Wild-ID (http://software.dartmouth.edu/Macintosh/Academic/Wild-ID_1.0.0.) is free photo matching software that employs the Signal Invariant Feature Transform (SIFT) algorithm that compares variable patterns within photographs. SIFT is a convenient pattern-matching algorithm because selected keypoints are somewhat robust to variation of photograph scale and rotation (Bolger 2012). The software compares an image to all other images in the database using these keypoint maps, providing the user with a ranked list of the highest scoring matches for each image based on their similarity. Similarity scores range from 0.0 (no similarity) to 1.0 (complete similarity) and provide a standardized measure of pattern resemblance contained within the image pairs.

This software is relatively simple to use and can easily identify likely matches (Figure 4). However, the software is labor intensive. The user must crop all images to minimize background and remove parts of individuals that are not the subject. Wild-ID also requires that the user create an external database to log matches between days. When a cropped image is processed, Wild-ID has been shown to reliably produce matches in a variety of terrestrial species as diverse as giraffe and salamander (e.g. Bendik et al. 2013; Bolger 2012; Morrison and Bolger 2014). Wild-ID can compare the same aspect in one cropped image to that shown in another to produce a “match pair” but cannot match different sides of the same animal to one another (e.g. left and right flanks). Given that the project goal was simply to determine the number of matching seals for the purpose of understanding site fidelity, the best available aspect (i.e., dorsal, ventral, right and left flanks) of each seal was cropped and used to test for matches against all available images. This method, however, produces a high false negative rate.

An important factor in image analysis using Wild-ID is the aspect angle of the photograph. The scale and orientation invariance of SIFT allows for direct use of images taken at aspect angles greater than and less than 90°. Keypoint matching accuracy for SIFT is above 50% for viewpoint changes of up to 50°, beyond which the algorithm becomes unreliable and number of false negatives rises dramatically (Lowe 2004). Since false negatives were not a major concern given the goals of this study, we decided to analyze images up to this limit in order to provide the highest likelihood of identifying true positive matches, despite the elevated false negative rate relative to using only photos of animals taken at 90 ° to the camera. This decision was motivated by our preliminary work with Wild-ID, which demonstrated that the software could sometimes correctly match a marginal quality image to another of high quality.

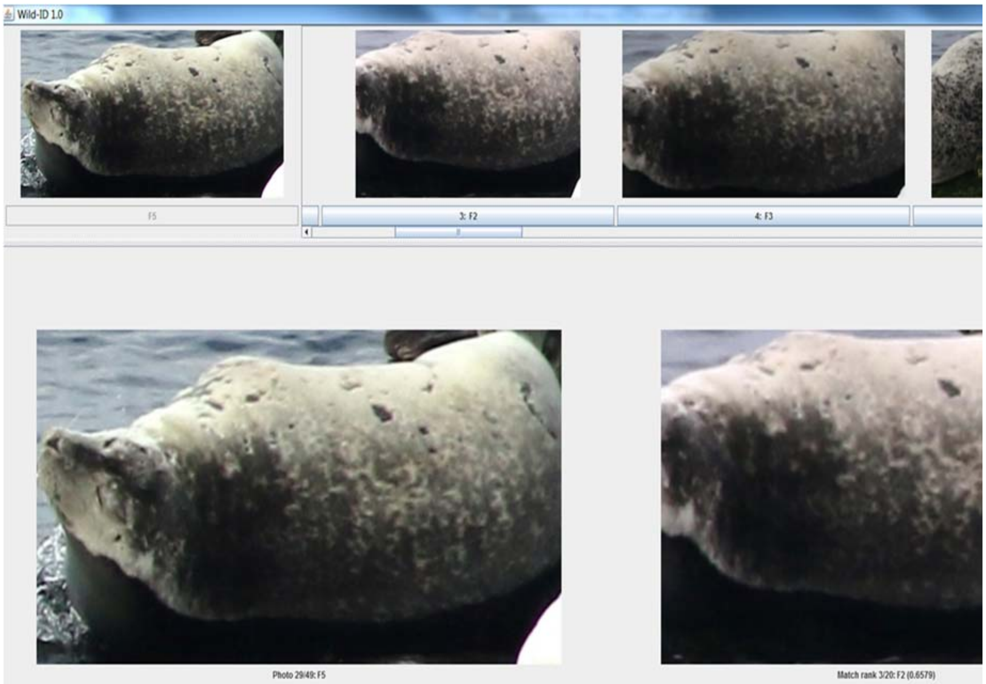

Figure 4. Processing pelage matching options using Wild-ID. Assisted by a similarity score (bottom right), the user selects the best match from the 20 best matches identified by the algorithm, or identifies the seal as unique (no previous matches in the database).

Extract Compare (http://conservationresearch.org.uk/Home/ExtractCompare/index.html) uses a similar pattern-matching algorithm, and pairs it with a 3-D wireframe surface model (Figure 5). Extract Compare has a more robust adjustment for differences in contrast between photos compared to Wild-ID, which allows improved matching of seals at different aspect angles and allows pattern matching of head and neck pelage. This software also includes a built-in database, which allows tracking of repeat encounters and links the right and left sides of the same animal. In combination, these enhancements dramatically reduce the false negative rate compared to Wild-ID and enhance our ability to track repeat matches. However, this software is also significantly more complex and time consuming than Wild-ID, and while the algorithm has been demonstrated repeatedly and successfully on gray seals (Hiby et al. 2007; Paterson et al. 2013)**,** previous usage with harbor seals has met with mixed results Harbor seals generally have less distinctive pelage patterns, and are therefore more challenging to match. This problem would likely exist regardless of software choice. Because Extract Compare uses an internal database, it is not necessary to organize and pre-crop images before loading. Furthermore, Extract Compare does allow for multiple aspect angles and even multiple seals to be extracted from each image. Therefore, we simply selected the sharpest available image of each seal for extraction, and extracted all viable aspects from that seal (e.g. head/neck, right/left flank, abdomen). In general, seals did not shift position substantially during monitoring, but whenever possible, additional aspects captured in multiple photos were analyzed to capture the maximum number of aspects for each seal.

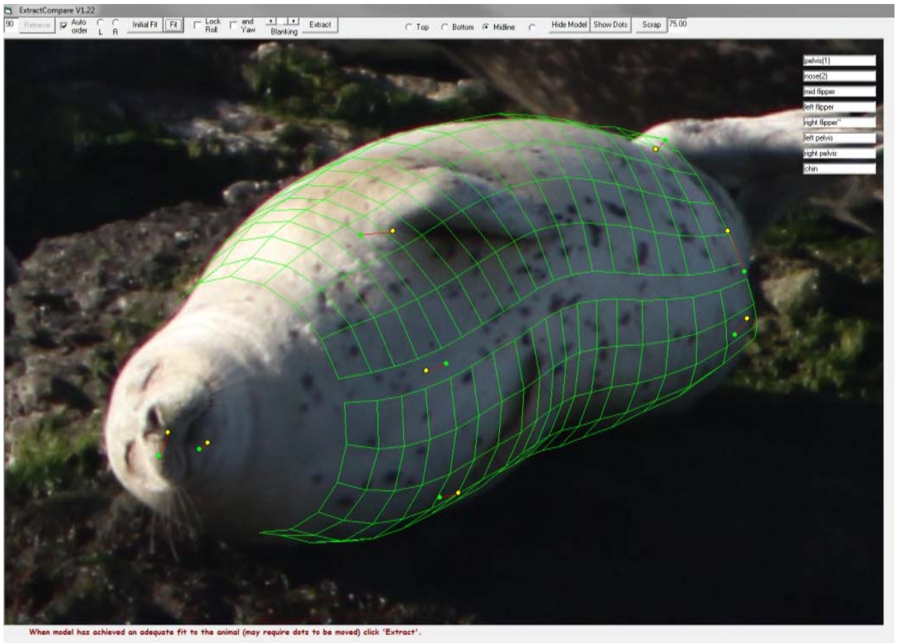

Figure 5. Extracting pelage patterns from a harbor seal abdomen using Extract Compare. The wire frame analysis compensates for differences in rotation and aspect between images

3. Results

3.1 Haul-out Counts: 2014/2015 and 2015/2016 Field Seasons

The seal season in Narragansett Bay is typically from fall through early spring. All counts represent a minimum number of seals because the west side of the haul-out site is obscured from view. The first seal observation of the 2014-2015 season was on December 4, 2014, although it is possible that seals arrived in Narragansett Bay earlier since monitoring did not occur until that date. The last seal of the season was observed on May 6, 2015, although monitoring continued for several weeks afterward. Approximately 693 seals were observed during 46 survey days. Seals were observed on 36 of 46 (78%) days, with a nonzero minimum count of one and maximum count of 44. On days when seals were observed, the average number of animals sighted was 19 (Figure 6).

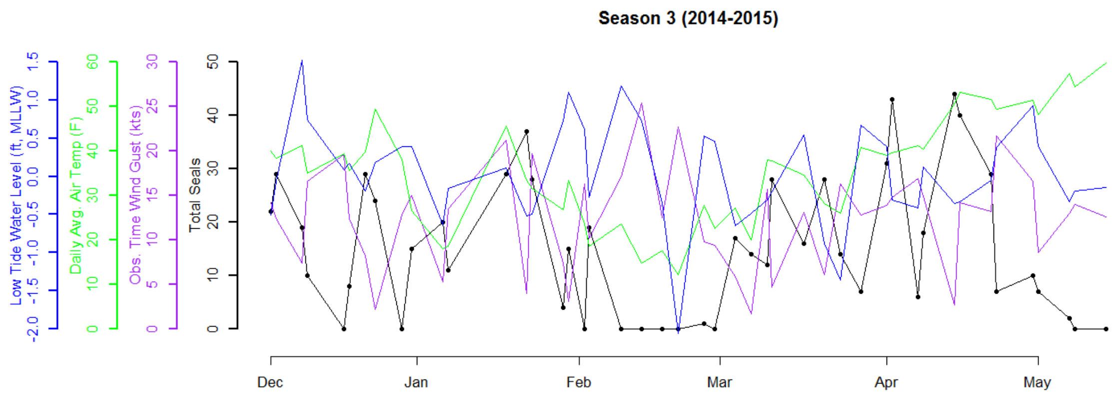

Figure 6. Seal counts with key environmental variables during the 2014-2015 field season.

Weekly monitoring began in August 2015 for the 2015-2016 season and seals were first observed on November 5, 2015. The last seal of the season was observed on May 4, 2016, although monitoring continued for several more weeks. During 29 survey days including and following November 5, 2015, a total of 624 seals were observed. Seals were observed on 26 of 29 (90%) of days, and were hauled out on 22 of 29 (76%) days, with a nonzero minimum count of one and maximum count of 49. On days when seals were observed, the average number of animals sighted was 24. No gray seals were positively identified during the season. Over the course of the season, one flush was observed following someone (not from the observation team) walking onto the beach.

Since monitoring this haul-out began in 2010, 1,644 seals were observed during 129 survey days. Over the course of the study, seals were observed on approximately 67% of observation days (discounting monitoring before the arrival of the first observed seal or after last seal observed in a season), with an overall average of 18.8 seals per day on days when seals were observed.

The peak number of seals per observation tends to be in early spring (March/April), with counts frequently exceeding 30 animals per day on days when seals were present (Figure 7). A dip in seal abundance occurred in February, which was the coldest month, both in terms of water temperature (Figure 8) and air temperature (Figure 9). The haul-out site was covered in ice for much of February 2015, which likely caused the pronounced dip in occurrence in 2014-2015 compared to the milder winter of 2015-2016.

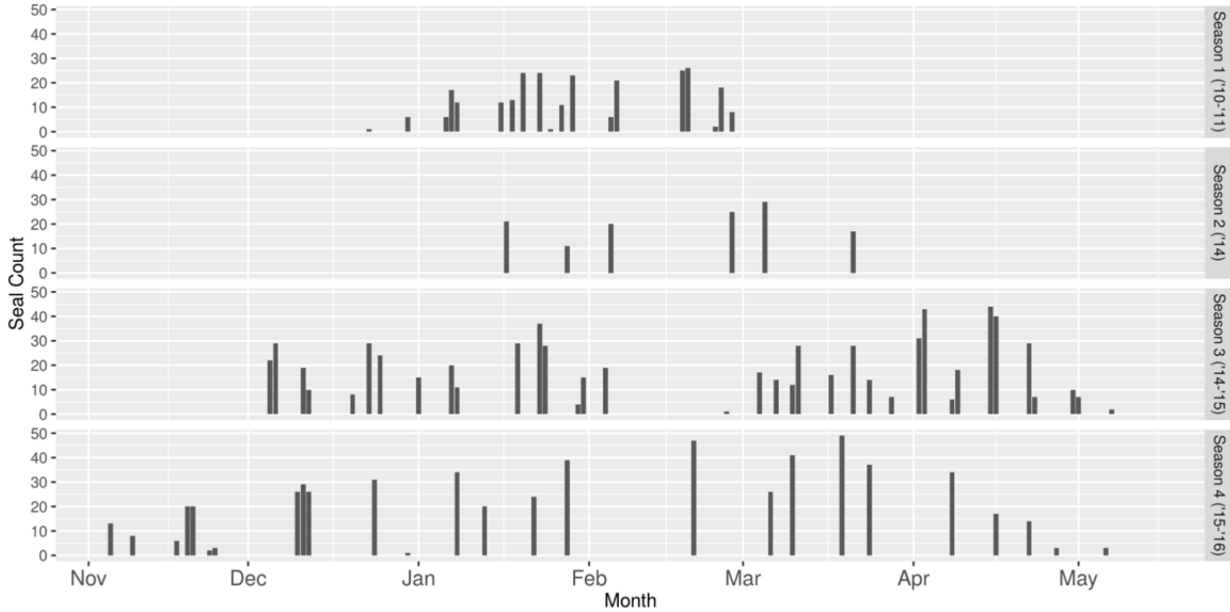

Figure 7. Seal counts over time for all field seasons.

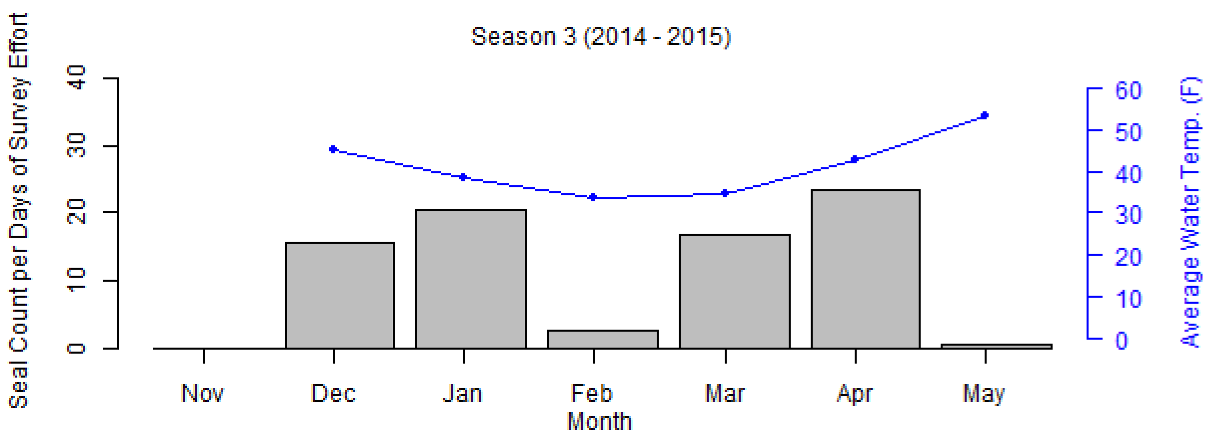

Figure 8. Average seal count by month with corresponding water temperature (2014-2015 field season)

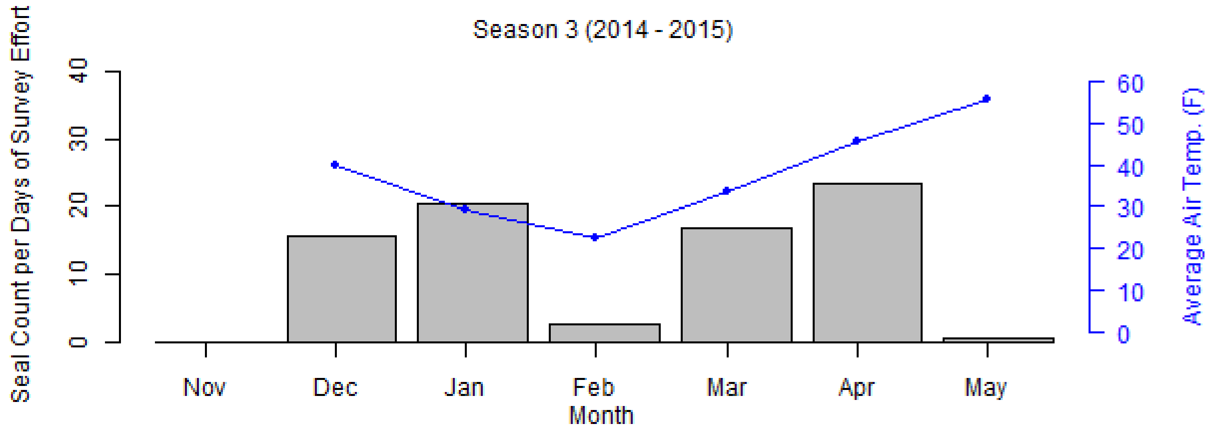

Figure 9. Average seal count by month with corresponding air temperature (2014-2015 field season)

We compared seal counts and presence/absence to environmental variables to investigate for patterns that might explain variations in seal count during the season (Table 3). Although many parameters showed a discernable relationship, the strongest relationships were with wind speed, water level at time of sampling (e.g. proximity to low tide and the magnitude of the low tide), and air temperature.

Table 3. Strongest correlations between seal abundance and environmental variables. The absolute value of Spearman's Rho indicates strength of correlation, ranging from 0 (weakest) to 1 (strongest), with the sign (+ or -) denoting positive or negative correlation. Variables are from the NOAA weather station located at Naval Station Newport unless otherwise noted.

Environmental Variable	Correlation with Seal Count (Spearman's Rho)
Observation Time Wind Gust	-0.41
Daily Maximum Wind Gust (Newport Airport)	-0.41
Observation Time Wind Speed	-0.35
Daily Average Air Temperature	0.31
Daily Average Wind Speed (Newport Airport)	-0.31
Daily Average Air Temperature (Newport Airport)	0.30
Observation Time Air Temperature	0.29
Observation Time Water Level	-0.28
Observation Time Barometric Pressure	0.28
Daily Average Air-Water Temperature Difference	0.27
Minutes Before or After Low Tide	-0.27
Low Tide Water Level	-0.26
Observation Time Air-Water Temperature Difference	0.24
Daily Average Barometric Pressure	0.24
Daily Average Water Temperature	0.21
Observation Time Water Temperature	0.18

Wind speed and direction appeared to have a substantial impact on the number of seals hauled out (Figure 10). In general, higher wind speeds corresponded to lower seal counts. Moderately strong winds from the south and west (directions from which the haul-out is protected) occasionally corresponded to large numbers of seals, while stronger winds from the north and east (with larger fetch) had a greater impact on seal abundance.

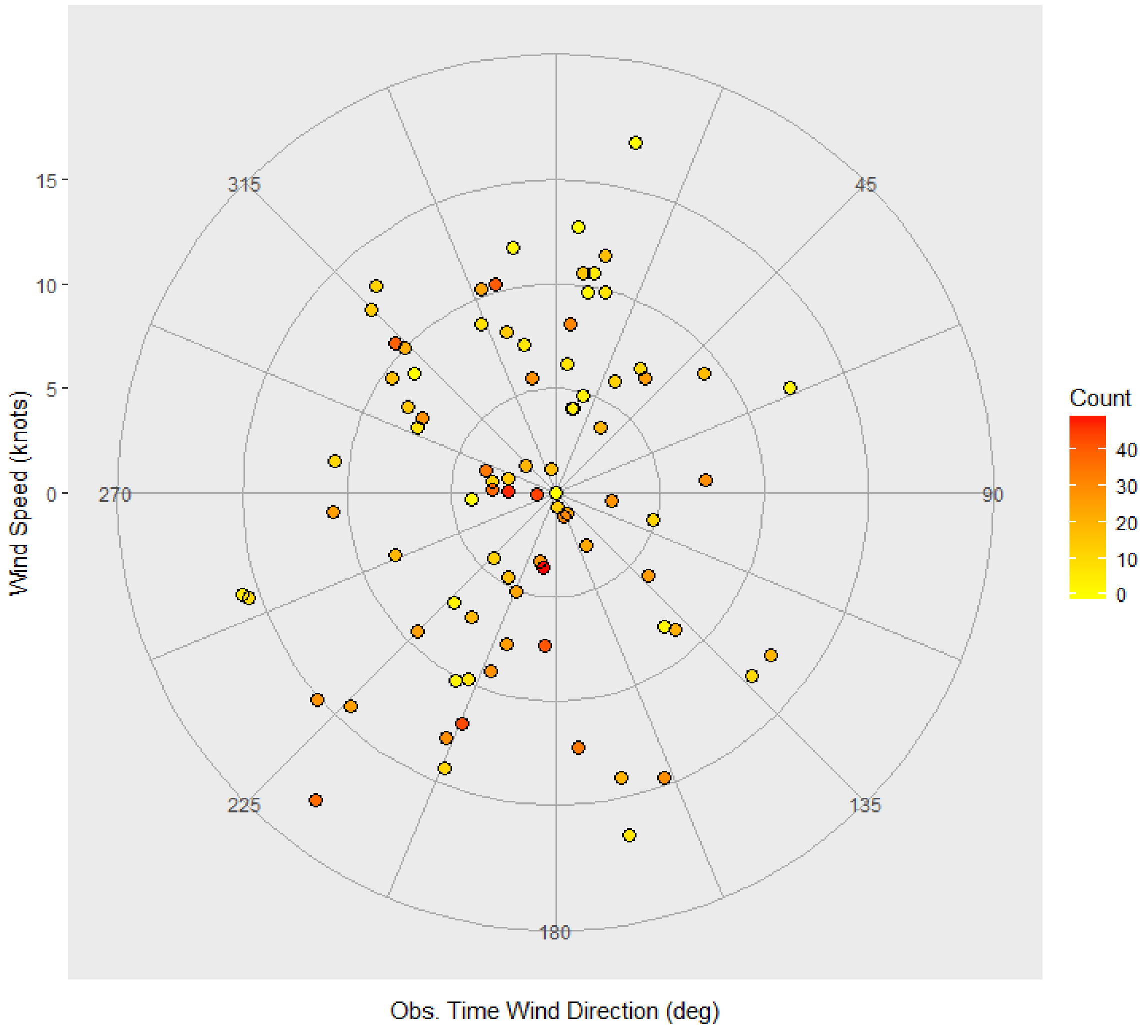

Figure 10. Seal abundance relative to wind speed and direction at time of observation (all seasons).

Temperature does appear to have an impact on seal abundance, but at least during the observation period, the relationship does not appear to be linear (Figure 11). Counts are lower on the coldest days, peak between about 38-45^{o}F, and then decline again as temperatures warm towards the end of the season. This pattern can also be seen in the mid-season dip in observed haul-outs during the month of February, which is usually the coldest month (Figure 8)

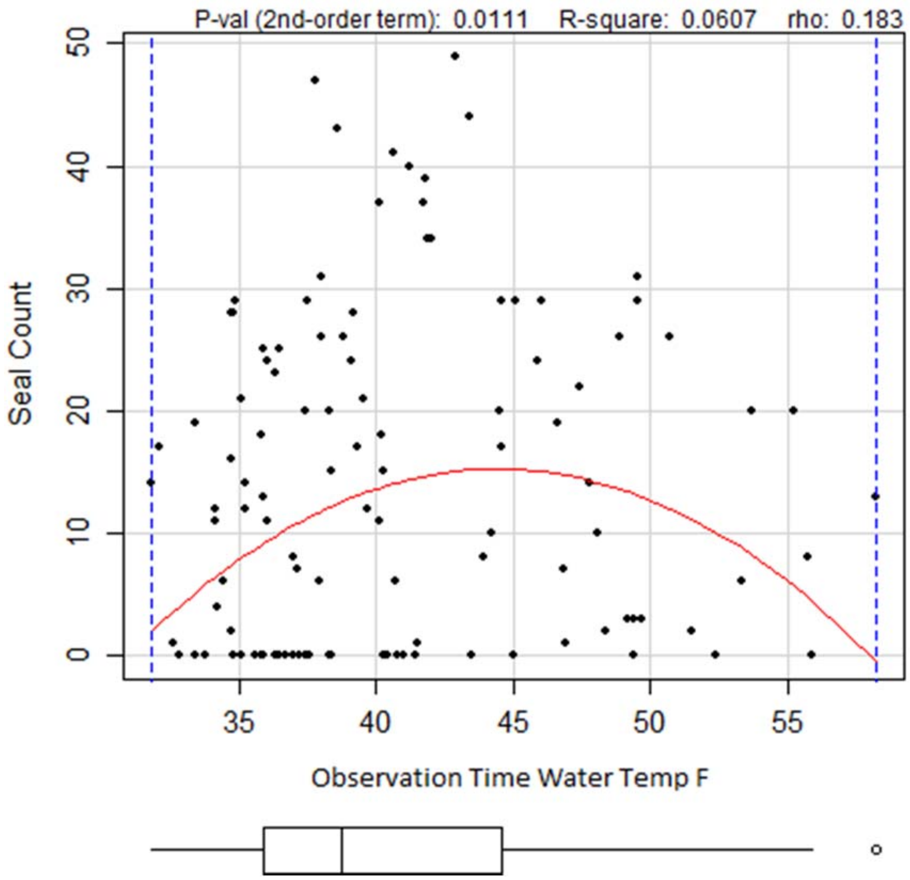

Figure 11. Seal count by water temperature at time of observation (all seasons). P value and R^2 are presented for the quadratic component of the relationship. The P value indicates that a quadratic fit is statistically better than a linear fit, while the R^2 describes the amount of additional variation explained by the quadratic term. The box and whiskers plot shows the mean, and upper and lower quartile, as well as the range of observed values.

Air temperature also seems to impact the number of seals hauled out, though not exactly in the same way as water temperature. A relatively strong linear relationship between air temperature and seal abundance is present, which only breaks down at the warmest of air temperatures, generally when the seals are leaving, or have already left for other reasons (Figure 12). Since one of the main reasons seals haul out during feeding season is thermoregulation, we would expect to see few seals hauled out when air temperatures are very cold. This pattern corresponds with the temporal pattern (Figure 9) of high seal numbers in December, early January, and March, with lower numbers during the very coldest part of winter.

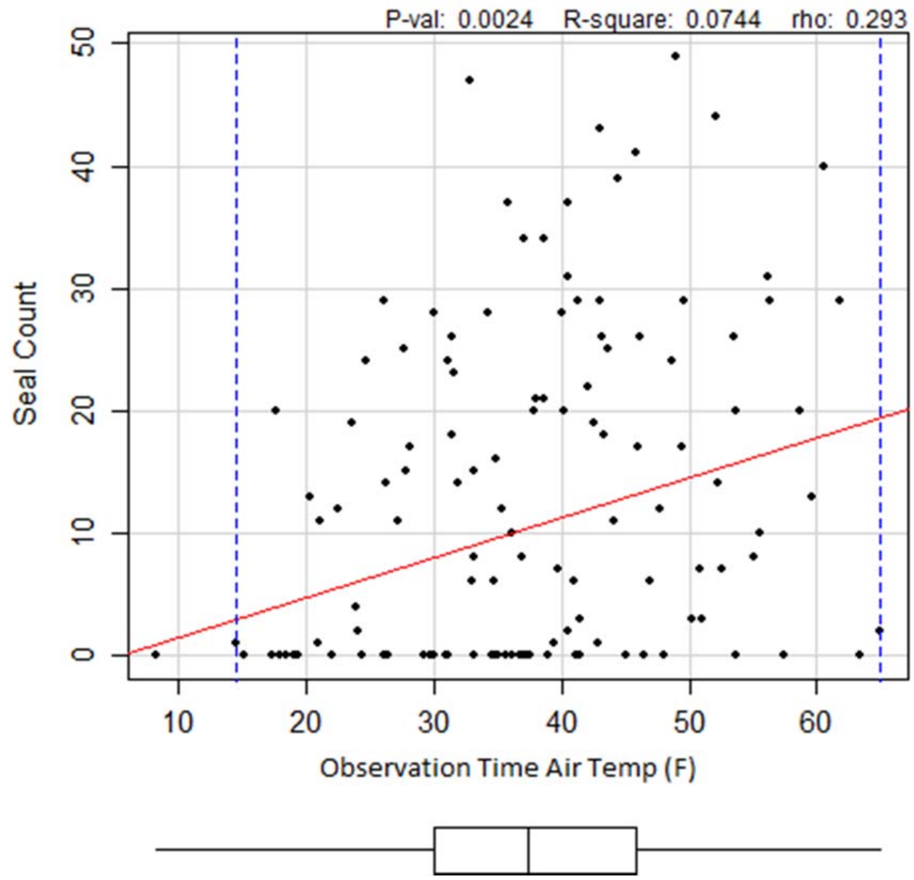

Figure 12. Seal count by air temperature at time of observation (all seasons). P value, R^2 and rho (correlation coefficient) are presented for the linear fit shown. Blue dotted lines indicate minimum and maximum temperatures at which seals were observed, though very few seals were observed in air temperatures below 20°F or above 62°F.

3.2 Photo-Identification

3.2.1 Wild ID

Wild-ID was used across the entire 2015-2016 field season, obtaining a usable crop for photo capture on 283 out of 624 (45%) observed seals during the season. Primary reasons for being unable to successfully photo-capture an animal included:

1) Observation: The animal was observed and counted, but never hauled out.
2) Obstruction: Obstructions such as rocks or other seals precluded capture of a large enough section of pelage to crop.
3) Aspect: The SIFT algorithm works best when the subject is photographed at 90^{o} to the camera. Beyond 50^{o} the algorithm is unreliable.
4) Environmental Conditions: Lighting, glare, reflection or shadow obscured the pelage pattern.

WILD-ID was tested using a database created from 498 cropped images from three days, which included 113 known matches (photos of the same animal on the same day) and 385 known non-matches (photos of different animals from the same day). The false negative and false positive rates were compared across a range of threshold similarity scores. Most known positive matches had similarity scores above 0.1, and most known negatives had similarity scores below 0.01, but scores between 0.01 and 0.1 were a mix of matches and non-matches (Figure 13).

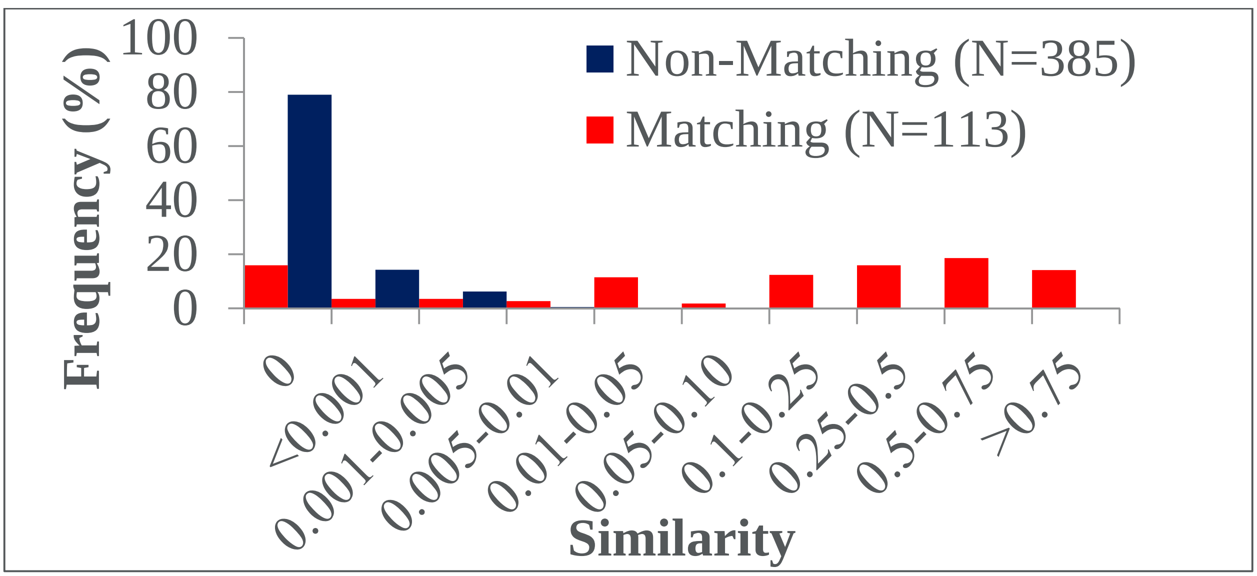

Figure 13. Frequency analysis of similarity scores for known matching and known non matching seals using Wild-ID.

Based on the goals of this study to quantify seal presence and understand site fidelity by individuals, it was important to minimize false positive matches and have confidence that those seals identified by the software as returning seals were actually returning. Therefore, we selected a threshold similarity score of 0.01 because of the low false positive rate. A user screening all photos and only considering matches with similarity score >0.01 would have a very low false positive rate (<0.5%), but a false negative rate of at least 26% (Figure 14).

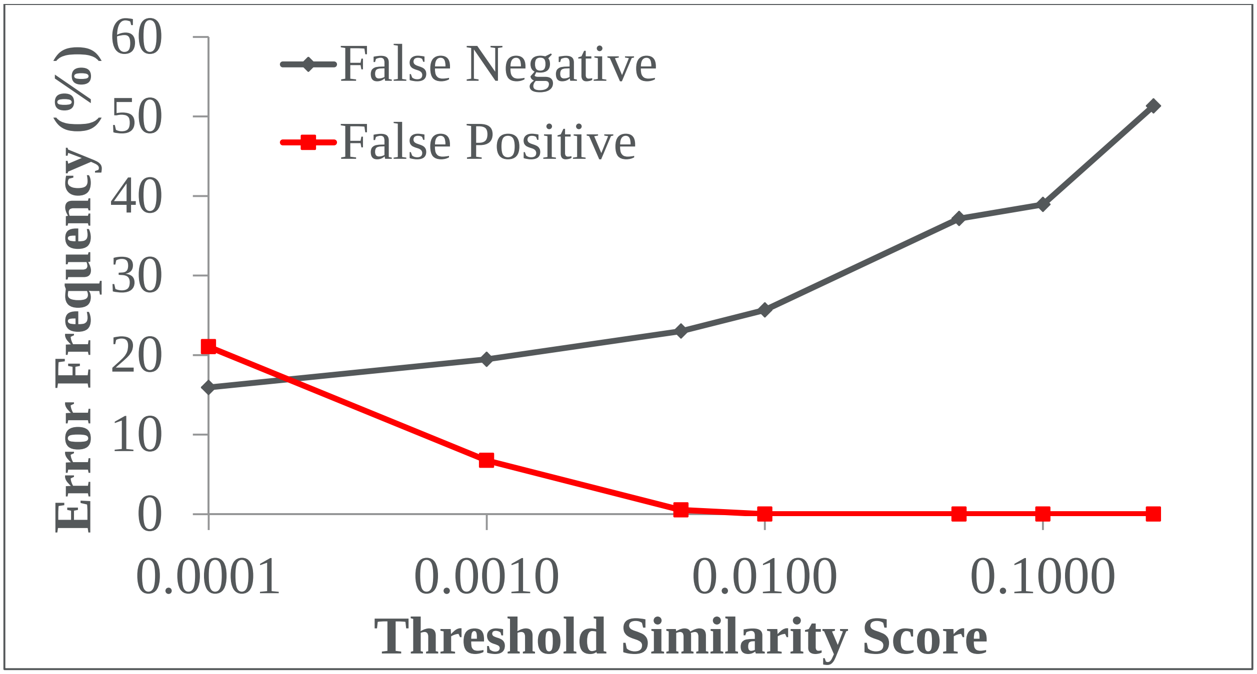

Figure 14. Frequency of false negative and false positive error across a range of threshold similarity scores using Wild-ID

The actual false negative rate would likely be much higher for an actual trial because all of the "known matches" used for this exercise were cropped from photographs with similar aspect angles. In the likely case that subsequent observations captured a different position or aspect angle of the seal, the false negative rate might be substantially higher. This false negative estimation also does not consider the rate of false negatives that would occur because this software is not able to match between the left and right sides of an animal. In a "real world" matching situation, the true false negative rate would be at least double this (52%). Reducing the similarity score threshold to 0.001 would decrease the false negative rate slightly, but would result in an order of magnitude increase in the false positive rate (to 6.8%).

By implementing this protocol across the entire season, we identified 38 matches, including seven animals which were observed on more than two days. The maximum number of observations for a single animal was ten (Table 4). In some cases the user was able to identify a confirmed visual match that was below the software threshold (a false negative). In those cases we often looked for another picture of one or both animals in the database to try to confirm or refute the match, either using Wild-ID or by eye. Particularly in cases where the animal had distinctive facial pelage (e.g. Figure 15), manual matching was able to identify many matches missed by Wild-ID. The high false negative rate associated with this process limits both the ability to assess if individual seals are returning to a haul-out and the potential to estimate the maximum duration that an individual animal is using the haul-out.

Table 4. Frequency of observation, photo capture ("mark"), and photo recapture for seals during the 2015-2016 field season.

Outcome	Frequency
Observed	624
Captured	283
Recaptured	38
Multi-Recapture	7

Figure 15. Example of seal with a distinctive facial marking. In many cases, repeat visitation by this animal, nicknamed "Boxer" due to his black eye, were false negative matches by the Wild-ID software, but easily detected manually by the observer.

3.2.2 Extract Compare

We experienced limited success with the Extract Compare software. After a long trial and de-bugging period, we were finally able to process a limited number of samples with Extract Compare. The process of outlining and fitting the wire frame to the animal for each aspect being extracted (e.g. head, neck, abdomen, flank, etc.) is very time consuming (3-5 minutes per aspect per animal per day) and has a steep learning curve. Once the wire frame is fit to the animal in the image, Extract Compare is able to handle many of the limitations experienced with Wild-ID, such as inability to account for differences in shading or rotation of the animal relative to the camera. We repeated the same process as performed during evaluation of Wild-ID, running a three-day sub-sample through Extract Compare. We were able to process and match images, but we were unable to output the similarity scores and conduct a histogram analysis due to what we assume is a bug in the testing protocol code that we have not been able to troubleshoot at this time. Thus, we are limited to qualitative comparisons of Wild-ID and Extract Compare for this task.

In general, the similarity scores produced by Extract Compare are much higher than those for Wild-ID, with most known matches scoring 0.5 or higher. Though a more quantitative analysis is necessary to confirm, we would expect that the threshold similarity score for Extract Compare would be about 0.2-0.3 (vs. 0.01 for Wild-ID). While these similarity scores are not directly comparable, this increase still indicates greatly improved sensitivity. The rate of false positives produced by the software, even using a threshold acceptance score of 0.3, is much higher, requiring user intervention to reject many potential matches for each verifiable match. The number of false positive matches may be mitigated as more photos are entered into the database because Extract Compare has the ability to show the user multiple images of the same seal against which to compare. Regardless, while precision is much higher, user effort is also higher with the increased processing time.

The improved sensitivity of Extract Compare produced a lower false negative rate (<10%) compared to Wild-ID (26%). Extract Compare is able to link left and right images of the same seal. In theory, this feature could dramatically lower the false negative rate. However, in order for this feature to be successful, the user must capture a left and right image of the same seal on the same day and manually associate them, which may be logistically challenging.

Extract Compare has a number of internal database features that permit tracking, storage, and association of animals (e.g. for multi-site comparisons, or tracking frequency of a calf with or without the mother), which could prove useful for a larger project, but which we have not yet examined for their functionality or ease of use.

4. Discussion

4.1 Population and Environmental Trends

Although we have only a very short time series to base general conclusions about population trends, the number of seals observed in each season does seem to be increasing. The time of first observation moved steadily earlier from 2010 to 2014 to 2015, and the average number of seals counted each day has increased over time (Table 5, see section 3.1 for more detail). Although the total number of observed animals in 2014-2015 was higher than 2015-2016, there were also several more observations made in that year. In addition, the portion of observations with seals present and hauled out has increased over time. The decrease in proportion of days where no seals are present may be an indication of resource pressure on the haul-out. If haul-out space is limited, and populations are increasing, we would expect to see animals hauled out more frequently and in a broader range of environmental conditions. It is also possible given our limited sample size and sporadic sampling, that we simply did not sample as much in bad weather, or that the weather in general was more conducive to seals hauling out. This could be corrected by developing relationships between environmental variables and seal abundance, which is discussed in more detail below.

Table 5. Seasonal survey effort (counting only days between first and last observation), total seal count, and effort-normalized average (number of seals observed per "in season" day) at the haul-out site.

Season	"In Season" Effort	Total Seal Count	Average Count	Frequency of non-zero observation
2010 - 2011	37	256	7	51%
2014	10	123	12	60%
2014 - 2015	44	693	16	82%
2015 - 2016	29	624	22	90%

The number of seals counted on a given day varies substantially based on weather and oceanography. It seems likely that some conditions influence the number of seals hauling out (e.g., air or water temperature, waves, wind) once they exceed a certain threshold. Statistically, this weakens the strength of univariate correlations. For example, in attempting to correlate air temperature and seal presence, other factors that may work in combination (e.g., wind speed and direction) may influence the number of seals hauling out. Some factors such as tide cycle and level can greatly reduce the amount of exposed rock, regardless of the air temperature. Despite this, there are clear patterns between seal numbers and environmental data. We propose that future efforts work towards the creation of a multivariate abundance model (e.g., a hurdle model), which uses certain conditions to predict presence/absence and then other conditions, given presence, to predict abundance. This would help us improve our understanding of how seal behavior is influenced by environmental variables in Narragansett Bay. Employing a multivariate abundance model would allow us to predict anticipated abundance given a weather forecast, and better understand how disturbance may be influencing haul-out utilization. It would also allow us to standardize counts of seals made under different environmental conditions, resulting in more robust estimates of population trends, at least at this specific haul-out.

The seals at this haul-out appear somewhat habituated to certain types of anthropogenic noise. We recorded potential disturbances during observations, including large container ships and boats nearby, pedestrian and vehicle traffic, and sailors performing loud drills. We did not observe many behavioral responses and only observed one disturbance-related full flush during our observations in 2015-2016, and one partial flush in 2014-2015. Most of the potential disturbance did not appear to elicit any measurable response from the animals already hauled out. The seals were seen flushing when someone was reported walking on the beach, which is closer to the haul-out site than the jogging path and road. This beach is not often used, so it is possible that the seals were not accustomed to that disturbance, or that the distance was too close. A multivariate abundance model, as proposed above, might allow us to ascertain if close proximity of a container ship might reduce the amount of seals willing to haul out on a given day relative to other days with similar environmental conditions.

4.2 Photo-Identification

We were able to use both photo-ID programs with limited success. While Wild-ID is simple, easy and fast to learn and use, we estimated that the false negative (missed matches) rate exceeded 50%. For example, Wild-ID successfully matched “Boxer” (Figure 15) only once, although visual ID confirmed presence 10 times. The high false negative rate significantly limits the utility of the software for harbor seal identification, to the point where it is not much better, if at all, than manually matching seals. The software may be more efficient than manual matching when using a large database. Wild-ID does provide enough information for us to know that many seals do return to the same haul-out, and at least a few seals do so regularly for at least several weeks. Some seals were observed frequently in the beginning of the season, but less so towards the end, and others seemed to only start using the haul-out later in the season, but once established, were semi-regular visitors.

Wild-ID was found to be highly dependent on photo quality to get a good match. In particular, the aspect angle of the photo and the sharpness and contrast of the pelage in the cropped image were critical. Wild-ID was occasionally able to make a match with a less sharp or partially obscured second image. Even though the false negative rate among images processed may be higher if marginal quality images are included in the database, the number of true positives identified would also increase so, depending on the goals of the project, it may be beneficial to include or exclude these marginal images. The false negative rate could be reduced by reviewing only seals with distinctive pelage marks, which are easier for the software to ID. For our study, since we were looking only to maximize true positives, these images were included in analysis. When including these images, we were still only able to capture about half of the seals present and fewer on days when the haul-out was very crowded. Regardless of how images are included or excluded from the catalog, cropped, and processed, the false negative rate is likely to be a barrier to using this software package for anything other than qualitative analyses.

Another limitation of Wild-ID is that multiple matches in a database cannot be easily logged. Once a match is accepted by the user, the software will automatically index to the next focal image. As a result, recapture data presented in Table 4 represents conservative minimum estimates. Because the software is limited to pairwise comparisons, the user effort grows geometrically as the size of the photo database increases, which could make the program unwieldy for comparisons across multiple sites or years.

Extract Compare is a powerful software utility, capable of accurate matching, storage, and database creation of multiple images of each seal, features which would be very useful as the database gets larger. In our limited work with this software, we found it much more accurate than Wild-ID, with a much lower false negative rate. The actual false negative rate would improve even further with Extract-Compare's ability to match the right and left side of an animal, which theoretically eliminates half of the false negatives. However, given that the seals at this particular haul-out are generally lethargic and rarely change position and the positioning of the haul-out, the photographer is unable to move around much to capture different angles (vs. a boat survey where you could shoot from alternate sides of the outcrop). It is unclear how often we would be able to successfully accomplish this, because it requires a known photograph of both the right and left sides of the animal to implement. In previous cases where this feature was employed, a chase boat was used to distract the seals and get them to turn their bodies so both sides could be captured (Paterson et al. 2013), but this would be substantially outside the scope of this project.

Although Extract Compare is substantially more powerful than Wild-ID, it is much more difficult and time consuming to use, and many of the advanced features do not appear to be fully functional at this time. It certainly has much more potential, but requires additional testing and debugging time before it could be broadly implemented, and would require substantial training.

In general, harbor seals appear to be more difficult to photo match than other species for which photo mark-recapture has been successfully implemented. Their pelage is not as uniquely marked as gray seals, and many animals have few distinguishing marks. Because the predominant pelage patterns are small dots and spots, patterns can easily be confounded by glare or shade in the image and by wet, muddy, or ruffled (when dry) pelage. Extract Compare seems to be better at working through this, particularly for shading and contrast issues, but the problem is still present. Both software systems are very good at matching seals with large clearly defined markings (e.g., uniquely shaped blotches, scars, etc.), but those seals are also easily matched visually without the aid of software.

5. Conclusions and Recommendations

Monitoring the haul-out at Naval Station Newport intermittently over the last five years indicates a trend of increasing utilization by harbor seals. Since inception in 2011, we see more seals on average during each observation and a higher percentage of observations with a non-zero number of seals. We do not have adequate data at this time to correlate this trend to human activity or large-scale environmental patterns. Image analysis shows substantial re-use among the population, with confirmed re-sighting of 38 animals during the 2015-2016 season. However, conclusions from the photo-recapture study were limited due to limitations of the software packages used. Wild-ID provides useful re-sighting information, but the high (>50%) false negative rate precludes additional quantitative conclusions. Extract Compare offers a much higher level of utility, with a substantial reduction in false negative rate, but is difficult and time consuming to use, and some features still require additional troubleshooting.

We hope to continue investigating and troubleshooting the use of Extract Compare, as we believe this software to have much higher potential than Wild-ID. We also recommend continuing to monitor for availability of new software that may be more stable or reliable. Future directions include collaboration with other local entities doing seal monitoring (e.g., Woods Hole Oceanographic Institute, Narragansett Bay Estuarine Research Reserve, Save the Bay), and developing a comprehensive photo database for Narragansett Bay. We also recommend a more thorough investigation of multivariate abundance modeling approaches. Development of a multivariate abundance model could help us understand how environmental conditions impact seal abundance, and therefore to correct for variability in survey effort, time of day, weather conditions, seasons, and years. This technique could also help us understand how anthropogenic impacts (e.g., sea level rise, disturbance, climate change) might impact seal abundance. Furthermore, this technique could begin to provide some insight into overall population patterns and trends, and would be the first step in developing a population level estimate for the Naval Station Newport haul-out and/or for the Narragansett Bay population in general.

6. Acknowledgements

This project is funded by U.S. Fleet Forces Command and undertaken by the Naval Undersea Warfare Center Division, Newport as part of the U.S. Navy's data gap program. We would like to thank Len Thomas at University of St. Andrews, Andrea Bogomolni at Woods Hole Oceanographic Institute, and Lisa Sette at the Center for Coastal Studies whose initial advice and feedback help to get this project off the ground.

From U.S. Fleet Forces Command, we would like to thank Laura Busch for her valuable feedback and continued support for this project. From Naval Undersea Warfare Center Division, Newport, we would like to thank Rob Davis and the Mission Environmental Planning Program for their valuable feedback and support for this project. Special thanks to Deanna Rees, Danielle Jones, and Brittany Bartlett from Naval Facilities Command Atlantic for their continued communication and collaboration on this project.

7. References

Barlas, M. E. (1999). *The distribution and abundance of harbor seals (Phoca vitulina concolor) and gray seals (Halichoerus grypus) in southern New England, Winter 1998- Summer 1999.* (Master's thesis), Boston University.

Bendik, N. F., Morrison, T. A., Gluesenkamp, A. G., Sanders, M. S., & O'Donnell, L. J. (2013). Computer-assisted photo identification outperforms visible implant elastomers in an endangered salamander, Eurycea tonkawae. *PloS one, 8*(3), e59424.

Bolger, D. T., T.A. Morrison, B. Vance, D. Lee, H. Farid. (2012). A computer-assisted system for photographic mark–recapture analysis. *Methods in Ecology and Evolution, 3*, 813-822.

Burns, J. J. (2008). Harbor seal and spotted seal *Phoca vitulina* and *P. largha*. In. In. Perrin, W. F., Wursig, B. & Thewissen, J. G. M. (Eds.), *Encyclopedia of Marine Mammals* (2nd ed., pp. 533-542): Academic Press.

Gilbert, J. R., & Guldager, N. (1998). *Status of Harbor and Gray Seal Populations in Northern New England*. Woods Hole, MA: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center

Gilbert, J. R., Waring, G. T., Wynne, K. M., & Guldager, N. (2005). Changes in abundance of harbor seals in Maine, 1981–2001. *Marine Mammal Science, 21*(3), 519-535.

Grellier, K., Thompson, P. M., & Corpe, H. M. (1996). The effect of weather conditions on harbour seal (Phoca vitulina) haulout behaviour in the Moray Firth, northeast Scotland. *Canadian Journal of Zoology, 74*(10), 1806-1811.

Hiby, L., Lundberg, T., Karlsson, O., Watkins, J., Jüssi, M., Jüssi, I., & Helander, B. (2007). Estimates of the size of the Baltic grey seal population based on photo-identification data. *NAMMCO Scientific Publications, 6*, 163-175.

Jacobs, S. R., & Terhune, J. M. (2000). Harbor seal (*Phoca vitulina*) numbers along the New Brunswick coast of the Bay of Fundy in autumn in relation to aquaculture. *Northeastern Naturalist, 7*(3), 289-296.

Jefferson, T. A., Webber, M. A., & Pitman, R. L. (2011). *Marine mammals of the world: a comprehensive guide to their identification*: Academic Press.

Kenney, R. D. (2014). Marine mammals of Rhode Island, part 5, harbor seal Retrieved from http://rinhs.org/uncategorized/marine-mammals-of-rhode-island-part-5-harbor-seal/ as accessed on 11 May 2015.

Lelli, B., & Harris, D. E. (2001). Human Disturbances Affect Harbor Seal Haul-Out Behavior: Can the Law Protect These Seals from Boaters? *Viewing Marine Mammals in the Wild*, 97.

Lowe, D. G. (2004). Distinctive image features from scale-invariant keypoints. *International journal of computer vision, 60*(2), 91-110.

McCormack, M. (2015). *Assessing the Applicability of Compuer Aided Photo-identification for Pinniped Studies Through the Determination of Site Fidelity in Long Island, NY Harbor Seals (Phoca Vitulina Concolor).* Masters, University of Miami.

Morrison, T. A., & Bolger, D. T. (2014). Connectivity and bottlenecks in a migratory wildebeest Connochaetes taurinus population. *Oryx, 48*(4), 613-621. doi: 10.1017/S0030605313000537

NOAA. (2015). Seal Watching Guidelines Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/education/ner_seal_watching.pdf

Paterson, W. D., Redman, P., Hiby, L. A., Moss, S. E., Hall, A. J., & Pomeroy, P. (2013). Pup to adult photo ‐ ID: Evidence of pelage stability in gray seals. *Marine Mammal Science, 29*(4), E537-E541.

Pauli, B., & Terhune, J. (1987). Meteorological influences on harbour seal haul-out. *Aquatic Mammals, 13*(3), 114-118.

Prescott, R. (1982). Harbor seals: Mysterious lords of the winter beach. *Cape Cod Life, 3*(4), 24-29.

Raposa, K. B., & Dapp, R. M. (2009). *A Protocol for Long-term Monitoring of Harbor Seals (Phoca vitulina concolor) in Narragansett Bay, Rhode Island*. Narragansett Bay Research Reserve. p. 48.

Richardson, W. J., Greene Jr, C. R., Malme, C. I., & Thomson, D. H. (2013). *Marine mammals and noise*: Academic press.

Rosenfeld, M., George, M., & Terhune, J. M. (1988). Evidence of autumnal harbour seal, *Phoca vitulina*, movement from Canada to the United States. *Canadian Field-Naturalist, 102*(3), 527-529.

Schroeder, C. L. (2000). *Population status and distribution of the harbor seal in Rhode Island waters.* Masters, University of Rhode Island, Kingston, RI.

Terhune, J., & Brillant, S. (1996). Harbour seal vigilance decreases over time since haul out. *Animal behaviour, 51*(4), 757-763.

Waring, G. T., Josephson, E., Maze-Foley, K., & Rosel, P. E. (2014). *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2013*. (NOAA Technical Memorandum NMFS-NE-228). Woods Hole, MA: U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center. p. 464.

Whitman, A. A., & Payne, P. M. (1990). Age of harbour seals, *Phoca vitulina* concolor, wintering in southern New England. *Canadian Field-Naturalist, 104*(4), 579-582.

Wilson, S. C. (1978). *Social Organization and Behavior of Harbor Seals, Phoca vitulina concolor, in Maine*. Washington, DC: Smithsonian Institution Press

APPENDIX N

NAVSTA NEWPORT NEARSHORE SURVEY REPORT

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FINAL

NEARSHORE SURVEYS FOR NAVAL STATION NEWPORT, RHODE ISLAND

November 2017

CONTRACT # N62470-13-D-8017; TO WE07

Final

NEARSHORE SURVEYS FOR NAVAL STATION NEWPORT, RHODE ISLAND

Contract # N62470-13-D-8017; TO WE07

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November 2017

Recommended Citation:

U.S. Navy. 2017. Nearshore Surveys, Naval Station Newport, Rhode Island, Draft Report. Prepared for NAVFAC Mid-Atlantic by Versar, Inc., under NAVFAC Contract N62470-13-D-8017, Delivery Order WE07. Springfield, Virginia.

EXECUTIVE SUMMARY

The GMI-AECOM Joint Venture (JV) team, represented by Versar, Inc. and subcontractors Normandeau Associates, Inc., AIS Scientific and Environmental Services, the Virginia Aquarium and Marine Science Center, and the Virginia Institute of Marine Science conducted a series of field surveys from the spring 2016 to winter 2017 within the nearshore and marine environments at seven Navy facilities including Naval Station Newport (NAVSTANPT), Rhode Island; Naval Weapons Station Earle, New Jersey; Naval Weapons Station Yorktown, including Cheatham Annex and Yorktown Fuels Terminal, and Naval Air Station Oceana-Dam Neck Annex and Naval Air Station Oceana Owl's Creek in Virginia. The purpose of the surveys was to characterize the nearshore community and marine environments documenting the floral and faunal species composition, shoreline type and anthropogenic features, and water quality information. Specifically, the seasonal surveys were designed and executed to record data and analyze

- benthic species, and sediment characteristics;
- nearshore water quality conditions;
- fish and invertebrate community assessment, including state and federally listed threatened and endangered species;
- submerged aquatic vegetation (SAV);
- intertidal flora and fauna; and
- marine mammals and sea turtles.

This report provides a summary and analysis of data collected at NAVSTANPT, Rhode Island. NAVSTANPT comprises approximately 400 hectares (988 acres) on the west shore of Aquidneck Island, facing the East Passage of Narragansett Bay, and is located in the towns of Portsmouth, Middletown, and Newport, Rhode Island. The facility also encompasses the northern third of Gould Island, which is part of the Town of Jamestown, Rhode Island.

The nearshore environment is defined in this study as the area encompassing the transition from subtidal aquatic habitats to associated upland systems and includes habitats from the riparian zone to the shallow subtidal waters. Because of the extensive portions of Narragansett Bay that are under the jurisdiction of the Navy, NAVST NPT encompasses approximately 500 hectares (1,235 acres) of nearshore habitat.

Other Navy reports and data available from the Navy, including a pinniped haul out and photo identification study conducted during the 2014 - 2015 and 2015 - 2016 seasons (Moll et al. 2016) and SAV mapping data conducted by the Rhode Island Eelgrass Mapping Taskforce (Bradley et al. 2013) are included in this summary report.

Other than the SAV and terrestrial vegetation and wildlife assessments, each survey was structured to have four seasonal replications. Surveys were conducted in May, July, and October 2016 and February 2017.

Benthic Sediment and Species Characteristics

A total of 32 sediment samples were collected at NAVSTANPT. The sediment composition at all sites was primarily composed of sand due to the proximity of and open access to the coast. Gravel was frequently present and comprised a greater percentage of the sediment composition at intertidal sites although gravel was also seen at subtidal sites. Silt and clay was also a large component of the sediment composition at the deeper subtidal sites. The variability of sediment composition at these sites could be a reflection of seasonal processes and bottom topography. These findings concur with a generalized depiction of bottom sediments (Narragansett Bay National Estuarine Research Reserve 2009) in that silt and clay are found in deeper channels but indicate more gravel is present in the nearshores areas than previously mapped.

A total of 32 benthic samples were collected from eight stations at NAVSTANPT over four seasons of sampling. As with the sediment sampling, benthic samples were taken from intertidal and subtidal locations. Benthic species inhabiting the nearshore habitats of NAVSTANPT were typical of the species observed in the Narragansett Bay area. The most common taxon found in the intertidal sediments were in the class Polychaeta (bristle worms), including *Parapionosyllis longicirrata*, *Spiochaetopterus costarum*, and members of the catworm family (Nephtyidae). The number of taxa found in the shallower intertidal zone was notably lower than the subtidal samples, which is typical of the coastal intertidal zone.

Water Quality and Chemistry

A total of 122 in situ water quality readings and 16 whole water samples were taken over the sampling period at the intertidal, subtidal, seine, and trawl survey locations at NAVSTANPT. In situ water quality measurements were collected to measure dissolved oxygen (DO) concentrations, pH, conductivity, and turbidity; whereas whole water samples were taken to estimate seasonal concentrations of nitrogen, nitrate/nitrite, phosphorous, and total suspended solids. Water quality and chemistry results were analyzed and compared to data from nearby National Estuarine Research Reserve System (NERRS) sampling stations (NERRS 2017). The observed ranges for all parameters with comparable regional data fell within the range of published values, except nitrate-nitrite nitrogen, which was 10 times greater than the highest published value. One DO reading was extremely low indicating hypoxic conditions.

Fish and Invertebrate Communities

The fish and invertebrate community assessments were conducted using trawls, seines, and ichthyoplankton tows. The inshore seine surveys during this study showed fish and invertebrate communities that were primarily composed of lower trophic level forage species and were less diverse than the nearshore trawl communities. Unlike the seine samples, the trawl samples consisted mainly of predatory fish and very few forage species in all seasons except for winter, which was dominated by sand shrimp, a forage crustacean. In total, 40 fish and invertebrate species were encountered during the four seasonal assessments. Longfin inshore squid (*Loligo pealeii*) was the most abundant species captured, which was followed by scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata*), Atlantic cod (*Gadus morhua*), and blueback herring (*Alosa aestivalis*).

Submerged Aquatic Vegetation

The GMI-AECOM JV team conducted field surveys for SAV and nearshore terrestrial vegetation and wildlife in the field at NAVSTANPT in August 2016. The SAV survey was designed using industry guidelines. In all, the GMI-AECOM JV team sampled for SAV at a total of 18 locations using survey-grade differential global positioning system (GPS) with sub-meter accuracy while aboard a 5-meter (m; 18-foot [ft]) Boston Whaler survey boat. In deeper water conditions where visibility from the surface was lacking, Versar used a high-quality GoPro Hero 4 Bluetooth-equipped underwater camera with powerful external light-emitting diode lighting to transmit clear underwater video footage to an iPad® tablet on the boat. The live videos were examined in situ on the boat for the presence of SAV. SAV presence was confirmed at 5 of 18 sample locations (approximately 28% of the total sample points) and confirmed several 2012 SAV locations that were remotely mapped by Rhode Island Eelgrass Taskforce (Bradley et al. 2013). All SAV observed by Versar consisted of one species, eelgrass (*Zostera marina*). A diversity of macroalgal species was also documented by the GoPro camera at each SAV sample site.

Terrestrial Vegetation and Wildlife Surveys

Pedestrian and boat surveys were conducted one time during the study period to characterize the vegetation and wildlife along the shoreline and up to approximately 50 m (164 ft) inland. The majority of the nearshore area at NAVSTANPT consists of developed land although a fringe of upland shrub/scrub generally occurred along the shoreline at the installation. Most of the shoreline has been stabilized by stone and concrete seawalls, bulkhead, or stone revetment and abruptly shifts from the aquatic to upland habitat with no natural shoreline or marsh. Areas of natural rock outcroppings also occur, as do narrow strips of sand and gravel beach. Wildlife observations include a variety of shorebirds and wading birds including six birds that are listed as state species of concern: great blue heron (*Ardea herodias*), black-crowned night heron (*Nyticorax nycticorax*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), American oystercatcher (*Haematopus palliatus*), and osprey (*Pandion haliaetus*).

Marine Mammals and Sea Turtles

Marine mammal and sea turtle surveys were conducted following open water shorelines at ~150 m (492 ft) from shore or at a distance where depth is ≥1 m at mean low water. Transit distance was about 19 kilometers (km; 12 miles [mi]) along Aquineck Island, 13 km (8 mi) back and forth across the East Passage, and 4 km (2 mi) around Gould Island. The only species that was sighted during the survey was harbor seal (*Phoca vitulina*). During the spring survey, one harbor seal was sighted on 12 May 2016. The seal was observed near the surface of the water and engaged in several small dives during the encounter. A group of three harbor seals were sighted on 1 February 2017 during the winter survey.

Summary

The resulting survey data provide a better understanding of the critical nearshore environment at NAVSTANPT. Information on these nearshore marine resources and aquatic habitats is often underrepresented in Integrated Natural Resources Management Plans. These data will aid the Navy in ensuring compliance with applicable federal, state, and local statutes and regulations and Department of Defense policies. In particular, these data will help fulfill the requirement of OPNAV M-5090.1 Section 12-3.4.b, which states “Navy INRMPs shall provide for the conservation of installation watersheds, shorelines, and near shore areas such that benefits are provided to aquatic species and habitats in waters adjacent to Navy installations”.

Data collected for each of the parameters described above are presented as **Appendix C** through **G** in electronic format provided on digital versatile disk (DVD). Tabular data are provided in Microsoft Excel® and Access® format. Geographic information systems data deliverables conform to current Navy adaptation of the Spatial Data Standards for Facilities, Infrastructure, and Environment version 3.01 format. Survey data are provided in relational tables for each survey transect or sample point. Scanned copies of raw datasheets are also provided on DVD.

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
µm	micron(s)
%	percent
cm	centimeter(s)
CPUE	catch per unit effort
DO	dissolved oxygen
ESA	Endangered Species Act
ft	foot(feet)
ft^2	square foot(feet)
GPS	global positioning system
hp	horsepower
in	inch(es)
JEB	Joint Expeditionary Base
JV	Joint Venture
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
m^2	square meter(s)
mg/L	milligram(s) per liter
mi	mile(s)
mi^2	square mile(s)
mL	milliliter(s)
mm	millimeter(s)
MMPA	Marine Mammal Protection Act
mS	millisiemen(s)
NAVSTANPT	Naval Station Newport
NEFSC	Northeast Fisheries Science Center
NERRS	National Estuarine Research Reserve System
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
oz	ounce(s)
ppt	part(s) per thousand
QA/QC	quality assurance/quality control
RIDEM	Rhode Island Department of Environmental Management
SAV	submerged aquatic vegetation
SOC	species of concern
TOC	total organic carbon

TSS	total suspended solids
U.S.	United States
USFWS	United States Fish and Wildlife Service
UXO	unexploded ordnance
VES	visual encounter survey
VIMS	College of William and Mary Virginia Institute of Marine Science

1.0 INTRODUCTION

1.1 Background

In 2014, the Navy initiated nearshore surveys at four installations; Naval Computer and Telecommunications Area Master Station Cutler in Maine, Portsmouth Naval Shipyard in New Hampshire, Submarine Base New London in Connecticut, and Joint Expeditionary Base (JEB) Little Creek Fort Story in Virginia. Surveys were conducted to collect baseline data on the nearshore environment to assist the Navy in planning and to provide data that can be used during consultations with agencies.

In 2015, the Navy initiated a second series of nearshore surveys at an additional seven installations including Naval Station Newport (NAVSTANPT) in Rhode Island, Naval Weapons Station Earle in New Jersey, and Naval Air Station Oceana Dam Neck Annex, Naval Air Station Oceana Owl's Creek, and Naval Weapons Station Yorktown, including Cheatham Annex and Yorktown Fuel Terminal, in Virginia. GMI-AECOM Joint Venture (JV) team, represented by Versar, Inc. and subcontractors Normandeau Associates, Inc., AIS Scientific and Environmental Services, the Virginia Aquarium and Marine Science Center, and the College of William and Mary Virginia Institute of Marine Science (VIMS) conducted the additional surveys from the spring 2016 to winter 2017. These surveys add to the suite of nearshore baseline data collected at Navy installations throughout the Mid-Atlantic region. As with the earlier surveys, the purpose of the current study is to characterize the floral and faunal species composition within the nearshore environments including shoreline type and anthropogenic features, and water quality information. The survey objectives were specifically to record and analyze data for

- benthic habitat, species, and sediment characteristics;
- nearshore water quality conditions;
- fish and invertebrate community assessment, including state and federally listed threatened and endangered species;
- submerged aquatic vegetation (SAV);
- intertidal flora and fauna; and
- marine mammals and sea turtles.

Data were collected during a series of four seasonal surveys to ensure seasonal changes in condition and species composition is represented. The four seasons were defined as winter (January – March), spring (April – June), summer (July – September), and fall (October – December). Relevant information from other Navy reports and available data from academic and other research institutions such as the Rhode Island Eelgrass Taskforce (Bradley et al. 2013) have also been incorporated into this report to provide additional background and regional information as well. The resulting data and summary analysis in this report provide information on nearshore marine resources and aquatic habitats, which are often underrepresented in Integrated Natural Resources Management Plans. These data will aid the Navy in ensuring compliance with applicable federal, state, and local statutes and regulations and Department of Defense policies.

1.2 Survey Area

NAVSTANPT comprises approximately 400 hectares (988 acres) on the western shore of Aquidneck Island, in the lower East Passage of Narragansett Bay, and is located in the towns of Portsmouth, Middletown, and Newport, Rhode Island. The facility also encompasses the northern third of Gould Island, which is part of the Town of Jamestown, Rhode Island (**Figure 1-1**).

Narragansett Bay, which is located almost entirely in Rhode Island, is New England's largest estuary. The Bay is a semi-enclosed 342-square kilometer (km^2, 147-square mile [mi^2]) estuary that receives freshwater input from several major rivers including the Providence, Seekonk, Palmer, Barrington, and Taunton Rivers. The mixing of freshwater inputs with seawater results in salinities that range between 24 parts per thousand (ppt) in the northern portions of the Bay and 32 ppt at the mouth of the Bay (Save the Bay 2017). The average depth throughout the Bay is approximately 9.0 meters (m; 29.5 feet [ft]) but is considerably deeper in the East Passage (15.2 m [49.9 ft]) (Narragansett Bay National Estuarine Research Reserve 2009).

Narragansett Bay's shoreline includes numerous coves and harbors, and its waters are dotted with 39 islands, the largest being Aquidneck Island, where NAVSTANPT is located. The survey area at NAVSTANPT included the nearshore areas of Aquidneck and Gould Islands. The nearshore environment is generally defined as the area encompassing the transition from subtidal marine habitats to associated upland systems and includes habitats from the marine riparian zone to the shallow subtidal waters (VIMS 2016). The base encompasses approximately 500 hectares (1,235 acres) of nearshore habitat.

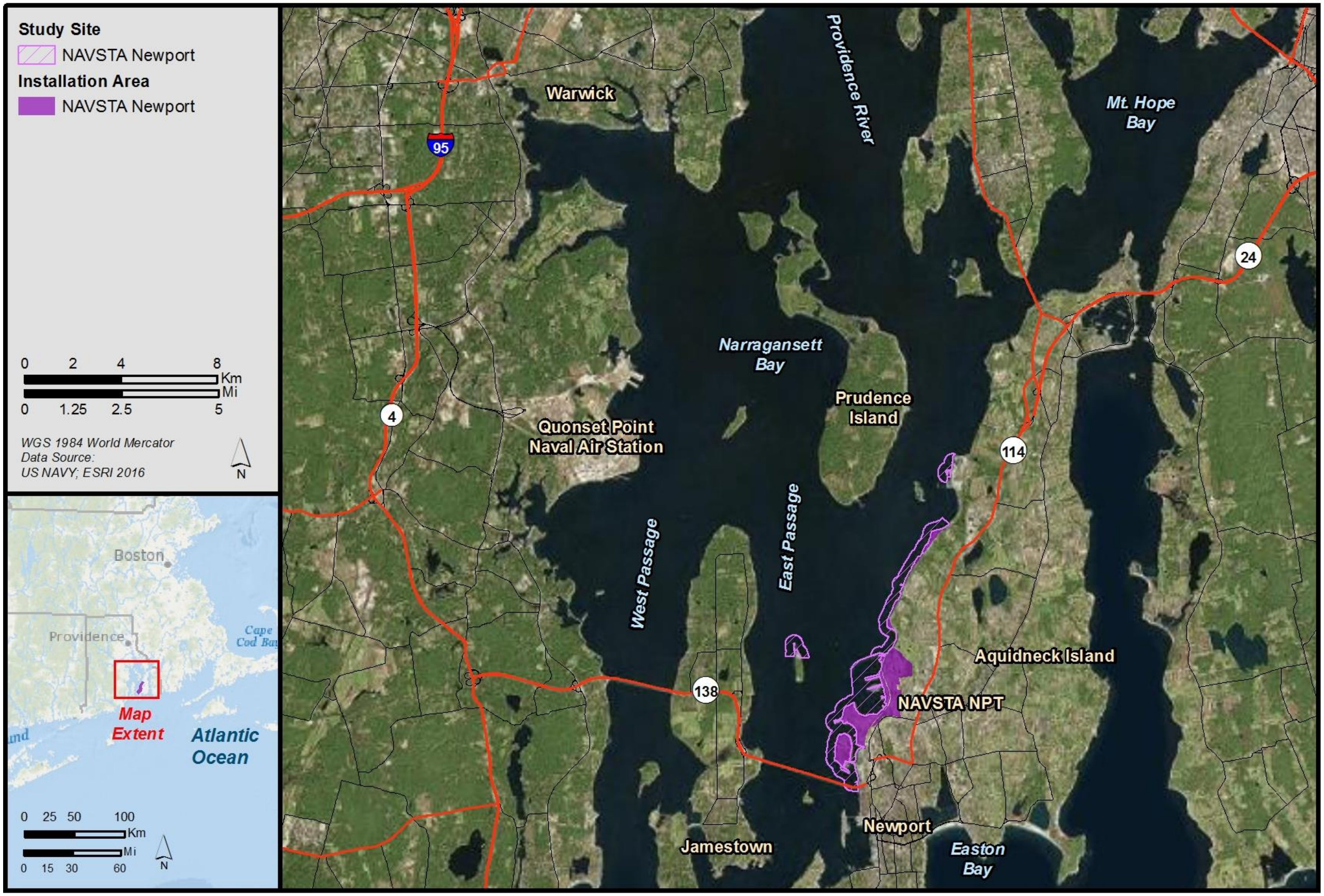


Figure 1-1. General Location of NAVSTANPT.

2.0 METHODS

2.1 Site Selection

The nearshore habitat characterization at NAVSTANPT was accomplished through a series of specialized surveys including benthic and water sample grabs, bottom trawls, beach seines, ichthyoplankton tows, marine mammal transects, and point samples for SAV. Other than the SAV, terrestrial vegetation, and wildlife assessments, the survey sites were selected to have four replications each for the intertidal and subtidal habitats within the survey area boundary, as well as the nearshore open water habitats adjacent to the installation. Surveys were conducted in May, July, and October 2016 and February 2017 by Normandeau Associates, Inc. and AIS Scientific and Environmental Services. The SAV and terrestrial assessments were conducted in August 2016 by Versar, Inc.

Conditions within the survey area, as provided by the Navy, were characterized by examining high- and low-tide maps and recent aerial imagery (Google Earth™) to assist in site selection. Because of the historic military use of Narragansett Bay and nature of the training mission at NAVSTANPT, munitions or unexploded ordnance (UXO) could potentially occur in the project area. The Navy reviewed and approved a detailed work plan with maps of the proposed survey areas before the surveys were begun to help ensure UXO avoidance. In addition, to minimize and avoid potential impacts to cultural resources that could have been present along the shoreline and in the nearshore environment, Versar reviewed an underwater archaeological investigation report for NAVSTANPT (Naval Facilities Engineering Command 1998), the Automated Wreck and Obstruction System maintained by the National Oceanic and Atmospheric Administration (NOAA 2016), the Rhode Island Marine Archaeology Project database of shipwrecks and submerged cultural resources (2013), and data from the Rhode Island Historic Preservation and Heritage Commission for the occurrence of any potential protected cultural resources. All potential cultural resource locations were considered when locating survey locations and known points were entered into the on-board global positioning system (GPS) and marked on maps to ensure avoidance. All proposed survey sites were approved by the Navy through the development and approval of a site work plan.

Once in the field, several of the original sampling points had to be moved because hazardous conditions were present (dangerous submerged rocks, sandbars, etc.). Each final sampling location was mapped in the field with a handheld GPS unit or the boat's on-board GPS unit. A composite of survey locations in the NAVSTANPT nearshore study area is represented on **Figures 2-1** through **2-3**. All trawl and tow lines are approximate locations as wave and wind action and on-site conditions strongly influenced the actual sample locations.

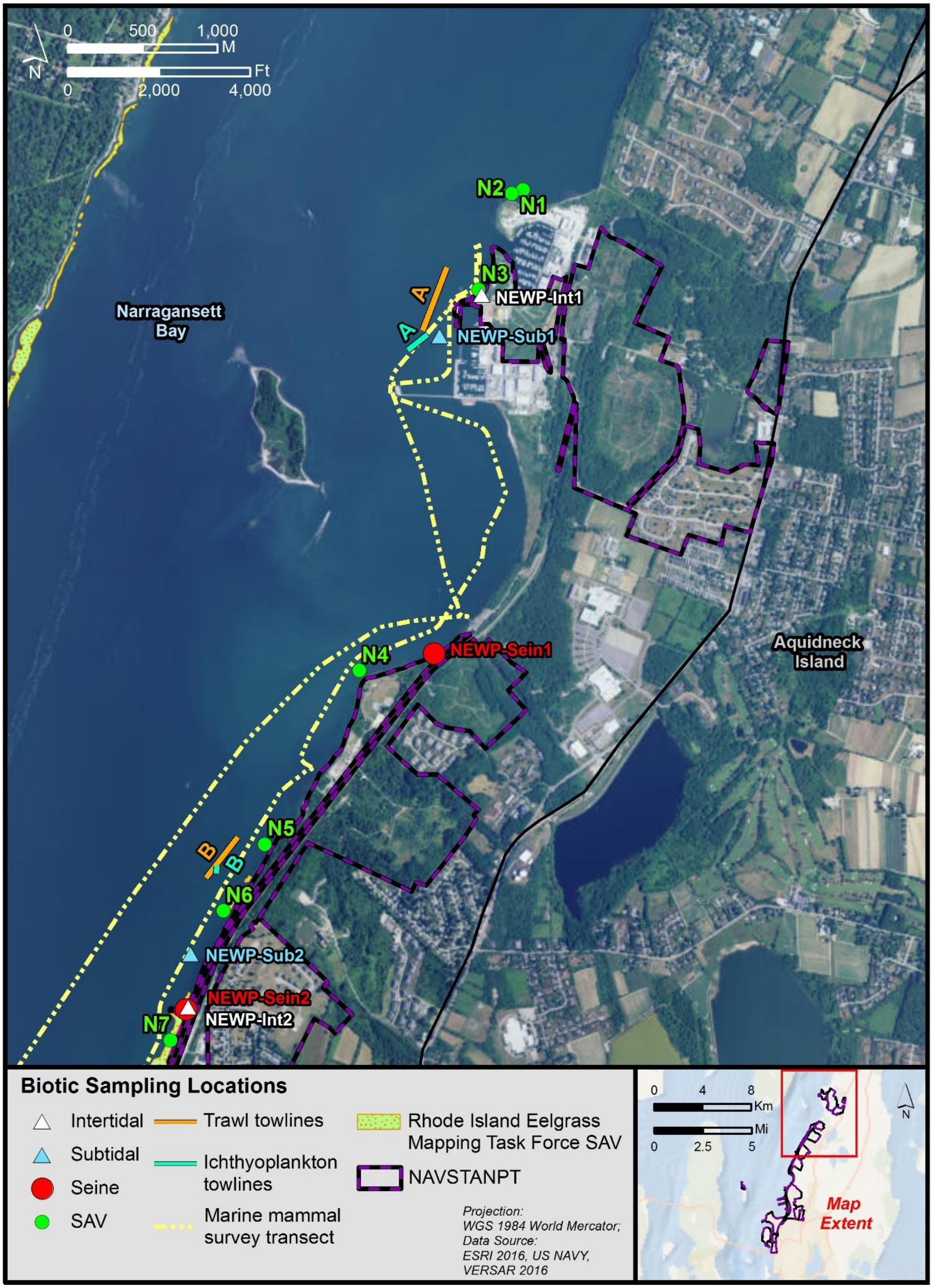


Figure 2-1. NAVSTANPT Nearshore Study Area (Northern View).

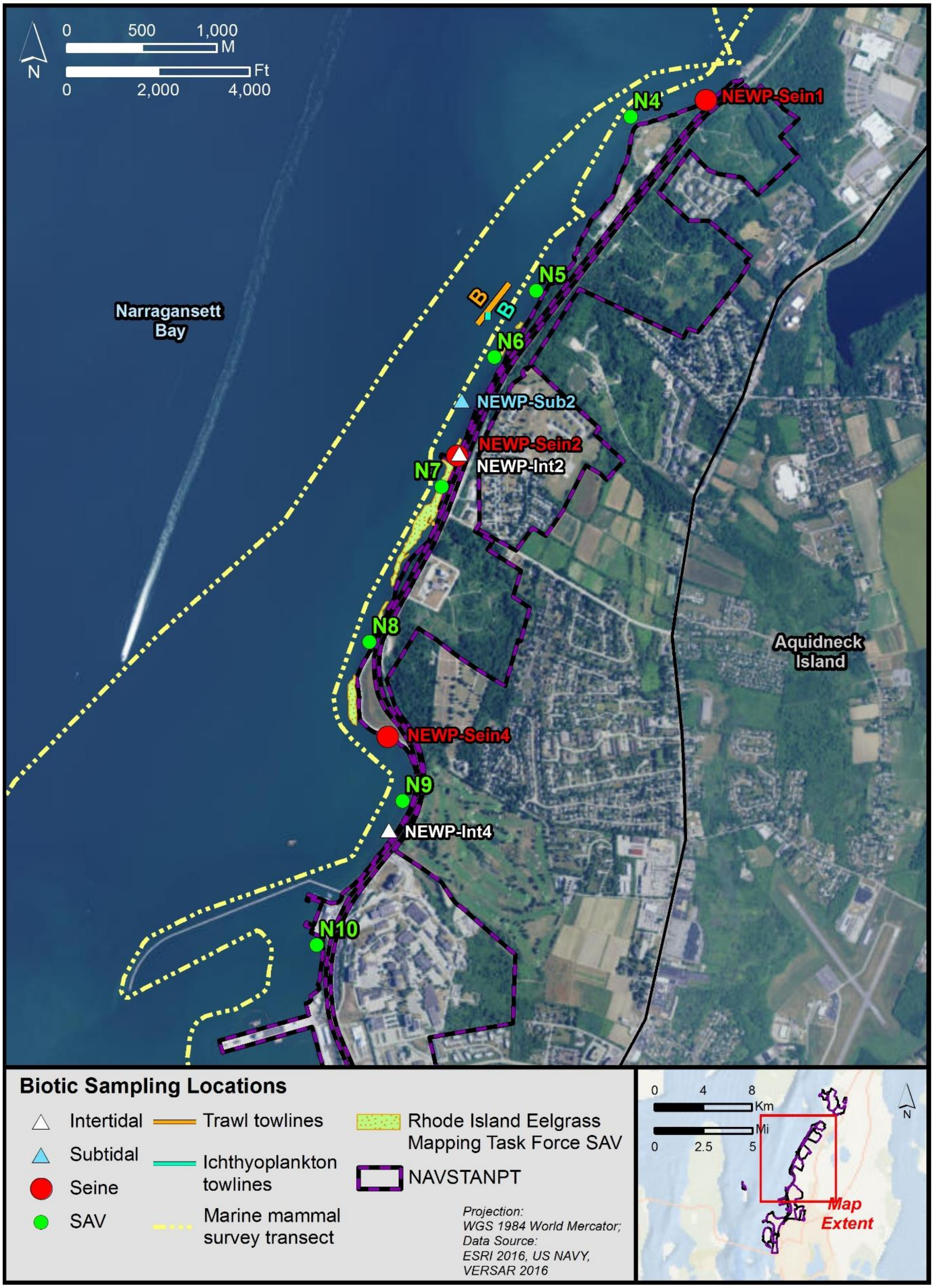


Figure 2-2. NAVSTANPT nearshore study area (Middle View).

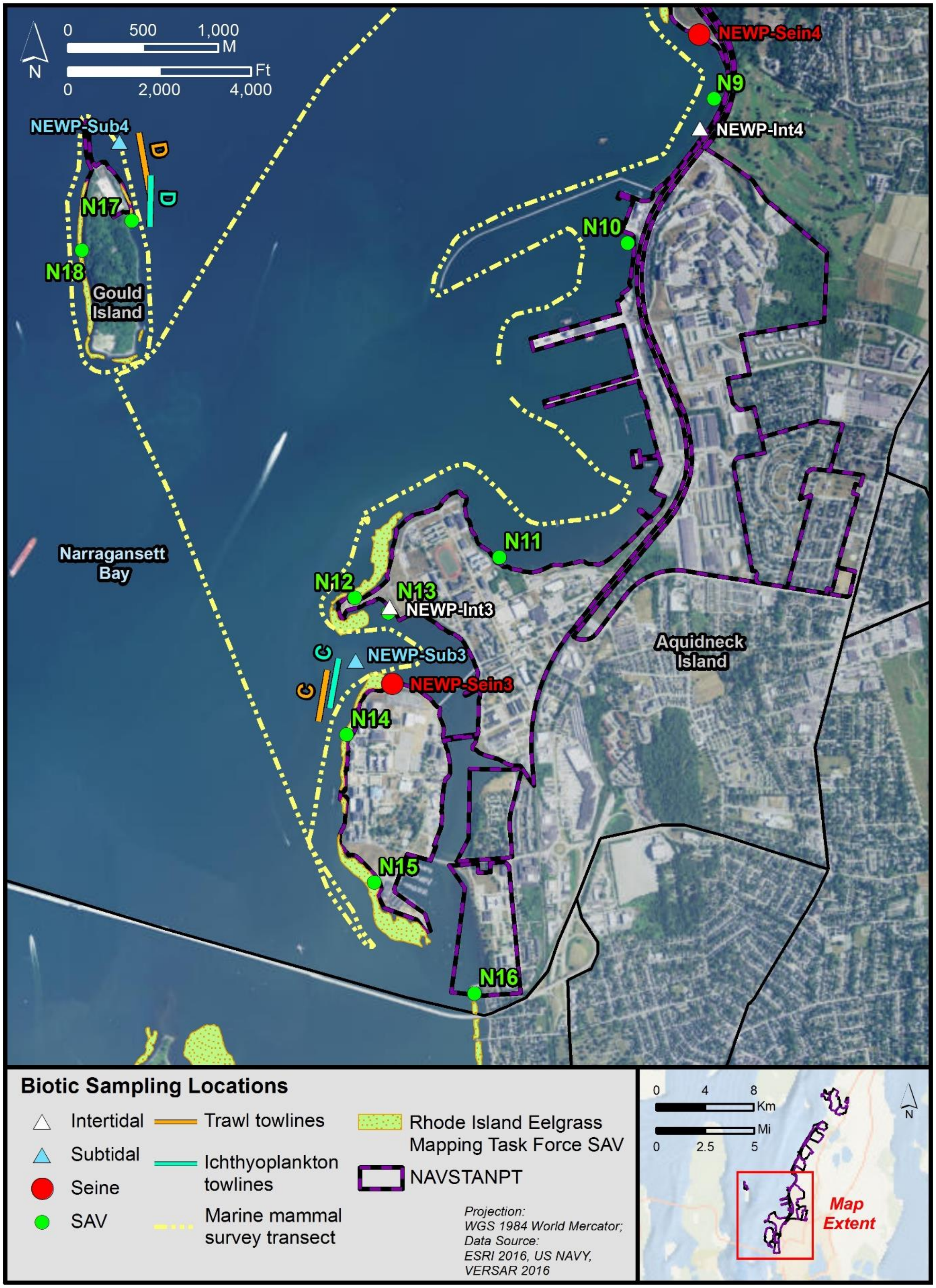


Figure 2-3. NAVSTANPT Nearshore Study Area (Southern View).

2.2 Wildlife Impact Minimization

The protection of wildlife species, including any protected by the United States (U.S.) Endangered Species Act (ESA) or listed as state species of concern (SOC) with potential to occur within the survey area, was a primary consideration for the survey teams. Trained, certified, professional biologists, and appropriately permitted staff were aboard all survey vessels during all surveys. All NOAA and Rhode Island Department of Environmental Management (RIDEM) Division of Fish and Wildlife scientific take permits required for this project are in **Appendix B**. Due to the methods used for trawling, sample collections, and marine mammal observations (i.e., slow cruising speed and the presence of on-board observers), the potential for a vessel striking marine mammals, sea turtles, or other wildlife was considered minimal. Additionally, the 7.6-m (25-ft) experimental research trawl nets used for sampling were submerged for a maximum of 5 minutes, which is not considered to be a threat to fish or sea turtles. Appropriate protocols were in place in the very rare case a marine turtle or other protected species was caught. This included contacting the Mystic Aquarium in Mystic, Connecticut, and notifying them of the catch and condition of the captured animal. If the animal had appeared to be injured, the stranding center would have been contacted to request instructions. In all other cases, the turtle would have been released back into the water and the stranding center notified of the release location. All other protected species would have been treated in the same manner with the Navy Installation Representative as the main point of contact for the reporting.

2.3 Benthic Species and Sediment Characteristics

2.3.1 Collection Methodology

The Versar team collected benthic invertebrate samples using a combination of platforms depending on site conditions. Subtidal benthic samples were collected aboard a Privateer Model 2400 Delaware Cabin vessel equipped with a 225-horsepower (hp) outboard and haul back gear, whereas shallow subtidal habitats were sampled using a 5.8-m (19-ft) 2001 Nauset Islander equipped with a 90-hp outboard motor. Shallow, intertidal habitats were sampled with a hand-operated Wildco© petite ponar (0.023-square meter [m^2; 0.25-square feet (ft^2)] surface sampling area) while deep, subtidal habitats were sampled using a Young Modified Van Veen (0.044-m^2 [0.5-ft^2] surface sampling area). The maximum depth of penetration for each grab was 10 centimeters (cm, 4 inches [in]).

A total of four intertidal and four subtidal benthic grabs were collected for a total of eight grabs per season. Each benthic grab was examined immediately after collection and physical characteristics were documented on the field data sheet (**Appendix C**).

For subtidal benthic stations, crews navigated by boat to each target location determined during the project-planning phase using an onboard GPS. Once the team arrived on site, the team deployed the sampler to the bottom and then recorded the actual GPS coordinates on the field datasheet. The first grab was sieved through a 500-micron (µm) screen and the remaining contents were transferred to a 10% buffered formalin solution stained with Rose Bengal, a biologic dye, to preserve the benthic invertebrate specimens. A second grab was collected for total organic carbon (TOC) and grain size analysis at the same location; 2 cm of surface sediment in the grab were removed, placed in a labeled 473-milliliter (mL; 16-ounce [oz]) collection container, and preserved on ice in the dark.

For intertidal benthic stations, crews navigated to each target location initially by boat. Once the team arrived on site, crews navigated to the precise location by foot using a handheld GPS. When the actual station location was determined, the team collected each sample using a hand ponar and recorded the actual GPS coordinates on the field datasheet. The entire contents of each grab were then transferred to a pre-labeled gallon sample bottle. A 10% buffered formalin solution stained with Rose Bengal was used to preserve any benthic invertebrate specimens. A sediment sample was collected by hand for TOC and grain size analysis at the same location; 2 cm of surface sediment adjacent to the sampling location were collected, placed in a labeled 473-mL (16-oz) collection container, and preserved on ice in the dark. All samples were then transported to the Versar laboratories in Columbia, Maryland, for sorting and identification of all macro-invertebrates and sediment analysis.

2.3.2 Laboratory Methodology

Samples were re-sieved in the laboratory using a 500-µm standard laboratory sieve. Organisms were sorted from debris under a professional grade dissection microscope and all organism were counted and identified to the lowest practical taxon. For quality assurance and quality (QA/QC) control purposes, 10% of the collections were re-analyzed to maintain a sorting error rate of less than 10% following Versar's standard laboratory operating procedures. All species counts are expressed in numbers per square meter based on the grab's sampling area.

Grain-size analysis was performed per American Society of Testing and Materials Method D422-63. Sieve sizes ranged from 4.75 millimeter (mm; 0.19 in) (U.S. Standard Sieve No.4) to 63 µm (U.S. Standard Sieve No. 230). Sediments were categorized by Wentworth's classifications (**Table 2-1**). TOC was calculated by weight loss from ignition at 500 degrees Celsius (ºC) for 4 hours after obtaining a dry constant weight (24 hours at 60ºC).

Table 2-1. Sieve sizes that were used for sediment particle distribution and the Wentworth sediment size categories (Buchanan 1984).

Sieve Number	Sieve Size	Wentworth Size Category
4	4.75 mm	Pebble
10	2.00 mm	Granule
20	850 µm	Very Coarse Sand
40	425 µm	Coarse Sand

Sieve Number	Sieve Size	Wentworth Size Category
60	250 µm	Medium Sand

Table 2-1. Sieve sizes that were used for sediment particle distribution and the Wentworth sediment size categories (Buchanan 1984) (Cont'd).

Sieve Number	Sieve Size	Wentworth Size Category
140	106 µm	Fine Sand
200	75 µm	Undefined
230	63 µm	Very Fine Sand
	<63 µm	Silt-Clay

µm = micron(s); mm = millimeter(s)

2.3.3 Data Analysis

For each benthic sample, the diversity of taxa, abundance (counts per square meter), percent dominance, and abundance of the top five species were calculated. Taxa diversity was measured as number of taxa and using the Shannon-Wiener Diversity Index (H'):

$$H' = -\sum_{i=1}^{s} (p_i)(\log_2 p_i)$$

where

i = the ith taxa in the sample

s = number of taxa in the sample

p_i = proportion of total sample belonging to ith species

and Pielou's Evenness Index (J'):

$$J' = H' / \log_2 s$$

where

H' = Shannon Index of Diversity

s = number of taxa in the sample

2.4 Water Quality and Chemistry

2.4.1 Collection Methodology

In situ water quality measurements were collected using a calibrated Yellow Springs Instruments 6820 Multi-Parameter Water Quality Sonde©. The sonde was outfitted with probes to measure dissolved oxygen (DO) concentrations, pH, conductivity, and turbidity. Water quality was measured prior to sampling at the subtidal benthic grab stations, bottom trawl stations, and seining stations to capture water conditions prior to disturbance.

In addition to the in situ readings, whole water samples were collected using an Alpha™ water sampler to assess suspended solids and nutrients. For each sample, a decontaminated sampler was rinsed with ambient site water and dropped to a predetermined depth of 1 m below the surface. A messenger weight was used to close the sampler. After collection, samples were decanted from the bottle and preserved on ice in an opaque container before transferring to Martel Laboratories, in Towson, Maryland, which is a National Environmental Laboratory Accreditation Program-certified analytical laboratory. Whole water samples were taken to estimate seasonal concentrations of nitrogen, nitrate/nitrite, phosphorous, and total suspended solids (TSS).

2.4.2 Data Analysis

In situ water quality readings were averaged by season with standard errors in the following units:

- DO (milligrams per liter [mg/L])
- pH (Standard Units)
- Specific Conductance (millisiemens [mS]/cm)
- Turbidity (nephelometric turbidity units [NTUs])
- Salinity (ppt)

Water chemistry data from Martel Laboratories was reviewed and reported as mean concentrations of Kjeldahl nitrogen, nitrate-nitrite nitrogen, total phosphorous, and TSS per season. These parameters use the following reporting limits to calculate mean concentrations (non-detected values used the detection limit):

- Kjeldahl nitrogen (0.50 mg/L),
- nitrate-nitrite nitrogen (0.05 mg/L),
- total phosphorous (0.01 mg/L),
- TSS (1 mg/L).

2.5 Fish and Invertebrate Community Assessment

2.5.1 Trawl Methods

A 7.6-m (25-ft) experimental research trawl was used to collect data for a fish community census. The trawl was outfitted with 3.8-cm (1.5-in) stretch mesh wings which tapered to a 3.17-cm (1.25-in) bag with a 0.63-cm (0.25-in) stretch mesh liner. The trawl net was towed on the bottom with the start and end GPS coordinates recorded to calculate total distance towed. After each trawl, the contents of the trawl were emptied into a holding tank with aerated water. Fish and invertebrates were sorted and identified to the lowest practical taxon. A representative subsample of 25 individuals from each species was measured and recorded to the nearest millimeter. Small invertebrates were identified and enumerated. Species that could not be identified in the field were preserved on ice or in buffered formalin for later identification.

Data Analysis

Species abundance was summarized as mean catch per unit effort (CPUE) for trawling. Seasonal changes were evaluated for species composition by season using pie charts. For trawls, CPUE was reported as the mean density of individual species per square kilometer of towed bottom.

Trawl area swept was calculated as

$$A = D * hr * x2$$

Where area (square kilometer), *A*, is the result of *D*, distance (kilometer), multiplied by the head rope length, *hr*, and head rope fraction, *x2*.

Distance in meters is calculated as

$$D = 111.12 * \sqrt{(lat_1 - lat_2)^2 * (lon_1 - lon_2)^2 * \cos^2(0.5*(lat_1 + lat_2))}$$

and head rope fraction is 0.5 (Pauly 1980).

2.5.2 Beach Seine Methods

A custom-made 45.7-m (150-ft) beach seine with 2.5-cm (1-in) stretch mesh with a fishing height of 2.4-m (8-ft), and a 2.4-m (8-ft) central bag was used for seine assessments. Crews anchored one end of the net onshore while the net was deployed by boat perpendicular to the beach until the bag was in the water. The net was then swept at a 90-degree arc back to the beach where it was hauled and processed. Fish and invertebrates were sorted and identified to the lowest practical taxon. A representative subsample of 25 individuals from each species was measured and recorded to the nearest millimeter. Small invertebrates were identified and enumerated, but not measured. Species that could not be identified in the field were preserved on ice or in buffered formalin for later identification at Versar laboratories in Columbia, Maryland.

Data Analysis

Species abundance was summarized as the mean CPUE and changes in species composition by season were evaluated using pie charts. All seine data will be reported as mean number of individual species per seine haul.

2.5.3 Ichthyoplankton Methods

Ichthyoplankton collections were made with a 0.5-m bongo net equipped with a 505-µm mesh net and a General Oceanics© flow meter positioned in the mouth of the net to measure total volume filtered. The net was towed into the ambient flow of the current. Sampling was conducted during daylight hours at three stations. Each sample consisted of a bottom-to-surface stepped oblique tow for the deeper stations (>3 m [118.1 in]). In the shallower stations (<3 m [118.1 in]), the net was towed subsurface (~1 m [39.4 in]) for the entire duration. Nets were towed for approximately 5 minutes. After each tow, the contents of the net were rinsed into a 110-µm sieve and transferred to a sample jar in a 10% formalin solution and stored for identification. Fish larger than 5 cm were identified to the lowest practical taxon, enumerated, and released alive.

In the laboratory, all samples were sorted to remove fish eggs and larvae. Samples with large amounts of debris and/or large ichthyoplankton abundances were split for processing. All larval fish and eggs were identified to the lowest practical taxon and counted. Eggs were not identified to species unless they presented obvious physical characteristics for species-specific identification. Ten percent of the collections were re-analyzed for QA/QC purposes to maintain a sorting error rate of less than 10%, following Versar's standard laboratory operating procedures. Eggs and larvae removed from the samples were transferred to labeled vials and preserved in 70% isopropyl alcohol for further reference.

Data Analysis

Ichthyoplankton densities were calculated for each species and major life stage (i.e., egg, yolk-sac, post-yolk sac, and juvenile). Volume of water filtered for each tow was calculated from the difference in flow meter readings with an applied conversion factor based on gear type and size. Species mean CPUE is reported as number of individuals per 1,000 cubic meters. Seasonal changes in ichthyoplankton species composition are evaluated through a series of pie charts.

2.6 Submerged Aquatic Vegetation Surveys

2.6.1 Review of Existing Submerged Aquatic Vegetation Mapping

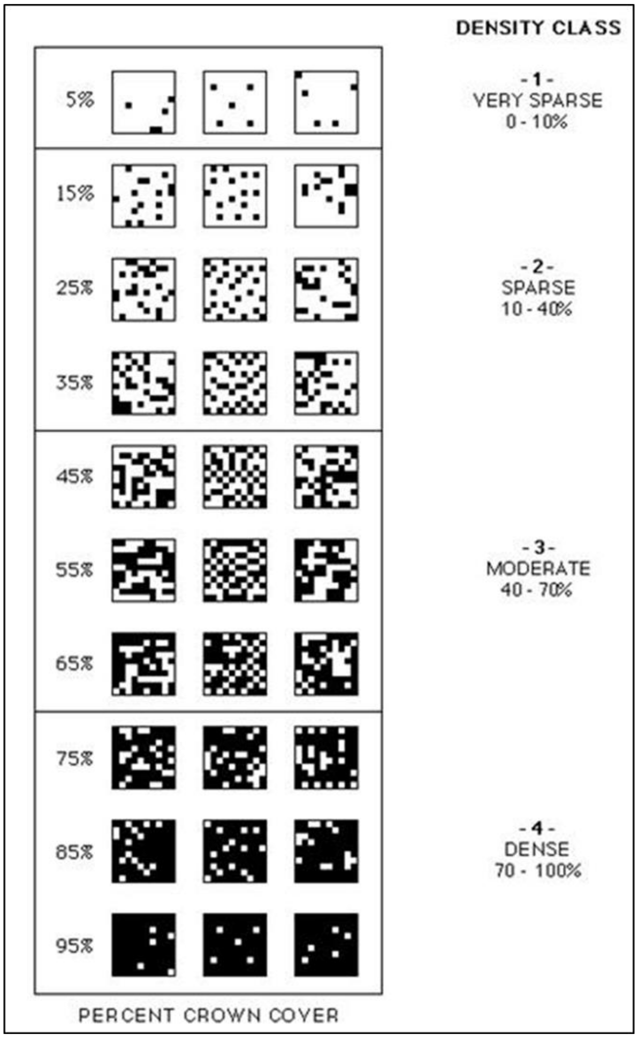
Versar conducted a review of existing SAV mapping and monitoring efforts in Narragansett Bay and its tributaries. The University of Rhode Island Environmental Data Center and their partners have mapped and monitored SAV in the Narragansett Bay for about 20 years. The SAV mapping project is a collaboration between members of the Rhode Island Eelgrass Mapping Taskforce, which is comprised of the University of Rhode Island, Save the Bay, Rhode Island Coastal Resources Management Council, National Estuarine Research Reserve, and U.S. Fish and Wildlife Service (USFWS). Mapping was conducted via photo-interpretation and ground-truthing. Digitizing was conducted at a scale of 1:1500 (Bradley et al. 2013). The resulting SAV mapping in the vicinity of the NAVSTANPT for the year 2012 by the Rhode Island Eelgrass Taskforce is depicted on **Figures 2-1** through **2-3**.

2.6.2 Submerged Aquatic Vegetation Field Surveys

The NAVSTANPT SAV and nearshore terrestrial vegetation and wildlife surveys were conducted in August 2016. The SAV survey was designed following guidelines by Lockwood (1991). SAV at NAVSTANPT was sampled in the field at a total of 18 points (see **Figures 2-1** through **2-3**). Versar used a high-quality GoPro Hero 4 Bluetooth-equipped underwater camera with powerful external light-emitting diode lighting to transmit clear underwater video footage to an iPad® tablet on the boat. The live videos were examined in situ on the boat for the presence of SAV. All videos were then saved for subsequent review and documentation. The SAV points were mapped using a survey-grade differential GPS with sub-meter accuracy, while aboard a 5-m (18-ft) Boston Whaler survey boat.

A portable 1-m^2 (3.3-ft^2) grid made of rigid polyvinyl chloride tubing sectioned off into 16 separate 25-cm (9.8-in) square cells was used to determine SAV coverage at each sampling point. The center of the grid was matched as closely as possible with the center of each sample point. Observations were made visually wherever possible, or by use of an underwater camera (as described above). Data collected at each sample point included grids per quadrat that SAV is present; color (green, brown, mottled); epiphytes (absent, light, heavy); flowers (yes, no); and depth to substrate/type (feet, substrate type – sand, silt, mud).

SAV density within discrete individual beds was estimated through use of a modified crown density scale using methods for the Chesapeake Bay (**Figure 2-4**; Orth et al. 2013). SAV beds were categorized into four classes based on a comparison with the density scale. These categories include 1, very sparse (<10% coverage); 2, sparse (10-40%); 3, moderate (40-70%); or 4, dense (70-100%). Either the entire bed or subsections within the bed were assigned a bed-density number corresponding to these density classifications. All SAV was positively identified using Gleason and Cronquist (1991) and the Field Guide to the Submerged SAV of Chesapeake Bay (USFWS 1990).



Source: Orth et al. 2013.

Figure 2-4. Crown density scale used for estimating density of submerged aquatic vegetation.

2.7 Nearshore Terrestrial Vegetation Surveys

Nearshore vegetation communities were surveyed by Versar at the NAVSTANPT on a qualitative basis using meander pedestrian transects and boat surveys. Each vegetation and land cover type along the shoreline and up to approximately 50 m (164 ft) inland was characterized by a staff botanist. Detailed notes on plant species present, community composition and structure were taken. Vegetation community descriptions were also captured in representative ground-level photographs (**Appendix A**).

2.8 Nearshore Terrestrial Wildlife Surveys

To determine wildlife species presence, Versar's wildlife biologists conducted a pedestrian and boat survey along the shoreline and in habitat adjacent to the shore, where accessible at NAVSTA PT. Bird and mammal observations were made both audially and visually (using binoculars for birds) and visual encounter surveys (VESs) were conducted for herpetofaunal species. The VES is most often used to determine the species richness of a site, compile a species list, and estimate relative abundances of species within an assemblage (Heyer et al. 1994). Surveys were conducted using a meander pedestrian transect during daylight hours only. Experienced wildlife personnel searched all available microhabitats including ground, water, under flotsam and rocks, stumps and logs, tree trunks, leaf litter, and other items. Cover objects moved during the survey were returned to their original positions to minimize habitat disturbance. All signs and actual observations of wildlife species were recorded by photograph and on dedicated datasheets.

2.9 Marine Mammal and Sea Turtle Surveys

Prior to the initial survey, a census route was established immediately adjacent to the installation, along the eastern shore of Aquidneck Island, across the East Passage of Narraganset Bay, and around Gould Island (see **Figures 2-1** through **2-3**). Transit distance was about 19 kilometers (km; 12 miles [mi]) along Aquineck Island, 13 km (8 mi) back and forth across the East Passage, and 4 km (2 mi) around Gould Island. The route followed open water shorelines at ~150 m (492 ft) from shore or at a distance where depth is ≥1 m at mean low water. A total of 4 survey days were scheduled (one for each season), with the first survey beginning in the spring of 2016. Surveys for sea turtles were accomplished at the same time as marine mammal surveys. Surveys were timed to maximize the daylight hours and only performed in favorable weather conditions, specifically surveys were not conducted if the Beaufort sea state was greater than three (**Table 2-2**).

A Privateer Model 2400 Delaware Cabin vessel was used for all the NAVSTANPT marine mammal surveys. The vessel was equipped with a 225-hp outboard engine and a Raymarine RC435 GPS. It was staffed with a captain and two to three observers. Each observer was equipped with binoculars, a digital camera, and datasheets. Observers were posted on the port and starboard side of the vessel, abreast the beam, resulting in a strip census of approximately 300 m (984 ft). Each observer scanned, with the naked eye, from directly ahead of the vessel to 90 degrees or perpendicular to the vessel. Additionally, the landward observer scanned the shoreline for signs of hauled out pinnipeds.

Table 2-2. Beaufort sea state descriptions.

Beaufort number	Wind Speed (knots)	Visual Clues (wave height)
0	<1	Calm, sea like a mirror (0 m [0 ft])
1	1-3	Light air, ripples only (< 0.2 m [1/2 ft])
2	4-6	Light breeze, small wavelets, crests have glassy appearance (max 0.3 m [1 ft])
3	7-10	Gentle breeze, large wavelets (0.6 m [2 ft]), crests begin to break (max 0.9 m [3 ft])
4	11-16	Moderate breeze, small waves, some white caps (max 1.5 m [5 ft])

5	17-21	Fresh breeze, moderate waves (1.8 m [6 ft]) many white caps (max 2.4 m [8 ft])

Before the vessel left the dock, the team checked the battery state, date, and time on the GPS and made a visual assessment of location accuracy before using the map feature on the GPS and on-vessel navigation system. During the survey, GPS tracks, track points, and waypoints were recorded and logged in ArcGIS format. Event codes were used to identify unique points in time that will be geospatially referenced. Environmental conditions were recorded at the beginning of each survey (Beaufort sea state, cloud cover, glare, and wind direction) and a waypoint was entered each time the environmental conditions changed throughout the trip. Observers took an “On Effort” waypoint at the beginning and an “Off Effort” waypoint at the end of each survey trip.

If a sighting occurred, a waypoint was collected as well as information about the sighting; including, species, group size, and behavior. Information on the group’s distance from the vessel was collected to facilitate the calculation of the animal’s actual location. This included the bearing of the animal (based on the location from vessel bow) and a distance measure (calculated from either the binocular reticle or an estimation of distance). When able, photos of the animals were collected. Event codes were used to classify each waypoint and recorded on the “Vessel Survey” datasheet. A “Trip Summary Report” datasheet was completed for each survey day and a “Sighting Sheet” datasheet was completed each time a marine mammal group was recorded. Scanned copies of all marine mammal data sheets are in **Appendix C**. GPS track and waypoints were uploaded into an ArcGIS geodatabase (**Appendix G**). Sighting, effort, and trip information was manually entered into the feature’s attribute table.

The collected data were used to assess presence/absence of marine mammal species. Because the amount of data collected was limited to one survey per season, abundance or density estimations cannot be calculated; however, these data can be compared to other published data and may be contributed to projects that combine and standardize multiple surveys in order to increase statistical power and generate density estimates.

3.0 RESULTS

3.1 Benthic Species and Sediment

3.1.1 Sediment Analysis Results

A total of 32 sediment samples were collected at NAVSTANPT. Analysis shows that sediments were primarily sand and gravel with some variability between stations. Throughout all seasons, intertidal sites had a composition of sand and gravel at 90% or higher. Intertidal stations 1, 3, and 4 primarily consisted of sand (57.4% - 98.7%). Intertidal station 2 was mostly gravel in the spring and summer (73.6% and 95. 5%, respectively) but briefly transitioned to a sandier substrate in the fall and winter (60.8% and 48.9%, respectively). The subtidal sites exhibited much more seasonal variability in sediment composition. Subtidal station 1 was mostly silt/clay and sand (44.6% - 57.8%) while subtidal stations 2, 3, and 4 had variable percentages of sand and gravel (**Table 3-1**). A full grain size analysis of each site as presented in Wentworth sediment size categories is in **Appendix E** (summary tables) and **F** (Access® database).

Table 3-1. Summary of benthic sediments collected at Naval Station Newport by season with percentage of silt/clay, sand, and gravel reported for each site.

Site	Type	Category	Spring 2016	Summer 2016	Fall 2016	Winter 2017
NEWP-Int1	Intertidal	Silt/Clay	1.7	1.6	1.4	1.2
		Sand	98.3	71.3	57.4	98.7
		Gravel	0.0	27.1	41.2	0.1
NEWP-Int2	Intertidal	Silt/Clay	1.9	0.7	2.3	0.9
		Sand	24.5	3.9	60.8	48.9
		Gravel	73.6	95.5	36.9	50.2
NEWP-Int3	Intertidal	Silt/Clay	1.4	3.0	4.0	4.2
		Sand	72.9	97.0	95.9	95.7
		Gravel	25.8	0.0	0.1	0.1
NEWP-Int4	Intertidal	Silt/Clay	1.6	3.6	9.6	4.9
		Sand	84.6	94.0	90.1	86.1
		Gravel	13.8	2.4	0.3	9.0
NEWP-Sub1	Subtidal	Silt/Clay	55.7	57.8	49.9	44.6
		Sand	44.3	39.5	48.8	48.5
		Gravel	0.0	2.7	1.3	6.9
NEWP-Sub2	Subtidal	Silt/Clay	40.7	17.7	26.1	23.6
		Sand	42.9	46.7	44.1	69.3
		Gravel	16.4	35.6	29.8	7.1

Table 3-1. Summary of benthic sediments collected at Naval Station Newport by season with percentage of silt/clay, sand, and gravel reported for each site (Cont'd).

Site	Type	Category	Spring 2016	Summer 2016	Fall 2016	Winter 2017
NEWP-Sub3	Subtidal	Silt/Clay	12.7	30.1	9.3	34.8
		Sand	86.6	67.2	90.6	62.9
		Gravel	0.6	2.6	0.1	2.3
NEWP-Sub4	Subtidal	Silt/Clay	50.8	5.6	7.3	13.0
		Sand	43.1	73.4	73.2	63.5
		Gravel	6.1	21.0	19.5	23.5

3.1.2 Benthic Community Results

A total of 32 benthic samples were collected from eight stations at NAVSTANPT over four seasons of sampling. As with the sediment sampling, benthic samples were taken from intertidal and subtidal locations. Subtidal sites had higher diversity than intertidal sites across all seasons, with a total of 171 and 93 unique species present, respectively (**Table 3-2**). Taxonomic diversity was highest in the summer in both tidal zones.

Table 3-2. Seasonal taxa counts at Naval Station Newport by season and zone. Analysis reports the number of unique taxa per season across all sampling sites.

Samples per Season	Number of Unique Taxa					
	Zone	All Seasons	Spring	Summer	Fall	Winter
N=4	Intertidal	93	28	65	39	36
N=4	Subtidal	171	75	116	72	89

Polychaetes dominated the benthic community at both the intertidal and subtidal sites (**Tables 3-3** and **3-4**). The intertidal community also consisted of bivalves, oligochaetes, amphipods, and hemichordates, in order of decreasing abundance (**Table 3-3**). Gastropods, bivalves, oligochaetes, and amphipods were the most abundant taxa in the subtidal community (**Table 3-4**). Species abundance was much higher in the subtidal compared to the intertidal, with mean abundances of approximately 13,000 and 4,300 individuals, respectively.

Table 3-3. Benthic analysis results for Naval Station Newport intertidal stations (INT). Seasonal analysis includes total organism abundance per square meter (T.A.), number of taxa (# Taxa), Shannon-Wiener diversity index (S.W.), Pielou's Evenness Index (P.E.), and the abundance per square meter (Abun) and percent dominance (% Dom) of the five most abundant species.

NEWP-INT1												
	Spring 2016			**Summer 2016**			**Fall 2016**			**Winter 2017**		
T.A.	3,364			3,250			360			3,409		
#Taxa	11			20			5			18		
S.W.	2.81			3.22			1.88			2.57		
P.E.	1.17			1.08			1.17			0.89		
	Name	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**
Top 1	Oligochaeta[1]	1,000	29.7	*Spisula solidissima*[2]	909	28.0	*Gemma gemma*	200	55.6	*Caulleriella venefica*	1,818	53.3
Top 2	*Gemma gemma*[2]	750	22.3	*Gemma gemma*	568	17.5	*Parapionosyllis longicirrata*[3]	40	11.1	*Gemma gemma*	568	16.7
Top 3	*Spiochaetopterus costarum*[3]	477	14.2	*Caulleriella venefica*[3]	409	12.6	*Crepidula* spp.[5]	40	11.1	*Leitoscoloplos robustus*	182	5.3
Top 4	*Leitoscoloplos robustus*[3]	386	11.5	*Saccoglossus kowalevskii*[4]	341	10.5	*Mediomastus ambiseta*[3]	40	11.1	Syllidae[3]	114	3.3
Top 5	Nephtyidae[3]	273	8.1	*Nephtys picta*[3]	295	9.1	*Tharyx* sp. A *Morris*[3]	40	11.1	*Cirriformia grandis*[3]	91	2.7
NEWP-INT2												
T.A	1,068			11,614			80			1,250		
#Taxa	11			30			2			1		
S.W.	2.19			3.31			1.00			0		
P.E.	0.91			0.97			1.44			0		
Top 1	Oligochaeta	477	44.7	*Polydora cornuta*[3]	4,045	34.8	*Tharyx sp. A Morris*	40	50	Oligochaeta	1,250	100
Top 2	*Littorina littorea*[5]	364	34.0	*Capitella teleta*[3]	2,318	20.0	Oligochaeta	40	50			
Top 3	Insecta[6]	45	4.3	*Microdeutopus* spp.[8]	773	6.7						
Top 4	Polynoidae[3]	23	2.1	Panopeidae[9]	705	6.1						
Top 5	*Carinomella lactea*[7]	23	2.1	Oligochaeta	682	5.9						

Table 3-3. Benthic analysis results for Naval Station Newport intertidal stations (INT). Seasonal analysis includes total organism abundance per square meter (T.A.), number of taxa (# Taxa), Shannon-Wiener diversity index (S.W.), Pielou's Evenness Index (P.E.), and the abundance per square meter (Abun) and percent dominance (% Dom) of the five most abundant species (Cont'd).

NEWP-INT3												
	Spring 2016			**Summer 2016**			**Fall 2016**			**Winter 2017**		
T.A.	5,160			8,159			2,136			682		
#Taxa	7			30			17			15		
S.W.	1.24			2.17			3.15			3.66		
P.E.	0.64			0.64			1.11			1.35		
	Name	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**
Top 1	Oligochaeta	3,720	72.1	*Pygospio elegans*[3]	5,682	69.6	*Parapionosyllis longicirrata*	705	33.0	*Spiophanes bombyx*	91	13.3
Top 2	Nemertina[7]	1,040	20.2	*Polydora cornuta*	341	4.2	*Ampelisca abdita*[1]	364	17.0	*Tellina agilis*	91	13.3
Top 3	Lacuna vincta[5]	200	3.9	*Spiochaetopterus costarum*	295	3.6	Nephtyidae	295	13.8	*Leitoscoloplos robustus*	91	13.3
Top 4	*Caulleriella venefica*	80	1.6	*Nephtys picta*	250	3.1	*Tellina agilis*[2]	136	6.4	*Gemma gemma*	68	10.0
Top 5	*Nephtyidae*	40	0.8	*Spiophanes bombyx*[3]	227	2.8	*Spiophanes bombyx*	114	5.3	*Apoprionospio pygmaea*[3]	68	10.0
NEWP-INT4												
T.A.	2,880			11,318			9,227			4,841		
#Taxa	6			30			29			25		
S.W.	0.74			2.99			3.53			3.28		
P.E.	0.41			0.88			1.05			1.02		
Top 1	Oligochaeta	2,560	88.9	*Caulleriella venefica*	5,409	47.8	*Parapionosyllis longicirrata*	2,591	28.1	*Caulleriella venefica*	2,068	42.7
Top 2	*Lacuna vincta*	120	4.2	*Tharyx sp. A Morris*	1,205	10.6	*Caulleriella venefica*	1,727	18.7	*Spiophanes bombyx*	523	10.8
Top 3	Polynoidae	80	2.8	*Brania wellfleetensis*[3]	818	7.2	Aoridae[8]	1,000	10.8	*Pygospio elegans*	409	8.5
Top 4	*Streblospio benedicti*[3]	40	1.4	*Polydora cornuta*	750	6.6	Oligochaeta	614	6.7	*Parapionosyllis longicirrata*	205	4.2
Top 5	Lumbrineridae[3]	40	1.4	*Spiophanes bombyx*	500	4.4	*Caprella penantis*[8]	568	6.2	Oligochaeta	205	4.2

[1]Oligochaeta = Subclass of Annelida (segmented worms)
[2]Bivalvia = Class of mollusk with shell consisting of two hinged parts
[3]Polychaeta = Bristle worms
[4]Hemichordata = a phylum of marine deuterostome animals
[6]Insecta = Class of anthropodea with the characteristics of three pairs of legs, segmented body (head, thorax, abdomen), and one pair of antennae.
[7]Nemertina = Ribbon worms
[8]Amphipoda = Order of crustacean with no carapace and laterally compressed bodies

[5]Gastropoda = Class of mollusks that that includes the groups of snails and slugs [9]Decapoda = 10-footed crustaceans such as crabs and shrimp

Table 3-4. Benthic analysis results for Naval Station Newport subtidal stations (SUB). Seasonal analysis includes total organism abundance per square meter (T.A.), number of taxa (# Taxa), Shannon-Wiener diversity index (S.W.), Pielou's Evenness Index (P.E.), and the abundance per square meter (Abun) and percent dominance (% Dom) of the five most abundant species.

NEWP-SUB1												
	Spring 2016			Summer 2016			Fall 2016			Winter 2017		
T.A.	7,159			12,659			13,295			9,955		
#Taxa	48			32			32			27		
S.W.	4.1			3.36			1.98			2.69		
P.E.	1.06			0.97			0.57			0.82		
	Name	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**	**Name**	**Abun**	**% Dom**
Top 1	*Polycirrus eximius*[1]	2,386	33.3	*Mediomastus ambiseta*[1]	5,250	41.5	*Mediomastus ambiseta*	9,636	72.5	*Mediomastus ambiseta*	5,455	54.8
Top 2	*Dipolydora socialis*[1]	432	6.0	*Nucula proxima*[2]	1,636	12.9	*Levinsenia gracilis*	909	6.8	*Levinsenia gracilis*	1,341	13.5
Top 3	*Polygordius jouinae*[1]	364	5.1	*Polydora cornuta*	909	7.2	Nephtyidae[1]	568	4.3	*Turbonilla interrupta*[3]	432	4.3
Top 4	*Scoletoma acicularum*[1]	341	4.8	*Levinsenia gracilis*[1]	750	5.9	*Nucula proxima*	250	1.9	*Acteocina canaliculata*[3]	409	4.1
Top 5	*Polydora cornuta*[1]	341	4.8	*Cylichnella bidentata*[3]	523	4.1	*Carinomella lactea*[4]	159	1.2	Nephtyidae	250	2.5
NEWP-SUB2												
T.A	13,455			40,977			16,159			13,432		
#Taxa	34			63			28			33		
S.W.	3.04			3.3			2.8			2.85		
P.E.	0.86			0.8			0.84			0.82		
Top 1	*Boonea seminuda*[3]	4,295	31.9	*Tharyx* sp. *A Morris*	13,886	33.9	*Boonea seminuda*	5,000	30.9	*Mediomastus ambiseta*	5,205	38.8
Top 2	*Crepidula fornicata*[3]	3,818	28.4	*Crepidula fornicata*	11,455	28.0	*Crepidula fornicata*	4,295	26.6	*Turbonilla interrupta*	4,364	32.5
Top 3	*Crepidula plana*[3]	1,432	10.6	*Boonea seminuda*	2,727	6.7	*Tharyx* sp. *A Morris*	3,364	20.8	Oligochaeta[6]	386	2.9
Top 4	*Balanus* spp.[5]	932	6.9	*Monticellina baptisteae*[1]	2,250	5.5	*Balanus* spp.	568	3.5	*Boonea seminuda*	386	2.9
Top 5	*Tharyx* sp. *A Morris*[1]	568	4.2	*Polydora cornuta*	1,318	3.2	*Crepidula plana*	568	3.5	Lumbrineridae[1]	341	2.5

Table 3-5. Benthic analysis results for Naval Station Newport subtidal stations (SUB). Seasonal analysis includes total organism abundance per square meter (T.A.), number of taxa (# Taxa), Shannon-Wiener diversity index (S.W.), Pielou's Evenness Index (P.E.), and the abundance per square meter (Abun) and percent dominance (% Dom) of the five most abundant species (Cont'd).

NEWP-SUB1												
	Spring 2016			Summer 2016			Fall 2016			Winter 2017		
T.A.	10,932			13,977			11,023			15,773		
#Taxa	22			37			40			48		
S.W.	2.72			3.91			3.73			4.29		
P.E.	0.88			1.08			1.01			1.11		
	Name	Abun	% Dom	Name	Abun	% Dom	Name	Abun	% Dom	Name	Abun	% Dom
Top 1	*Microdeutopus anomalus*	3,386	31.0	*Microdeutopus anomalus*	3,227	23.1	*Tharyx* sp. *A Morris*	3,432	31.1	Oligochaeta	2,295	14.6
Top 2	*Capitella teleta*[1]	3,091	28.3	*Crepidula fornicata*	2,159	15.5	*Boonea seminuda*	1,432	13.0	*Mediomastus ambiseta*	2,205	14.0
Top 3	Oligochaeta[6]	2,227	20.4	*Tellina agilis*	1,227	8.8	*Crepidula fornicata*	1,159	10.5	*Apoprionospio pygmaea*[1]	1,432	9.1
Top 4	*Polydora cornuta*	432	4.0	*Capitella teleta*	1,045	7.5	*Astyris lunata*[3]	750	6.8	*Tharyx* sp. *A Morris*	1,432	9.1
Top 5	*Tellina agilis*[2]	341	3.1	*Mediomastus ambiseta*	818	5.9	*Turbonilla interrupta*	545	5.0	*Crepidula fornicata*	1,250	7.9
NEWP-SUB2												
T.A	2,295			17,432			3,909			5,318		
#Taxa	13			69			28			34		
S.W.	2.06			4.29			3.77			3.78		
P.E.	0.8			1.01			1.13			1.07		
Top 1	*Balanus* spp.	1,477	64.4	*Monticellina baptisteae*	5,386	30.9	*Mediomastus ambiseta*	1,159	29.7	*Mediomastus ambiseta*	1,477	27.8
Top 2	*Polycirrus eximius*	250	10.9	*Scoletoma hebes*[1]	1,568	9.0	*Paracaprella tenuis*[7]	409	10.5	*Polygordius jouinae*	955	18.0
Top 3	*Paradoneis* spp.[1]	114	5.0	*Polycirrus eximius*	1,250	7.2	*Ninoe nigripes*[1]	318	8.1	*Tharyx* sp. *A Morris*	455	8.6
Top 4	*Turbonilla interrupta*	68	3.0	Oligochaeta	1,046	6.0	*Nucula proxima*	295	7.6	*Monticellina* spp.[1]	341	6.4
Top 5	*Nucula proxima*	68	3.0	*Mediomastus ambiseta*	682	3.9	*Caprella linearis*[7]	273	7.0	*Polycirrus eximius*	227	4.3

[1]Polychaeta = Bristle worms
[2]Bivalvia = Class of mollusk with shell consisting of two hinged parts
[3]Gastropoda = Class of mollusks that that includes the groups of snails and slugs
[4]Nemertina = Ribbon worms
[5]Cirripedia = Class of arthropods that are the barnacles
[6]Oligochaeta = Subclass of Annelida (segmented worms)
[7]Amphipoda = Order of crustacean with no carapace and laterally compressed bodies

3.2 Water Quality

3.2.1 In Situ Water Quality

A total of 122 in situ water quality readings were taken over the sampling period at the intertidal, subtidal, seine, and trawl survey locations at NAVSTANPT. The observed temperature range was from 3.4 to 24.8ºC during the four seasons of monitoring with the maximum observed temperature occurring during the summer and the minimum observed during the winter. DO and percent saturation ranged from 1.6 to 13.6 mg/L and 17.3 to 165.6%, respectively. The minimum values for both parameters were observed during the summer and the maximum values were observed in the fall. The spring reading for percent saturation of DO were inadvertently not recorded, as it was clear on the datasheet that this measurement was required.

Observed pH ranged from 7.7 to 8.5 with the minimum value observed during the summer and the maximum value observed during the fall. Across the sites, observed conductivity and salinity measurements ranged from 41.2 to 52.1 mS/cm and 29.2 to 33.7 ppt, respectively. The minimum observed values for conductivity occurred during the summer and the maximum value was observed during the winter. Both the observed minimum and maximum salinity values occurred during the summer. Observed turbidity values ranged from 0.0 to 16.3 NTUs. The minimum value was seen in both the fall and winter sampling whereas the maximum value also occurred in the fall. Seasonal in situ readings are summarized for mean and range across all sampling types and depths (**Table 3-6**). Water quality details for each specific reading can be found in **Appendix E** on DVD.

All of the in situ water quality parameters analyzed during this study were significantly influenced by season and location. A one-way analysis of variance found a significant effect of season on water temperature ($p<0.001$, $r^2=0.98$), DO ($p<0.001$, $r^2=0.57$), pH ($p<0.001$, $r^2=0.88$), salinity ($p<0.001$, $r^2=0.09$), conductivity ($p<0.001$, $r^2=0.21$), and turbidity ($p<0.1$, $r^2=0.05$), (**Figure 3-1**).

3.2.2 Whole Water Sample Chemistry

A total of 16 whole water samples (four per season) were collected for water chemistry analysis. Site water was collected prior to the collection of subtidal benthic infauna. Water chemistry data from Martel Laboratories was reviewed and reported. Seasonal means and standard errors were calculated for the entire site (**Table 3-7**).

All Kjeldahl nitrogen samples were below the detection limit and were therefore reported as 0.50 mg/L. The mean value for nitrate-nitrite nitrogen, total phosphorous, and TSS varied across seasons. Mean nitrate-nitrite varied from 0.72 to 2.05 mg/L with summer samples having the highest mean. Spring samples had the lowest mean value. Total phosphorus ranged from 0.03 to 0.05 mg/L with the highest observed mean value in the fall and lowest observed mean value in the winter. TSS mean values ranged from 4.0 to 7.0 mg/L with a peak in summer and the lowest value in winter.

Table 3-6. Summary of seasonal in situ water quality data for NAVSTANPT from spring 2016 to winter 2017. Number of samples (n), mean, minimum (min), and maximum (max) are reported for dissolved oxygen, pH, conductivity, salinity, and turbidity.

Season	n	Temperature			Dissolved oxygen (mg/L)			Dissolved oxygen percent saturated (%)			pH			Specific conductance (mS/cm)			Salinity (ppt)			Turbidity (NTU)		
		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Spring 2016	30	11.2	9.7	12.9	9.7	9.1	10.3	*	*	*	8.0	7.8	8.1	47.5	41.8	49.4	31.0	29.6	32.1	0.9	0.1	3.0
Summer 2016	28	21.9	19.2	24.8	7.7	1.6	10.7	88.0	17.3	122.6	7.9	7.7	8.1	48.1	41.2	51.5	31.6	29.2	33.7	2.5	0.1	14.7
Fall 2016	32	17.1	15.8	17.9	10.4	9.1	13.6	130.5	113.8	165.6	8.3	8.2	8.5	48.2	47.3	48.5	31.5	30.8	31.7	0.9	0.0	16.3
Winter 2017	32	4.2	3.4	4.9	10.7	10.2	11.8	101.3	97.9	108.7	7.9	7.8	8.0	50.0	46.0	52.1	31.9	29.2	33.5	0.8	0.0	4.8

*Values for dissolved oxygen percent saturation were inadvertently omitted from the spring 2016 sampling event
°C = degree(s) Celsius; % = percent; mg/L = milligram(s) per liter; mS/cm = millisiemen(s) per centimeter; NTU = nephelometric turbidity unit; ppt = part(s) per thousand

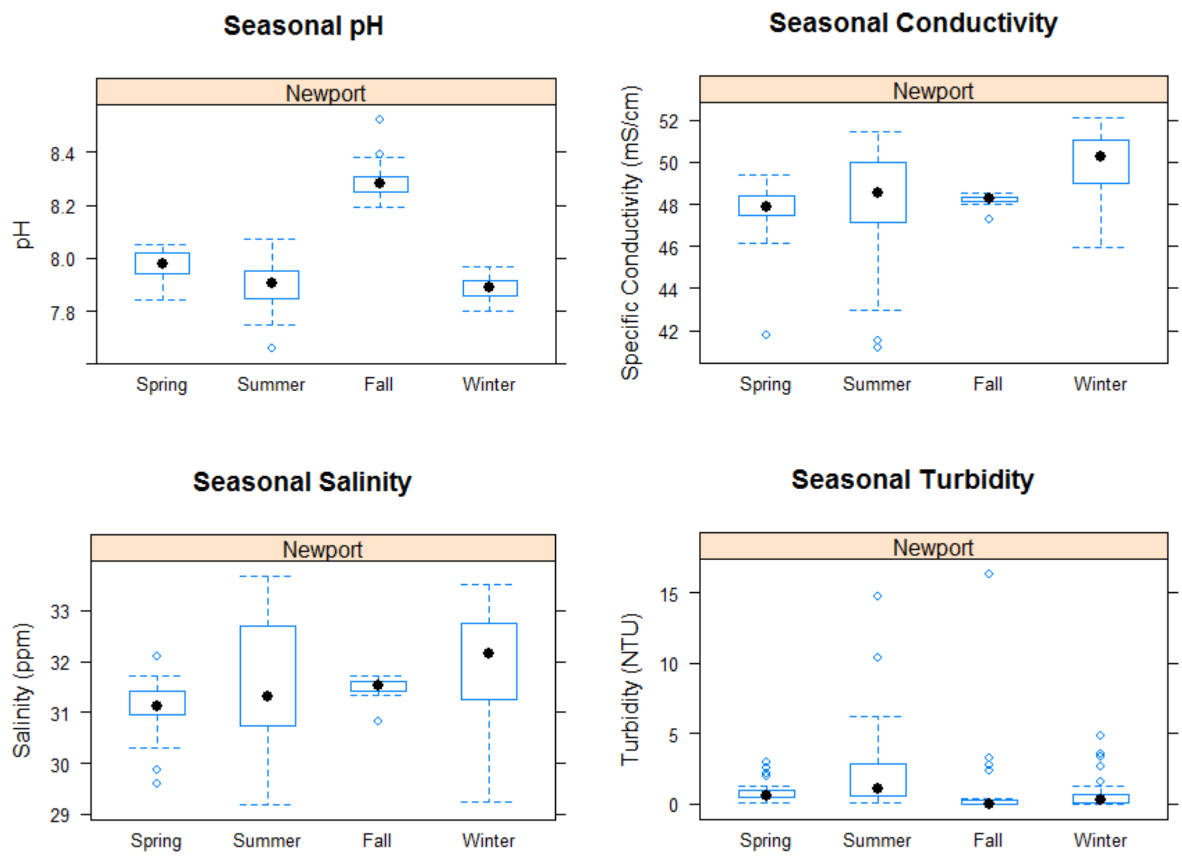


Figure 3-1. Boxplot of seasonal water temperature, dissolved oxygen, pH, salinity, and turbidity for NAVSTANPT. Boxes indicate a median value (dark dot) and the 25th and 75th percentiles. Whiskers indicate 1.5* interquartile range with points representing outliers.

Table 3-7. Summary of seasonal water chemistry data for NAVSTANPT. Means and standard errors (S.E.) of four samples taken per season.

Season	n	Kjeldahl nitrogen (mg/L)		Nitrate-nitrite nitrogen (mg/L)		Total phosphorous (mg/L)		Total Suspended Solids (mg/L)	
		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Spring 2016	4	0.50	0.0	0.72	0.05	*	*	6.0	1.0
Summer 2016	4	0.50	0.0	2.05	0.12	0.04	0.01	7.0	1.0
Fall 2016	4	0.50	0.0	0.98	0.08	0.05	0.01	6.0	1.0
Winter 2017	4	0.50	0.0	1.98	0.02	0.03	0.01	4.0	1.0

Season	n	Kjeldahl nitrogen (mg/L)		Nitrate-nitrite nitrogen (mg/L)		Total phosphorous (mg/L)		Total Suspended Solids (mg/L)	
		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.

*Total phosphorus was not analyzed/reported for the spring effort for NAVSTANPT.
mg/L = milligram(s) per liter

3.3 Fish and Invertebrate Community Results

3.3.1 Trawl Survey Results

A total of four trawls were conducted each season during the fish community assessment with 16 samples collected overall. A total of 29 species, including finfish, crabs, cephalopods (squid), and skates were caught during the trawl surveys. For seasonal comparisons, CPUE for each taxon was calculated as number of individuals per square kilometer trawled. Mean CPUE and mean total length (millimeters), when applicable, were then calculated for each season (**Table 3-8**). In addition to CPUE, the seasonal trawl diversity was calculated as the proportion of individuals by taxa to total trawl catch.

Table 3-8. Species taxonomic name, common name, mean catch per unit effort (CPUE), and mean total length (millimeters) for NAVSTANPT seasonal trawls. CPUE is in number per square kilometer trawled.

Scientific Name	Common Name	Values	Spring	Summer	Fall	Winter
Anchoa mitchilli	Bay anchovy	CPUE	1,254			
		Length	76			
Cancer irroratus	Atlantic rock crab	CPUE			280	
		Length			n/a	
Centropristis striata	Black sea bass	CPUE	1,010	8,924	3,606	
		Length	83	111	143	
Cephalopoda	Squids	CPUE	752			
		Length	n/a			
Crangon septemspinosa	Sand shrimp	CPUE				76,269
		Length				n/a
Etropus microstomus	Smallmouth flounder	CPUE	251	2,333	717	
		Length	65	98	103	
Gadus morhua	Atlantic cod	CPUE	25,157			
		Length	61			
Homarus americanus	American lobster	CPUE		651		
		Length		73		
Leucoraja erinacea	Little skate	CPUE		726		
		Length		453		
Leucoraja ocellata	Winter skate	CPUE		326	252	
		Length		650	477	
Libinia emarginata	Spider crab	CPUE	1,081		155	267
		Length	86		n/a	n/a

Loligo pealeii	Longfin inshore squid	CPUE		19,168	929	
		Length		50	82	
Merluccius bilinearis	Silver hake	CPUE	580			
		Length	109			

Table 3-8. Species taxonomic name, common name, mean catch per unit effort (CPUE), and mean total length (millimeters) for NAVSTANPT seasonal trawls. CPUE is in number per square kilometer trawled (Cont'd).

Scientific Name	Common Name	Values	Spring	Summer	Fall	Winter
Myoxocephalus aenaeus	Grubby sculpin	CPUE				276
		Length				95
Paralichthys dentatus	Summer flounder	CPUE	254	400	864	
		Length	360	354	295	
Paralichthys oblongus	Fourspot flounder	CPUE		651	155	
		Length		323	102	
Peprilus triacanthus	Butterfish	CPUE		691		
		Length		144		
Pholis gunnellus	Rock gunnel	CPUE	251			1,229
		Length	120			123
Prionotus carolinus	Northern sea robin	CPUE		2,965		
		Length		140		
Pseudopleuronectes americanus	Winter flounder	CPUE	1,400	1,282	860	
		Length	244	173	339	
Scophthalmus aquosus	Windowpane flounder	CPUE		786		
		Length		131		
Squilla empusa	Mantis shrimp	CPUE		536	280	
		Length		n/a	n/a	
Stenotomus chrysops	Scup/porgy	CPUE	1,739	10,847	2,554	
		Length	223	172	100	
Syngnathus fuscus	Northern pipefish	CPUE				276
		Length				198
Synodus foetens	Inshore lizardfish	CPUE			155	
		Length			251	
Tautoga onitis	Tautog	CPUE	193	1,527	1,121	
		Length	240	254	164	
Tautogolabrus adspersus	Cunner	CPUE	251	1,052	155	615
		Length	58	114	151	46
Urophycis chuss	Red hake	CPUE				680
		Length				55
Urophycis regia	Spotted hake	CPUE	1,217	461		1,655
		Length	113	105		75

Spring trawls were dominated by Atlantic cod (*Gadus morhua*, 69%), followed by *Stenotomus chrysops*, commonly referred to as either scup or porgy, which constituted an additional 6% of the catch. The remaining 11 taxa identified during the trawl survey accounted for the remaining 25% of the catch (**Figure 3-2**).

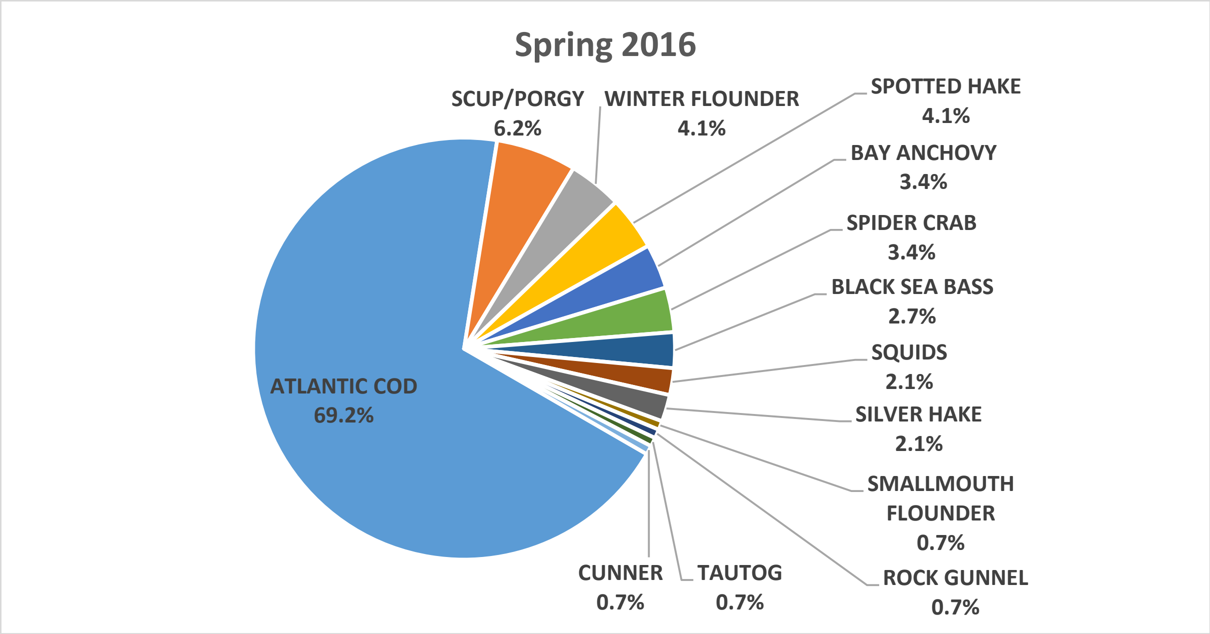


Figure 3-2. Summary of trawl surveys with percent occurrence by taxa for four trawls at NAVSTANPT during spring 2016 sampling.

A total of four species constituted 78% of the summer trawl catch. These species included longfin inshore squid (*Loligo pealeii*, 36%), Atlantic scup or porgy (21%), black sea bass (*Centropristis striata*, 16%), and the northern searobin (*Prionotus carolinus*, 5%). An additional 12 taxa made up the remaining 22% of catch (**Figure 3-3**).

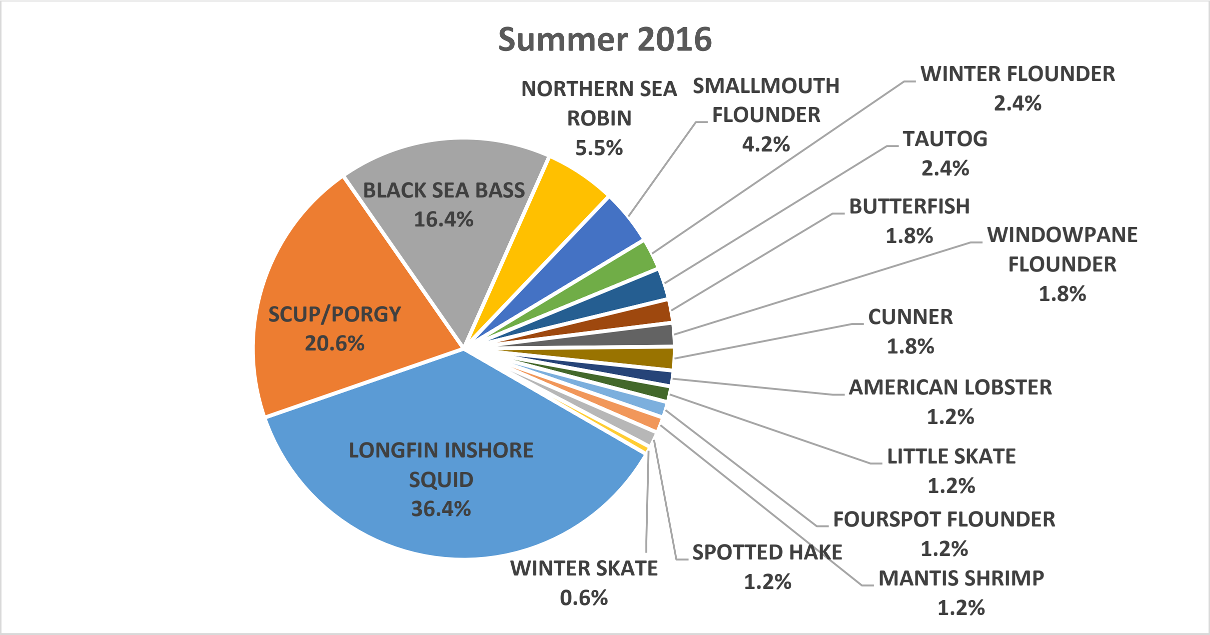


Figure 3-3. Summary of trawls surveys with percent occurrence by taxa for four trawls at NAVSTANPT during summer 2016 sampling.

The most abundant species for the fall trawl surveys include black sea bass (27%), Atlantic scup (25%), and longfin inshore squid (12%). The remaining 36% of catch included 10 additional species (**Figure 3-4**). The winter trawl was dominated by sand shrimp (*Crangon septemspinosa*, 93%), with seven other taxa accounting for the remaining 7% of the catch (**Figure 3-5**).

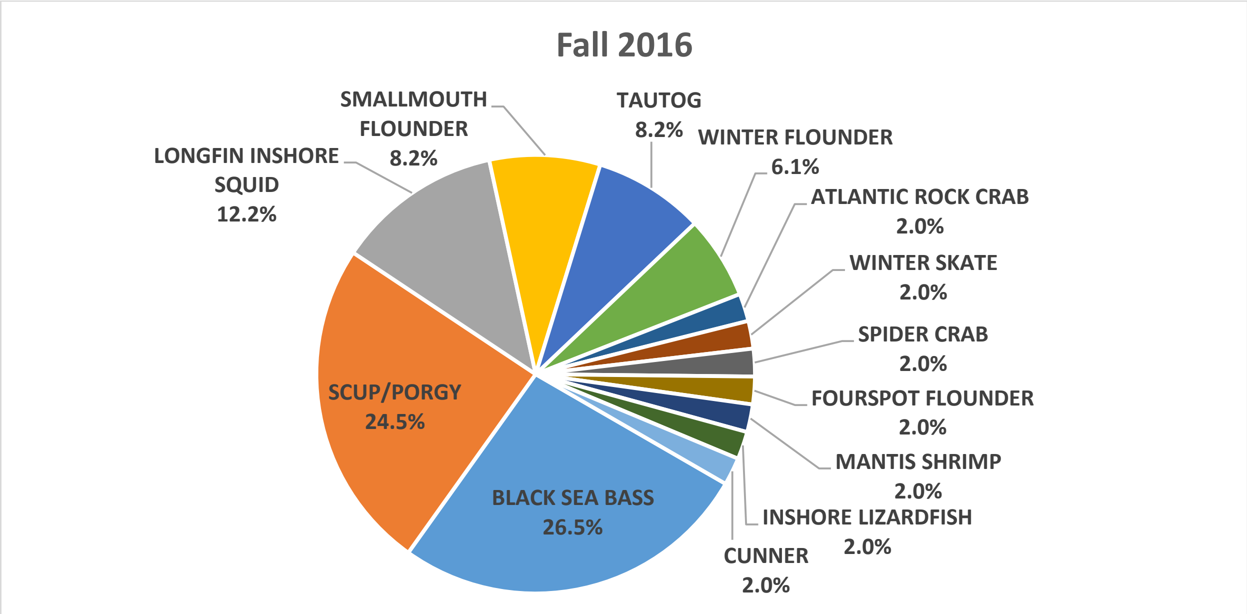


Figure 3-4. Summary of trawl surveys with percent occurrence by taxa for four trawls at NAVSTANPT during fall 2016 sampling.

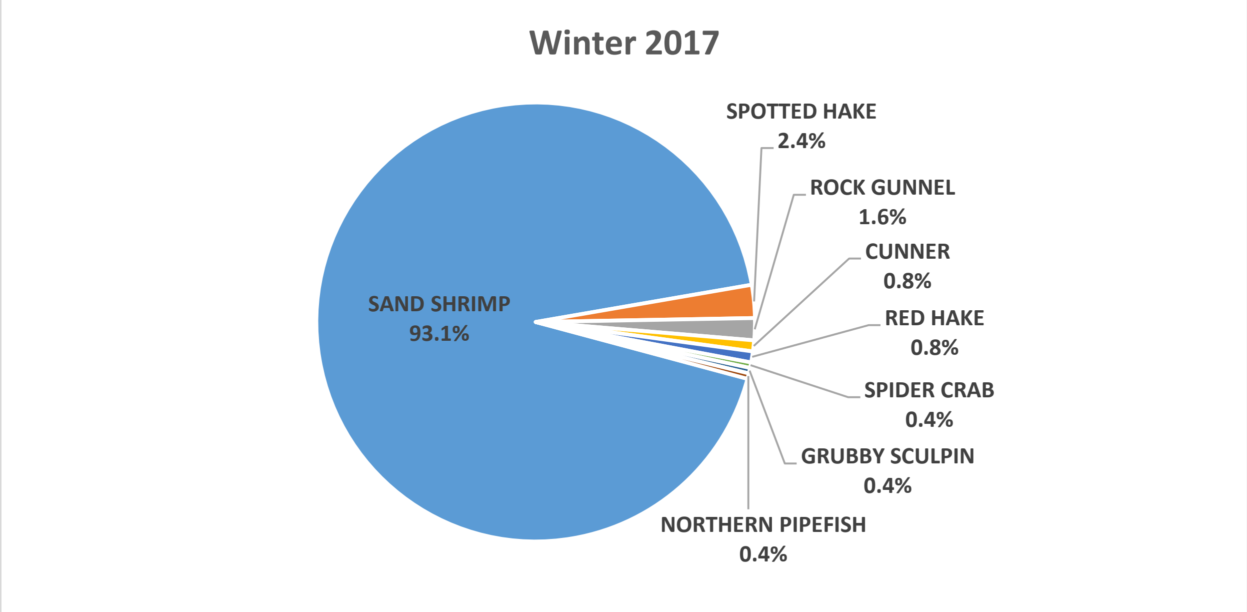


Figure 3-5. Summary of trawl surveys with percent occurrence by taxa for four trawls at NAVSTANPT during winter 2017 sampling.

3.3.2 Beach Seine Results

A total of 16 seine pulls were conducted during the assessment of NAVSTANPT, with four seines per sampling season. For seasonal comparisons, CPUE for each taxon was calculated as number of individuals per seine haul. Mean CPUE and when applicable, mean total length (millimeters) was calculated for each season (**Table 3-9**). There were no captures during the winter seining event. In addition to CPUE, the seasonal seine diversity was calculated as the proportion of individuals by taxa to total seine catch.

Table 3-9. Species taxonomic name, common name, and mean catch per unit effort (CPUE), and mean total length (millimeters) for NAVSTANPT seasonal seines. CPUE is in number per seine haul.

Taxonomic Name	Common Name	Values	Spring	Summer	Fall	Winter
Alosa aestivalis	Blueback herring	CPUE		5.5		
		Length		82		
Alosa pseudoharengus	Alewife	CPUE			13.5	
		Length			131	
Brevoortia tyrannus	Atlantic menhaden	CPUE			0.75	
		Length			100	
Carcinus maenas	Green crab	CPUE	0.25	1.75	3.25	
		Length	50	51	n/a	
Fundulus majalis	Striped killifish	CPUE			6.5	
		Length			112	
Libinia emarginata	Spider crab	CPUE			0.25	

		Length			n/a	
Menidia menidia	Atlantic silverside	CPUE		1.25		
		Length		60		
Mercenaria mercenaria	Northern quahog	CPUE		0.25		
		Length		44		
Mugil cephalus	Striped mullet	CPUE			0.25	
		Length			134	
Myoxocephalus aenaeus	Grubby sculpin	CPUE			0.25	
		Length			126	
Ovalipes ocellatus	Lady crab	CPUE		0.25	0.75	
		Length		85	n/a	
Paguroidea	Hermit crab	CPUE			3.75	
		Length			n/a	
Pseudopleuronectes americanus	Winter flounder	CPUE			1.25	
		Length			71	
Pomatomus saltatrix	Bluefish	CPUE		0.25		
		Length		103		
Tautoga onitis	Tautog	CPUE		1.75		
		Length		84		

Spring seining had only one green crab (*Carcinus maenus*). Summer seining had a total of four species that constituted 94% of the summer seine samples. These species include blueback herring (*Alosa aestivalis*, 50%), green crab (16%), tautog (T*autoga onitis*, 16%), and Atlantic silversides (*Menidia menidia*, 12%). An additional three taxa composed the remaining 6% of seine catches (**Figure 3-6**).

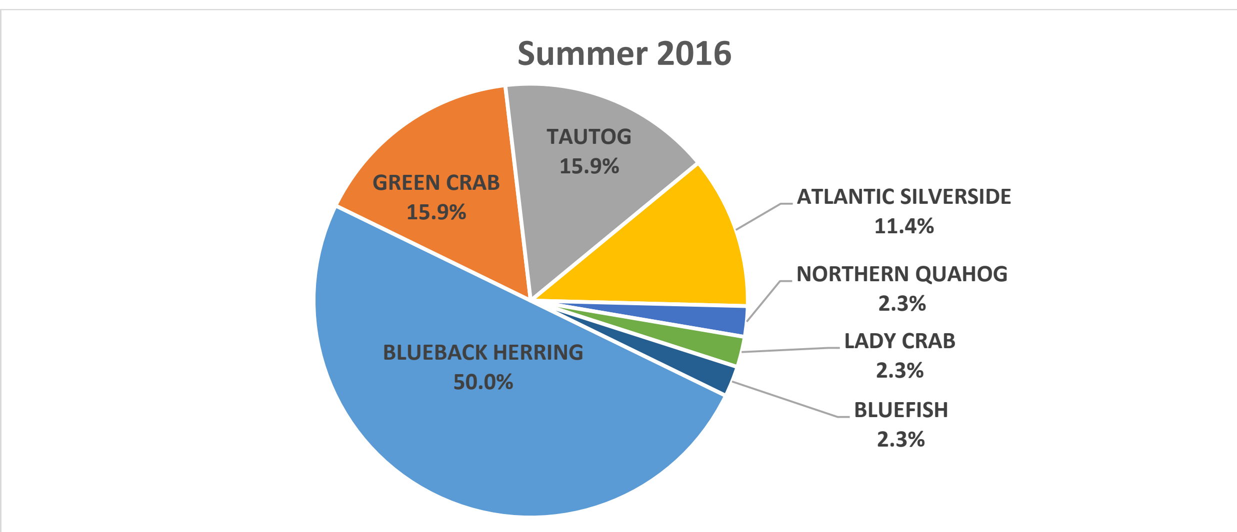


Figure 3-6. Summary of seine surveys with percent occurrence by taxa for four seines at NAVSTANPT during summer 2016 sampling.

The most abundant species for the fall included alewife (*Alosa pseudoharengus*, 44%), striped killifish (*Fundulus majalis*, 21%), and hermit crabs (*Paguroidea*, 12%). The remaining eight taxa constituted 23% of the catch (**Figure 3-7**).

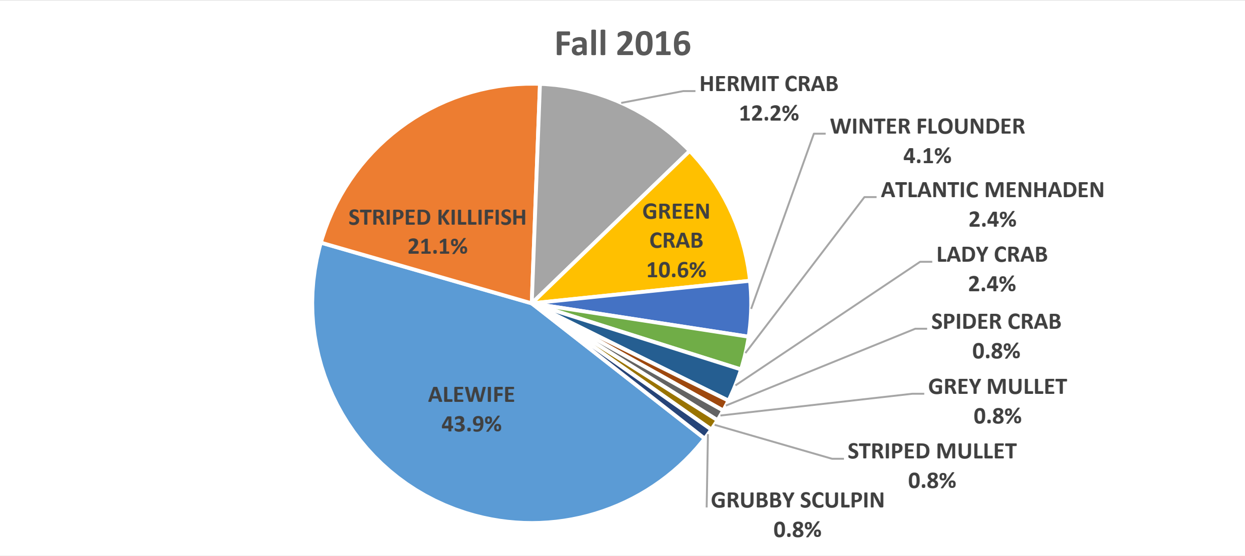


Figure 3-7. Summary of seine surveys with percent occurrence by taxa for four seines at NAVSTANPT during fall 2016 sampling.

The only taxa that reoccurred for at least two seasonal sampling events include the green crab, which was present in the spring, summer, and fall samples and the lady crab (*Ovalipes ocellatus*), which was present in summer and fall samples.

3.4 Submerged Aquatic Vegetation Results

Both benthic macroalgae (i.e., seaweed) and seagrass were documented during the SAV survey at NAVSTANPT (**Figure 3-8**). Eelgrass (*Zostera marina*) was documented on 5 of the 18 sample points (28% of the sample points). Included were SAV points 7, 8 (near grid), 14, 15, and 18. At SAV point 8, no eelgrass was present inside or directly adjacent to the sampling grid, but patchy clumps of living SAV were observed in the general vicinity of the sample point. SAV at points 7, 14, 15, and 18 was moderately dense, at a 65% to 70% total cover. Eelgrass density near SAV point 8 was somewhat sparse, at an estimated 35% to 40% cover. All eelgrass observed during these surveys appeared to be robust and healthy and was green or mottled in color. All of the eelgrass observed possessed flowering structures. In the geographic region of the project, eelgrass flowers from approximately late June through September (Gleason and Cronquist 1991).

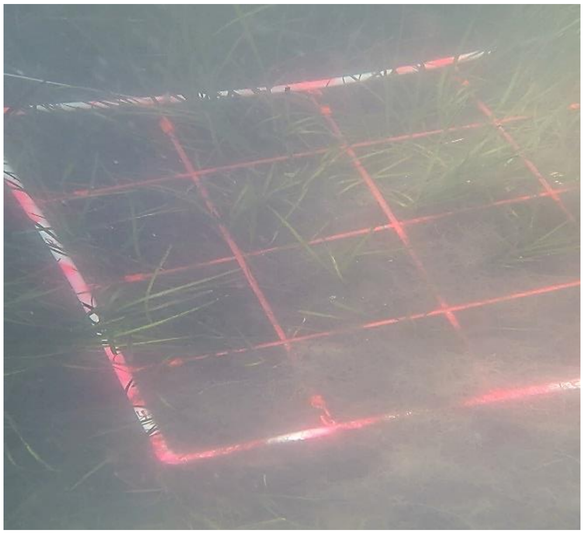
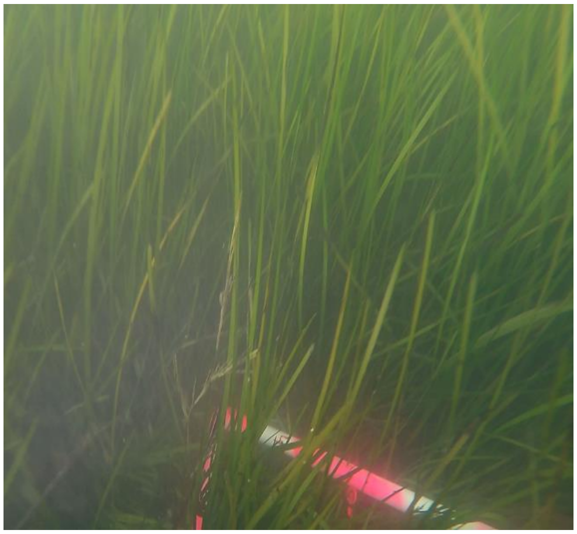



Figure 3-8. Moderately dense eelgrass at SAV point 7 (left) and SAV point 18 (right).

The depth to substrate where SAV was observed typically ranged from 1 to 1.5 m (3.3 to 4.9 ft) beneath the water surface. The substrate in all cases where SAV was found was sand and cobbles or sand and silt with scattered shells. A couple areas within the survey had substrates dominated by cobbles, small rocks, or other coarse materials. Little vegetation and no SAV was observed in these places. Water quality in study site was often turbid, limiting visibility for the surveys.

In addition to the eelgrass documented at NAVSTANPT, a number of benthic macroalgae species were recorded at each sample site by the GoPro camera (**Table 3-10**). Five species of red algae, six species of brown algae, and three species of green algae were identified. The most frequently occurring species was dead man's fingers (*Codium fragile*), an invasive non-native species (Narragansett Bay Research Reserve 2010). This species was observed at all but one SAV sample point (N10).

Table 3-10. Macroalgae species documented during SAV video surveys at NAVSTANPT, August 2016.

Scientific Name	Common Name	Survey Point
Agardhiella subulata	A red algae	N1, N4
Cladophora spp.	A green algae	N10, N11, N12, N13, N14, N15, N16, N17, N3, N8, N9
Cladostephus spongiosus	A brown algae	N1, N8, N16,
Codium fragile	Dead man's fingers. A green algae	N1, N2, N3, N4, N5, N6, N7, N8, N9, N11, N12, N13, N14, N15, N16, N17
Fucus spp.	Rock weeds	N16
Fucus vesiculosus	Bladderwrack	N5, N8, N10, N17

Gloiosiphonia capillaris	A red algae	N1, N 4, N8, N9, N11, N12, N16, NN 17, N18
Gracilaria spp.	Red weeds	N9, N10
Grateloupia turuturu	A red algae	N17, N4, N5
Polysiphonia stricta	A red algae	N1, N 4, N5, N7, N13, N 15, N16
Sargassum filipendula	A brown algae	N10, N5
Sphaerotrichia divaricata	A brown algae	N3, N5, N8, N10
Sphaerotrichia divaricate	A brown algae	N13
Ulva spp.	Sea Lettuces	N10, N14

3.5 Nearshore Terrestrial Vegetation

Much of the shoreline at NAVSTANPT has been stabilized by seawalls or stone revetment or is lined with naturally occurring boulders. As a result, most of the shoreline abruptly shifts from the aquatic to upland habitat no little beach or marsh habitat. Infrequent narrow strips of sand and gravel beach, however, do occur, such as at the McAllister Point Landfill north of Stillwater Basin.

Most of the shoreline vegetation at the main base consisted of a thicket of shrubs and vines or maintained lawn and landscaped areas with scattered mature specimen trees; very little natural vegetated habitat occurred. A comprehensive list of terrestrial plant species identified during the 2016 nearshore survey is in **Table 3-11**. Non-native shrubs such as bush honeysuckle (*Lonicera* spp.), multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata*) were the dominant species along much of the shoreline, though native sumacs (*Rhus* spp.) were also observed. Vine species included the non-native Japanese honeysuckle (*Lonicera japonica*) and oriental bittersweet (*Celastrus orbiculata*), as well as native grapes (*Vitis* spp.) and poison ivy (*Toxicodendron radicans*). Red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and eastern white pine (*Pinus strobus*) were some of the most frequently observed tree species. The non-native tree of heaven (*Ailanthus altissima*) also occurred in several locations along the shoreline. Herbaceous species observed included tansy (*Tanacetum vulgare*), common reed (*Phragmites australis*), and lawn grasses.

The shoreline at Gould Island also had areas of natural rocky outcroppings and has also been stabilized by anthropogenic features such as seawalls and revetment. The same vegetation communities were observed, though no landscaped areas or large specimen trees were observed.

Table 3-11. Terrestrial Vegetation observed at NAVSTANPT, August 2016.

Scientific Name	Common Name	Native/Alien (N/A)

Trees		
Acer rubrum	Red maple	N
Juniperus virginiana	Red cedar	N
Liquidambar styraciflua	Sweetgum	N
Nyssa sylvatica	Black gum	N
Pinus taeda	Loblolly pine	N
Prunus serotina	Black cherry	N
Quercus alba	White oak	N
Quercus velutina	Black oak	N
Shrubs/woody vines		
Baccharis halimifolia	Baccharis / Groundsel bush	N
Iva frutescens	High tide bush	N
Lonicera japonica	Japanese honeysuckle	A
Smilax rotundifolia	Common greenbrier	N
Toxicodendron radicans	Poison ivy	N
Forbs/Graminoids		
Distichlis spicata	Saltgrass	N
Phragmites australis	Common reed	A
Salicornia spp.	Glassworts	N
Spartina alterniflora	Smooth cordgrass	N
Spartina cynosuroides	Big cordgrass	N
Spartina patens	Saltmeadow cordgrass	N

3.6 Nearshore Terrestrial Wildlife

Birds were the only type of wildlife observed in the nearshore area of the NAVSTANPT during Versar's field studies in August 2016 (**Table 3-12**). None of the observed bird species are federal- or state-listed threatened or endangered; however, several are listed as a state Species of Concern by the Rhode Island Natural Heritage Program (Enser 2006). Species of Concern include species that are not currently considered state threatened or endangered but are listed due to various factors of rarity and/or vulnerability. Some species listed in this category may warrant endangered or threatened designation, but status information is presently not well known.

Table 3-12. NAVSTANPT Terrestrial Wildlife Observed[1], August 2016.

Common Name	Scientific Name	State Status	Observation Location of SOC
Double-crested Cormorant (B)	*Phalacrocorax auritus*	N/A	
Greater black-backed Gull (B)	*Larus marinus*	N/A	
Herring Gull (B)	*Larus argentatus*	N/A	

Laughing Gull (B)	*Larus atricilla*	N/A	
Ring-billed Gull (B)	*Larus delawarensis*	N/A	
Great Blue Heron (B)	*Ardea herodias*	SOC	Near N5 41° 33’56.35” N 71° 17’51.22” W
Black-crowned Night Heron (B)	*Nyticorax nycticorax*	SOC	Observed at least 13 individuals on north side of rock jetty 41° 32’08.81” N 71° 19’08.81” W
Great Egret (B)	*Ardea alba*	SOC	East end of rock jetty 41° 32’13.80” N 71° 18’52.08” W
Snowy Egret (B)	*Egretta thula*	SOC	Observed several individuals along Gould Island shoreline 41° 31’56.81” N 71° 20’33.83” W
American Oystercatcher (B)	*Haematopus palliatus*	SOC	Observed several individuals on north side of rock jetty 41° 32’03.57” N 71° 19”23.42” W
Osprey (B)	*Pandion haliaetus*	SOC	Fly-by at approximately: 41° 31’29.57” N 71° 18’59.49” W

B = confirmed nesting record(s) within Rhode Island, SOC = Species of Concern
Source: RIBird.org 2012, Rhode Island Natural Heritage Program 2006

A total of 11 bird species were observed at NAVSTANPT during the August 2016 nearshore surveys; all are considered to breed in the region either as resident or seasonally occurring species (see **Table 3-12**). The most commonly occurring species at the time of the surveys were greater black-backed gull (*Larus marinus*), double-crested cormorant (*Phalacrocorax auritus*), and herring gull (*Larus argentatus*), which were found in a variety of aquatic habitats. Six bird species that were identified at NAVSTANPT are listed as Species of Concern in Rhode Island: great blue heron (*Ardea herodias*), black-crowned night heron (*Nyticorax nycticorax*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), American oystercatcher (*Haematopus palliatus*), and osprey (*Pandion haliaetus*). All of these species have potential to breed in the vicinity but are not likely to nest at NAVSTANPT because of the lack of suitable habitat.

3.7 Marine Mammals and Sea Turtles

3.7.1 Effort and Sightings

Four surveys were conducted between May 2016 and February 2017 covering a total of 89 km of census transect and 11 hours and 51 minutes of survey time (**Table 3-13**; **Figure 3-9**). The only species that was sighted during the survey was harbor seal (*Phoca vitulina*). During the spring survey, one harbor seal was sighted on 12 May 2016. The seal was observed near the surface of the water near a rock outcropping, which is known haul out site (Moll et al. 2016). The seal engaged in several small dives during the encounter. A group of three harbor seals was sighted on 1 February 2017, during the winter survey. All three of the harbor seals were at the surface and watched the vessel pass. One dead harbor seal carcass was observed in the 12 May 2016 survey and reported to the Mystic Aquarium Stranding Network.

Table 3-13. Summary of NAVSTANPT marine mammal and sea turtle census surveys, May 2016 – February 2017.

Survey Date	Start Time (local)	Stop Time (local)	Total Survey (minutes)	Total Survey (kilometers)	Encounters – Harbor Seal	Group Size – Harbor Seal
12-May-16	7:58	11:38	220	29	1	1
14-Jul-16	7:54	10:24	150	25	0	0
13-Oct-16	7:56	10:57	181	16	0	0
1-Feb-17	7:55	10:35	160	19	1	3
TOTALS			711 min (11 hr 51 min)	89 km	2	4

hr = hour(s); km = kilometer(s); min = minute(s)

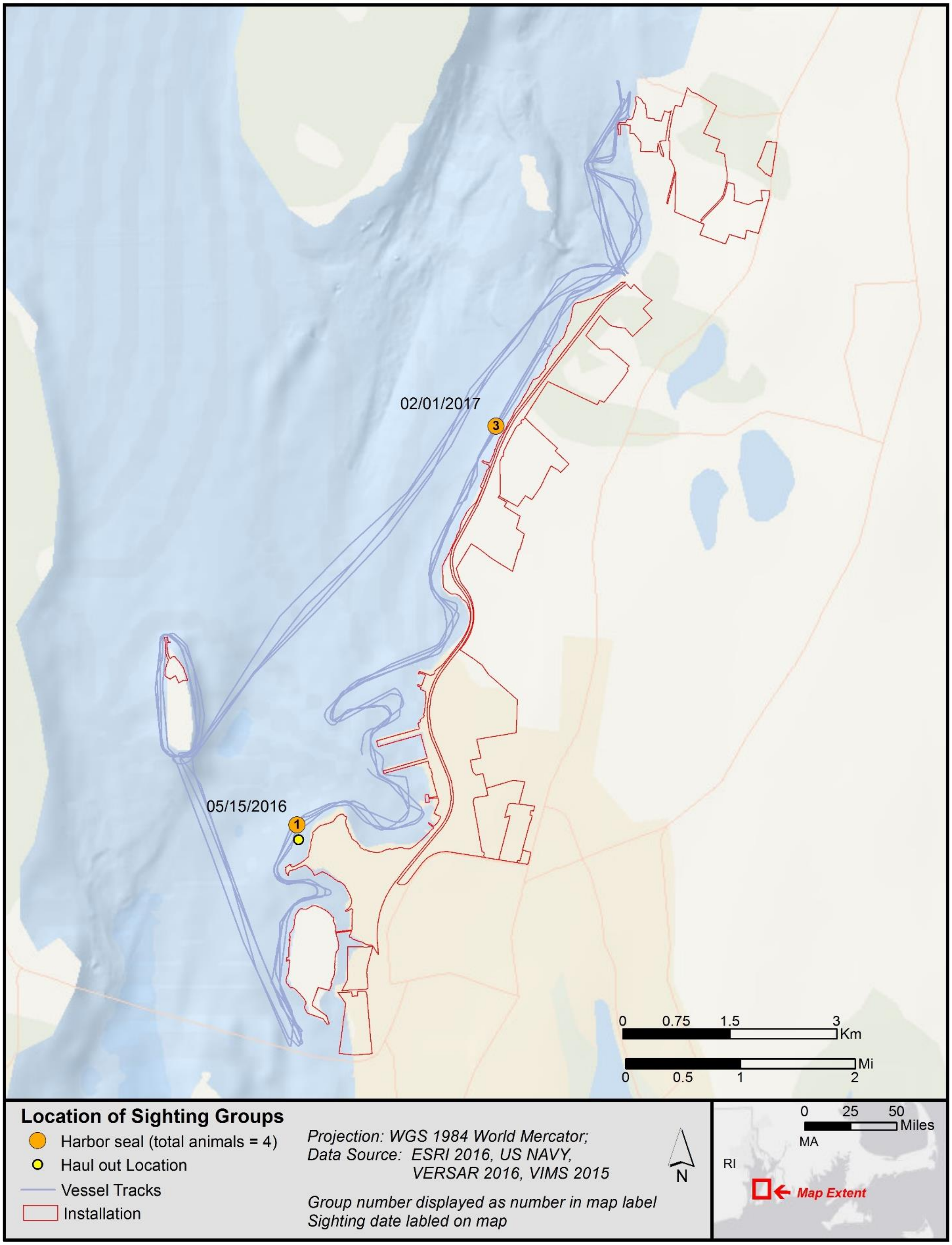


Figure 3-9. NAVSTANPT Nearshore Study Area Sightings and Vessel Track Marks.

4.0 DISCUSSION

4.1 Benthic Sediment and Species Composition

The sediment composition at all NAVSTANPT sites was primarily composed of sand due to the proximity of and open access to the coast. Gravel was frequently present and comprised a greater percentage of the sediment composition at intertidal sites, although gravel was also seen at subtidal sites. Silt and clay were also a large component of the sediment composition at the deeper, subtidal sites. The variability of sediment composition at these sites could be a reflection of seasonal processes and bottom topography. These findings concur with a generalized depiction of bottom sediments (Narragansett Bay National Estuarine Research Reserve 2009) in that silt and clay are found in deeper channels but indicate more gravel is present in the nearshore areas than previously mapped.

Benthic species inhabiting the nearshore habitats of NAVSTANPT were typical of the species observed in the Narragansett Bay area. The most common taxon found in the intertidal sediments were in the class Polychaeta (bristle worms), including *Parapionosyllis longicirrata*, *Spiochaetopterus costarum*, and members of the catworm family (Nephtyidae). The number of taxa found in the shallower intertidal zone was notably lower than the subtidal samples, which is typical of the coastal intertidal zone. Most species in the intertidal are adapted to survive stressful environments in which water depths change approximately 0.9 to 1.2 m (3 to 4 ft) every 12 hours. The subtidal zone is also less susceptible to wave action, currents, and extreme weather conditions, allowing a diversity of benthic species to settle in these habitats in higher abundances. Additionally, many benthic organisms, especially bottom feeders, prefer the silty sediments of the subtidal over the coarser granules of sand, gravel, and cobble because these soft-bottom sediments have a higher organic content. The mix of silt, sand, and gravel in the subtidal may also support a higher diversity of benthic species than the intertidal because the various grain sizes can provide a variety of microhabitats in which organisms can find refuge. Overall, the number of unique taxa observed followed seasonal patterns consistent with the environmental and subtidal zones.

4.2 Water Quality and Chemistry

The limited number of water samples collected seasonally for 1 year by the GMI-AECOM team do not provide enough data to demonstrate trends in water quality in the nearshore environment at NAVSTANPT; however, long-term water monitoring data are available from state and national sources and are discussed here in comparison to the observed 2016-2017 water quality measurements recorded in the study area. Regional data from two sampling stations located in proximity to the installation are used in the following discussion. The two sampling stations, one at the southern tip of Prudence Island, approximately 4.8 km (3 miles) north of NAVSTANPT, and one at Potters Cove in Jamestown, approximately 6.4 km (4 miles) southwest of the installation are part of the NOAA National Estuarine Research Reserve System (NERRS), which has been collecting water quality and nutrient data in the Bay since 2002 (NERRS 2017). Comparisons of the data and any notable seasonal trends are discussed below.

Seasonal water temperatures at NAVSTANPT showed similar trends across all sites with a predictable seasonal cycle of the lowest average temperatures (4.2ºC) occurring in the winter and the highest average temperatures (21.9ºC) occurring in the summer. The observed temperatures were within the range of published temperatures for the Prudence Island sampling site, which ranged from -2.0ºC in winter to just over 25.6ºC in summer (NERRS 2017). Of note is the documented increase in temperatures from historical temperatures in Narragansett Bay. Since the 1890s, mean temperatures in the lower Bay increased from about 3.1˚C in winter and 18.7˚C in summer to current levels, with most of the increase occurring in recent years (NERRS 2009). Temperature increases have had an effect on the Bay's ecology including changes in phenology of seasonal phytoplankton blooms and dominant fish species that occur (Smith et al. 2010).

DO levels also follow a seasonal pattern, with the highest levels in winter when biological activity is low and lowest levels in the summer when respiration rates are higher and oxygen solubility is lower. The observed average winter levels of DO (10.7 mg/L average) and average summer levels (7.7 mg/L average) at NAVSTANPT were within the range of published data (2.5 mg/L to 13.6 mg/L) from the Prudence Island sampling station (NERRS 2017). The minimum DO level observed, 1.6 mg/L, is indicative of hypoxic conditions (DO levels below 3.0 mg/L). Hypoxia is caused by excess nutrient pollution, primarily from human activities such as agriculture and wastewater, although warming temperatures and nitrogen fluxes contribute significantly to the occurrence of hypoxic events. Large hypoxic events can cause fish kills and may be responsible for die-offs of certain mussel species in Narragansett Bay (Narragansett Bay National Estuarine Research Reserve 2009); however, the deeper, colder waters of the East Passage are less susceptible to hypoxia than the warmer shallower waters of other portions of the Bay (Melrose et al. 2007).

Typically, salinity levels vary seasonally in the Bay in response to increased riverine inputs in winter and lower inputs in summer. At NAVSTANPT, however, the salinity measurements varied little between sites and seasonally. Across all observations the lowest salinity was 29.19 ppt in the summer. The highest observed salinity across all sites was also during the summer with a value of 31.93 ppt. Most of the readings (92%) were above 30 ppt, which is classified as euhaline. Euhaline waters are waters with a salinity between 30 and 35 ppt and are typical of most marine and oceanic waters. The observed salinity readings are within published range of 17.4 to 37.9 ppt (NERRS 2017).

Turbidity measurements were provided to evaluate the general clarity of the water and are an important indicator of how much light penetrates the water. Seasonally, water is typically clearest in winter and more turbid in summer, though it also can be influenced by external factors such as biological activity, weather, wind, freshwater run-off, tidal cycles, and human disturbance when collecting in situ measurements. Values amongst all NAVSTANPT sites varied from 0.0 to 16.3 NTUs, with the lowest measure in the winter and the highest in the fall. The observed levels were well within the range of published turbidity for the Bay, which range from below 0 to 2,054 NTUs (NERRS 2017).

Sufficient nutrient levels in freshwater and estuarine ecosystems are essential for aquatic plants, algae, and phytoplankton productivity; however, excessive nutrients can lead to an increased production rate of organic matter within the ecosystem, causing eutrophication and may result in hypoxia. Nitrogen and nitrate-nitrite are key indicators of nutrient loading resulting from agricultural runoff or wastewater treatment facilities. Kjeldahl nitrogen levels in all GMI-AECOM samples were below the detection limit, whereas mean nitrate-nitrite levels ranged from 0.72 mg/L to 2.05 mg/L. Nitrate-nitrite levels measured at the Potters Cove sampling station ranged from 0.005 mg/L to 0.26 mg/L (NERRS 2017). Regional data were not found for phosphorus and TSS for comparison with the GMI-AECOM sample data.

4.3 Fish and Invertebrate Community

The fish and invertebrate community assessments were conducted using trawls, seines, and ichthyoplankton tows. The use of these three different techniques allowed for community assessments across life stages by using different gear sizes and locations (nearshore and offshore).

4.3.1 Fisheries Assessment

The inshore seine surveys during this study showed fish and invertebrate communities that were primarily composed of lower trophic level forage species and were less diverse than the nearshore trawl communities. Unlike the seine samples, the trawl samples consisted mainly of predatory fish and very few forage species in all seasons except for winter, which was dominated by sand shrimp, a forage crustacean.

In addition to differences in community structure between inshore seines and nearshore trawls, strong seasonal changes in fish and invertebrate communities were observed at NAVSTANPT. The general trends observed were typical of temperate species that migrate nearshore during warmer temperatures and move further offshore to seek refuge from the colder winter temperatures (Cushing 1990; Sims et al. 2001).

In total, spring trawls across all sites produced a total of 13 species with juvenile Atlantic cod predominating over all species. The five most commonly caught species were Atlantic cod with an average of 25,157 individuals per square kilometer; scup/porgy with an average of 1,739 individuals per square kilometer; winter flounder (*Pseudopleuronectes americanus*) at 1,400 individuals per square kilometer; bay anchovy (*Anchoa mitchilli*) at 1,254 individuals per square kilometer; and spotted hake (*Urophycis regia*) at 1,217 individuals per square kilometer.

As expected, summer trawls had the greatest number of species with a total of 16 taxa represented. During the summer, the top five observed species were longfin inshore squid with an average of 19,168 individuals per square kilometer, scup/porgy (10,847 individuals per square kilometer), black sea bass (8,924 individuals per square kilometer), northern sea robin (2,965 individuals per square kilometer), and smallmouth flounder (2,333 individuals per square kilometer).

As temperature began to cool in the fall, the overall number of taxa declined to 13 species. Black sea bass (3,606 individuals per square kilometer) were the dominant species followed by scup/porgy (2,554 individuals per square kilometer), tautog (1,121 individuals per square kilometer), longfin squid (929 individuals per square kilometer), and summer flounder (864 individuals per square kilometer).

Winter trawl surveys had the lowest number of taxon observed with eight taxa total. Sand shrimp averaged 76,269 individuals per square kilometer. The presence of the sand shrimp likely attracted other demersal predators that were also observed in the catches: spotted hake (1,655 individuals per square kilometer), rock gunnel (*Pholis gunnellus*, 1,229 individuals per square kilometer), red hake (*Urophyscis chuss*, 680 individuals per square kilometer), and cunner (*Tautogolabrus adspersus*, 615 individuals per square kilometer).

The use of a beach seine allowed for the assessment of shallow inshore communities. The seine samples were dominated by small forage fish and crustaceans with a few instances of juvenile predatory fish. Interestingly, only two taxa were found in both trawl samples and seine samples. Both tautog and winter flounder were found across the sampling types with smaller individuals found in the seine (inshore) versus the trawl (nearshore) habitat. This transition of younger, smaller juveniles to deeper water as they grow is typical for many nearshore species.

Like the trawl surveys, the seine samples exhibited seasonal variation in species number and composition. Overall, seines produced the highest number of taxa in the summer and fall season when shallower waters were the warmest. Summer sampling had a total of seven species dominated by blueback herring averaging (5.5 individuals per seine) while fall sampling observed 11 taxa which were dominated by alewife (13.5 individuals per seine). During the spring and winter sampling, the taxon diversity was starkly different. A single green crab was observed in the spring season and no taxa were observed across all stations during the winter.

In total, 40 fish and invertebrate species were encountered during the four seasonal assessments. Longfin inshore squid was the most abundant species captured, which was followed by scup, black sea bass, Atlantic cod, and blueback herring.

4.3.2 Key Commercially Important Species

Throughout the sampling study, none of the species observed were state- or federal-listed threatened or endangered species; however, various commercially and recreationally important species were observed. Four of the key economic fish species that constituted larger portions of the trawl samples are described below.

Atlantic Cod

Cod - by New York. Forest, Fish and Game Commission

Atlantic cod support both important commercial and recreational fisheries. Stocks, currently in an overfished condition, have declined greatly due to overfishing, which continues to occur, and environmental changes (Mayo and Col 2006; Zemeckis et al. 2014). Atlantic cod are a marine demersal species that inhabit cool-temperate to subarctic waters. Along the east coast of the U.S., Atlantic cod occur from Greenland to North Carolina (Lough 2004). Data collected during surveys conducted by Northeast Fisheries Science Center (NEFSC) bottom trawl surveys (Lough 2004) and datasets from the University of Rhode Island, Graduate School of Oceanography and the RIDEM fish trawl surveys (Narragansett Bay Estuary Program 2017) indicate relatively few Atlantic cod occur in Narragansett Bay. Active spawning areas are located off the coast of Maine, New Hampshire, and Massachusetts and at Georges Bank, Block Island, and Cox Ledge south of Narragansett Bay.

On average, mature total length is 390 mm for males and 420 mm for females (O'Brien et al. 1993). Atlantic cod observed in the spring trawl samples during GMI-AECOM team study were juveniles ranging from 51-72 mm in total length (**Figure 4-1**).

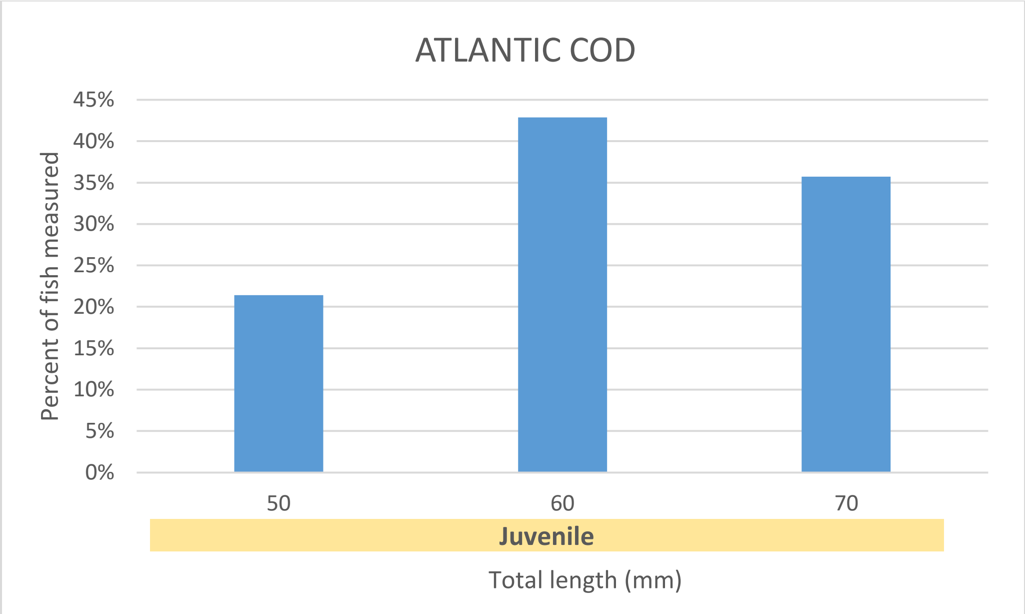
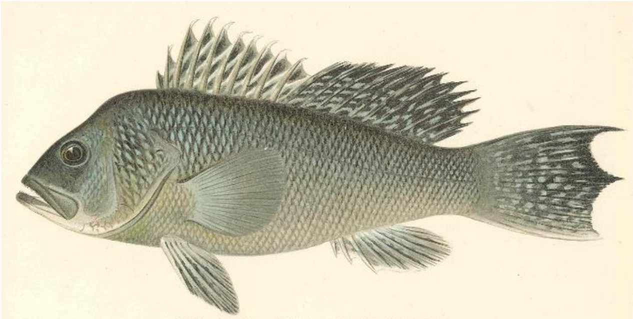


Figure 4-1. Length frequency of Atlantic cod measured during the NAVSTANPT trawl surveys. Percent of fish measured were binned in 10-mm increments. Fish less than 390 mm in total length were classified as juveniles.

Juvenile fish can be found on a wide range of sediment types which include sand to gravelly sand to gravel pavement. As their size increases, juveniles move towards gravel pavement habitat. The gravel and complex habitats may lead to greater survival by providing refuge from predators and increased food availability (Lough 2004).

<u>Black Sea Bass</u>



Black sea bass by New York Fish and Game Commission

Black sea bass are an important economic species supporting both recreational and commercial fisheries in the U.S. Black sea bass are warm-temperate species that range from southern Nova Scotia and the Bay of Fundy to southern Florida and into the Gulf of Mexico (Drohan et al. 2007). The northern stock is distributed primarily between Cape Cod and Cape Hatteras. Black sea bass are typically found on the continental shelf in complex habitats such as reefs and shipwrecks, but young of the year fish also occur in large numbers in structurally complex estuarine habitats including rocky reefs, cobble and rock fields, and mussel beds. They may also use man-made habitats such as artificial reefs, shipwrecks, bridge abutments, piers, and pilings (Drohan et al. 2007). Populations of this warm-water species have increased in Narragansett Bay in recent years (Narragansett Bay Estuary Program 2017).

Black sea bass migrate offshore and south in the fall and return north and inshore to coastal areas and bays in spring. During the summer, adult black sea bass are found generally at depths less than 37 m (120 ft) (Drohan et al. 2007). Currently, the stock is neither overfished or experiencing overfishing and in 2009 the stock was declared rebuilt (NEFSC 2017).

Mature adults ranged in size from 192 to 216 mm. Maturation length for black sea bass is considered to be 191 mm in total length (O’Brien et al. 1993). Fish observed during the GMI-AECOM spring, summer, and fall sampling periods consisted mostly of juveniles (91%) ranging in size from 68 to 176 mm (**Figure 4-2**).

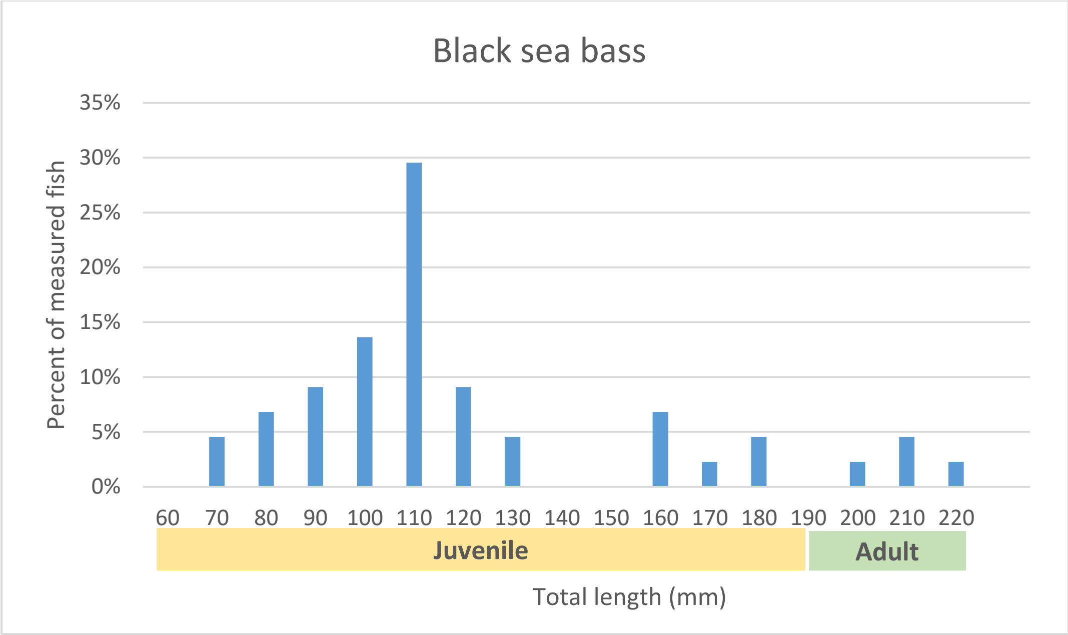
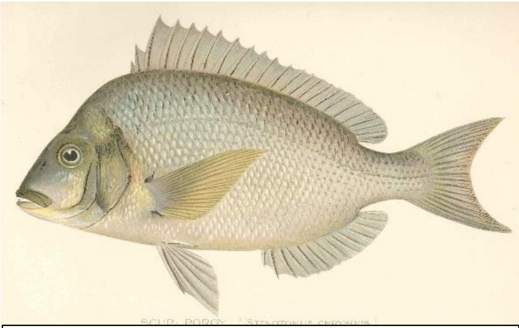


Figure 4-2. Length frequency of black sea bass measured during the NAVSTANPT trawl surveys. Percent of fish measured were binned in 10-mm increments. Fish less than 190 mm in total length were classified as juveniles.

Scup/Porgy



Scup/Porgy by New York Fish and Game Commission - New York

Scup/Porgy is an important recreational and commercial species along the Atlantic coast of the U.S. Scup are distributed primarily between Cape Coad and Cape Hatteras. As with black sea bass, this warm-water species has increased in Narragansett Bay in recent years (Narragansett Bay Estuary Program 2017).

Like many temperate fish species, they undergo a seasonal migration. In spring, they migrate north and inshore to New Jersey and southern New England where they remain until fall. Inshore habitat for adults and juveniles include areas of salinity mixing zones and are associated with sand, mud, and eelgrass. In addition to these nearshore mixing zones, juveniles also are found in estuaries and costal bays. Scup winter in offshore waters along the Continental shelf between New Jersey and North Carolina (Steimle et al. 1999). Currently, the stock is neither overfished or experiencing overfishing and, in 2009, the stock was declared rebuilt (NEFSC 2015).

Individuals typically reach maturity at 155 mm (O'Brien et al. 1993). Both juveniles and adults were observed during the trawl surveys with lengths ranging from 68 to 333 mm (**Figure 4-3**), with juveniles making up 62% of the observed catch.

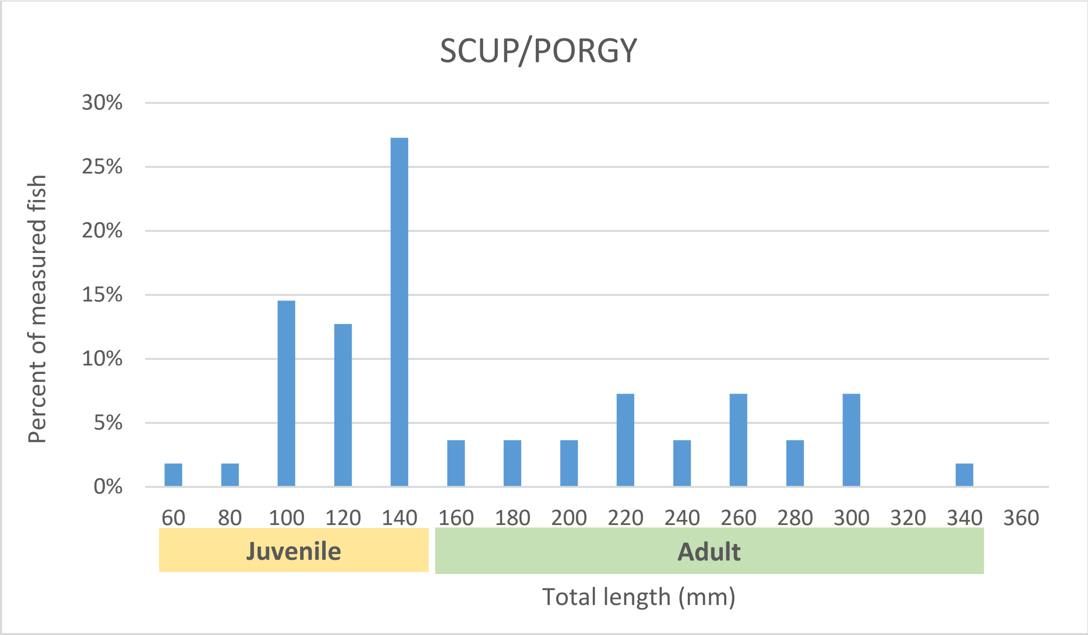


Figure 4-3. Length frequency of Scup/Porgy measured during the NAVSTANPT trawl surveys. Percent of fish measured are binned in 20-mm increments. Fish less than 155 mm in total length were classified as juveniles.

Summer Flounder

Summer Flounder by State of New York Forest, Fish, and Game Commission

Summer flounder is one of the most sought after commercial and recreational fish along the Atlantic coast. Summer flounder is another warm-temperature species that is increasing in Narragansett Bay (Narragansett Bay Estuary Program 2017)). Summer flounder are found in inshore and offshore waters from Nova Scotia to the east coast of Florida. Summer flounder arrive in April in the New York Bight and continue to move inshore during May and June. Summer flounder begin an offshore migration in September and are usually gone from the northern part of the range by October or November. Juvenile summer flounder make use of several different estuarine habitats. These habitats include marsh creeks, seagrass beds, mud flats and open bay areas. Adult summer flounder are generally associated with sandflats but have also been found on artificial reefs, mud flats, and mouths of estuaries (Packer et al. 1999). Currently, the stock is experiencing localized overfishing in some areas, but the overall stock is not overfished (Terceiro 2015).

Summer flounder mature around 249 mm for males and 280 for females (O'Brien et al. 1993). During the survey, five summer flounder were caught with sizes ranging from 215 to 429 mm in total length. At least 80% of the flounder caught were mature adults.

4.4 Submerged Aquatic Vegetation

Eelgrass contributes significantly to the health and productivity of Narragansett Bay. It plays an important role in coastal ecosystems because it provides critical habitat for juvenile marine life, helps stabilize surface sediments, and aids in filtering particles from the water column (Bradley et al. 2013). Dense eelgrass stands are particularly important as breeding and nursery areas for young finfish and shellfish and for providing protection from predators. Research in Rhode Island and elsewhere suggests that eelgrass habitats serve a functional role as refuges from predation for some prey fish. These findings have documented that eelgrass beds increase survivorship of species such as tautog (*Tautoga onitis*), cunner, and silversides (*Menidia menidia*) (Schwartz 2009). Eelgrass also supports a host of fauna including nematodes, polychaetes, oligochaetes, and bivalves, that provide food for fish such as winter flounder that feed on shrimp and sandworms living within the beds (NOAA 1999).

Historically, eelgrass beds occurred throughout the Narragansett Bay and could even be found in the more polluted areas of the upper Narragansett Bay and Providence River (Schwartz 2009). The current distribution of eelgrass in Narragansett Bay is patchy and is generally limited to shallow embayments with mud-sand substrata. Recent assessment efforts by the Rhode Island Eelgrass Mapping Taskforce indicated where areas of SAV occurred near NAVSTANPT. The Versar SAV survey confirmed several of the mapped locations (see **Figures 2-1** through **2-3**). As with eelgrass, macroalgae are also an important resource as food and/or shelter for a large range of fish, shellfish, and other invertebrate species, and they often act as nurseries for juvenile fish; however, many macroalgae may grow excessively in nutrient-enriched areas, causing problems such as hypoxia and smothering of fauna. The eelgrass observed at Points 14 and 15 was moderately dense and healthy but appeared to occur in only a narrow, patchy band on the west side of Coasters Harbor Island. The same was true for Points 7 and 8; the SAV observed here was moderately dense and healthy but appeared to occur in only a narrow, patchy discontinuous band close to the shore. The densest SAV was observed at Point 18 on the west side of Gould Island. It was green and nearly free of epiphytes. No SAV was found on the east side of Gould Island at Point 17.

In addition to the eelgrass documented at NAVSTANPT, benthic macroalgae species were recorded at all 17 sample sites by the GoPro camera during the SAV survey. As with eelgrass, macroalgae are also an important resource as food and/or shelter for a large range of fish, shellfish, and other invertebrate species, and they often act as nurseries for juvenile fish; however, many macroalgae may grow excessively in nutrient-enriched areas, causing problems such as hypoxia and smothering of fauna. The most frequently occurring species, dead man's fingers, is considered an invasive non-native species (Narragansett Bay Research Reserve 2010).

This species displaces native sea grasses and seaweeds and can be detrimental for native fish and invertebrate species as it can smother shellfish by preventing them from opening their valves and makes it difficult for invertebrates and fish to move among it and forage on the ocean floor (Narragansett Bay Research Reserve 2010).

Supplemental plantings at existing eelgrass beds or establishment of new beds would enhance SAV in the nearshore environments at NAVSTANPT, providing habitat for a variety of finfish, shellfish, waterfowl, and other wildlife, while improving water quality in the Bay. Sites with appropriate substrate, acceptable water clarity, and appropriate depth, as indicated by benthic habitat and sediment characteristic results, should be considered for restoration sites. Teaming with local restoration specialists such as the Rhode Island Eelgrass Task Force or Rhode Island University Graduate School of Oceanography would provide the needed expertise and help ensure planting success. However, as the most significant threats to eelgrass beds in Narragansett Bay are nutrient pollution from sewage and polluted runoff from the land (Rhode Island Habitat Restoration Team n.d.), ensuring compliance with all storm water quality regulations and reducing nutrient and sediment loads in runoff from base activities are measures that could help improve water quality and benefit SAV. Assessing shoreline conditions and identifying areas that could be stabilized with living shorelines and enhancing native vegetation cover in sparsely vegetated areas are recommended actions. In addition, participating in regional efforts to restore and/or enhance shellfish beds could help improve water clarity. Restoration and enhancement projects can be coordinated with by non-profit organizations (e.g. The Nature Conservancy or Save the Bay), federal agencies (e.g. NOAA or the Environmental Protection Agency), and/or academic institutions (e.g. University of Rhode Island). All projects must be conducted in partnership and/or in consultation with the Rhode Island Department of Environmental Management and Rhode Island Coastal Resources Management Council.

4.5 Nearshore Terrestrial Vegetation

The majority of the nearshore area at the NAVSTANPT consists of developed land with buildings and other infrastructure such as parking lots, roads, and other anthropogenic features. A fringe of upland shrub/scrub occasionally occurred along the shoreline at the installation. These areas were typically very dense and difficult to traverse and were dominated by non-native, invasive shrubs, and vines. A program of invasive species removal is recommended to control aggressive species such as Japanese honeysuckle, autumn olive, oriental bittersweet, and Japanese barberry from the forest and scrub/shrub areas to reduce competition with native vegetation and improve wildlife habitat.

4.6 Nearshore Terrestrial Wildlife

Many aquatic birds were observed along the north side of the long rock jetty to the north of Coddington Cove. In particular, a total of 13 black-crowned night herons were observed here during one pass in the boat. Interestingly, this rock jetty likely represents some of the best habitat for aquatic birds on the entire installation. It is not likely that any of these bird species breed on NAVSTANPT, as no appropriate habitat for the aquatic colonial nesters seems to exist at the facility. A total of 11 bird species were observed at NAVSTANPT during the August 2016 surveys, six of which are listed as state SOC. The SOCs include great blue heron, black-crowned night heron, great egret, snowy egret, American oystercatcher, and osprey. Of these osprey are known to nest on NAVSTANPT (Kam, NAVSTANPT Natural Resources Manager, personal communication).

4.6.1 Protected Species and Species of Concern

Great Blue Heron

Blue Heron by Alan D. Wilson

The great blue heron is a large-sized, blue-gray heron with a wide black stripe over the eye, a long s-shaped neck, long legs, and long, stout, yellow-orange bill (Cornell Lab of Ornithology 2017c). Great blue herons are listed as state Species of Concern for breeding populations by the Rhode Island Natural Heritage Program (Enser 2006). Great blue herons occur throughout most of North America and breed throughout Rhode Island. They mainly nest in trees but will also nest on the ground, in shrubs, and on structures such as duck blinds, channel markers, or artificial nest platforms. Breeding birds nest in rookeries that can have several hundred pairs.

Black-crowned Night Heron

Black-crowned night heron by Laitche

Black-crowned night herons are small black and gray herons with short yellow legs, short stout neck, and heavy pointed all-black bills (Cornell Lab of Ornithology 2017b). Juveniles are streaked brown with white spots on wings and yellow and black bills. Black-crowned night herons are listed as state Species of Concern for breeding populations by the Rhode Island Natural Heritage Program (Enser 2006). This species was hunted for plumes though the 1900s and populations were extirpated from the Rhode Island mainland and large islands by the 1970s (RIDEM 2015). The population increased to approximately 700 breeding pairs in 1983 and then declined to about 214 nests by 2013 (RIDEM 2015). Black-crowned night herons are solitary, mostly nocturnal foragers and colonial nesters, mainly nesting in trees on uninhabited islands. This species uses a wide variety of coastal habitat for foraging and can congregate in coastal areas during spring and fall migration. Primary threats to this species are introduction of predator species to islands habitats (facilitated by bridges), human disturbances of nesting and foraging habitat, and loss of habitat due to human activity and climate change (RIDEM 2015).

Great Egret


Great Egret by USFWS

The great egret is a large-sized, all-white heron with a long s-shaped neck, long, black legs, black feet, and a long, stout, yellow-orange or black and yellow bill (Cornell Lab of Ornithology 2017d). This egret is differentiated from other white egrets by the body size and build and leg, foot, and bill color. Great egrets are listed as state Species of Concern for breeding populations by the Rhode Island Natural Heritage Program (Enser 2006). After being extirpated from the state for decades in the early 1900s, the species returned to breed in Rhode Island in the 1960s (RIDEM 2015). The population increased to approximately 250 breeding pairs by 2003 and then declined to about 123 nests in 2013. Great egrets typically forage in salt marshes along the coast and nest mainly on uninhabited islands in Narragansett Bay and on Block Island (RIDEM 2015). Primary threats to this species are introduction of predator species to islands habitats (facilitated by bridges), human disturbances of nesting and foraging habitat, and loss of habitat due to human activity and climate change (RIDEM 2015). During spring and fall migration, this species may be observed in salt marshes.

Snowy Egret


Snowy Egret by Franco Folini

The snowy egret is a slender, medium-sized, all-white heron with long, thin black legs, yellow feet, and a long, slender, black bill with a patch of yellow skin at the base (Cornell Lab of Ornithology 2017e). This egret is differentiated from other white egrets by the body size and build and leg, foot, and bill color.

Snowy egrets are listed as Species of Concern for breeding populations by the Rhode Island Natural Heritage Program (Enser 2006). This species ranges throughout the Americas and is common in coastal areas throughout Rhode Island, though they are primarily known to nest on larger uninhabited islands in Narragansett Bay and on Block Island (RIDEM 2015). As with many birds, populations of snowy egret were decimated by plume hunters in late 1800s but have recovered since international treaties were adopted (National Audubon Society 2017). Nationwide, the number of breeding pairs has been a high conservation concern due to declining population trends (RIDEM 2015). They nest in colonies which are often quite large and may be occupied by other heron and egret species. They build stick nests in trees near fresh or salt water and forage along the shorelines (National Audubon Society 2017). Nests are usually 5-10 ft above the ground but sometimes as high as 30 ft. During spring and fall migration, this species may be observed in salt marshes. Primary threats to this species are introduction of predator species to islands habitats (facilitated by bridges), human disturbances of nesting and foraging habitat, and loss of habitat due to human activity and climate change (RIDEM 2015).

American Oystercatcher

American oystercatcher by Kevin Bercaw

The American oystercatcher is a large shorebird, with a long bright orange bill that specializes in catching bivalves. It is boldly colored with a black back, white underside, and orange bill and eye-ring (Cornell Lab of Ornithology 2017a). The American oystercatcher is listed as a state Species of Concern for breeding populations by the Rhode Island Natural Heritage Program (Enser 2006). Oystercatcher populations declined seriously in the 19th century as a result of intensive market hunting and egg collecting, then recovered in the 20th century and are currently doing fairly well in much of their range (National Audubon Society 2017). In the past four decades, the American oystercatcher has expanded their breeding distribution from the southern U.S. and is now a localized breeding species in Rhode Island. Breeding occurs on small predator-free islands in Narragansett Bay and Little Narragansett Bay where gulls and egrets also nest. During migration, American oystercatchers are uncommon and localized in Rhode Island (RIDEM 2015).

This species uses coastal beaches, tidal flats, and salt marshes with extensive sand beaches for feeding. The presence of food supplies such as oyster beds and clam flats is an important feature. American oystercatchers commonly nest on high, sandy sites such as dunes; low, flat, sandy areas with good cover; dredge spoil; or marsh islands. Oystercatcher nests consist of scraped out depressions in the sand that are lined with shells, pebbles, and bits of tide wrack (National Audubon Society 2017). Primary threats to this species are introduction of predator species to islands habitats (facilitated by bridges), human disturbances of nesting and foraging habitat, loss of habitat due to human activity and climate change, and oil spills (RIDEM 2015).

4.7 Marine Mammals and Sea Turtles

Previous surveys and literature have documented the presence of protected and endangered marine species in Narraganset Bay and Rhode Island Sound. Most of these documented species were not sighted during this project's surveys, and because of the temporal and spatial scope, the reported surveys were too limited to gather a representative sample size. At least 36 species of marine mammals (30 cetaceans, 5 seals, and 1 manatee) and 4 species of sea turtles have been sighted in the marine waters of Narragansett Bay, Block Island Sound, Rhode Island Sound, and nearby Atlantic continental shelf waters off the coast New England (Cetacean and Turtle

Assessment Program, University of Rhode Island 1982; Shoop and Kenney 1992; Waring et al. 2008). Furthermore, each of the species is protected under the ESA, the Marine Mammal Protection Act (MMPA), or both.

Kenney and Vigness-Raposa (2010) conducted a cumulative analysis that applied sightings per unit effort calculations to survey data, opportunistic sighting data, stranding records, and fishery bycatch records in order to predict the seasonal relative abundance of sea turtles and marine mammals within the area between 70°W and 73°W and north of 39°30'N ("Rhode Island study area"). The researchers used the abundance estimates to define each species by occurrence. Occurrence for all 36 species were categorized as extinct, hypothetical, rare (<10 records), regular (10-100 records), or common (>100 records). The NAVSTANPT nearshore study area is considerably smaller and less ecologically diverse then the "Rhode Island study area"; however, one can infer that animals sighted in the larger study area can be used as a baseline list of marine mammals and sea turtles that have been sighted within or near the NAVSTANPT nearshore study area. Non-pelagic marine mammal and sea turtle species reported by Kenney and Vigness-Raposa (2010) to be common or regular are listed in **Table 4-1** and can be considered species that have been known to inhabit the NAVSTANPT nearshore study area.

Table 4-1. Non-pelagic, marine mammal and sea turtle species reported by Kenney and Vigness-Raposa (2010) to be common or regular in area that includes the NAVSTANPT study area.

Species	ESA Listing	Occurrence Class
Class Mammalia:		
Order Cetacea: whales, dolphins, and porpoises		
Family Balaenidae - right whales		
North Atlantic right whale *(Eubalaena glacialis)*	Endangered/MMPA	Common
Family Balaenopterdae- rorquals		
Humpback whale (*Megaptera novaeangliae*)	Endangered/MMPA	Common
Fin whale (*Balaenoptera physalus*)	Endangered/MMPA	Common
Common minke whale (*Balaenoptera acutorostrata*)	MMPA	Common
Family Phocoenidae – porpoises		
Harbor porpoise (*Phocoena phocoena*)	MMPA	Common
Family Delphinidae – dolphins		
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	MMPA	Common
Common bottlenose dolphin (*Tursiops truncatus*)	MMPA	Common
Short-beaked common dolphin (*Delphinus delphis*)	MMPA	Common
Striped dolphin (*Stenella coeruleoalba*)	MMPA	Regular
Order Carnivora: carnivores		
Family Phocidae – seals		
Harbor seal (*Phoca vitulina)*	MMPA	Common

Species	ESA Listing	Occurrence Class
Gray seal (*Halichoerus grypus)*	MMPA	Common

Table 4-1. Non-pelagic, marine mammal and sea turtle species reported by Kenney and Vigness-Raposa (2010) to be common or regular in area that includes the NAVSTANPT study area (Cont'd).

Species	ESA Listing	Occurrence Class
Harp seal (*Pagophilus groenlandicus*)	MMPA	Common
Hooded seal (*Cystophora cristata*)	MMPA	Regular
Class Reptilia:		
Order Testudines: turtles		
Family Dermochelyidae – leatherback sea turtle		
Leatherback sea turtle *(Dermochelys coriacea)*	Endangered	Common
Family Cheloniidae – hard-shelled sea turtles		
Loggerhead sea turtle *(Caretta caretta)*	Threatened	Common
Kemp's ridley sea turtle *(Lepidochelys kempii)*	Endangered	Regular

MMPA = Marine Mammal Protection Act

Common = >100 total records
Regular = 10 –100 records

<u>Harbor Seals</u>

Adult harbor seals are usually between 1.7 and 1.9 m long with males being slightly larger than females (NOAA 2016) (**Figure 4-4**). They vary in color from light grey to almost black and may have dark block spots with an abdomen that is lighter in color than the rest of the body. The harbor seal has a rounded head with a concave face and eyes that are close to the nose. A distinctive feature is that the nostrils are close together and when viewed head on, they look like a "V". They are usually gregarious and haul out together, sometimes by the hundreds. Harbor seals are found mostly in temperate coastal regions and use sandy or rocky sites as haul out and pupping areas. Their southern range is from North Carolina to Canada. They eat schooling fish, ground fish, and octopus. Harbor seals are not listed under the ESA or on the Rhode Island state list; however, they are protected under the MMPA.

Figure 4-4. An adult and juvenile harbor seal. Illustration credit – OBIS Sea Map.

Harbor seals are the most common seals in the U.S. The best current abundance estimate of harbor seals is 75,834 (CV=0.15), which is from a 2012 population estimate for the harbor seal in New England waters (NOAA 2017). They are also common inhabitants of Narragansett Bay from October through April or early May where they overwinter in the Bay's relatively warm and protected waters. The number of seals in Narragansett Bay has increased over the last few decades due to the MMPA of 1972 and the ending of a bounty on seals in the early 1960s (Kenney 2014). The largest number of harbor seals recorded during annual surveys by Save the Bay was 603 in 2016 (The Newport Daily News 2016).

Currently, 20 haul out sites are known throughout Narragansett Bay (Moll et al. 2016); nearly all are rocky ledges and isolated rocks that are mostly submerged at high tide. One haul out site located at NAVSTANPT near Coddington Point has been studied by the Navy since 2010 and was the focus of a pinniped haul out and photo identification study conducted during the 2014 - 2015 and 2015 - 2016 seasons (Moll et al. 2016). The site is a rock outcropping known as “the Sisters” that is completely submerged at high tide but can provide space for more than 40 seals to haul out at low tide (Moll et al. 2016). Since monitoring began at this site, 1,644 seals have been observed during 129 survey days. Over the course of the study, seals were observed on approximately 67% of observation days, with an overall average of 18.8 seals per day on days when seals were observed. Between 2010 and 2016 the average count of seals per day increased from 7 to 22 (Moll et al. 2016).

The harbor seal observation made on 12 May 2016 during the GMI-AECOM JV survey was a single individual milling and diving in the water near the Sisters haul out site (see **Figure 3-9**). The sightings made on 1 February 2017 were in the water approximately 6 km north of the Sisters.

5.0 CONCLUSIONS

The four seasonal surveys conducted at NAVSTANPT from the spring 2016 to winter 2017 contribute to the Navy's knowledge and understanding of the nearshore environment and its characteristic flora and fauna. This survey met the objectives identified by the Navy to record and analyze baseline data for the benthos, water quality, fish and invertebrate community, SAV, intertidal flora and fauna, and any marine mammal and sea turtle that may occur in the nearshore areas of Aquidneck and Gould Islands in the Narragansett Bay.

Survey results from NAVSTANPT largely indicate conditions in the base's nearshore environment are comparable to conditions in the greater Narraganset Bay. Benthic sediments and faunal communities showed seasonal variability and were consistent with subtidal and intertidal habitats in which they occurred. Similarly, water quality parameters also showed seasonal variability and, with the exception of the mean summer nitrate-nitrite value, were within the range of regional published values from sampling stations located in the vicinity of the installation. It is not known if the increase in nitrate-nitrite was a regional or local event as regional data were not yet available for the summer of 2016 as of this writing. Extremely low DO oxygen levels were also recorded during the summer sample season at one sample station. Although excessive nitrogen levels contribute to low DO conditions, the highest nitrogen concentrations were recorded at NEWP-Sub3 in the center of the base and NEWP-Sub4 at Gould Island, whereas the low DO was recorded at Trawl A in the north part of the base.

The intertidal seining and subtidal trawls identified a diverse fish and invertebrate community with a total of 40 individual fish and invertebrate species captured during the four seasonal assessments. The inshore seine surveys showed fish and invertebrate communities that were primarily composed of lower trophic level forage species, whereas the trawl samples indicated a community that primarily consisted of predatory fish. Although no rare, threatened, or endangered fish or invertebrate species were encountered during the surveys, a large number of juvenile and adult commercially important species were encountered confirming the importance of this vital estuarine habitat.

Surveys conducted with underwater GoPro video found an abundant and diverse community of both benthic macroalgae (e.g., seaweed) and seagrass. Eelgrass was documented on 5 of the 18 sample points (28% of the sample points), which included SAV points 7, 8, 14, 15, and 18. Continued restoration of eelgrass beds at NAVSTANPT would further enhance this rich community. The invasive green algae, dead man's fingers, was the most abundant algae encountered and was documented at all but one SAV sample site. Although impractical on a large scale, mechanical control of this species should be considered in restoration sites.

Because of the limited time spent surveying, the paucity of marine mammal and sea turtle sightings cannot be considered representative of the area. Several studies have shown at least 16 species of marine mammals and sea turtles to be common or regular inhabitants of Narragansett

Bay and nearby waters. Navy studies of seal haul out sites at NAVSTANPT further support the known occurrence of marine mammals in the area. Additional data from NOAA Fisheries' annual marine mammal stock assessments, the University of Rhode Island Graduate School of Oceanography, Save the Bay, and Rhode Island Coastal Resources Management Council can provide valuable long-term trends in the occurrence of marine mammals and sea turtles in the Bay and can help guide policy and management decisions.

6.0 LITERATURE CITED

Bradley, M., R. Hudson, M. C. Cole, K. Raposa, and A. MacLachlan. 2013. 2012 Mapping submerged aquatic vegetation (SAV) in Rhode Island coastal waters. University of Rhode Island, in collaboration with Save the Bay; the National Estuarine Research Reserve; and the U.S. Fish and Wildlife Service SNE/NYB Coastal Ecosystems Program, Providence, Rhode Island.

Buchanan, J. B. 1984. Sediment analysis. Second edition. Pages 41-65 *in* N. A. Holme and A. D. McIntyre, editors. Methods for the study of marine benthos. Blackwell Scientific Publications, Oxford, United Kingdom.

Cetacean and Turtle Assessment Program (CETAP). 1982. A characterization of marine mammals and turtles in the Mid- and North Atlantic areas. University of Rhode Island.

Cornell Lab of Ornithology. 2017a. All about birds: American oystercatcher. <https://www.allaboutbirds.org/guide/American_Oystercatcher/id>. Accessed 28 June 2017.

Cornell Lab of Ornithology. 2017b. All about birds: black-crowned night heron. <https://www.allaboutbirds.org/guide/Black-crowned_Night-Heron/id>. Accessed 28 June 2017.

Cornell Lab of Ornithology. 2017c. All about birds: great blue heron. <https://www.allaboutbirds.org/guide/Great_Blue_Heron/id>. Accessed 28 June 2017.

Cornell Lab of Ornithology. 2017d. All about birds: great egret. <https://www.allaboutbirds.org/guide/Great_Egret/id>. Accessed 28 June 2017.

Cornell Lab of Ornithology. 2017e. All about birds: snowy egret. <https://www.allaboutbirds.org/guide/Snowy_Egret/id>. Accessed 28 June 2017.

Cushing, D. H. 1990. Plankton production and year-class strength in fish populations: an update of the match/mismatch hypothesis. Advances in Marine Biology 26:249–293.

Drohan A. F, J. P. Manderson, and D. B. Packer. 2007. Essential fish habitat source document: black sea bass, *Centropristis striata*, life history and habitat characteristics. Second edition. National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service NE 200.

Enser, R. W. 2006. Rare native animals of Rhode Island. Rhode Island Natural Heritage Program, Rhode Island Department of Environmental Management, Providence, Rhode Island.

Gleason, H. A. and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. Second edition. Willard Grant Press. Boston, Massachusetts.

Heyer, W. R., M. A. Donnelly, R. W. McDiarmid, L. A. C. Hayek, and M. S Foster (eds). 1994. Measuring and monitoring biological diversity, standard methods for amphibians. Smithsonian Institution Press, Washington, D.C.

Jefferson, T. A, S. Leatherwood, and M. A. Webber. 1993. FAO species identification guide: marine mammals of the world. United Nations Environment Programme, Food and Agriculture Organization of the United Nations, Rome, Italy.

Kenney, R. D. 2014. Marine mammals of Rhode Island, part 5, harbor seal. <http://rinhs.org/uncategorized/marine-mammals-of-rhode-island-part-5-harbor-seal/>. Accessed 11 May 2017.

Kenney, R. D., and K. J. Vigness-Raposa. 2010. Marine mammals and sea turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and nearby waters: An analysis of existing data for the Rhode Island ocean special area management plan. Technical Report 10. University of Rhode Island. 10 June.

Lockwood, J. C. 1991. Seagrass survey guidelines for Maryland. National Marine Fisheries Service, Habitat and Protected Resources Division - Sandy Hook Laboratory. Highlands, NJ. Prepared for the Maryland Interagency Seagrass Policy Committee.

Lough, R. G. 2004. Essential fish habitat source documents: Atlantic cod, *Gadus morhua*, life history and habitat characteristics. Second edition. National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service NE 190.

Mayo, R. K., and L. A. Col. 2006. The 2005 assessment of the Gulf of Maine Atlantic cod stock. U.S. Department of Commerce, Northeast Fisheries Science Center Reference Document 06-02.

Melrose, D. C., C. Oviatt, and M. Berman. 2007. Hypoxic events in Narragansett Bay, Rhode Island, during the summer of 2001. Estuaries and Coasts 30(1):47-53.

Moll, T. E., J. S. Krumholz, G. H. Mitchell, C. G. Tompsett, T. E. Vars, and Z. D. Singer-Leavitt. 2016. 2015/16 annual progress report: haul-out counts and photo-identification of pinnipeds in Narragansett Bay, Rhode Island. Prepared for U.S. Fleet Forces Command, Norfolk, Virginia. December.

Narragansett Bay Estuary Program. 2017. State of Narragansett Bay and its Watershed. <http://nbep.org/the-state-of-our-watershed/technicalreport/>. Accessed 1 June 2017.

Narragansett Bay National Estuarine Research Reserve. 2009. An ecological profile of the Narragansett Bay National Estuarine Research Reserve. K. B. Raposa and M. L. Schwartz (eds.), Rhode Island Sea Grant, Narragansett, Rhode Island. <http://nbnerr.org/research-and-monitoring/publications/>. Accessed 1 March 2017.

Narragansett Bay Research Reserve. 2010. The Rhode Island marine and estuarine invasive species site. <http://www.rimeis.org/profiles.html>. Accessed 12 July 2017.

National Audubon Society. 2017. Guide to North American birds. <http://www.audubon.org/bird-guide>. Accessed 20 June 2017.

National Estuarine Research Reserve System (NERRS). 2017. System-wide monitoring program data export system. <http://cdmo.baruch.sc.edu/get/export.cfm>. Accessed 17 May 2017.

National Oceanic and Atmospheric Administration (NOAA). 1999. Essential fish habitat sources document: Winter flounder, *Pseudopleuronectes amaericanus*, life history and habitat characteristics. NOAA Technical Memorandum NMFS-NE-138.

National Oceanic and Atmospheric Administration (NOAA). 2016a. Automated wreck and obstruction system (AWOIS). <http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html. Accessed 28 February 2016.

National Oceanic and Atmospheric Administration (NOAA). 2016b. NOAA Fisheries. Harbor seal (*Phoca vitulina*). http://www.fisheries.noaa.gov/pr/species/mammals/seals/harbor-seal.html>. Accessed 15 June 2017.

National Oceanic and Atmospheric Administration (NOAA). 2017. Harbor seal (*Phoca vitulina vitulina*): Western North Atlantic Stock <https://www.nefsc.noaa.gov/publications/tm/tm241/137_F2016_harborseal.pdf>. Accessed 15 June 2017.

Naval Facilities Engineering Command, Northern Division. 1998. Phased underwater archaeological investigations in Narragansett Bay waters in the vicinity of Naval Education and Training Center and the Naval Undersea Warfare Center, NPT, RI. Prepared by The Cultural Resource Group Louis Berger & Associates. Contract N62472-97-D-1390.

Newport Daily News. 2016. Backyard & Beyond: Harbor seals are a true success story. On-line news article < http://www.newportri.com/newportdailynews/columns/backyard_and_beyond/backyard-beyond-harbor-seals-are-a-true-success-story/article_92fdd07a-228a-54a1-99bc-862039ef17bb.html>. Accessed 15 June 2017,

Northeast Fisheries Science Center (NEFSC). 2015. 60th northeast regional stock assessment workshop (60th SAW) assessment report. U.S. Department of Commerce, Northeast Fisheries Science Center Reference Document 15-08.

Northeast Fisheries Science Center (NEFSC). 2017. 62nd northeast regional stock assessment workshop (62nd SAW) assessment report. U.S. Department of Commerce, Northeast Fisheries Science Center Reference Document 17-03.

O'Brien, L., J. Burnett, and R. K. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. National Oceanic and Atmospheric Administration Technical Report National Marine Fisheries Service 113.

Orth, R. J., D. J. Wilcox, J. R. Whiting, L. S. Nagey, A. K. Kenne, and E. R. Smith. 2013. 2013 distribution of submerged aquatic vegetation in the Chesapeake Bay and coastal bays. Final Report to U.S. Environmental Protection Agency Grant Number CB96314501-0. Gloucester, Virginia.

Packer, D. B., S. J. Griesbach, P. L. Berrien, C. A. Zetlin, D. L. Johnson, and W. W. Morse. 1999. Essential fish habitat source document: summer flounder, *Paralichthys dentatus*, life history and habitat characteristics. National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service NE 151.

Pauly, D. 1980. A new methodology for rapidly acquiring basic information on tropical fish stocks: growth, mortality and stock-recruitment relationships. Stock assessment for tropical small-scale fisheries:154-172.

Rhode Island Department of Environmental Management (RIDEM). 2015. Rhode Island wildlife action plan update. Rhode Island Department of Environment, The Nature Conservancy, and Rhode Island University. <http://www.dem.ri.gov/programs/fish-wildlife/ wildlifehuntered/swap15.php>. Accessed 1 March 2017.

Rhode Island Natural Heritage Program. 2006. Rare native animals of Rhode Island. Revised March 2006.

Rhode Island Marine Archaeology Project. 2013. Shipwrecks and submerged cultural resources of Rhode Island. Second edition. Compiled and Edited by D. K. Abbass, Newport, Rhode Island.

Rhode Island Habitat Restoration Team. n.d. Rhode Island's Coastal Habitats: Seagrass. <http://www.edc.uri.edu/restoration/html/intro/sea.htm>. Accesses 20 October 2017.

RIBird.org. 2012. Rhode Island Checklist. <http://ribird.org/ri_checklist>. Accessed 11 May 2017.

Save the Bay. 2017. Fact and figures about Narragansett Bay. <http://www.savebay.org/bayfacts>. Accessed 1 March 2017.

Schwartz, M. 2009. Estuarine Habitats of Narragansett Bay In Narragansett Bay National Estuarine Research Reserve. Chapter 8. An Ecological Profile of the Narragansett Bay National Estuarine Research Reserve. K.B. Raposa and M.L. Schwartz (eds.), Rhode Island Sea Grant, Narragansett, Rhode Island. <http://nbnerr.org/research-and-monitoring/
publications/>. Accessed 1 March 2017.

Shoop, C. R., and R. D. Kenney. 1992. Distributions and abundances of loggerhead and leatherback sea turtles in northeastern United States waters. Herpetological Monographs 6:43–67.

Sims, D. W., M. J. Genner, A. J. Southward, and S. J. Hawkins. 2001. Timing of squid migration reflects North Atlantic climate variability. Proceedings of the Royal Society of London B, 268:2607-2611.

Smith, L., S. Whitehouse, and C. Oviatt. 2010. Impacts of climate change on Narragansett Bay. Northeastern Naturalist 17(1):77-90.

Steimle, F.W., C. A. Zetlin, P. L. Berrien, D. L. Johnson, and S. Chang. 1999. Essential fish habitat source document: scup, *Stenotomus chrysops*, life history and habitat characteristics. National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service NE 149.

Terceiro, M. 2015. Stock assessment update of summer flounder for 2015. U.S. Department of Commerce, Northeast Fisheries Science Center Reference Document 15-13.

United States Fish and Wildlife Service (USFWS). 1990. Field guide to the submerged aquatic vegetation of Chesapeake Bay. U.S. Fish and Wildlife Service Chesapeake Bay Estuary Program, Annapolis, Maryland.

Virginia Institute of Marine Science (VIMS). 2016. Research: nearshore ecology. Center for Coastal Resources Management. <http://ccrm.vims.edu/research/nearshore_ecology/index.html#nearshore>. Accessed 1 March 2017.

Waring, G. T., E. Josephson, C. P. Fairfield, and K. Maze-Foley (eds.). 2008. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2007. National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service -NE-205. Woods Hole, Massachusetts.

Zemeckis, D., M. Dean, and S. Cadrin. 2014. Spawning dynamics and associated management implications for Atlantic cod. North American Journal of Fisheries Management 34(2):424-442.

APPENDIX A: SITE PHOTOGRAPHS

Photo 1. View looking east at narrow margin of upland deciduous forest in the vicinity of the public boat ramp off Burma Road at NAVSTANPT, 10 August 2016. Principal tree species here included black cherry (*Prunus serotina*), red maple (*Acer rubrum*), northern red oak (*Quercus rubra*), and Eastern white pine (*Pinus strobus*). Principal shrubs and herbaceous plants in this location included smooth sumac (*Rhus glabra*) and autumn olive (*Elaeagnus umbellata*).

Photo 2. View looking east at the rocky shoreline to the south of Weaver Cove in the northern part NAVSTANPT, 10 August 2016.

Photo 3. View looking east at the shoreline in the southern part at NAVSTANPT, 10 August 2016. Note the sand/gravel beach exposed at low tide and the preponderance of maintained lawn grass in the mid-ground of the photo.

Photo 4. View looking west-northwest from the southern part of NAVSTANPT, at the Claiborne Pell Newport Bridge (Route 138), 10 August 2016. Note the small rocky outcrop in the foreground. Many similar small outcrops exist on this part of the Narragansett Bay; these provide habitats for aquatic birds, such as the double-crested cormorants in this picture.

Photo 5. View looking east at an old railroad bridge near the middle of the installation in the general vicinity of Lawton Valley Reservoir. The bridge spans a small unnamed tidal tributary that drains the reservoir.

Photo 6. View looking northeast at unused pilings near Coddington Cove, in the southern part of NAVSTANPT, 10 August 2016. Note that these pilings and other derelict structures provide important loafing and feeding habitats for aquatic birds such as greater black-backed gulls, herring gulls, and double-crested cormorants.

Photo 7. View looking east from the northern part of Coddington Cove at NAVSTANPT, 10 August 2016. Note the typical abrupt change from the aquatic habitats in the foreground to the scrubby upland habitats behind the rock and concrete seawall.

Photo 8. View looking southeast at a narrow parcel of upland deciduous shrub-scrub, along the Narragansett Bay shoreline, to the north of the rock seawall at NAVSTANPT, 10 August 2016. Note the dense mixture of shrubs and small trees and the abrupt, rocky shoreline.

Photo 9. Detail photo depicting the rock wall jetty in the Narragansett Bay, to the north of Coddington Cove at NAVSTANPT, 10 August 2016. Many aquatic birds were observed along the north side of the jetty during the early August 2016 Versar field studies. In particular, a total of 15 black-crowned night herons were observed here during one pass in the boat.

Photo 10. View looking east at the exposed sandy shoreline at low tide along the Narragansett Bay, to the immediate north of the McAllister Point Landfill at NAVSTANPT, 10 August 2016. An SAV bed was located at Data Point 7, shoreward of where this photo was taken.

Photo 11. View looking west at the east-central side of Gould Island at NAVSTANPT, 10 August 2016. Note typical abrupt change from the aquatic habitats in the foreground to the rocky shoreline to scrubby upland habitats.

Photo 12. View of Gould Island's rocky shoreline with greater black backed gulls, herring gulls, and ring-billed gulls at NAVSTANPT, 10 August 2016.

Photo 13. Spring sighting of one harbor seal at Naval Station Newport 12 May, 2016.

Photo 14. Winter sighting of three harbor seals at Naval Station Newport, 13 October, 2016.

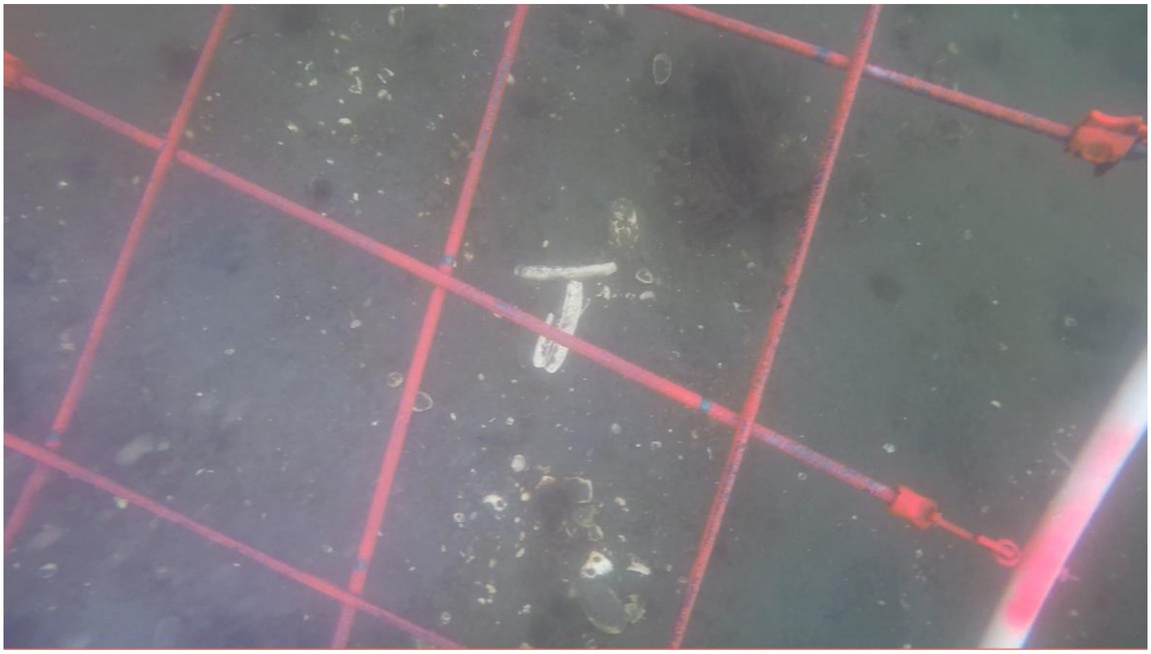


Photo 13. Sand, cobble, shell fragments, and red algae (*Agardhiella subulata)* at N1, 10 August 2016 from GoPro video.

Photo 14. Dead man's fingers (*Codium fragile*) at N2, 10 August 2016 from GoPro video.

Photo 15. *Cladophora* sp., and dead man's fingers at N3, 10 August 2016 from GoPro video.

Photo 16. A red algae (*Grateloupia turuturu*) and dead man's fingers at N4, 10 August 2016 from GoPro video.

Photo 17. Dead man's fingers and bladderwrack (*Fucus vesiculosus*) at N5, 10 August 2016 from GoPro video.

Photo 18. Dead man's fingers at N6, 10 August 2016 from GoPro video.

Photo 19. Eelgrass (*Zostera marina*) at N7, 10 August 2016 from GoPro video.

Photo 20. Dead man's fingers, a brown algae (*Cladostephus spongiosus)*, and green algae *(Fucus vesiculosus* and *Cladophora* sp.) at N8, 10 August 2016 from GoPro video.

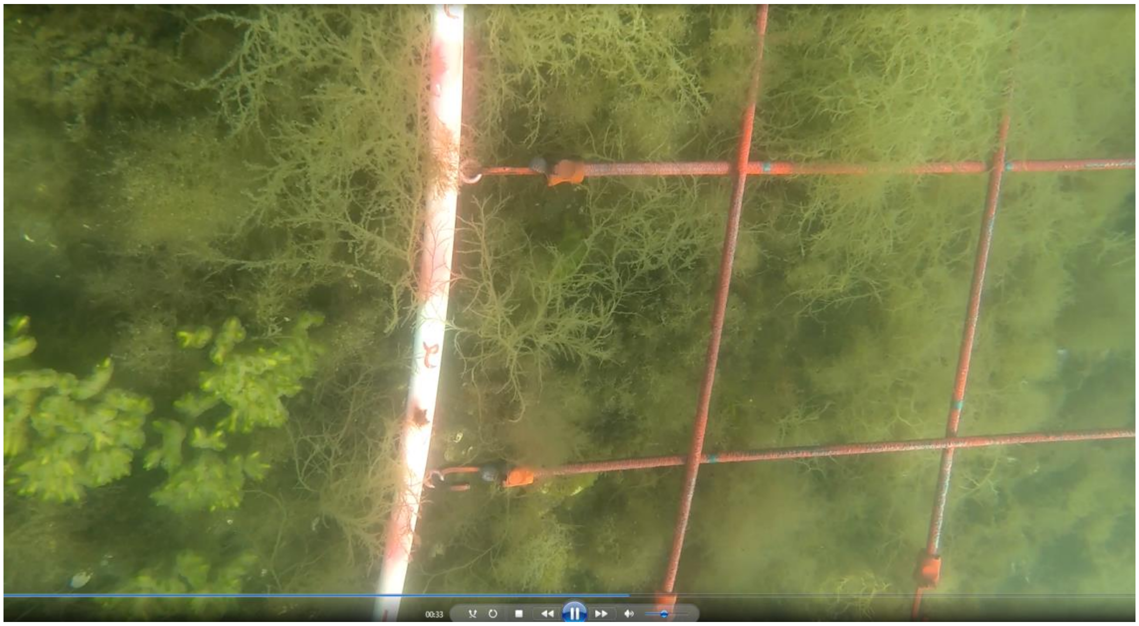


Photo 21. Dead man's fingers and green algae (*Fucus vesiculosus, Cladophora* sp.) N9, 9 August 2016 from GoPro video.

Photo 22. Green algae (*Fucus vesiculosus*, *Cladophora* sp.) and brown algae (*Sphaerotrichia divaricata*) at N10, 9 August 2016 from GoPro video.

Photo 23. Red algae (*Gloiosiphonia capillaris*) and green algae (*Cladophora* sp.) at N11, 9 August 2016 from GoPro video.

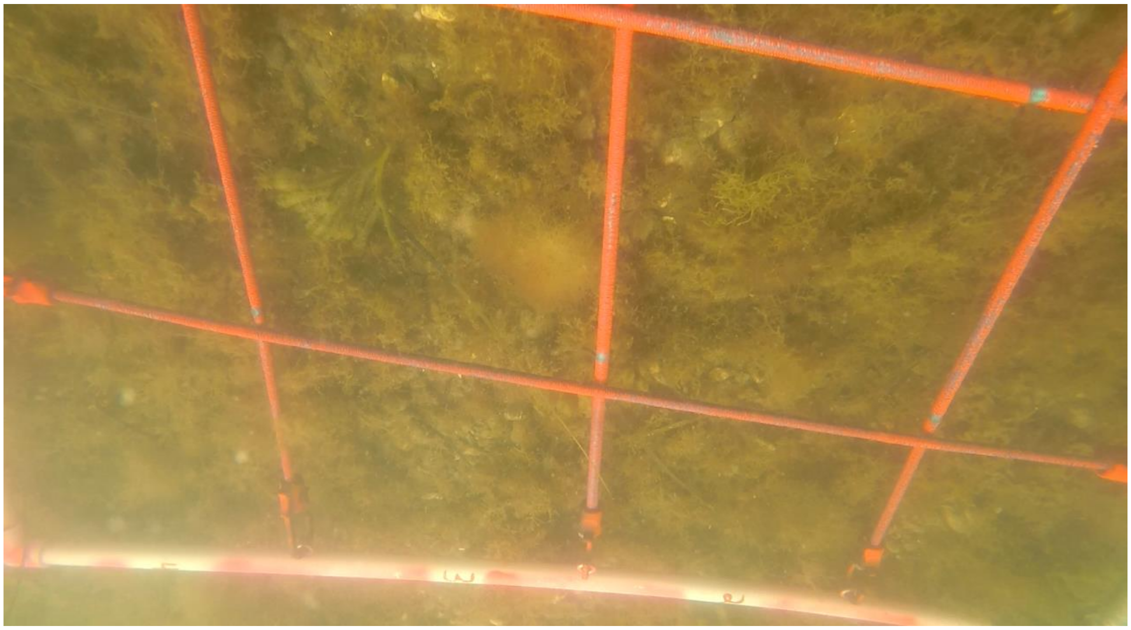


Photo 24. Dead man's fingers, green algae (*Cladophora* sp.), red algae (*Gloiosiphonia capillaris*) at N12, 9 August 2016 from GoPro video.

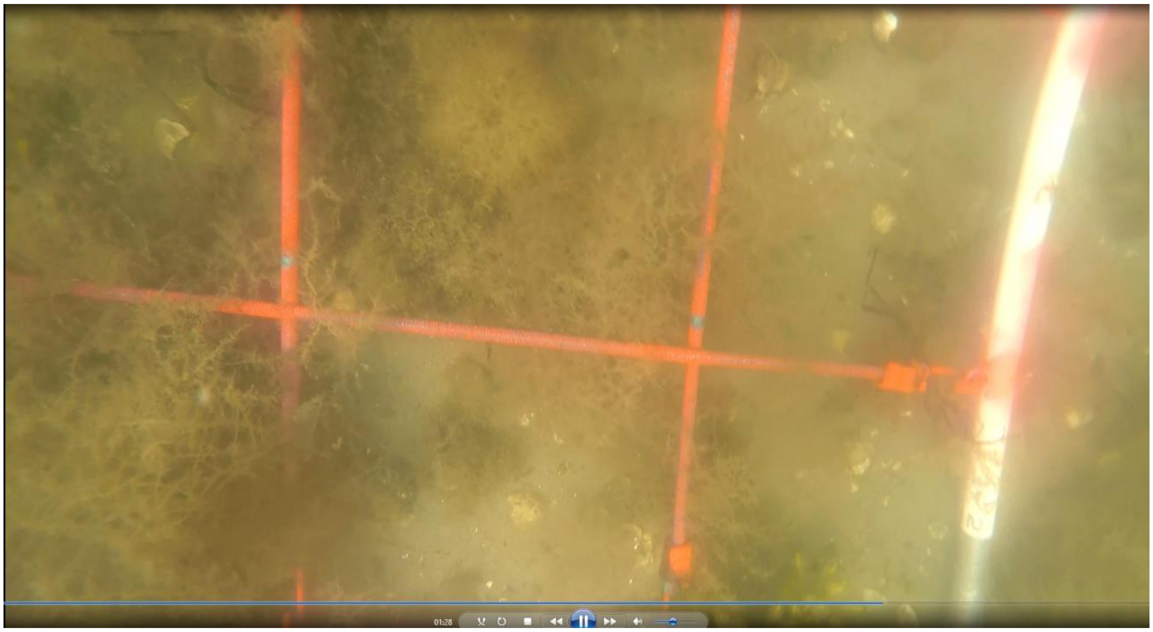


Photo 25. Dead man's fingers, green algae (*Cladophora* sp.), red algae (*Gloiosiphonia capillaris*), and brown algae (*Sphaerotrichia divaricata*) at N13, 9 August 2016 from GoPro video.

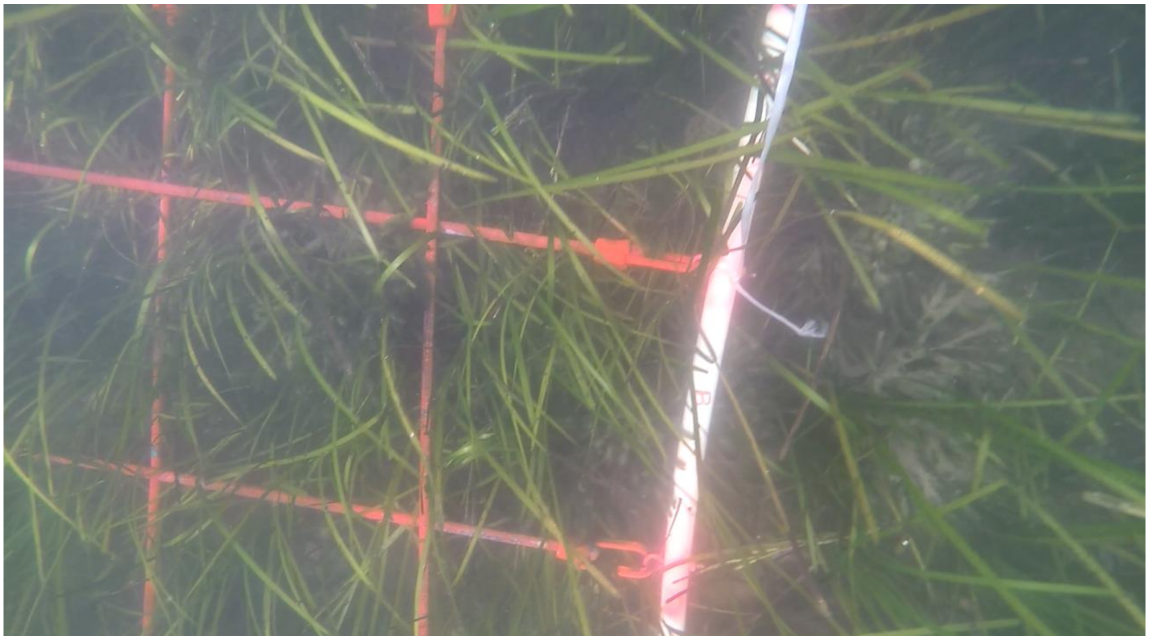


Photo 26. Eelgrass at N14, 9 August 2016 from GoPro video.

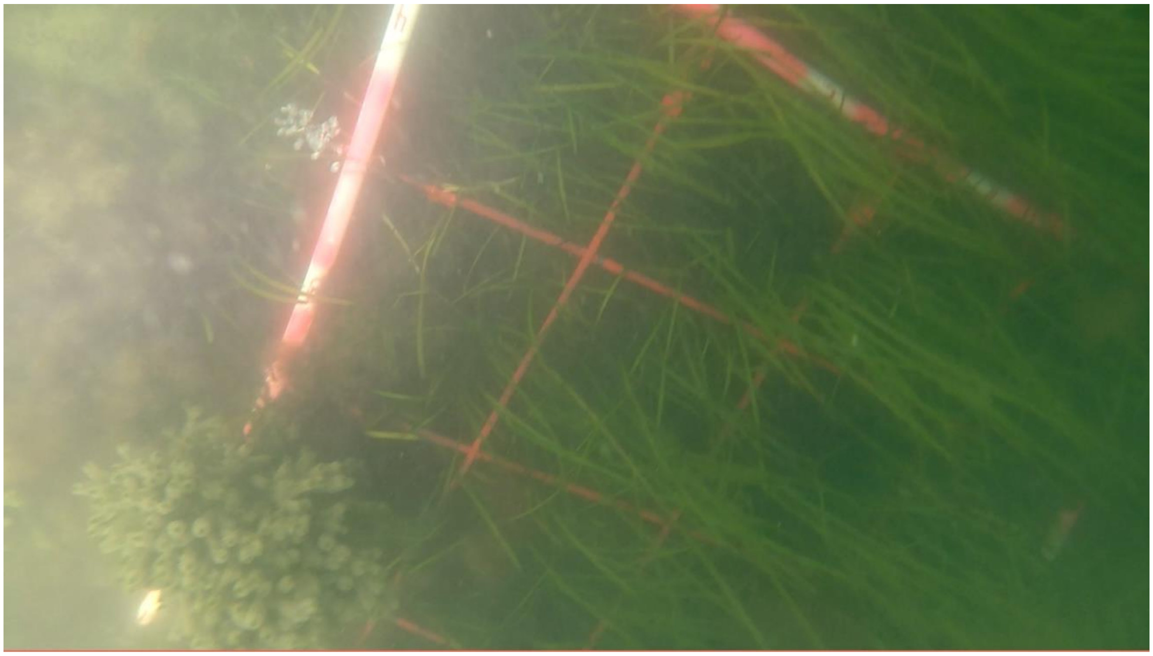


Photo 27. Eelgrass and dead man's fingers at N15, 9 August 2016 from GoPro video.

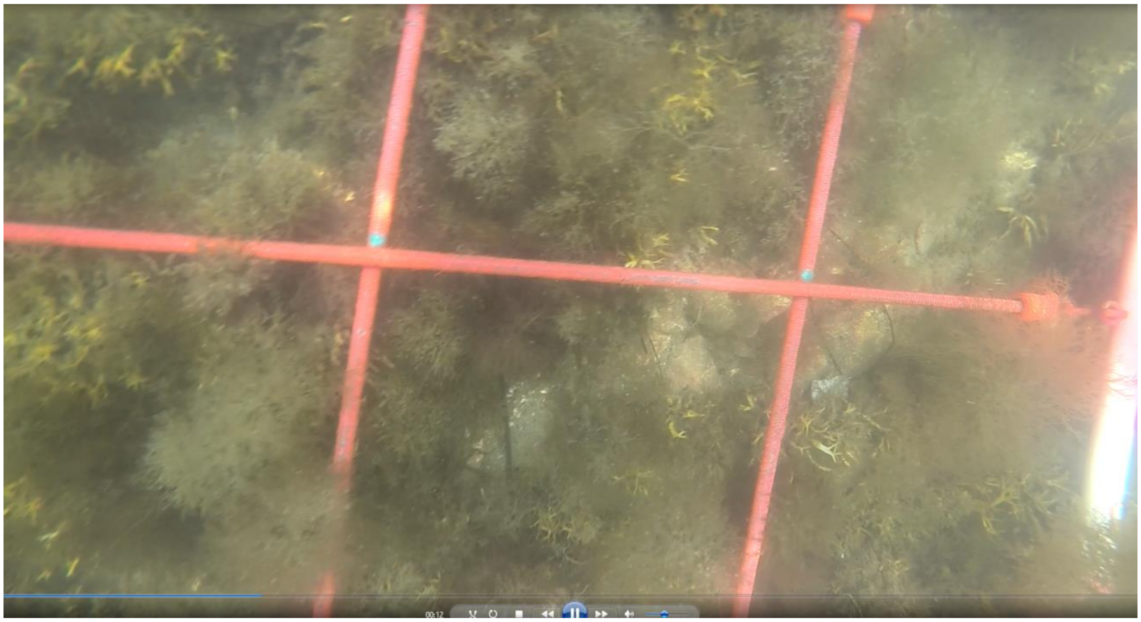


Photo 28. Green algae (*Cladophora* sp, *Cladostephus spongiosus*, *Codium fragile*, *Fucus* sp.) and brown algae (*Polysiphonia stricta*) at N16, 9 August 2016 from GoPro video.

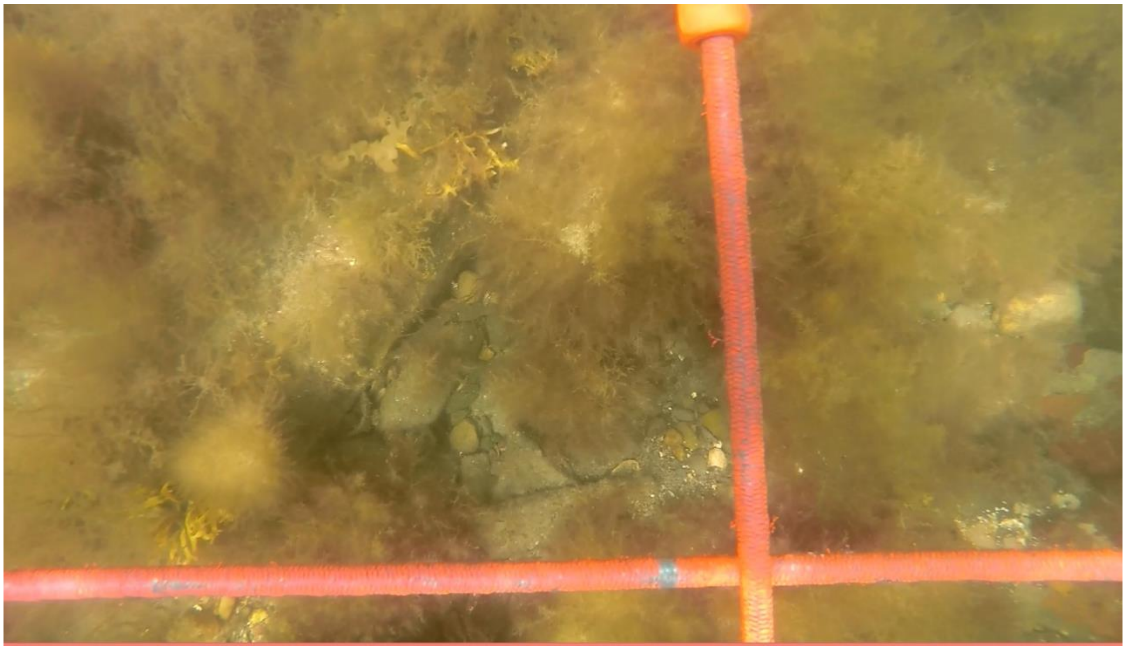


Photo 29. Green algae (*Cladophora* sp. *Cladostephus spongiosus*, *Fucus* sp.), red algae (*Gloiosiphonia capillaris*, and brown algae (*Polysiphonia stricta*, *Grateloupia turuturu*) at N17, 9 August 2016 from GoPro video.

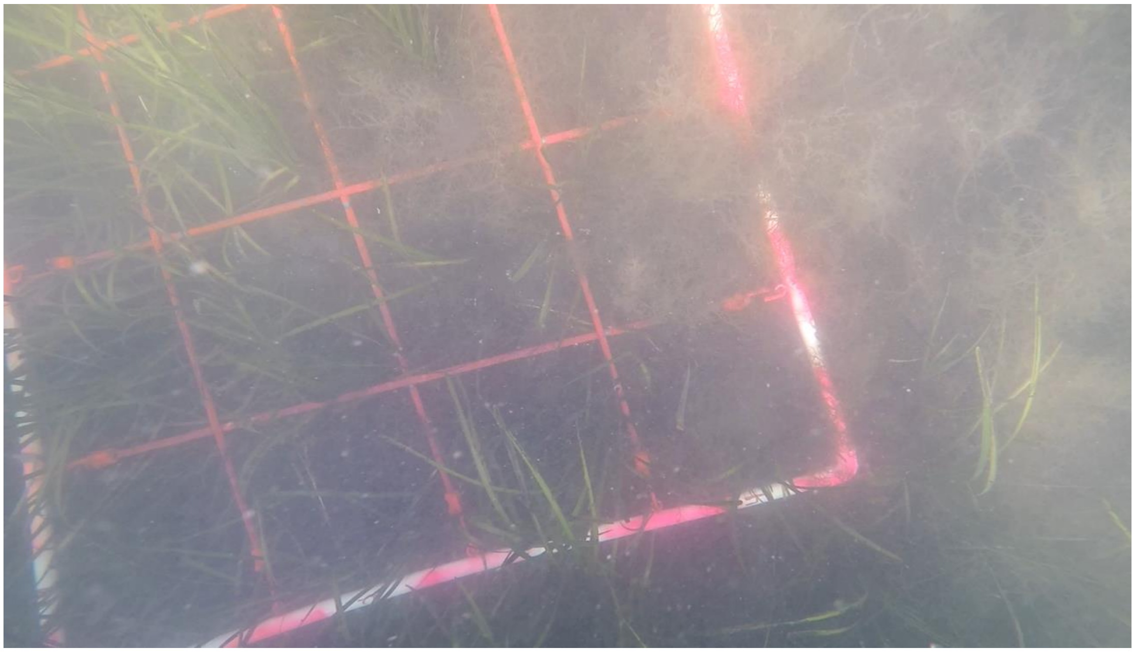


Photo 30. Eelgrass and brown algae (*Sphaerotrichia divaricata*) at N18, 9 August 2016 from GoPro video.

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APPENDIX B: PERMITS (ON DVD)

APPENDIX C: FIELD DATASHEETS (ON DVD)

APPENDIX D: SUBMERGED AQUATIC VEGETATION VIDEOS (ON DVD)

APPENDIX E: DATA TABLES (ON DVD)

APPENDIX F: ACCESS DATABASE (ON DVD)

APPENDIX G: GEO-DATABASE (ON DVD)

APPENDIX O

NAVSTA NEWPORT INSTRUCTION 5090.26B
RECREATIONAL FISHING PROCEDURES

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DEPARTMENT OF THE NAVY
NAVAL STATION NEWPORT
690 PEARY STREET
NEWPORT, RI 02841-1522

IN REPLY REFER TO:

NAVSTANPTINST 5090.26B
ENV
JUL 21 2014

NAVAL STATION (NAVSTA) NEWPORT INSTRUCTION 5090.26B

From: Commanding Officer, Naval Station Newport

Subj: NAVAL STATION NEWPORT RECREATIONAL FISHING PROCEDURES

Ref: (a) DoD Instruction 4715.3
(b) OPNAV M-5090.1, Environmental Readiness Program Manual
(c) Rhode Island Marine Fisheries Statute and Regulations Part VII dated March 19, 2014
(d) State of Rhode Island Fish and Wildlife Freshwater and Anadromous Fishing Regulations for the 2014-2015 Season
(e) 2014 Rhode Island Freshwater Fishing Abstract

Encl: (1) NAVSTA Fishing License Suspension/Revocation
(2) NAVSTA Fishing License Example
(3) Map of Installation Restoration (IR) Program Sites

1. *Purpose*. Establish policy, procedures and responsibilities for recreational fishing at NAVSTA.

2. *Cancellation*. NAVSTANPTINST 5090.26A

3. *Policy*

a. Per references (a) thru (e), it is DoD policy to allow recreational fishing at military installations in compliance with Federal and state regulations and best wildlife management practices. Fishing is controlled by the NAVSTA Commanding Officer (CO) by this locally published instruction which conforms to all Federal and state wildlife conservation statutes.

b. Violation of this instruction or references (a) through (e) may result in prosecution through applicable Federal and state laws, as well as suspension or revocation of NAVSTA fishing privileges per the guidelines in enclosure (1).

4. Responsibilities

a. Executive Officer

(1) Review the fishing policy annually as appropriate to base, state, and federal policy.

b. NAVSTA Environmental Program Manager

(1) Oversee the base fishing program as it relates to the management of wildlife resources.

(2) Provide policy guidance and recommendations to the command for the management of fish and wildlife resources.

(3) In cooperation with the NAVSTA Natural Resources Manager, coordinate and maintain the development and conservation of the base wildlife resources.

(4) Liaise with Rhode Island Department of Environmental Management, Division of Fish and Wildlife personnel as necessary.

(5) Resolve disputes over the management and harvesting of fish and assist NAVSTA Security with enforcement of Federal, State and local fishing laws and regulations.

(6) Issue base fishing licenses for distribution at the Environmental Division Program Office.

c. NAVSTA Security Director

(1) Review and forward reports of fishing regulation violations to the CO and the Environmental Program Manager.

d. NAVSTA Security Department

(1) Enforce all Federal, State and local laws and regulations with respect to legal fishing on NAVSTA.

(2) Is authorized to conduct inspections of anglers, fishing equipment, and catch to determine compliance with all applicable laws and licenses.

(3) Permit access to fishing areas for authorized personnel only, as outlined in this instruction.

5. General Information

a. Authorized Personnel. The following persons are authorized to fish at NAVSTA with due regard to references (c) and (d) for size and season requirements:

(1) Active duty military personnel and their dependents.

(2) DoD civilian employees at NAVSTA and their dependents.

(3) Active duty reservists at NAVSTA and their dependents.

(4) DoD contract support employees at NAVSTA.

(5) Retirees.

(6) Guests of the Commanding Officer.

b. Fishing License(s)

(1) An appropriate state license for freshwater and/or saltwater fishing is required.

(2) A NAVSTA fishing license is required for all persons fishing on or from NAVSTA property. This can be obtained via the Natural Resources Program Manager, at the Environmental Department, Building 1, aboard NAVSTA.

(3) A fishing license is not required for minors under the age of 16 years old, any blind person, or any disabled veteran.

c. Protected Wildlife. No angler shall harass, injure, hunt, or take any other wildlife. Fish are protected by species, size and season as authorized in references (c) and (d). Due to federal protection laws, if a marine mammal or sea turtle is sighted in the vicinity of active fishing all fishing in that area is to stop. Upon sighting, the angler is expected to make every effort to report sighting to NAVSTA Environmental Natural Resources Program Manager via section 3 subpart b of this instruction. Shannon Kam is the NAVSTA Natural Resources Manager and can be reached at 401-841-6377.

d. Littering. Littering at NAVSTA is prohibited. All refuse shall be removed from the fishing site(s) and placed in designated trash containers. Refuse will not be buried or burned while on NAVSTA.

e. Open Fires. Open fires are not permitted at NAVSTA.

f. Illegal Substances. All are prohibited while on NAVSTA.

g. Violation of Instruction. All violations of this instruction or other applicable laws and regulations shall be immediately reported to the CO, Environmental Program Manager and NAVSTA Security.

6. Procedures

a. Fishing

(1) A Rhode Island Fishing License and NAVSTA Fishing License are required for all persons who fish at NAVSTA unless exempt under section 4 b.(3) of this instruction.

(2) Persons under the age of 16 must be accompanied by an adult angler in possession of both a NAVSTA and Rhode Island Freshwater or Saltwater Fishing License.

(3) Issuance and acceptance of a NAVSTA fishing license by any recreational angler will relieve the Federal Government of all liability in the case of accident or injury. Individual anglers should read and understand all applicable Federal, State, local, and NAVSTA fishing regulations before being issued a license.

(4) Individuals will not be charged a fee to obtain a NAVSTA fishing license.

(5) Each NAVSTA license shall be valid for a period through December 31st of the issuing year.

(6) Environmental shall issue a copy of enclosure (3) with every license which highlights installation restoration sites that anglers are not authorized to fish from as shown in red on the enclosure.

(7) Weenechasset Bridge is authorized for fishing; Toner Bridge is not authorized for fishing anytime of the year.

(8) All fishermen ten years of age or younger are required to wear a Coast Guard approved Personal Floatation Device and be under the constant supervision of their adult sponsor.

b. Fishing Seasons/Days

(1) Unless otherwise specified herein, limits, seasons, times and methods of fishing at NAVSTA shall conform to State and Federal regulations. Line fishing is the only authorized method for fishing on NAVSTA. References (c) and (d) will be the guide for fishing seasons and are to be followed at all times.

c. Access to Fishing Areas

(1) Enclosure (3) is a map of unauthorized fishing areas at NAVSTA highlighted in red. Fishing is prohibited from these areas.

(2) Every angler must carry a valid NAVSTA fishing license in addition to the applicable Rhode Island State Saltwater or freshwater fishing license on their person.

(3) Specific areas and fishing dates may be closed by the ICO, Natural Resources Manager, or Security Department at any time at their discretion and without prior notification.

(4) If any fishing tournaments and/or other special events are to take place, the approval of Shannon Kam, Natural Resources Manager, and the CO are required. She can be contacted by phone (401-841-6377) or email (Shannon.kam@navy.mil) and will arrange to brief the CO for approval.

(5) Access to allowable fishing areas is acceptable at any hour of the day.

d. Regulations for Fishing. Anglers will fish in compliance with Rhode Island fishing regulations in accordance with reference (c) and (d) regarding limits, season, and physical characteristics.

7. Questions regarding this program should be referred to the Natural Resources Program Manager at (401) 841-6377.

D. W. MIKATARIAN

NAVSTA LICENSE SUSPENSION/REVOCATION

1. Policy. The privilege of fishing at NAVSTA is governed by the NAVSTA ICO.

2. Authority. The CO, Natural Resources Manager and Security Department shall enforce regulations. The above have the authority to suspend or revoke fishing privileges as appropriate.

3. Violations. The following is a list of common violations and maximum administrative actions which may be taken against persons who violate applicable state and Federal statutes and provisions of this instruction. License suspensions may be in addition to criminal prosecution and/or prosecution through the Uniform Code of Military Justice where applicable.

ACTION	VIOLATION
TERMINATION	Catching and keeping of fish species not authorized in accordance with references (c) and (d);
TERMINATION	Catching and keeping of fish outside of appropriate season in accordance with references (c) and (d);
TERMINATION	Catching and keeping of fish species in numbers outside of limits delineated in references (c) and (d);
TERMINATION	Catching and keeping of fish outside the dimensions authorized in accordance with reference (c);
TERMINATION	Fishing under the influence of or in possession of illegal substances;
TERMINATION	Violation licensing procurement as delineated in this instruction;
TERMINATION	Violation of fishing days/times;
TERMINATION	Open fires;
TERMINATION	Littering;
TERMINATION	Unauthorized damage to vegetation, natural resources, and wildlife as delineated in this instruction;
TERMINATION	Unauthorized vehicle parking;

FISHING LICENSE

1. NAVSTA hereby grants authorization for recreational fishing on NAVSTA property. This Permit will be valid to the last day of the year it is issued.

2. The bearer of this fishing license agrees to comply in full with all Rhode Island regulations governing fishing and the terms and conditions of NAVSTANPTINST 5090.26B. Any violations of governing regulations will result in the permanent revocation of this license and all future fishing privileges at NAVSTA and may subject the permit holder to criminal prosecution.

3. Issuance and acceptance of this fishing license by any recreational angler will relieve the Federal Government of all liability in the case of accident or injury. Individual anglers should read and understand all applicable Federal, State, local, and NAVSTA fishing regulations before being issued a license.

****
I agree to comply in full with all regulations governing fishing aboard Naval Station Newport. I understand that signing and accepting this license relieves the Federal Government of all liability in the case of accident or injury.

____(Permit Holder)
Signature

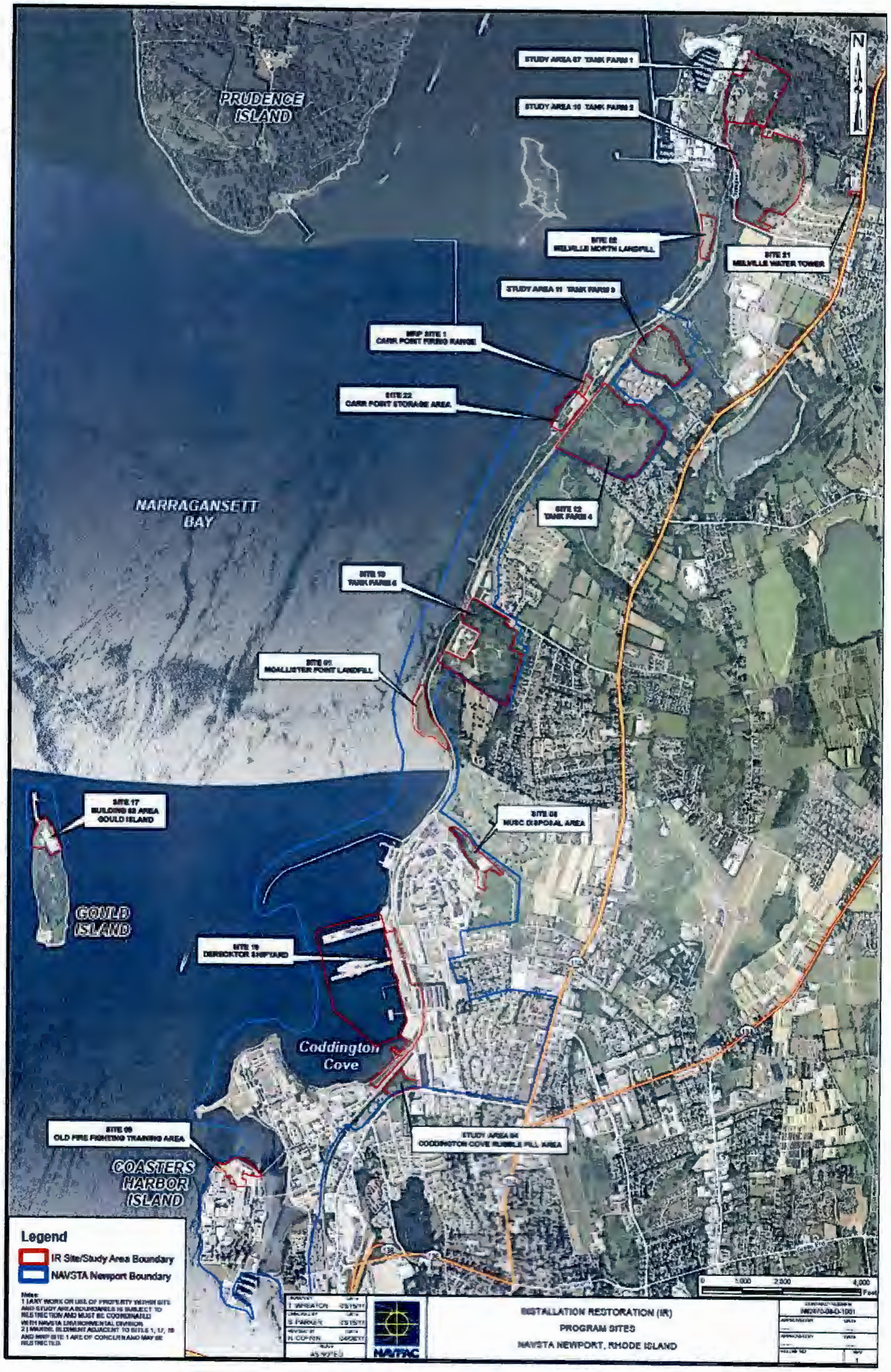
____(Permit Holder)
Printed Name

____
Date

****

____
Endorsement by Shannon Kam
NAVSTA Natural Resources Program Manager

____
Date Issued


N
STUDY AREA 07 TANK FARM 1
STUDY AREA 10 TANK FARM 2
PRUDENCE ISLAND
SITE 02
MELVILLE NORTH LANDFILL
SITE 21
MELVILLE WATER TOWER
STUDY AREA 11 TANK FARM 3
MRP SITE 1
CARR POINT FIRING RANGE
SITE 22
CARR POINT STORAGE AREA
SITE 12
TANK FARM 4
NARRAGANSETT BAY
SITE 13
TANK FARM 5
SITE 01
MCALLISTER POINT LANDFILL
SITE 17
BUILDING 32 AREA
GOULD ISLAND
SITE 08
NUSC DISPOSAL AREA
GOULD ISLAND
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0 1,000 2,000 4,000 Feet
INSTALLATION RESTORATION (IR)
PROGRAM SITES
NAVSTA NEWPORT, RHODE ISLAND
NAVFAC

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APPENDIX P

FORT BELVIOR POLICY MEMORANDUM #27, TREE REMOVAL AND PROTECTION

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DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

REPLY TO
ATTENTION OF

IMBV-PW 11 October 2012

MEMORANDUM FOR US Army Fort Belvoir Personnel

SUBJECT: Fort Belvoir Policy Memorandum #27, Tree Removal and Protection

1. References.

a. American Association of Nurseryman Standard for Nursery Stock (ANSI Z60.1), as amended.

b. Fort Belvoir Integrated Natural Resource Management Plan Appendix L, Section 1.7: Protection of Retained Trees.

2. Purpose. To ensure protection and preservation of specimen trees on Fort Belvoir.

3. Applicability. This policy applies to all military, civilian, and tenant activities on Fort Belvoir.

4. Policy.

a. Fort Belvoir's urban forest and associated natural resources are a major asset to the Installation and its residents. In recognition of the value and benefits that trees provide to the Fort Belvoir Community, all proposed tree removals, as well as construction and excavation activities that may impact the growth and survival of trees, require prior review and written approval by the Fort Belvoir Director of Public Works.

b. It is the policy of Fort Belvoir to promote site planning techniques and construction practices that maximize retention and protection of trees before considering removal. Site reviews regarding natural resource impacts shall be made early in the planning and design process. When considering open trenching of utility lines, consideration must be given to boring, pipe-bursting, slip-lining and other techniques that lower impacts to trees. Utility rights-of-way shall be co-located except when prohibited by code. Tree protection measures for retained trees shall be required for all construction. Project leaders, master planners, and designers shall meet with DPW Environmental and Natural Resources Division (ENRD) to review project objectives, design features, natural resource impacts and mitigations, and compliance with applicable environmental laws and regulations.

c. Construction projects shall include a DPW approved landscape plan. The construction design and landscape plan shall include mitigation for tree loss and identification of all trees four inches and larger in diameter at breast height that may be impacted by the construction project, to include specimen trees that should be preserved as well as tree replacements and new plantings.

d. Two new trees shall be planted for each live tree four inches in diameter and larger removed through construction, unless the project in question is expressly exempted from this replacement requirement. The rationale behind this 2:1 replacement ratio is that trees planted in urban forest situations only survive for an average of seven years and trees being replaced are generally far larger than trees planted as in-kind, compensatory mitigation. Requirements for size and species will depend upon site characteristics and location. DPW-ENRD will make this assessment. Tree replacements will generally adhere to a prescribed scheme that includes nursery-grown landscape trees for those removed in improved grounds and high visibility areas, and native tree seedlings with a mixture of landscape trees in unimproved grounds. If it is not possible to plant the required number of replacement trees, project-related alternatives such as environmentally-beneficial restoration, enhancement, or preservation measures may be done. DPW approval of out-of-kind, compensatory mitigations is required and funding must be equivalent to that required to plant the remaining trees. DPW-ENRD maintains a list of mitigation options and restoration sites.

e. All trees to be planted shall meet the specifications of American Association of Nurseryman Standard for Nursery Stock (ANSI Z60.1) latest edition. Plantings shall be prepared in accordance with the Fort Belvoir Integrated Natural Resource Management Plan Appendix L, Section 1.7 and DPW-ENRD requirements.

f. A Tree Protection Plan shall be prepared in accordance with DPW-ENRD requirements and included with the 35 percent design submittal.

g. Dogwood, Holly, Redbud, and Mountain Laurel are to be left standing on utility rights-of-way unless an exception is specifically approved in writing by DPW-ENRD.

5. Proponent. The Directorate of Public Works is the proponent for this policy at 703-806-4142.

GREGORY D. GADSON
Colonel, FA
Commanding

APPENDIX Q

FEDERAL STRAY ANIMAL POLICY AND GUIDANCE

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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, D.C. 20350-2000

IN REPLY REFER TO

5090
Ser N456M/1U595820
10 JAN 2002

From: Chief of Naval Operations

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULATIONS ON NAVY PROPERTY

Ref: (a) SECNAVINST 640l-lA, of 16 Aug 94, Veterinary health services
(b) AFPMB TIM #37, Guidelines for Reducing Feral/Stray Cat populations on Military Installations in the united states
(c) OPNAVINST 6250.4b, dtd 27 Aug 1998, pest Management programs
(d) Executive order 13112 of 3 Feb 1999, Invasive Species

1.This letter clarifies the application of reference (a) regarding the prevention of free roaming (also called wild, feral or stray) tat and dog populations on Navy installations. The objective is to prevent injury or disease to Navy personnel, and eliminate adverse impacts on native wildlife. It requires Navy commands to institute pro-active pet management procedures in order to prevent establishment of free roaming cat and dog populations. Free roaming cats and dogs pose a potential public health threat to personnel on Navy installations, and they pose a threat to wildlife including endangered species and migratory birds.

2.Existing policy at paragraph 4-2c(4) of reference (a) states Dogs, cats, and other privately-owned or stray animals will not be permitted to run at large on military reservations. consistent with this policy, Navy commands must ensure the humane capture and removal of free roaming cats and dogs. Consistent with this requirement, Trap/Neuter/Release (TNR) programs will no longer be established on Navy land. All existing TNR programs on Navy land must be terminated no later than 1 January 2003.

3.Responsible pet ownership is a key factor in eliminating free roaming cat and dog populations. In consultation with supporting Army Veterinary Office, installations shall implement appropriate pet management measures to preclude establishment of feral cat/dog populations, including, but not limited to the following:

Require installation residents to keep and feed pet animals indoors or under close supervision when outdoors (such as on leash and collar or other physical control device - cage, fenced yard etc.).

Encourage neutering or spaying of cats and dogs before they reach reproductive age (exceptions to this policy can be made on a case by case basis as determined by the Installation Commander).

Require routine vaccinations of vats and dogs for rabies and other diseases as required by federal, state and local laws and ordnances. A current vaccination record is required at time of registration of pets.

Require microchipping registration (or other system of pet identification approved by supporting veterinary office) of all pet cats and dogs brought onto installations. Installation residents must register cats and dogs and have pets wear registration or identification tags at all times.

Prohibit the feeding of feral animals on the installation.

Provide educational materials to pet owners regarding installation regulations and general pet management.

Enforce prohibition of abandonment of animals on installations.

Comply with all humane and animal control regulations at the federal, state and local level (and their equivalents in host nation countries).

Navy installations in Europe that do not have a supporting veterinary office contact 100th Medical Detachment (VA HQ) (011) 49-622-177-2968; for all other locations that do not have a supporting veterinary office the POC is the VETCOM HQ, Commander (210) 221-6522.

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULATIONS ON NAVY PROPERTY

4. Effective prevention, management and elimination of feral cat and dog populations requires close coordination and cooperation between natural resources, pest management, security, veterinary, and housing personnel to develop and implement an effective and humane program. Reference (b) provides information for preventing free roaming cat populations on military installations General pest management guidelines are detailed in reference (c). Every effort should be made to work with other federal, state and local agencies to support reference (a) and reference (d) by eliminating free roaming cat and dog populations on Navy land. Navy commands. should work with local animal control agencies to determine the best approach for the ultimate disposition of the captured animals. Every effort should be made, if practical, to find homes for adoptable feral cats and dogs.

5. My point of contact on this issue is Mr. Joe Cook, CNO N456M, at (703) 602-5335, or DSN 332-5335.

William G. Mattheis

WILLIAM G. MATTHEIS
Deputy Director, Environmental
Protection, Safety and Occupational
Health Division

Distribution:
CINCLANTFLT (N465)
CINCPACFLT (N465)
COMNAVRESFOR (01E, N46)
CNR (91)
CNET (44)
COMNAVSECGRU (N443)
COMNAVTELCOM (N451)
BUMED (NEGC-EPWR)
COMNAVAIRSYSCOM (AIR.OY)
COMSPAWARSYSCOM (07-1)
COMNAVSUPSYSCCM (4A2, 421)
COMNAYSEASYSCOM (SEA 00T)
COMNAVFACENGCOM (ENV, 09)
CINCUSNAVEUR (N4, N76)
COMSC (NOCEP)
COMNAVMETOCCOM (N13)

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULTIONS ON NAVY PROPERTY

Distribution:
CHBUMED (NEHC-EPWR)
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OAGC (I&E)
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CMC, LFL
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COMNAVREG SE
NTC GREAT LAKES
COMNAVRESFOR
COMNAVREG SW
COMNAVREG PEARL HARBOR
COMNAVMARIANAS
COMNAVREG NW
CNFJ
CNFK
PACNAVFACENGCOM PEARL HARBOR HI (CODE 23)
LANTNAVFACENGCOM NORFOLK VA (CODE 2032)
SOUTHWESTNAVFACENGCOM SAN DIEGO CA (CODE 03EN)
SOUTHNAVFACENGCON CHARLESTON SC (CODE 064)
ENOFLOACT NE PHILADELPHIA PA (CODE 18)
ENGFLDACT WEST SAN BRUNO CA (CODE 053)
ENGFLDACT CHES WASHINGTON DC (CODE 20E)
ENGFLDACT NW POULSBO WA (CODE 05EC4)
CO PWC GREAT LAKES
CO PWC GUAM
CO PWC JACKSONVILLE
CO PWC NORFOLK
CO PWC PEARL HARBOR
CO PWC PENSACOLA
CO PWC SAN DIEGO
CO PWC SAN FRANSICO BAY
CO PWC WASHINGTON DC
CO PWC YOKOSUKA
CO CEC PORT HUENEME
CO CEC GULFPORT
QESO
MESO
DODVSA/OTSG (Chief Animal Medicine)

Armed Forces Pest Management Board

TECHNICAL GUIDE NO. 37

****

INTEGRATED MANAGEMENT OF STRAY ANIMALS ON MILITARY INSTALLATIONS

****

Published and Distributed by the
Information Services Division
Armed Forces Pest Management Board
Forest Glen Section
Walter Reed Army Medical Center
Washington, DC 20307-5001

Office of the Deputy Under Secretary of Defense
For Installations & Environment

May 25, 2012

TABLE OF CONTENTS

ACKNOWLEDGMENTS

This technical guide was prepared by Mr. John A. Wildie, Army Environmental Command Pest Management Consultant; Mr. Mathew Kramm, Air Education and Training Command, Pest Management Consultant; and Mr. Steven Watters, Fort Belvoir, Virginia, Installation Pest Management Coordinator. Dr. William B. Miller, Army Environmental Command, Pest Management Consultant, provided editorial assistance.

Appreciation is extended to Dr. Robert Vogelsang, Colonel, Veterinary Corps, U. S. Army Public Health Command, who reviewed and provided comments on the draft of this technical guide.

Dr. Richard G. Robbins, Armed Forces Pest Management Board, provided comprehensive editing and coordination of review comments. Finally, we wish to thank the staff of the Armed Forces Pest Management Board, who assisted in printing, collating and mailing this technical guide.

DEFINITIONS

a. Darting. An injection-type device (dart) delivered by an air-powered rifle or blow pipe/gun. The dart often contains a tranquilizer to stop the animal from escaping and allow capture.

b. Euthanasia (lethal injection). For stray animal control, euthanasia (lethal injection) is administered by a Veterinary Corps officer. The word comes from the Greek, meaning "good death."

c. Neutering. Neutering is the removal of the sex organs (testicles) from a male animal.

d. Spaying. Spaying is the removal of the sex organs (ovaries) from a female animal.

e. Stray Animals. For the purposes of this guide, a stray animal is an Uncontrolled Dog or Cat (UDC). The animal is homeless, ownerless, or is a privately owned dog or cat allowed unrestricted roaming.

f. Tranquilizing drugs. Narcotics whose use is regulated by the Drug Enforcement Agency and that are available and issued only to licensed veterinarians.

REFERENCES

a. Department of Defense Instruction 4150.07, DoD Pest Management, 29 May 2008

b. Army Regulation 40–905/SECNAVINST 6401.1B/AFI 48–131 Veterinary Health Services, 26 August 2006

INTRODUCTION

a. Stray animals on military installations can affect the health and welfare of personnel, their pets, and wildlife populations. Control of stray animals is a very sensitive undertaking.

b. The longer a stray remains uncontrolled, the more it poses a threat to personnel, their pets, and wildlife.

c. Allowing a stray animal to roam freely is detrimental to the health and welfare of the animal

d. Forward comments and recommended changes to U.S. Army Garrison Forest Glen, Armed Forces Pest Management Board, ATTN: Editor Information Services, 2460 Linden Lane, Building 172, Silver Spring, MD 20910, or send by fax to (301) 295-7473.

PURPOSE

a. This technical guide will:

(1) Provide Installation or Garrison Commanders with an example of a Stray Animal Control Policy (Appendix A).

(2) Identify the responsibilities and resources required to implement this policy.

(3) Provide guidelines for the capture, management and disposition of stray animals on military installations.

(4) Protect working animals, pets and wildlife from injury and death caused by stray animals.

(5) Suggest integrated management options and identify coordination requirements to humanely control stray animals on military installations.

b. This technical guide is written for all military installations in the United States, regardless of size or owning command. Installations outside the United States will comply with host country regulations or final governing standards where they exist.

RATIONALE FOR CONTROLLING STRAY ANIMALS ON MILITARY INSTALLATIONS

1. Humane Treatment and Concerns

a. Rescue, adoption or return of stray animals allows them to be cared for and loved as pets.

b. Caring for stray animals, by providing them food and water, is ultimately not in the animals' best interest. Such care encourages breeding and further population growth. Installations with feral cat populations are a prime example of this problem.

c. Abandoning any pet is inhumane.

i. Stray animals may survive for many years before succumbing to starvation, disease, injury or death, but their quality of life is questionable.

ii. Stray animals are exposed to disease, starvation, environmental hazards, and injury from attack by other animals or vehicles.

d. Euthanizing a stray animal can, on occasion, be considered a humane action. It is always the last resort and should be practiced only when rescue and adoption are not possible.

2. Disease Transmission

a. Stray animals can harbor and transmit a variety of diseases to humans and their pets. Some diseases, such as rabies, can be fatal to both humans and pets.

b. Stray animals may transit diseases by biting or scratching a person or another animal. A bite or a scratch from a stray animal can result in a medical emergency and may require transporting the victim for examination and treatment by a physician (e.g., cat scratch fever).

c. A pet's health is threatened by a bite or scratch from a stray animal. Injured pet animals should be taken to a veterinarian for examination and treatment.

3. Physical Injury and Death

a. Small children and elderly people are at the greatest risk from stray animal attacks, bites and scratches.

b. Anyone can be physically injured by being scratched or bitten by a stray animal.

4. Other Concerns and Threats

a. Stray animals often live in close association with humans for food (either by scavenging or because people feed them) and shelter (under buildings and other structures).

b. Stray animals can damage structures, contaminate food supplies, and kill birds and other wildlife.

c. Stray animals harbor ectoparasites, such as ticks, fleas and mites. These parasites can leave the animal and infest their bedding/nesting materials. Personnel cleaning these areas are exposed to disease and bites from these parasites (ectoparasites).

d. Stray animals may transmit disease by defecating in play and recreation areas.

PARTNERING WITH FEDERAL AND LOCAL ANIMAL CONTROL AGENCIES, SHELTERS AND RESCUE AGENCIES

a. The Integrated Pest Management Coordinator (IPMC), Veterinary Services and Public Affairs personnel should, in coordination, identify local animal control agencies, animal shelters and rescue agencies. Such agencies can assist the installation in humane disposition of stray animals captured on the installation.

b. Command Information Messages on pet ownership should stress the following five points. When possible, include local animal control or human society contacts.

(1) Being a responsible pet owner. This includes the spaying/neutering of the pet animal, which prevents reproduction in stray populations and can prolong the pet's life.

(2) Keeping pets indoors.

(3) Appropriately restraining and controlling pets when outdoors.

(4) Emphasizing adoption as an alternative to euthanizing.

(5) Humanely euthanizing terminally sick and injured stray animals to relieve their pain and suffering.

c. The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services is a federal agency that can perform wild animal control (See Reference a, E4.7.13).

STRAY ANIMAL CAPTURE METHODS

1. Non-Lethal Capture Methods

a. Live Trapping. Live trapping is time consuming, and the cost of traps may be substantial.

(1) Regardless of cost, this method of control is the preferred non-lethal method. Selecting a trap large enough to accommodate the animal to be trapped is very important. It is better to have a trap that is too large than too small.

(2) Regardless of placement, vandalizing of traps may occur. They may be damaged, sprung or stolen, and captured animals may be injured or released.

(3) Trap shyness may be an issue. The larger the uncontrolled cat or dog population, the more likely it is that some of the untrapped animals may become trap shy. Varying placement location and the time the trap is left in place may increase success. Frequently changing trap locations, leaving the trap out for short periods (3-4 days), or leaving the trap open (Pre-Baiting, 6(d) below) may result in capture of trap-shy animals.

(4) Many different models of humane live box-type traps are commercially available. They vary in price, construction, and style.

  (a) Some traps have only one entrance door, others have two. Both types operate in basically the same way.

  (b) Some two-door traps are designed so that only one door is open for trapping. A vertical sliding door on the non-entrance end remains closed and latched and is used for removal of the trapped animal.

  (c) Some two-door traps allow both doors to be open to let the animal see through the trap. This type of trap is often used for animals that are very shy and reluctant to enter any partially closed object.

(5) Position traps in areas where stray animals and wild animals are frequently observed. If the trapping location is next to a building or structure, place the trap opening parallel with the wall of the building.

(6) Baiting the trap, to include selection and placement, is the most important factor.

  (a) Place the bait in the trap so the animal completely enters the trap. This will prevent the animal from taking the bait without springing the trap.

  (b) Monitor bait and traps daily. The environment (wind, dust, rain), insects and age adversely affect the bait and thus reduce its attractiveness.

  (c) Use a variety of baits, since all stray animals may not be equally attracted to the same food. Be aware that baits may attract wild animals into traps. Do not become alarmed or surprised when wild animals, such as skunks, raccoons and opossums, enter the trap and are captured. Be prepared: carry gloves and protective gear for this eventuality.

  (d) Pre-baiting is an effective method to accustom target animals to entering the trap for food. When pre-baiting, disengage the trap door release mechanism. Place the bait in an open trap that doesn't close. Pre-baiting can indicate the attractiveness of different "foods" to determine target animal bait preferences.

(7) Routinely monitor traps, usually daily, to ensure that trapped animals are confined for the shortest possible time. During inclement weather (rain, snow, high or low temperatures), traps may require more frequent monitoring.

(a) Frequent monitoring will:

1. Lessen the risk of injury to trapped animals.

2. Reduce stress on trapped animals.

3. Decrease the likelihood that other animals will observe a trapped animal, possibly increasing trap shyness in un-trapped animals.

4. Prevent a trapped animal from being exposed and unprotected for long periods under adverse environmental conditions (snow, rain, freezing, or very hot temperatures).

(b) If a trap is not going to be monitored at least daily, the trap mechanism should be left open and the bait removed. The bait can be left to act as a pre-bait to entice target animals into the trap, but it may also entice non-targets. Use this technique over the weekends when no one is monitoring the trap.

(c) When an animal has been captured, covering the trap with a cloth may calm the animal. This may make the animal's removal easier.

(8) When animal control personnel suspect human interference with traps, notify the responsible authority to prevent such interference.

b. Leghold and Conibear Traps and Snares. The American Veterinary Medical Association opposes the use of conventional, unmodified steel-jawed leghold traps. Legitimate management practices that necessitate the capture of animals should employ the most humane traps and techniques. Such traps and techniques should reduce injury and stress, minimize pain and suffering, and prevent capture of non-target animals.

c. Hand Capture Methods. Use nets, catch poles and net guns for capturing trap-shy stray animals. A blind alley can reduce an animal's movement and ease its capture. Exercise caution, since the animal may struggle violently during netting or snaring.

d. Tranquilizer Methods.

(1) Drugged Baits. Only use veterinarian-approved baits.

(2) Darting. There are several types of dart guns that are commercially available. The dart contains tranquilizing drugs that immobilize an injected animal, facilitating its capture.

(a) Only conduct darting under the supervision of veterinary personnel.

(b) The veterinarian determines the drug, dosage and delivery system (compressed-air operated or blow gun), as well as any special handling instructions for the darted animal.

1. Conduct darting operations with all appropriate dart delivery systems on hand and available to properly and humanely perform this operation.

2. Drug and dose selection are critically important in the prevention of overdosing or adverse reactions.

(3) Other Tranquilizing Methods. Military or state veterinarians can approve other tranquilizing methods as new humane animal capture methods and technologies become available.

2. Lethal Capture Methods

a. Shooting.

(1) Consider all non-lethal options before resorting to shooting. Shooting is only justified when an emergency situation exists, such as increased likelihood of disease (rabies) or injury (attack) to personnel and pets.

(a) Brief the Installation or Garrison Commander prior to shooting any animal (cat, dog or wild). Consider making this part of the Commander's Critical Information Requirements (CCIR).

(b) Prior to shooting, Installation or Garrison Public Affairs should prepare announcements and talking points to communicate why emergency shooting is required. Essentially, explain why the animal is to be shot.

(c) First responders, such as military police, may shoot an animal when persons are at immediate risk of animal bites and attacks. This is a law enforcement issue rather than a pest management issue.

(2) Where shooting is justified and appropriate, conduct shooting safely. Ideally, this would be under the supervision of military law enforcement personnel.

(a) The weapon must kill the animal humanely and quickly. Small caliber weapons are best in most urban situations. Larger caliber rifles or shotguns may be appropriate for rural situations.

(b) The person shooting must be trained and qualified to use the weapon selected. The installation or garrison should refer to local laws or regulations for the proper shooting of stray animals.

(3) Animal control personnel involved in shooting stray or wild animals must know and practice firearm safety rules and demonstrate firearm proficiency in accordance with DoD, Service and State Regulations.

(4) Restrict the number of potential shooters to only a few well-trained individuals.

(5) After shooting, quickly remove the deceased animal and dispose of the carcass in

accordance with local or state rules. If the animal is suspected of being rabid, coordinate with Veterinary Services or local public health authorities. Submit tissue samples for testing as quickly as possible.

b. Poisoning. There are no poisons or fumigants registered by the United States Environmental Protection Agency for use in controlling cats or dogs. Therefore, the use of any substances to poison stray animals is illegal and prohibited.

MANAGEMENT

The topics below are presented as means to control stray animals and identify some of the potential pitfalls. They are intended to be instructive and not prescriptive in developing the installation Stray Animal Control Policy.

1. Management Issues

a. Installations may have difficulty keeping stray animals from gaining access to the installation. Typically, animals seek food, water and shelter. They are not concerned with gates, security checkpoints, or building safeguards. With few exceptions, stray animals are a concern at military installations.

b. Reduction of stray populations is a realistic and achievable goal. Total elimination of all stray animals occurring on an installation is unlikely. Management of uncontrolled cat and dog populations should target reducing the impacts of these animals on personnel, installation facilities, and wildlife.

(1) In order to achieve this goal, control must be constant.

(2) The faster stray animals are removed from an installation, the less likely it is that they will attract other animals to the installation.

(3) Quick action will help reduce stray populations by removing sexually mature animals before they can breed.

2. In-House Management Procedures

a. To control stray animals, installations may do the following. These options are presented as guidance rather than prescriptive statements.

(1) Designate installation activities responsible for conducting animal control operations. Although the installation's veterinary service staff provides direct animal medical care and professional advice, they lack the resources or personnel to operate a stray animal shelter.

(2) Properly train and equip personnel to handle all animals encountered on the installation. The number of personnel required will depend on the size of the installation (acreage and number of facilities) and scope of the problem.

(3) Develop written agreements with local animal control agencies, shelters and rescue agencies for the off-installation disposition of captured animals, as appropriate.

(4) Use contractual agreements with other federal, state or local non-governmental animal control agencies to augment installation resources.

b. Stray animal control requests may occur on a 24 hour basis year-round. Control personnel's duty hours should be flexible, since peak animal activity hours may be outside the normal workday. After duty hours, conduct animal control tasks, such as picking up stray animals, as described in this technical guide and as needed based on health and safety requirements.

c. Stray animal control is often mistakenly excluded from vertebrate control programs. Vertebrate animals are commonly thought of as wild animals, such as fox, raccoons, skunks, and coyotes. However, stray animals are also "vertebrate animals" and should be included.

d. Take captured stray animals to installation Veterinary Services facilities (when these facilities are available) or to a local off-installation animal control agency, shelter or rescue facility to determine:

(1) If the captured animal has ever been micro-chipped or tagged to identify the animal's owner.

(2) If the animal's health poses a threat to other animals at the Veterinary Services facilities or to rescued animals at local animal control agencies, shelter or rescue facilities.

(3) If the animal is in poor health, and not eligible for adoption, then consider euthanasia (lethal injection).

(a) If Veterinary Services are available on the installation and can perform euthanasia (lethal injection), they will complete the procedure and dispose of the animal carcass in accordance with established guidelines.

(b) If Veterinary Services are not available, transfer the animal to an appropriate off-installation facility capable of euthanasia (lethal injection).

3. Contracted Management Procedures

a. Contract stray animal control to augment in-house pest control operations when required.

b. When contracting stray animal control, monitoring is essential to ensure that the contractor provides responsive and adequate services. The Performance Work Statement must include the humane capture, handling, removal and disposition of captured stray animals. Ensure that stray animal control contracts are reviewed by the supporting military Veterinarian prior to solicitation.

c. The contractor should provide records of animal control (a pest control function) operations to the IPMC. The IPMC is responsible for recording all pest control operations performed on the installation. Identify and include all pest control operations (including stray animal control) in the Integrated Pest Management Plan.

d. In Privatized Housing, pest control (including stray animals) is the responsibility of the Privatized Housing Owner in accordance with the governing lease agreements.

4. Preventing Contributing Factors

a. Prohibit installation personnel from providing food, water and shelter to stray animals and/or tampering with or releasing captured stray animals from traps.

b. Provide dumpsters and garbage containers with tight-fitting lids to prevent stray and wild animals from foraging for food scraps.

(1) Repair or replace containers with damaged doors or lids.

(2) If contractors conduct the installation's solid waste collection and disposal program, have quality assurance inspectors ensure that all waste receptacles have properly fitting and operating closures.

c. Brush and junk piles, construction and repair materials storage yards, and accesses to building crawl spaces may harbor stray and wild animals. This may increase stray animal contact with installation personnel.

(1) Routinely monitor materials storage yards to ensure that these areas do not become populated by stray animals. Contractor lay-down or equipment concentration sites in or near construction sites can provide suitable harborage for stray or wild animals.

(2) Have facility managers/building custodians routinely inspect building doors, windows and sub-floor openings and submit work orders for corrective action to repair or replace damaged access points.

(a) Have facility managers/building custodians ensure that repairs or replacements are completed in a timely manner and function properly to exclude animals.

1. When stray cats or dogs or wild animals have been entering and using a crawl space area, have facility managers/building custodians place a work order to trap the animal(s).

2. Do not close and seal the crawl space access until installation pest control personnel ensure that all stray or wild animals are removed.

3. Following removal of the animals, ensure that the crawl space is treated for ectoparasites that may remain in bedding/nests.

5. Records and Document Management

a. Document all stray cat and dog control efforts, including the date and location, number, and type of animal caught.

b. Document property damage or injury to personnel and pets caused by stray animals.

c. Document road-killed carcass collection and disposition as appropriate and directed by local or state regulations.

6. Public Awareness and Education

a. The public generally views the capture and disposition of stray and wild animals as inhumane. Many people believe “disposition” means “killing the animal’ – euthanasia (lethal injection). Increase the public’s knowledge of and support for stray animal control on the installation by establishing a public awareness and education program.

b. Use installation media (e.g., newspapers, TV access channel) to notify installation personnel before initiating any major trapping or shooting operation to control stray animals.

(1) Anticipate questions or concerns that may be expressed by various community and national organizations advocating humane animal treatment. Thinking through these issues and being prepared with information will go a long way toward gaining trust and support.

(2) Provide information about the hazards caused by stray animals and stress the link to personnel health, safety and welfare and protection of wildlife from these animals.

(3) Be open and informative when presenting information to the public about stray animal control. Clearly explain the need to control these animals, the goals and objectives of the program, and how the program will capture and manage stray animals.

(4) If part of the policy, emphasize that captured stray animals will not be released back onto the installation.

(5) Emphasize the installation policy of not providing food, water or shelter for stray animals. Tampering with traps or releasing trapped animals can make control harder and increases the risk to human and animal health.

DISPOSITION OF STRAY ANIMALS

1. On-Site Disposition Procedures

a. When suitable kennel facilities, staffing and funding exist on the installation, maintain captured stray animals for at least three (3) business days (excluding holidays and weekends (in accordance with Reference b, page 3), after which the uncontrolled cats or dogs are transferred to local off-installation animal control agencies, shelter and rescue agencies, adopted or otherwise disposed.

(1) The 3-day holding period should provide sufficient time to coordinate with local animal control agencies, shelter and rescue agencies and/or to locate the owners of the uncontrolled or lost animals (tags and/or microchips). At the discretion of the Installation or Garrison Commander, this holding period can be extended.

(2) When healthy stray animals are to be put up for adoption by installation personnel, Veterinary Services may provide neutering or spaying, vaccinations and micro-chipping for future identification should the uncontrolled cat or dog again escape their owner's control. Veterinary Services may be able to provide this service subject to the availability of resources and funds. Fees to offset these expenses should be determined by the Installation or Garrison Commander based on Veterinarian recommendations.

b. The Installation or Garrison Public Affairs Office can publish articles in the installation newspaper, place announcements on installation television channels, and place notifications in public high-use facilities like the commissary and exchange that there are healthy stray animals available for adoption, as well as the adoption procedures to be followed.

c. Animals that are not adopted after a reasonable period will be transferred to local animal control agencies, shelters or rescue agencies for disposition. When these organizations refuse to accept the stray animals, the Installation or Garrison Commander will determine animal disposition based on the installation's/garrison's capacity and resources to maintain strays for an extended period and upon recommendation from the installation/garrison or supporting Veterinarian regarding health issues. Stray animals must not be released into the environment from which they were captured. Animals should be euthanized when other non-lethal alternatives are unavailable.

2. Off-Site Disposition Procedures

a. When suitable kennel facilities, staffing or funding do not exist on the installation, transfer captured stray animals to local animal control agencies, shelters and rescue agencies for disposition.

b. The local community can provide the resources under a cooperative agreement or contracting vehicle. Types of contracts include an annual charge or a per animal charge.

ADDITIONAL CONSIDERATIONS

a. There are public and animal welfare groups concerned about the humane treatment of stray animals. Ensure that they are informed about the development of any stray animal policy. Within your community, these groups realize and understand that control of stray animals is required and advocate responsible pet ownership.

(1) Installation and Garrison Commanders should strive to obtain support from these groups for the installation stray animal control program.

(a) Consider inviting these groups to the installation and provide an information briefing in a positive atmosphere (comfortable facility with refreshments). Although these groups may have a very different agenda from the commander, it is important to include them in order to correct any misconceptions about DoD programs. If there is a control facility on post/base, provide a tour, allowing these groups to observe the installation animal control operation and to suggest improvements.

(b) Consider all suggestions. Implement or incorporate suggestions that could improve the program. When a suggestion is implemented, provide feedback, good or bad, to the individual or group making the suggestion. Make the results part of the public record. This will demonstrate the measures being attempted and the success or failure of those measures.

(c) Cooperate with local animal control agencies, shelters and rescue agencies that handle, manage and dispose of stray animals.

b. Commanders:

(1) Ensure that any animal control program includes humane treatment of captured animals.

(2) Consider euthanasia (lethal injection) to be humane treatment when conditions justify this action.

(3) Ensure that a Stray Animal Control Program, once implemented, is given sufficient resources (facilities, manpower and funds, as appropriate) to enable the program to succeed.

(4) Ensure that methods used to control stray animals on the installation are effective and efficient and, like any other pest control operation, incorporate the philosophy of Integrated Pest Management.

(5) Integrated Pest Management considers all aspects of control, including trapping, darting, shooting, habitat and food source reduction, and public awareness and education to produce an effective and humane program for minimizing uncontrolled cat and dog populations on the installation

SUMMARY

a. Responsible pet owners vaccinate, identify via tags and chips, and properly control their pets. Responsible pet ownership is the key to a successful stray animal control policy.

b. Responsible pet owners also spay and neuter their animals to help control pet populations.

c. Although well intentioned, individuals who feed stray animals only encourage their reproduction and help maintain the population.

d. The least desirable action is destruction of a dog or cat due to the owner’s lack of care. The pet suffers because of irresponsible human behavior.

APPENDIX A - SAMPLE STRAY ANIMAL CONTROL POLICY

1. The policy below is for illustration and instruction. It provides a sample policy and outline of the responsibilities on an installation or garrison.

2. Use this sample policy for your installation's/garrison's stray animal policy. The coordinating instructions and resourcing sections are left out as each installation and garrison is unique. Add additional material to make the policy applicable to your installation or garrison.

STRAY ANIMAL CONTROL POLICY

SUMMARY. This policy provides the governing policy for the possession and control of animals onto XXXXX.

Ref: (a) DoDI 4150.07, DoD Pest Management, 29 May 2008
(b) AR 40-905/SECNAVINST 6401.1B/AFI 48-131, Veterinary Health Services, 29 August 2006
(c) Title 18, USC 31 - Definitions
(d) Title 40, USC 3103 - Admission of Guide Dogs or Other Service Animals Accompanying Individuals with Disabilities

1. <u>Purpose</u>. The purpose of this document is to establish the local policy and procedures governing the possession and control of animals maintained on this installation or brought onto XXXXX. This includes those measures necessary to protect the health, safety, and harmonious coexistence of personnel, their family members, and their animals on this installation.

2. <u>Applicability</u>. This policy is applicable to all persons entering the XXXXX military installation.

3. <u>Responsibilities</u>

   a. Installation or Garrison Commander will:

      (1) Ensure that stray animals are controlled on the installation to protect the health, morale and welfare of installation personnel and their pets; protect wildlife; prevent damage to government property; and effect mission accomplishment.

      (2) Ensure that adequate resources (manpower, facilities, equipment and funds) are available to implement an Uncontrolled Cat and Dog Control Program and operate on-site associated facilities, as appropriate.

      (3) Establish an installation policy that prohibits installation personnel from providing food, water or shelter to stray animals or wild animals and provides sanctions for non-compliance.

(4) Establish an installation policy that prohibits personnel from tampering with or releasing captured uncontrolled cats or dogs and wild animals from traps and provides sanctions for non-compliance.

(5) Establish an installation policy outlining the responsibilities of residents for the proper care and maintenance of their pets, with sanctions for non-compliance.

(a) Breeding of stray animals in military family housing is prohibited.

(b) The Commander will determine, in consultation with servicing legal counsel and Veterinarian recommendations, the number of cats or dogs or combination permitted in a set of quarters.

(6) Establish procedures for proper disposal of uncontrolled cat or dog and wild animal carcasses found on the installation, personal pets, or animals that are euthanized by a Veterinarian or expire while under care at Veterinary Services facilities, in accordance with State and local regulations.

b. IPMC will:

(1) Establish an installation Integrated Pest Management Plan that includes an Uncontrolled Cat and Dog Control Program. Each Integrated Pest Management Plan will:

(a) Define procedures for the humane capture, management and disposition of stray animals.

(b) Identify and delineate responsibilities of installation activities such as, but not limited to, Veterinary Services, military law enforcement, Public Affairs, and Facilities Engineers/Public Works Pest Control, that are required for the implementation of this program.

(2) Coordinate, as appropriate, with local animal control agencies, shelters or rescue agencies to augment and assist the installation in humanely managing stray animals captured on the installation.

(3) Establish, as appropriate, agreement(s) between the installation and local animal control agencies, shelters and rescue agencies to pick up or receive the transfer of stray animals captured on the installation.

c. Occupational Medicine Services will:

(1) Establish an occupational medicine health program for all installation personnel who are occupationally exposed to uncontrolled and possibly unvaccinated cats or dogs.

(2) The Installation Medical Authority will determine program requirements, including, but not be limited to, pre-employment, pre-exposure and post-exposure requirements and periodic monitoring of immunized personnel at a frequency to ensure that protection levels are maintained.

(a) When an immunized person is exposed to or has contact with a known or suspected rabies-infected animal, the Installation Medical Authority or the individual's physician will determine what treatment will be provided to the exposed individual.

(b) When a non-immunized person is exposed to or has contact with a known or suspected rabies-infected animal, a post-exposure treatment should be initiated as soon as possible after exposure unless otherwise directed by the Installation Medical Authority or the exposed individual's physician. Rabies can be a fatal disease if treatment is delayed.

d. Veterinary Services will:

(1) Provide guidance to military and Department of Defense civilian personnel who bring their pets onto the installation. The guidance should emphasize, but not be limited to, pet owner responsibilities and proper care and management of their pets while on the installation.

(2) Examine captured uncontrolled cats or dogs to determine if the animal was ever micro-chipped and/or can be positively identified. If micro-chipped, extract the data to determine ownership and vaccination status.

(3) Examine and evaluate captured any stray animal to determine its health and if the animal:

(a) Can be rescued and adopted, or

(b) Due to injury or disease, the animal's survival is questionable and the Veterinarian recommends euthanasia (lethal injection) as a humane alternative.

(4) Provide humane treatment on site of captured uncontrolled cats or dogs, subject to availability of resources (facilities, manpower and funding).

(5) Establish procedures for euthanasia (lethal injection) of stray animals or wild animals in accordance with American Veterinary Medical Association recommendations.

(6) Establish procedures and provide training for installation Pest Control and/or Animal Control personnel using tranquilizing darts and dart weapons.

e. Military Law Enforcement will:

(1) Respond to reports of stray animals and wild animals in areas such as military family housing, barracks, and administration/office areas to protect personnel from uncontrolled and wild animal contact.

(2) Notify pest control or other installation animal control personnel, as appropriate. If possible, safely restrain the animal until properly trained and equipped personnel arrive to capture and remove it.

(3) Use appropriate force, including lethal force, as necessary, when an animal appears to be sick or its behavior is erratic and not typical, e.g., when it is aggressive or attacks without provocation and cannot be restrained without possible injury to military law enforcement or installation personnel. If the animal is suspected of being rabid, and lethal force is necessary, avoid damage to the brain to allow subsequent testing to confirm rabies status.

(4) Provide secure storage for and issuance of weapons and munitions to pest control or other animal control personnel who are authorized to use weapons for darting or shooting uncontrolled cats or dogs or wild animals.

(5) Provide training and validation qualifications for pest control and other animal control personnel who may be required to shoot animals to ensure that these individuals are proficient in the use of weapons and can accurately hit the target.

(6) Provide oversight when shooting or darting operations are to be conducted to ensure public safety.

f. Public Affairs Office will:

(1) Publicize in installation news media (newspapers, on-installation television) the procedures for reporting and dealing with stray animals until properly trained and equipped personnel arrive, as well as installation polices prohibiting the provision of food, water and shelter to uncontrolled cats, dogs or wild animals, or their release from traps.

(2) Develop and publish articles in installation news media on pet owner responsibilities for the humane treatment of their pets and the sanctions for failure to comply with installation policies.

(3) Assist the Integrated Pest Management Coordinator to partner with local animal control agencies, shelters, and rescue agencies to ensure that the installation presents a positive pro-life image to these agencies and the public by the humane handling and disposition of stray animals on the installation.

(4) Publish notifications in installation news media when stray cats or dogs are at the on-site animal facility for adoption.

g. Military Family Housing will:

(1) Provide all personnel owning pets (cats or dogs), at the time they are assigned family housing, with the Commander's policy pertaining to the proper care and maintenance of their cat or dog and stray animal control.

(2) Provide all personnel with the Commander's stray animal policy. Family housing occupants must notify the Housing Office if they later obtain a cat or dog. Upon receipt of that notification, the Housing Office will provide the housing occupants with the Commander's policy for proper care and maintenance of their pet.

(3) Emphasize to pet owners that failure to comply with the Commander's policies may result in a loss of their housing assignment, requiring them to move out of family housing and obtain housing off the installation. Although a loss of government quarters may present a hardship to the individual and their family, this hardship does not justify noncompliance with established installation policies.

(4) Pet owners are not allowed to breed their cats or dogs without written permission from the Commander.

h. Pest Control and Other Animal Control Personnel will:

(1) Implement the Uncontrolled Cat and Dog Control Program, unless otherwise directed.

(a) Installation pest control is usually assigned to installation Facilities Engineering/Public Works, unless otherwise specified by local policy. Pest control is responsible for capturing uncontrolled cats or dogs on the installation.

i. When installation pest control is insufficiently staffed and resourced, this function can be contracted to a local or federal agency.

ii. When the installation pest control function has been contracted, this operation will be performed by the contracted agency, unless otherwise specified.

(2) Receive specialized training from Veterinary Services personnel in the humane treatment and handling of captured stray animals.

(a) When darting is used to capture an uncontrolled cat or dog, the Veterinarian will determine the proper tranquilizing medication and dosage and dart size.

(b) Military law enforcement personnel will retain control of and will issue the darting weapon and provide on-site supervision of the darting operation to ensure public safety. Local SOP on this process will ensure that a timely response occurs.

(3) Receive medical immunizations and monitoring, as appropriate, to protect from

exposure to potential rabies-infected animals.

(4) When lethal shooting is required, the firearm and ammunition to be used will be issued by and under the direct supervision and control of military law enforcement personnel, who will provide on-site supervision and public safety during the shooting operation.

i. Personnel Who Own Animals and Reside on Military Installations will:

(1) Identify their pet:

(a) Ensuring that their pet is micro-chipped or have their pet micro-chipped within 30 days of occupying a residence on the installation.

(b) Ensuring that their pet wears a collar with identification and rabies vaccination tags when the animal is outside.

(c) Micro-chipping and collars with tags will assist personnel who recover animals that escape to return pets to owners as soon as possible. Collars with tags provide a clearly visible signal to animal control personnel that an animal is someone's pet and not an uncontrolled animal.

(2) Properly Care and Maintain Pets:

(a) Ensure that pet vaccinations are current and attach rabies vaccination tags to the animal's collar.

(b) Feed pets indoors, whenever possible or practical. If feeding outdoors, remove excess uneaten food to prevent attraction of stray animals and wild animals that can pose a health and/or safety threat to pets.

(c) Water is essential to prevent pets left outdoors from becoming dehydrated. Monitor water bowls and refill as needed. Unattended bowls containing water can become a breeding site for mosquitoes. Provide pets shelter when they are left outdoors.

(d) It is recommended that pets kept outdoors be neutered or spayed. Unspayed females, if left outdoors and accessible, will attract males when in cycle. Cats can escape a fenced yard and breed more easily than dogs. Do not let cats roam outdoors.

i. Owners who have American Kennel Club pedigreed pets, **AND HAVE APPROVAL FROM THE GARRISON COMMANDER**, may not need to spay or neuter their animals.

ii. Breeding animals for a business (commercial animal) on the installation is not permitted, even in government housing.

(3) Implement Responsible Pet Ownership:

(a) If a pet escapes or becomes lost on the installation, the owner should contact the installation animal control activity for assistance and the local Veterinary Services to determine if the animal has been turned in. If the animal has been located but is still loose, the pet owner will be requested to assist in re-capturing their pet.

(b) If a pet repeatedly escapes and installation animal control is involved in its re-capture, the installation Military Housing Office will be notified by installation pest control or animal control to take appropriate action to ensure that this problem (lack of pet owner control) does not continue.

(c) The usual fence height for residential units is four (4) feet for chain-link and five (5) to six (6) feet for wooden fences. However, regardless of the fence height or materials used, it is the owner's responsibility to ensure that their animal remains in its designated area and does not create a nuisance or health concern for other residents.

i. Owners of cats will not leave their animals unsupervised outdoors. Fences will not prevent cats from leaving the yard. Do not leave cats outdoors.

ii. With few exceptions, these fence heights will keep dogs confined. However, if the owner has a dog that can escape, an appropriate restraint, such as a chain and collar, must also be used.

j. Supervisors, Facility Managers and Building Custodians will:

(1) Notify installation animal control personnel and request capture and removal of uncontrolled cats or dogs or wild animals that have been observed in or around their facilities.

(2) Ensure that facility personnel do not provide food and/or water to uncontrolled cats, dogs or wild animals, or tamper with traps placed to capture these animals.

(a) Feeding uncontrolled cats, dogs or wild animals, or releasing trapped animals or tripping traps to prevent their capture, is prohibited.

(b) Feeding may appear to be humane treatment but aggravates the installation's stray animal problem.

i. Inform individuals observed providing food and/or water to stray animals, or releasing trapped animals, of installation policy and request them to stop (First Incident).

ii. If the individual persists, notify his/her supervisor and request that appropriate action be taken to stop this behavior (Second Incident).

iii. If the individual continues to disregard the Commander's policy, elevate the issue up the individual's chain of command for appropriate disciplinary action (Third Incident).

4. Privately Owned Animals

a. Animals on Post. All domestic animals brought onto or maintained within the confines of XXXXX are included within the meaning of this regulation.

b. Withdrawal of privileges. Violations of the requirements of this regulation may result in:

(1) Withdrawal of animal keeping privileges.

(2) Removal of the offending animal.

APPENDIX R

SPECIES LIST FOR NATIVE PLANTINGS

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Rhode Island Recommended

Commercially available native plant species suitable for planned landscapes in Rhode Island. Visit our Suppliers Directory to locate businesses that sell native plants or seeds or provide professional landscape or consulting services in this state. Visit the Organizations Directory to locate native plant societies, conservation groups, governmental agencies, botanical gardens, arboreta, and other plant-related organizations in this state.

Scientific Name	Common Name	Duration	Habit	Sun	Water
Acer rubrum	Red Maple, Scarlet Maple, Soft Maple	Perennial	Tree	Sun, Part-shade	Moist
Acer saccharinum	Silver Maple, Soft Maple, White Maple	Perennial	Tree	Sun, Shade, Part-shade	Moist
Acer saccharum	Sugar Maple, Northern Sugar Maple	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Achillea millefolium	Common Yarrow, Western Yarrow, Yarrow, Milfoil	Perennial	Herb	Sun, Part-shade	Dry
Actaea pachypoda	White Baneberry, Dolls Eyes	Perennial	Herb	Shade, Part-shade	Wet, Moist
Actaea rubra	Red Baneberry	Perennial	Herb	Sun, Shade, Part-shade	Moist
Adiantum pedatum	Northern Maidenhair Fern, Maidenhair Fern	Perennial	Fern	Shade, Part-shade	Moist
Alnus incana ssp. *rugosa*	Speckled Alder	Perennial	Tree	Sun, Shade, Part-shade	Moist
Alnus serrulata	Smooth Alder, Hazel Alder, Brookside Alder, Tag Alder, Common Alder, Black Alder	Perennial	Shrub	Sun, Shade, Part-shade	Wet, Moist
Amelanchier canadensis	Canadian Serviceberry, Canadian Service-berry, Shadblow Serviceberry, Juneberry, Shadbush, Junebush	Perennial	Tree	Sun, Shade, Part-shade	Wet, Moist
Anaphalis margaritacea	Western Pearly Everlasting, Pearly-everlasting	Perennial	Herb	Sun, Part-shade	Dry
Anemone canadensis	Canadian Anemone, Round-leaf Thimbleweed, Canada Anemone, Windflower, Meadow Anemone	Perennial	Herb	Shade, Part-shade	Moist
Aquilegia canadensis	Eastern Red Columbine, Wild Red Columbine	Perennial	Herb	Shade, Part-shade	Moist, Dry

Aronia arbutifolia	Red Chokeberry, Red Chokecherry	Perennial	Shrub	Sun	Moist
Asclepias tuberosa	Butterflyweed, Butterfly Milkweed, Orange Milkweed, Pleurisy Root, Chigger Flower	Perennial	Herb	Sun	Moist, Dry
Betula lenta	Sweet Birch, Cherry Birch, Black Birch, Mahogany Birch	Perennial	Tree	Shade, Part-shade	Moist, Dry
Betula populifolia	Gray Birch, White Birch, Aspen-leaved Birch	Perennial	Tree	Sun, Shade, Part-shade	Wet, Moist, Dry
Campanula rotundifolia	Bluebell Bellflower, Bluebell Of Scotland, Bluebell, Harebell, Witches' Thimble	Perennial	Herb	Sun, Shade, Part-shade	Dry
Campanulastrum americanum	American Bellflower, Tall Bellflower	Annual	Herb	Part-shade	Moist
Campsis radicans	Trumpet Creeper, Trumpet Vine, Common Trumpet Creeper, Cow Vine, Foxglove Vine, Hellvine, Devil's Shoestring	Perennial	Vine	Sun	Moist, Dry
Carpinus caroliniana	American Hornbeam, Blue Beech, Water Beech, Musclewood, Ironwood	Perennial	Tree	Shade, Part-shade	Moist
Carya glabra	Pignut Hickory, Sweet Pignut Hickory, Coast Pignut Hickory, Pignut, Sweet Pignut, Smoothbark Hickory, Broom Hickory, Red Hickory, Swamp Hickory, Switch Hickory, Switchbud Hickory	Perennial	Tree	Sun, Shade, Part-shade	Dry
Carya ovata	Shagbark Hickory, Carolina Hickory, Scalybark Hickory, Upland Hickory, Shellbark Hickory	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Carya tomentosa	Mockernut Hickory, Mockernut Hickory, Big Bud Hickory, Mockernut, White Hickory, Whiteheart Hickory, Fragrant Hickory, Bigbud Hickory, Hardbark Hickory, Hognut, Bullnut	Perennial	Tree	Part-shade	Moist
Ceanothus americanus	New Jersey Tea, Redroot	Perennial	Shrub	Shade, Part-shade	Moist, Dry
Chamaecyparis thyoides	Atlantic White Cedar	Perennial	Tree	Part-shade	Wet
Chamerion angustifolium ssp. *angustifolium*	Fireweed, Narrow-leaf Fireweed, Willow Herb	Perennial	Herb	Sun	Moist
Chrysopsis mariana	Maryland Goldenaster, Maryland Golden-aster	Perennial	Herb	Sun	Wet
Claytonia caroliniana	Carolina Springbeauty	Perennial	Herb	Part-shade	Wet, Moist
Claytonia virginica	Virginia Springbeauty, Springbeauty	Perennial	Herb	Part-shade	Moist
Comptonia peregrina	Sweet-fern, Sweetfern	Perennial	Shrub	Part-shade	Dry
Conoclinium coelestinum	Blue Mistflower, Wild Ageratum, Blue Boneset	Perennial	Herb	Sun, Part-shade	Moist
Coreopsis lanceolata	Lanceleaf Coreopsis, Lance-leaved Coreopsis, Lanceleaf Tickseed, Sand Coreopsis	Perennial	Herb	Sun, Shade,	Dry

				Part-shade	
Cornus alternifolia	Alternateleaf Dogwood, Alternate-leaf Dogwood, Pagoda Dogwood	Perennial	Shrub	Shade, Part-shade	Moist
Cornus florida	Flowering Dogwood, Virginia Dogwood, Florida Dogwood, White Cornel, Arrowwood, American Boxwood, False Box, St. Peter's Crown, Corona De San Pedro	Perennial	Tree	Shade, Part-shade	Moist, Dry
Cornus sericea ssp. *sericea*	Redosier Dogwood, Red Osier Dogwood	Perennial	Tree	Sun, Shade, Part-shade	
Desmodium canadense	Showy Tick Trefoil	Perennial	Herb	Sun	Moist, Dry
Eutrochium purpureum	Purple Joepyeweed, Sweet-scented Joepyeweed, Sweet Joepyeweed	Perennial	Herb	Sun, Shade, Part-shade	Moist
Fagus grandifolia	American Beech, White Beech, Red Beech, Ridge Beech, Beechnut Tree	Perennial	Tree	Shade, Part-shade	Moist
Fothergilla gardenii	Dwarf Witchalder, Dwarf Witch-alder, Dwarf Fothergilla	Perennial	Shrub	Sun, Part-shade	
Fothergilla major	Mountain Witchalder, Mountain Witch-alder, Large Fothergilla	Perennial	Shrub	Sun, Part-shade	Moist
Fraxinus americana	White Ash, American Ash, Cane Ash, Smallseed White Ash, Biltmore White Ash, Biltmore Ash	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Fraxinus nigra	Black Ash	Perennial	Tree	Sun, Shade, Part-shade	Wet, Moist
Gaultheria procumbens	Eastern Teaberry, Wintergreen, Checkerberry	Perennial	Shrub	Shade, Part-shade	Moist, Dry
Gaylussacia baccata	Black Huckleberry	Perennial	Shrub	Sun, Shade, Part-shade	Wet, Moist, Dry
Hamamelis virginiana	Witch-hazel, American Witch-hazel, Common Witch-hazel, Winterbloom, Snapping Hazelnut, Striped Alder, Spotted Alder, Tobacco-wood, Water-witch	Perennial	Tree	Shade, Part-shade	Moist, Dry
Helianthus tuberosus	Jerusalem Artichoke, Sunchoke	Perennial	Herb	Sun	Moist, Dry
Hibiscus moscheutos	Crimson-eyed Rose-mallow, Marshmallow Hibiscus	Perennial	Shrub	Sun, Part-shade	Wet, Moist
Ilex glabra	Inkberry, Gallberry	Perennial	Shrub	Part-shade	Wet, Moist
Ilex opaca	American Holly, White Holly, Prickly Holly, Evergreen Holly, Christmas Holly, Yule Holly	Perennial	Tree	Sun, Shade,	Wet, Dry

				Part-shade	
Ilex verticillata	Common Winterberry, Winterberry, Michigan Holly, Black Alder	Perennial	Tree	Sun, Shade, Part-shade	Wet, Moist, Dry
Juglans nigra	Black Walnut, Eastern Black Walnut, American Black Walnut	Perennial	Tree	Sun, Part-shade	Moist
Juniperus virginiana	Eastern Red Cedar, Eastern Redcedar, Virginia Juniper, Red Juniper, Pencil Cedar, Carolina Cedar, Red Savin, Baton Rouge	Perennial	Tree	Sun, Shade, Part-shade	Dry
Kalmia latifolia	Mountain Laurel, Calico Bush, Kalmia	Perennial	Shrub	Part-shade	Moist
Liatris spicata	Dense Blazing Star, Dense Gayfeather, Dense Liatris, Marsh Blazing Star, Marsh Gayfeather, Marsh Liatris	Perennial	Herb	Sun	Moist
Lindera benzoin	Northern Spicebush, Spicebush, Wild Allspice	Perennial	Shrub	Sun, Shade, Part-shade	Wet, Moist, Dry
Liquidambar styraciflua	Sweetgum, American Sweetgum, Red Gum, White Gum, Star-leaved Gum, Starleaf Gum, Alligator Tree, Satin Walnut, Bilsted, Liquidambar	Perennial	Tree	Part-shade	Moist
Liriodendron tulipifera	Tulip Tree, Tulip Poplar, Yellow Poplar	Perennial	Tree	Sun, Shade, Part-shade	Moist
Lobelia cardinalis	Cardinal Flower	Perennial	Herb	Sun, Shade, Part-shade	Wet, Moist
Lobelia siphilitica	Great Blue Lobelia	Perennial	Herb	Sun, Shade, Part-shade	Wet, Moist
Lupinus perennis	Sundial Lupine, Wild Lupine	Perennial	Herb	Sun, Part-shade	Moist, Dry
Maianthemum racemosum ssp. *racemosum*	Feathery False Lily Of The Valley, False Spikenard, False Solomon's Seal, Solomon's Plume, Smilacina	Perennial	Herb	Shade, Part-shade	Moist
Matteuccia struthiopteris	Ostrich Fern	Perennial	Herb, Fern	Shade, Part-shade	Moist
Mitchella repens	Partridgeberry, Twinberry, Running Box, Pigeon Plum	Perennial	Herb	Shade, Part-shade	Moist, Dry
Mitella diphylla	Twoleaf Miterwort, Miterwort	Perennial	Herb	Shade	Moist
Monarda didyma	Scarlet Beebalm, Oswego Tea, Red Bergamot	Perennial	Herb	Sun, Part-shade	Wet, Moist
Monarda fistulosa	Wild Bergamot, Beebalm	Perennial	Herb	Sun, Part-shade	Moist, Dry

Morella pensylvanica	Northern Bayberry, Candleberry	Perennial	Shrub	Part-shade	Moist
Nyssa sylvatica	Blackgum, Black Tupelo, Tupelo, Sourgum, Pepperidge, Tupelo Gum	Perennial	Tree	Sun, Shade, Part-shade	Moist
Osmunda cinnamomea	Cinnamon Fern	Perennial	Herb, Fern	Sun, Shade, Part-shade	Wet, Moist
Osmunda claytoniana	Interrupted Fern	Perennial	Herb, Fern	Shade	Moist
Osmunda regalis	Royal Fern	Perennial	Herb, Fern	Shade, Part-shade	Wet, Moist
Parthenocissus quinquefolia	Virginia Creeper	Perennial	Vine	Sun, Shade, Part-shade	Moist
Penstemon digitalis	Mississippi Penstemon, Mississippi Beardtongue, Smooth White Penstemon, Smooth White Beardtongue, Talus Slope Penstemon, Talus Slope Beardtongue, Foxglove Penstemon, Foxglove Beardtongue	Perennial	Herb	Sun, Part-shade	Wet, Moist, Dry
Penstemon hirsutus	Hairy Penstemon, Hairy Beardtongue	Perennial	Herb	Sun, Shade, Part-shade	Dry
Phlox divaricata	Wild Blue Phlox, Louisiana Phlox, Blue Woodland Phlox, Sweet William, Wild Sweet William	Perennial	Herb	Shade, Part-shade	Moist
Phlox subulata	Creeping Phlox, Moss Phlox, Moss Pink, Rock Pink	Perennial	Herb	Sun, Part-shade	Dry
Physostegia virginiana	Fall Obedient Plant, False Dragonhead, Virginia Lions-heart	Perennial	Herb	Sun, Shade, Part-shade	Moist
Pinus resinosa	Red Pine, Norway Pine, Canadian Pine	Perennial	Tree	Sun	Moist, Dry
Pinus rigida	Pitch Pine, Torch Pine	Perennial	Tree	Sun	Dry
Pinus strobus	Eastern White Pine, Weymouth Pine	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Podophyllum peltatum	Mayapple, Indian Apple, Wild Mandrake, Pomme De Mai, Podophylle Pelt	Perennial	Herb	Shade, Part-shade	Moist
Polemonium reptans	Greek Valerian, Jacob's Ladder	Perennial	Herb	Shade	Moist
Polystichum acrostichoides	Christmas Fern	Perennial	Fern	Shade, Part-shade	Moist
Prunus maritima	Beach Plum	Perennial	Shrub	Sun	Moist, Dry
Prunus serotina	Black Cherry, Wild Black Cherry, Rum Cherry	Perennial	Tree	Sun,	Moist,

				Shade, Part-shade	Dry
Prunus virginiana	Chokecherry, Common Chokecherry, Choke Cherry	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Pteridium aquilinum	Western Bracken Fern, Bracken Fern, Western Bracken, Bracken	Perennial	Herb, Fern	Shade, Part-shade	Wet, Moist, Dry
Quercus alba	White Oak, Northern White Oak, Eastern White Oak, Stave Oak, Ridge White Oak, Forked-leaf White Oak	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Quercus coccinea	Scarlet Oak, Red Oak	Perennial	Tree	Sun	Moist
Quercus ilicifolia	Bear Oak, Scrub Oak	Perennial	Shrub, Tree	Sun	Dry
Quercus macrocarpa	Bur Oak, Burr Oak, Savanna Oak, Overcup Oak, Prairie Oak, Mossy-cup Oak, Mossy-overcup Oak, Blue Oak	Perennial	Tree	Sun, Shade, Part-shade	Wet, Moist, Dry
Quercus phellos	Willow Oak, Swamp Willow Oak, Pin Oak, Peach Oak	Perennial	Tree	Part-shade	Moist
Quercus rubra var. *ambigua*	Northern Red Oak	Perennial	Tree		
Quercus stellata	Post Oak, Iron Oak, Cross Oak	Perennial	Tree	Part-shade	Dry
Rhododendron prunifolium	Plumleaf Azalea	Perennial	Shrub	Part-shade	Moist
Rhus copallinum	Winged Sumac, Shining Sumac, Flameleaf Sumac, Mountain Sumac, Dwarf Sumac, Wing-rib Sumac, Black Sumac, Upland Sumac	Perennial	Shrub	Sun	Dry
Rhus typhina	Staghorn Sumac, Velvet Sumac	Perennial	Shrub, Tree	Sun, Shade, Part-shade	Dry
Rosa palustris	Swamp Rose	Perennial	Shrub	Sun, Shade, Part-shade	Wet, Moist
Rudbeckia hirta	Black-eyed Susan, Common Black-eyed Susan, Brown-eyed Susan	Annual	Herb	Sun	Moist, Dry
Rudbeckia laciniata	Green-headed Coneflower, Greenhead Coneflower, Cutleaf Coneflower, Wild Goldenglow, Sochan	Perennial	Herb	Sun, Shade, Part-shade	Moist
Sassafras albidum	Sassafras, White Sassafras, Ague Tree, Cinnamon Wood, Mitten Tree, Saloop, Smelling Stick	Perennial	Tree	Sun, Shade, Part-shade	Moist
Sibbaldiopsis tridentata	Shrubby Five-fingers	Perennial	Herb	Sun	
Silene virginica	Fire Pink, Scarlet Catchfly	Perennial	Herb	Part-shade	Moist, Dry

Silphium perfoliatum	Cup Plant, Indian Cup	Perennial	Herb	Sun	Wet, Moist, Dry
Sorbus americana	American Mountain Ash, American Mountain-ash	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Spiraea tomentosa	Steeplebush	Perennial	Shrub	Sun, Shade, Part-shade	Moist
Symphyotrichum novae-angliae	New England Aster, New England American-aster	Perennial	Herb	Part-shade	Moist
Tilia americana	American Basswood, American Linden, Lime Tree, Bee Tree	Perennial	Tree	Sun, Shade, Part-shade	Moist, Dry
Tsuga canadensis	Eastern Hemlock	Perennial	Tree	Shade, Part-shade	Moist
Vaccinium angustifolium	Lowbush Blueberry, Late Lowbush Blueberry	Perennial	Shrub	Sun, Shade, Part-shade	Moist, Dry
Vaccinium corymbosum	Highbush Blueberry	Perennial	Shrub	Sun, Shade, Part-shade	Wet, Moist, Dry
Vaccinium macrocarpon	Cranberry, Large Cranberry	Perennial	Shrub	Part-shade	Wet
Viburnum acerifolium	Mapleleaf Viburnum, Maple-leaf Viburnum, Maple-leaf Arrowwood, Arrowwood	Perennial	Shrub	Sun, Shade, Part-shade	Moist, Dry
Viburnum lentago	Nannyberry, Blackhaw, Sweet Viburnum, Sheepberry	Perennial	Shrub	Sun, Shade, Part-shade	Moist
Viola pedata	Birdfoot Violet, Bird's-foot Violet, Bird-foot Violet	Perennial	Herb	Shade, Part-shade	Dry
Viola sororia	Missouri Violet, Common Blue Violet, Hooded Blue Violet, Florida Violet, Meadow Violet, Confederate Violet, Dooryard Violet, Purple Violet, Woolly Blue Violet, Wood Violet, Hooded Violet	Annual	Herb	Sun, Part-shade	Moist

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APPENDIX S

MEMORANDUMS OF UNDERSTANDING / AGREEMENTS

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Marine Mammal Health and Stranding Response Program

October 20, 2006

Glenn,

Please find the enclosed MOA signed by Patricia Kurkul, NOAA Fisheries, Northeast Regional Administrator. Copies have been retained by our office.

Thank you,

Mendy Garron

Mendy Garron

Mendy Garron
NER Stranding Coordinator
Protected Resources Division
1 Blackburn Drive
Gloucester, MA 01930
978-281-9300 x6528
Mendy.Garron@noaa.gov

Memorandum Of Agreement

Between

Naval Station Newport

Naval Undersea Warfare Center Division, Newport

And

National Oceanic And Atmospheric Administration Fisheries Service, Northeast Regional Office, Protected Resources Division

1. Parties. The parties to this Memorandum of Agreement (MOA) are the Naval Station Newport (hereinafter NAVSTANPT), Naval Undersea Warfare Center Division, Newport (hereinafter NUWCDIVNPT) and the National Oceanic and Atmospheric Administration Fisheries Service, Northeast Regional Office, Protected Resources Division (hereinafter NOAAFS).

2. Authority. This cooperative effort is undertaken under the authority of the Marine Mammal Protection Act (MMPA), 16 U.S.C. §§ 1361 *et seq.*; and the Endangered Species Act (ESA), 16 U.S.C. §§ 1531 *et seq.*

3. Purpose. The purpose of this MOA is to provide access to a secure location at NAVSTANPT or NUWCDIVNPT Stillwater Basin for the necropsy of large whales, the rarest of which are North Atlantic right whales. The necropsy team would be composed of NOAA personnel and their contractors, as well as volunteers from NAVSTANPT and NUWCDIVNPT who wish to participate.

4. Background. North Atlantic right whales are now threatened by extinction with a total population estimate of approximately 300 animals, most of which can be found in New England waters seasonally. Right whales have been protected through whaling prohibitions for over 60 years and by the MMPA since 1972 and the ESA since 1973. Even with these statutory protections, however, recovery of the species has not occurred. Therefore, careful study of dead right whales whenever feasible may reveal the actual cause of death and may lead to measures that prevent future mortality and improve chances of recovery. Currently, no designated secure location for the study of dead large whales exists in southern New England. The NUWCDIVNPT and NAVSTANPT locations and their features represent a rare combination of necessary components for large whale necropsy and the study of mortality mainly because their boat ramp and beaches are not for public use and they provide a great measure of security throughout the process.

Therefore, the NOAAFS desires through this MOA to have access to, and make use of, the properties at NAVSTANPT or NUWCDIVNPT, including the Stillwater Basin boat ramp and parking lot, as a secure necropsy location under the conditions described below. The Stillwater Basin boat ramp is best for logistical reasons with NAVSTANPT beaches available for backup should normal ramp operations be scheduled during the projected necropsy period (see Item 6 below). The boat ramp is only available for necropsy if the procedure does not interfere with scheduled operations.

5. Responsibilities.

a. NAVSTANPT and NUWCDIVNPT shall:

(1) The NAVSTANPT Commanding Officer will permit a NOAAFS or NOAAFS contracted vessel with a dead large whale in tow, and a tug with a disposal barge, to enter into restricted waters for the sole purpose of necropsy and removal of remains. Authorized vessels will remain 100 feet or more from any Navy or Coast Guard vessel.

(2) The NAVSTANPT Environmental Point Of Contact (POC) shall provide the NAVSTANPT and NUWCDIVNPT (when appropriate) Security Heads, or designated representatives, a list of those NOAAFS personnel, contractors, and assistants who will perform or assist with the necropsy. If accessing NUWCDIVNPT grounds, visitor requests must be received by NUWCDIVNPT security three days in advance. In emergency situations, the 3-day period can be waived and the NUWCDIVNPT POC shall provide the information.

(3) The NUWCDIVNPT POC shall assist NOAAFS personnel or their contractors in procuring necessary camera and equipment passes. For example, camera passes are required when at NUWCDIVNPT and can be acquired from the NUWCDIVNPT Security Division.

(4) Navy POCs shall allow no cameras other than those carried to document the necropsy by Navy personnel, NOAAFS, or their contractors to be used at the necropsy. No press will be allowed access to the Stillwater Basin while whales are being processed unless authorized to do so by the NUWCDIVNPT Commander or Public Affairs Officer (PAO).

b. The NOAAFS shall:

(1) NOAAFS personnel or their contractors who desire to participate in the necropsy shall provide the following information and documentation to the NAVSTANPT Security Heads via the Environmental POC: his/her name, organization and affiliations, business address, contact telephone numbers, a photograph, a statement that the individual is a U. S. citizen (includes crewmembers). Captains of vessels that wish to enter the restricted area must be ready to verify the identity of any crewmember with a valid photo identification card.

(2) The contracted vessels shall contact NAVSTANPT Security using VHF Channel 16 at least 15 minutes before entering the restricted area and again on departing a restricted area. NAVSTANPT uses VHF Channel 10 as a working channel. Call signs are either 'Newport Port Control,' 'Naval Station Security Boat,' and/or 'Naval Station Security.' If any of these means of communication is ineffective, vessel captains may contact NAVSTANPT Security at 401-841-4041 using a cell phone or other means to connect to a landline.

(3) The NOAAFS shall provide for complete cleanup of the necropsy area and disposal of the carcass off-site by any legal means.

(4) The NOAAFS POC shall provide a full report explaining the findings of the necropsies to the Commanding Officer, NAVSTANPT and the Commander, NUWCDIVNPT when it becomes available. No pronouncement as to cause will be released until laboratory studies are complete.

(5) NOAAFS personnel and their contractors, assistants, and volunteers recognize that in the event of terrorist action(s) (or attempted action(s)) within the restricted area that they will be at risk of personal injury or loss of life and/or at risk of loss or damage to their property as a direct or indirect result of terrorist action(s) or as a result of potential collateral effects of the U. S. Government's response to terrorist action(s) or attempted action(s). By entering the restricted area, the NOAAFS and their contractors, assistants, and volunteers knowingly assume all risks of: (1) terrorist action(s), attempted action(s) and (2) the appropriate response thereto by the United States including, but not limited to, the use of deadly force.

(6) NOAAFS POC or contracted experts shall provide a time estimate to the Commander, NUWCDIVNPT if the Stillwater Basin boat ramp and parking lot are to be used for a complete work-up of the animal(s) including clean-up operations. If schedule conflicts exist for the Stillwater Basin site, then other options for necropsy such as reconsideration of the other available locations at NAVSTANPT shall be considered. NUWCDIVNPT facilities can only be used on a 'not to interfere' with operations basis.

6. Administration of the Agreement.

a. The NAVSTANPT Point of Contact for this agreement is:
Ms. Shannon Kam, Code N8N (401-841-6377).

b. The NUWCDIVNPT Point of Contact for this agreement is:
Mr. Glenn Mitchell, Code 551 (401-832-1617).

c. The NOAAFS NERO PRD Point of Contact for this agreement is:
Ms. Mendy Garron, US Stranding Network Regional Coordinator
(978-281-9300 Extension 6528 or Pager 978-585-7149)

7. Administrative Provisions.

a. This MOA shall become effective on the date of the latest signature affixed to the document and shall remain in effect indefinitely.

b. The agreement shall be reviewed five years from the date of signing for required changes and at anytime upon the request of either party.

c. Requests for revision and/or modification shall be forwarded from one party to all others via written notice at least 60 days prior to the effective date of the proposed changes.

d. This agreement may be terminated by mutual agreement of the parties at any time. Unilateral termination of the agreement shall require at least 60 days prior written notice to the other party in the agreement.

8. Signatures.

T. W. MALLOY, CAPT, USN
Commanding Officer
Naval Station Newport
Newport RI

SEP 27, 2006
(Date)

M. W. BYMAN, CAPT, USN
Commander
Naval Undersea Warfare Center
Division, Newport
Newport, RI

9/11/06
(Date)

PATRICIA KURKUL
Regional Administrator
NOAA Fisheries Service
Gloucester, MA

Oct 18, 2006
(Date)

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE COMMANDING OFFICER, NAVAL STATION NEWPORT,
PERTINENT FEDERAL AND STATE AGENCIES
AND
THE RHODE ISLAND LOBSTERMAN's ASSOCIATION
AND
OCEAN STATE FISHERMAN'S ASSOCIATION

5800
Ser N01L/1151
21 JUN 02

Subject: MEMORANDUM OF UNDERSTANDING

Ref: (a) 33 U.S. Code 1, Et seq.
(b) ACE Notice of Proposed Restricted Area of 21 May 02
(c) 33 C.F.R. 334.4

1. Purpose: The purpose of this Memorandum of Understanding (MOU) is to establish the boundaries and area of access for lobster fisherman into Naval Station (NAVSTA) Newport's navigable waters and to comply with reference (a).

2. Situation: The Rhode Island Lobsterman's Association and the Ocean State Fisherman's Association (Association) on behalf of its members and any other lobster fisherman who become signatories to this MOU desire that lobstermen have access to the long established and demarcated restricted areas in the vicinity of NAVSTA Newport for the purpose of placing and retrieving lobster traps and related fishing equipment.

The situation is that NAVSTA must maintain proper security and force protection in the restricted areas proposed by reference (b) where lobsterman may wish to fish. The purpose of the proposed regulation is to create an area of separation between general navigation on the East Passage of Narragansett Bay and active military ships berthed at NAVSTA Newport. This would be to improve security for the ships and personnel on board and the safety of the public. The area would be marked off with a series of danger area marker buoys and may sometimes be boomed off. The proposed rule will be promulgated in the Federal Register per reference (c). A description of the area and the proposed regulation is contained in reference (b).

The signatories to this MOU and its members affirm their desire for access to the restricted area for the purpose of harvesting lobsters and similar fishing operations.

Subject: MEMORANDUM OF UNDERSTANDING

3. Scope: This MOU shall apply to the restricted areas only when the current force protection condition (FPCON) is BRAVO or lower. Whenever NAVSTA is ordered by appropriate authority to a higher FPCON level, there shall be no entry by any lobsterman into a restricted area for any reason. NAVSTA will promptly notify the Associations' president, the Rhode Island Department of Environmental Management (DEM), and the U.S. Coast Guard in the event of a change in FPCON. Furthermore, in the event the NAVSTA is ordered by appropriate authority to place a barrier, buoyed or otherwise, around piers, berths and/or vessels, there shall be no entry beyond the barrier for any reason. NAVSTA will notify the Associations, the Rhode Island DEM, and the U.S. Coast Guard in advance of the placing of such a barrier. Likewise, whenever there is an active U.S. Navy warship in port, there shall be no entry by any lobsterman into a restricted area for any reason unless advised otherwise.

4. Agreement: The Commanding Officer (CO), NAVSTA Newport, members of the Rhode Island Lobsterman's Association and the Ocean State Fisherman's Association, upon their execution of this MOU, hereby agree that:

a. The CO, NAVSTA will permit the Associations' members and individual lobstermen (upon their execution of this MOU) to enter into the restricted waters in the vicinity of NAVSTA Newport for the sole purpose of placing and retrieving lobster traps and related fishing equipment (fish traps) incident to the harvesting of lobsters and fish and such entry is only authorized where fisherman will remain 100 feet away from any Navy or Coast Guard vessel, pier, or similar docking system where vessels are moored or can be moored.

b. The Association shall provide to the NAVSTA Security Department Head, or designated representative, a list of those lobstermen (Association members or individual lobstermen) who desire to harvest lobsters within a demarcated restricted area.

c. All lobstermen who desire to enter a restricted area shall provide the following information and documentation to the NAVSTA Security Department Head: his/her name, address, and telephone number; the name, address and telephone number of any crew member(s), a statement that he/she (and any crew member(s)) is (are) a United States citizen(s), the name of his/her boat; the hull or registration number; the color code and registration number of lobster/fishing buoys; and the vessel's radio channel

Subject: MEMORANDUM OF UNDERSTANDING

and call sign. Furthermore, all captains of vessels that are lobstermen who desire to enter a restricted area shall obtain from the NAVSTA Security Department, at no cost to them, a recent color photograph of himself/herself; and four (4) recent color photographs of his/her boat (one (1) view of each side, the front and the rear of the vessel). In this regard, lobstermen will contact the NAVSTA Security Department Head at 401-841-4041, or his designated representative, to make arrangements for this prescribed photo taking requirement. Moreover, all captains of vessels that are lobstermen who desire to enter a restricted area must be ready to verify the identity of any crew member(s) with a valid photo identification card. The Associations' lobstermen, upon providing the above information and submitting to photograph, shall receive a chart of the waters surrounding the NAVSTA, with the restricted areas clearly demarcated, as well as a placard that will be affixed to the lobsterman's vessel for identification and registration purposes. This placard, which will be furnished by NAVSTA Security, will be colored-coded by year and shall be renewed annually. This information shall be presented to and registration shall take place at the NAVSTA Pass and Identification Office outside Gate Number 1.

d. Lobstermen shall contact NAVSTA Security using VHF Channel 16 at least fifteen (15) minutes before entering a restricted area and again upon departing a restricted area. NAVSTA Newport uses VHF Channel 10 as a working channel. Call signs are either "Newport Port Control," "Naval Station Security Boat," and/or "Naval Station Security." Lobstermen shall use one of these call signs when communicating with NAVSTA Newport. If any of these means of communication are ineffective, Lobstermen may contact NAVSTA Security at 401-841-4041 using a cell phone or similar means of communication.

IN NO INSTANCE SHALL ANY LOBSTER TRAP OR BUOY INSIDE A DEMARCATED RESTRICTED AREA BE PLACED WITHIN ONE HUNDRED (100) FEET OF ANY STRUCTURE, PIER, DOCK, BERTH, OR VESSEL.

e. The Associations' members and individual lobstermen recognize that in the event of terrorist action(s) (or attempted action(s)) within a restricted area lobstermen will be at grave risk of personal injury or loss of life and/or at risk of loss or damage to their property, either as a direct or indirect result of terrorist action(s) or as the result of the potential collateral effects of the U.S. Government's response to terrorist action(s) or attempted action(s). By entering a restricted area lobstermen knowingly assume any and all risks of: (1) terrorist action(s), attempted action(s) and (2) the appropriate response thereto by the United States including, but not limited to, the use of deadly force.

5. Effective Date: This MOU is effective immediately.

6. Penalties: Failure by a lobsterman to comply with any of the terms and conditions of this MOU shall result in the NAVSTA taking the following action(s) against such individual(s):

a. First offense - the lobsterman shall receive a written warning signed by the Commanding Officer. Violators will be placed in a probationary status for one (1) year.

b. Second Offense - the lobsterman's privilege to enter the restricted areas shall be rescinded immediately, the lobsterman shall surrender his/her registration placard, and the Rhode Island DEM shall be notified of the decision. Any captain of a vessel who enters NAVSTA Newport waters after losing their privileges shall be prosecuted for trespassing.

7. In connection with the implementation of this MOU, the Associations' members shall cooperate fully with representatives of NAVSTA Newport, the U.S. Coast Guard, the U.S. Army Corps of Engineers and the Rhode Island DEM.

8. The Associations' members further acknowledge the necessity of moving their lobstering equipment when notified of a ship movement. The Commanding Officer, NAVSTA Newport shall provide as much advance notification to the Associations' members as possible, consistent with security and force protection constraints. Information concerning ship movements will be furnished to the Newport Harbormaster, and to the extent possible, to the Associations' members.

9. FACSIMILE SIGNATURES: Any signatures sent through facsimile shall serve the same function and legality as an original signature.

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Subject: MEMORANDUM OF UNDERSTANDING

R. A. Cooper

R. A. COOPER
COMMANDING OFFICER
NAVAL STATION NEWPORT

5/29/02
PRESIDENT, RHODE ISLAND LOBSTERMAN'S
ASSOCIATION

Russell E. Wallis
PRESIDENT, OCEAN STATE FISHERMAN'S
ASSOCIATION

5800
Ser N01L/1215
9 Jul 02

ADDENDUM TO
MEMORANDUM OF UNDERSTANDING
BETWEEN
THE COMMANDING OFFICER, NAVAL STATION NEWPORT,
PERTINENT FEDERAL AND STATE AGENCIES
AND
THE RHODE ISLAND LOBSTERMAN's ASSOCIATION
AND
OCEAN STATE FISHERMAN'S ASSOCIATION

Subject: MEMORANDUM OF UNDERSTANDING

Ref: (d) Memorandum of Understanding Ser N01L/1151 of 21 Jun 02

1. By a meeting held on 21 June 2002, Naval Station (NAVSTA) Newport and the Narragansett Indian Land and Water Resource Commission, acting on behalf of the Narragansett Indian Tribe (hereinafter, "the parties"), have met and resolved any outstanding government-to-government questions with respect to Title 33 of the United States Code.

2. By mutual agreement, the terms of reference (d) are hereby incorporated by reference and are made a part hereto, and the parties agree to enter the MOU of reference (d), a copy of which has been previously provided, thus giving tribal lobsterman permission to conduct lobster related fishing activities in the restricted area delineated under reference (d).

3. Effective immediately, undersigned below, and its members, are deemed signatories to reference (d) and, as such, shall abide by the terms thereof.

4. Any signatures sent through facsimile shall serve the same function and legality as an original signature.

R. A. Cooper
R. A. COOPER
COMMANDING OFFICER
NAVAL STATION NEWPORT

Date: 08 July 02

CHAIRMAN
NARRAGANSETT INDIAN
LAND & WATER RESOURCE COMMISSION.
FOR AND ON BEHALF OF THE
NARRAGANSETT INDIAN TRIBE

Date: 6/24/2002

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APPENDIX T

TECHNICAL GUIDANCE FOR ASSESSING THE EFFECTS OF ANTHROPOGENIC SOUND ON MARINE MAMMAL HEARING

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2018 Revision to:

Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0)

Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts

Office of Protected Resources
National Marine Fisheries Service
Silver Spring, MD 20910

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-OPR-59
April 2018

2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0)

Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts

NOAA Technical Memorandum NMFS-OPR-59
April 2018

U.S. Department of Commerce
Wilbur Ross, Secretary

National Oceanic and Atmospheric Administration
Tim Gallaudet, Ph.D., USN Ret., Acting Administrator

National Marine Fisheries Service
Chris Oliver, Assistant Administrator for Fisheries

Recommended citation:

National Marine Fisheries Service. 2018. 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 p.

Copies of this report may be obtained from:

Office of Protected Resources
National Oceanic and Atmospheric Administration
1315 East-West Highway, F/PR2
Silver Spring, MD 20910

Or online at:
NOAA Fisheries Publication web site

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North Atlantic right whales (*Eubalaena glacialis*), Low-frequency cetacean Photo: NOAA
Bottlenose dolphin (*Tursiops truncatus*), Mid-frequency cetacean Photo: Allison Henry (NOAA)
Dall's porpoise (*Phocoenoides dalli*), High-frequency cetacean Photo: Kate Stafford (NOAA)
California sea lion (*Zalophus californianus*), Otariid pinniped Photo: Sharon Melin (NOAA)

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

a	Low-frequency exponent
ABR	Auditory Brainstem Response
AEP	Auditory Evoked Potentials
AM	Amplitude Modulated
ANSI	American National Standards Institute
b	High-frequency exponent
BOEM	Bureau of Ocean Energy Management
C	Weighting function gain (dB)
CT	Computerized Tomography
D	Duty Cycle
dB	Decibel
PK	Peak sound level
DPOAE	Distortion product otoacoustic emission
$E_{aud}(f)$	Auditory exposure function
E_0	Exposure Threshold
EEH	Equal Energy Hypothesis
EO	Executive Order
EQL	Equal Loudness
ES	Executive Summary
ESA	Endangered Species Act
f_0	Best hearing (kHz)
f_1	Low-frequency cutoff (kHz)
f_2	High-frequency cutoff (kHz)
G&G	Geological and Geophysical
h	hour
HF	High-frequency
HISA	Highly Influential Scientific Assessment
Hz	Hertz
in^3	Cubic inches
ISI	Influential Scientific Information
ISO	International Organization for Standardization
IQG	Information Quality Guidelines
K	Exposure function gain (dB)
kHz	Kilohertz
LDEO	Lamont-Doherty Earth Observatory
LF	Low-frequency
$L_{0\text{-pk}}$	Peak sound pressure level
$L_{0\text{-pk,flat}}$	Peak sound pressure level (unweighted)
$L_{E,24h}$	Sound exposure level, cumulative 24h
MF	Mid-frequency
min	Minutes
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSE	Mean-squared error
m	meter
msec	Milliseconds
NAZ	Narrow Azimuth
NIHL	Noise-induced Hearing Loss
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRC	National Research Council
NS2	National Standard 2
NSF	National Science Foundation
OMB	Office of Management and Budget
ONMS	Office of National Marine Sanctuaries
OPR	Office of Protected Resources
OSHA	Occupational Safety and Health Administration
OW	Otariids in water
p_0	Sound Pressure Level
Pa	Pascals
π	pi
PK	peak sound pressure level
PTS	Permanent Threshold Shift
PW	Phocids in water
R	Range
R_0	“Safe Distance”
R^2	Goodness of fit
RMS	Root-Mean-Square sound pressure level
S	Source Factor
S_E	Energy Source Factor
s	Seconds
s	Distance from source
s_0	Slope
SEL	Sound exposure level
SEL_{cum}	Cumulative sound exposure level
SIO	Scripps Institution of Oceanography
SL	Source Level

SL_E	Energy Source Level
s_0	Slope (dB/decade)
SPL	Sound Pressure Level
SSC-PAC	SPAWAR Systems Center Pacific
τ	1/repetition rate
TAP	U.S. Navy's Tactical Training Theater Assessment and Planning Program
TS	Threshold Shift
TTS	Temporary Threshold Shift
μPa	Micropascal
μPa^2-s	Micropascal squared second
USFWS	U.S. Fish and Wildlife Service
v	Velocity (transit speed)
$W_{\mathrm{aud}}(f)$	Auditory weighting function
WAZ	Wide Azimuth
WFA	Weighting factor adjustments

EXECUTIVE SUMMARY

This document provides voluntary technical guidance for assessing the effects of underwater anthropogenic (human-made) sound on the hearing of marine mammal species under the jurisdiction of the National Marine Fisheries Service (NMFS) and was completed in collaboration with the National Ocean Service (NOS), Office of National Marine Sanctuaries. Specifically, it identifies the received levels, or thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to underwater anthropogenic sound sources. This Technical Guidance may be used by NMFS analysts/managers and other relevant action proponents/stakeholders, including other federal agencies, when seeking to determine whether and how their activities are expected to result in potential impacts to marine mammal hearing via acoustic exposure. Please note that action proponents have discretion as to whether to use the Technical Guidance; other scientifically rigorous methods are acceptable. This document outlines the development of NMFS' thresholds and describes how they will be updated in the future.

NMFS has compiled, interpreted, and synthesized the scientific literature, including a Technical Report by Dr. James Finneran (U.S. Navy-SPAWAR Systems Center Pacific (SSC-PAC)) (Finneran 2016; Appendix A of this Technical Guidance), to produce thresholds for onset of temporary (TTS) and permanent threshold shifts (PTS) (Table ES2). This document includes a protocol for estimating PTS onset thresholds for impulsive (e.g., airguns, impact pile drivers) and non-impulsive (e.g., tactical sonar, vibratory pile drivers) sound sources, the formation of marine mammal hearing groups (low- (LF), mid- (MF), and high- (HF) frequency cetaceans, and otariid (OW) and phocid (PW) pinnipeds; Table ES1), and the incorporation of marine mammal auditory weighting functions (Figures ES1 and ES2) into the derivation of PTS onset thresholds. These thresholds are presented using dual metrics of weighted cumulative sound exposure level (SEL_{cum}) and peak sound level (PK) for impulsive sounds and weighted SEL_{cum} for non-impulsive sounds.

While the Technical Guidance's thresholds are more complex than those used to date in most cases by NMFS, they reflect the current state of scientific knowledge regarding the characteristics of sound that have the potential to impact marine mammal hearing sensitivity. NMFS recognizes that the implementation of marine mammal weighting functions and the weighted SEL_{cum} metric represent new factors for consideration, which may extend beyond the capabilities of some action proponents. Thus, NMFS has developed alternative tools for those who cannot fully incorporate these factors (See Appendix D, Technical Guidance's companion User Spreadsheet tool[1], and recently developed User Spreadsheet Manual (NMFS 2018)[1]).

These thresholds do not represent the entirety of a comprehensive analysis of the effects of a proposed action, but rather serve as one tool (along with, e.g., behavioral impact thresholds, auditory masking assessments, evaluations to help understand the ultimate effects of any particular type of impact on an individual's fitness, population assessments, etc.) to help evaluate the effects of a proposed action and make the relevant findings required by NOAA's various statutes. The Technical Guidance may inform decisions related to mitigation and monitoring requirements, but it does not mandate any specific mitigation be required. The Technical Guidance does not address or change NMFS' application of these thresholds in the regulatory context, under applicable statutes and does not create or confer any rights for or on any person, or operate to bind the public. It only updates NMFS' thresholds based on the most recent science.

This Technical Guidance is classified as a Highly Influential Scientific Assessment (HISA) by the President's Office of Management and Budget (OMB). As such, independent peer review was required prior to broad public dissemination by the Federal Government. Details of the three peer reviews, associated with the Technical Guidance, are within this document (Appendix C).

[1] Link to Technical Guidance web page.

REVISIONS TO 2016 TECHNICAL GUIDANCE

Presidential Executive Order (EO) 13795, Implementing an America-First Offshore Energy Strategy (82 FR 20815; April 28, 2017), states in section 2 that "It shall be the policy of the United States to encourage energy exploration and production, including on the Outer Continental Shelf, in order to maintain the Nation's position as a global energy leader and foster energy security and resilience for the benefit of the American people, while ensuring that any such activity is safe and environmentally responsible." Section 10 of the E.O. called for a review of the 2016 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Technical Guidance; NMFS 2016a) as follows: "The Secretary of Commerce shall review [Technical Guidance] for consistency with the policy set forth in Section 2 of this order and, after consultation with the appropriate Federal agencies, take all steps permitted by law to rescind or revise that guidance, if appropriate."

To assist the Secretary in carrying out the directive under EO 13795, NMFS held a 45-day public comment period (82 FR 24950; May 31, 2017) and a Federal Interagency Consultation (September 25, 2017) to solicit comments on the Technical Guidance for consistency with the EO's policy.

Many of the comments NMFS received, including those from Federal agencies, were supportive of the Technical Guidance, including the science used in its derivation and the robust process that NMFS followed, including four independent peer reviews. The majority of commenters recommended that the Technical Guidance remain unchanged. The Federal agencies, Members of Congress, and subject matter experts expressed support for the Technical Guidance as reflecting the best available science. NMFS received no recommendations to rescind the 2016 Technical Guidance. The majority of comments pertained to recommendations to improve implementation of the Technical Guidance, rather than the Technical Guidance itself, or were beyond the scope of the Technical Guidance and/or its review under section 10 of EO 13795.

NMFS' evaluation of comments received during this process affirmed that the Technical Guidance is based on upon the best available science. However, to facilitate its use and implementation, NMFS revised the 2016 Technical Guidance (NMFS 2016a), per approval of the Secretary of Commerce, to provide improvements and clarification on implementation of the document (i.e., 2018 Revised Technical Guidance, Version 2.0).

SUMMARY OF TECHNICAL ASPECTS

This document is organized so that the most pertinent information can be found easily in the main body. Additional details are provided in the appendices. Section I introduces the document. NMFS' thresholds for onset of PTS for marine mammals exposed to underwater sound are presented in Section II. NMFS' plan for periodically updating thresholds is presented in Section III. More details on the development of thresholds, the peer review and public comment process, research recommendations, alternative methodology, and a glossary of acoustic terms are found in the appendices.

The following Tables and Figures summarize the three main aspects of the Technical Guidance: 1) Marine mammal hearing groups (Table ES1); 2) Marine mammal auditory weighting functions (Figures ES1 and ES2; Table ES2); and PTS onset thresholds (Table ES3).

Table ES1: Marine mammal hearing groups.

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz

***** Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

Table ES2: Summary of auditory weighting and exposure function parameters.*

Hearing Group	a	b	f_1 (kHz)	f_2 (kHz)	C (dB)	K (dB)
Low-frequency (LF) cetaceans	1.0	2	0.2	19	0.13	179
Mid-frequency (MF) cetaceans	1.6	2	8.8	110	1.20	177
High-frequency (HF) cetaceans	1.8	2	12	140	1.36	152
Phocid pinnipeds (PW) (underwater)	1.0	2	1.9	30	0.75	180
Otariid pinnipeds (OW) (underwater)	2.0	2	0.94	25	0.64	198

* Equations associated with Technical Guidance's auditory weighting ($W_{aud}(f)$) and exposure functions ($E_{aud}(f)$):

$$W_{aud}(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\} \quad \text{dB}$$

$$E_{aud}(f) = K - 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{\left[1+(f/f_1)^2\right]^a\left[1+(f/f_2)^2\right]^b}\right\} \quad \text{dB}$$

Table ES3: Summary of PTS onset thresholds.

	PTS Onset Thresholds* **(Received Level)**	
Hearing Group	**Impulsive**	**Non-impulsive**
Low-Frequency (LF) Cetaceans	*Cell 1* $L_{p,\text{0-pk,flat}}$: 219 dB $L_{E,p,\text{ LF,24h}}$: 183 dB	*Cell 2* $L_{E,p,\text{ LF,24h}}$: 199 dB
Mid-Frequency (MF) Cetaceans	*Cell 3* $L_{p,\text{0-pk,flat}}$: 230 dB $L_{E,p,\text{ MF,24h}}$: 185 dB	*Cell 4* $L_{E,p,\text{ MF,24h}}$: 198 dB
High-Frequency (HF) Cetaceans	*Cell 5* $L_{p,\text{0-pk,flat}}$: 202 dB $L_{E,p,\text{HF,24h}}$: 155 dB	*Cell 6* $L_{E,p,\text{ HF,24h}}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 7* $L_{p,\text{0-pk.flat}}$: 218 dB $L_{E,p,\text{PW,24h}}$: 185 dB	*Cell 8* $L_{E,p,\text{PW,24h}}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	*Cell 9* $L_{p,\text{0-pk,flat}}$: 232 dB $L_{E,p,\text{OW,24h}}$: 203 dB	*Cell 10* $L_{E,p,\text{OW,24h}}$: 219 dB

* Dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds are recommended for consideration.

<u>Note</u>: Peak sound pressure level ($L_{p,\text{0-pk}}$) has a reference value of 1 µPa, and weighted cumulative sound exposure level ($L_{E,p}$) has a reference value of 1µPa^{2}s. In this Table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kHz). The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The weighted cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these thresholds will be exceeded.

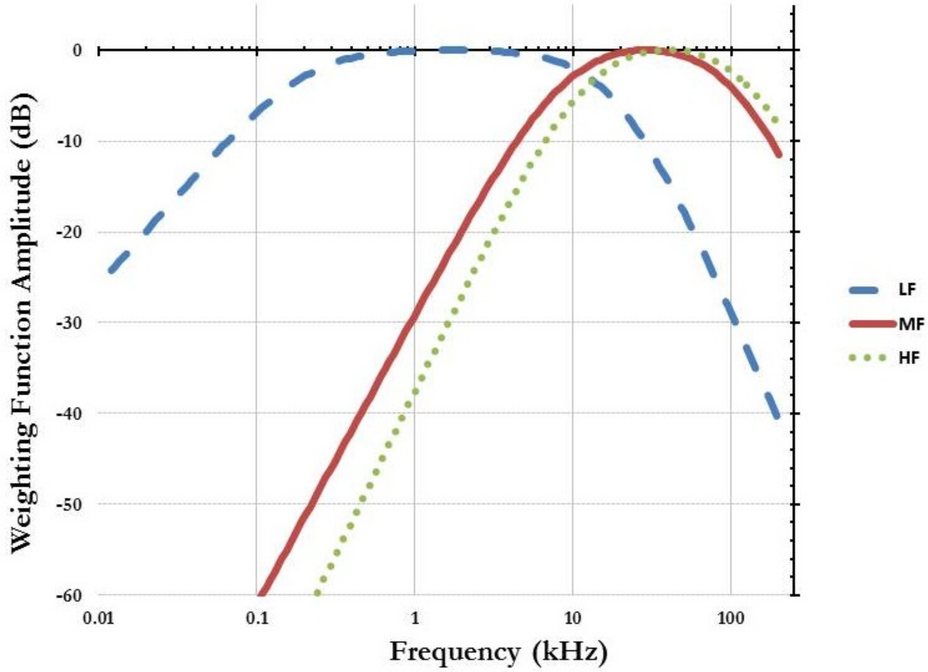

Figure ES1: **Auditory weighting functions for low-frequency (LF; dashed line), mid-frequency (MF; solid line), and high-frequency (HF; dotted line) cetaceans.**

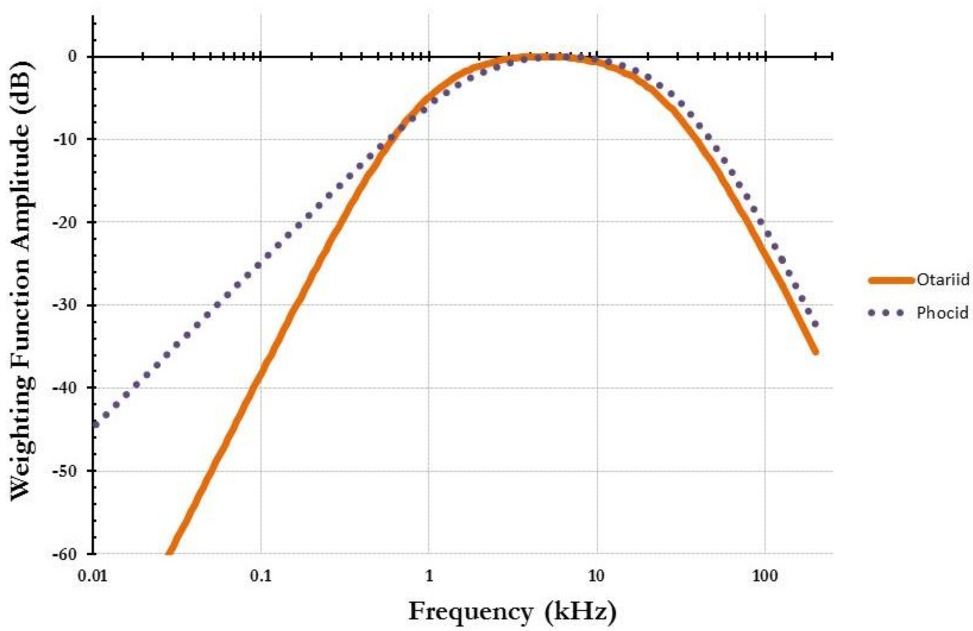

Figure ES2: **Underwater auditory weighting functions for otariid (OW; solid line) and phocid (PW; dotted line) pinnipeds.**

REVISION TO: TECHNICAL GUIDANCE FOR ASSESSING THE EFFECTS OF ANTHROPOGENIC SOUND ON MARINE MAMMAL HEARING (VERSION 2.0)

UNDERWATER THRESHOLDS FOR ONSET OF PERMANENT AND TEMPORARY THRESHOLD SHIFTS

I. INTRODUCTION

This document provides technical guidance[2] for assessing the effects of anthropogenic (human-made) sound on the hearing of marine mammal species under the jurisdiction[3] of the National Marine Fisheries Service (NMFS) and was completed in collaboration with the National Ocean Service (NOS), Office of National Marine Sanctuaries. Specifically, it identifies the received levels, or thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity for acute, incidental exposure to all underwater anthropogenic sound sources. This Technical Guidance is intended for use by NMFS analysts/ managers and other relevant action proponents/stakeholders, including other federal agencies, when seeking to determine whether and how their activities are expected to result in impacts to marine mammal hearing via acoustic exposure. This document outlines NMFS' thresholds, describing in detail threshold development (via Appendix A), and how they will be revised and updated in the future.

The thresholds presented in this document do not represent the entirety of an effects analysis, but rather serve as one tool among others (e.g., behavioral impact thresholds, auditory masking assessments, evaluations to help understand the effects of any particular type of impact on an individual's fitness, population assessments, etc.), to help evaluate the effects of a proposed action and make findings required by NOAA's various statutes. The Technical Guidance may inform decisions related to mitigation and monitoring requirements, but it does not mandate any specific mitigation be required[4]. The Technical Guidance does not address or change NMFS' application of these thresholds in the regulatory context, under applicable statutes and does not create or confer any rights for or on any person, or operate to bind the public. It only updates NMFS' thresholds based on the most recent science.

[2] The use of the Technical Guidance is not mandatory; it does not create or confer any rights for or on any person, or operate to bind the public. An alternative approach that has undergone independent peer review may be proposed (by federal agencies or prospective action proponents) and used if case-specific information/data indicate that the alternative approach is likely to produce a more accurate estimate of auditory impact for the project being evaluated; and if NMFS determines the approach satisfies the requirements of the applicable statutes and regulations.

[3] Link to marine mammals under NMFS' jurisdiction. This document does not pertain to marine mammal species under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction (e.g., walrus, polar bears, West Indian manatees, sea otters). However, since marine mammal audiogram data are limited, a decision was made to include all available datasets from in-water groups, including sirenian datasets (Gerstein et al. 1999; Mann et al. 2009), to derive composite audiogram parameters and threshold of best hearing for LF cetaceans (see Appendix A_1). Additionally, audiogram data from a single Pacific walrus (Kastelein et al. 2002) and a single sea otter (Ghoul and Reichmuth 2014) were included in the derivation of the composite audiogram for OW pinnipeds.

[4] Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance. NMFS acknowledges exclusion zones and monitoring zones often correspond to thresholds but that is not a legal requirement, and the thresholds may make such a simple correlation more challenging. The Technical Guidance can be used to inform the development of mitigation or monitoring. NMFS is currently developing a separate document further describing how the Technical Guidance is used in the MMPA authorization process to inform mitigation decisions. This document, when available, can be found at: NMFS Incidental Take Authorization web page.

Note: This document does not set forth requirements to conduct sound source verification studies.

1.1. THRESHOLDS WITHIN THE CONTEXT OF AN EFFECTS ANALYSIS

The Technical Guidance's thresholds do not represent the entirety of an effects analysis, but rather serve as one tool to help evaluate the effects of sound produced during a proposed action on marine mammals and make findings required by NOAA's various statutes. In a regulatory context, NMFS uses thresholds to help assess and quantify "take" and to conduct more comprehensive effects analyses under several statutes. NMFS is currently developing a separate document[5] further describing how the Technical Guidance is used in the MMPA authorization process to estimate "take."

Specifically, the Technical Guidance will be used in conjunction with sound source characteristics, environmental factors that influence sound propagation, anticipated marine mammal occurrence and behavior near the activity, as well as other available activity-specific factors, to estimate the number and types of takes of marine mammals. This document only addresses thresholds for auditory impact (i.e., does not address or make recommendations associated with sound propagation or marine mammal occurrence or density).

1.2 ADDRESSING UNCERTAINTY AND DATA LIMITATIONS

Inherent data limitations occur in many instances when assessing acoustic effects on marine mammal hearing. Data limitations, which make it difficult to account for uncertainty and variability, are not unique to assessing the effects of anthropogenic sound on marine mammals and are commonly encountered by resource managers (Ludwig et al. 1993; Francis and Shotton 1997; Harwood and Stokes 2003; Punt and Donovan 2007). Southall et al. (2007) and Finneran (2016) acknowledged the inherent data limitations when making recommendations for criteria to assess the effects of noise on marine mammals, including data available from a limited number of species, a limited number of individuals within a species, and/or limited number of sound sources. Both Finneran (2016) and Southall et al. (2007) applied certain extrapolation procedures to estimate effects that had not been directly measured but that could be reasonably approximated using existing information and reasoned logic. The Technical Guidance articulates where NMFS has faced such uncertainty and variability in the development of its thresholds.

1.2.1 Assessment Framework

NMFS' approach applies a set of assumptions to address uncertainty in predicting potential auditory effects of sound on individual marine mammals. One of these assumptions includes the use of "representative" or surrogate individuals/species for establishing PTS onset thresholds for species where little to no data exists. The use of representative individuals/species is done as a matter of practicality (i.e., it is unlikely that adequate data will exist for the all marine mammal species found worldwide or that we will be able to account for all sources of variability at an individual level) but is also scientifically based (i.e., taxonomy, hearing group). As new data become available for more species, this approach can be reevaluated. NMFS recognizes that additional applicable data may become available to better address many of these issues (e.g., uncertainty, surrogate species, etc.).[6] As these new data become available, NMFS has an approach for updating this document (see Section III).

[5] Document, when available, can be found at: NMFS Incidental Take Authorization web page.

[6] NMFS is aware that the authors of Southall et al. (2007) are in the process of updating their original publication and recognizes that when this updated publication becomes available, it may suggest alternative means for predicting an

1.2.2 Data Standards

In assessing potential acoustic effects on marine mammals, as with any such issue facing the agency, standards for determining applicable data need to be articulated. Specifically, NOAA has Information Quality Guidelines[7] (IQG) for "ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the agency" (with each of these terms defined within the IQG). Further, the IQG stipulate that "To the degree that the agency action is based on science, NMFS will use (a) the best available science and supporting studies (including peer-reviewed science and supporting studies when available), conducted in accordance with sound and objective scientific practices, and (b) data collected by accepted methods or best available methods."

The National Research Council (NRC 2004) provided basic guidelines for National Standard 2 (NS2) in section 301 of the Magnuson-Stevens Fishery Conservation and Management Act, which states that "Conservation and management measures shall be based upon the best scientific information available" (NOAA 2013). They recommended that data underlying the decision-making and/or policy-setting process be: 1) relevant, 2) inclusive, 3) objective, 4) transparent and open, 5) timely, 6) verified and validated, and 7) peer reviewed.[8] Although NRC's guidelines (NRC 2004) were not written specifically for marine mammals and this particular issue, they do provide a means of articulating minimum data standards. NMFS considered this in assessing acoustic effects on marine mammals. Use of the NRC Guidelines does not preclude development of acoustic-specific data standards in the future.

II. NMFS' THRESHOLDS FOR ONSET OF PERMANENT THRESHOLD SHIFTS IN MARINE MAMMALS

The Technical Guidance advances NMFS' assessment ability based upon the compilation, interpretation, and synthesis of the scientific literature. This document provides thresholds for the onset of PTS based on characteristics defined at the acoustic source. No direct measurements of marine mammal PTS have been published; PTS onset thresholds have been extrapolated from marine mammal TTS measurements (i.e., using growth rates from terrestrial and marine mammal data). PTS onset thresholds, for all sound sources are divided into two broad categories: 1) impulsive and 2) non-impulsive. Thresholds are also presented as dual metric thresholds using weighted cumulative sound exposure level ($SEL_{cum,}$) and peak sound pressure (PK) metrics for impulsive sounds. As dual metrics, NMFS considers onset of PTS to have occurred when either one of the two metrics is exceeded. For non-impulsive sounds, thresholds are provided using the weighted SEL_{cum} metric. Additionally, to account for the fact that different species groups use and hear sound differently, marine mammals are sub-divided into five broad hearing groups (i.e., LF, MF, HF, PW, and OW) and thresholds in the weighted SEL_{cum} metric incorporate auditory weighting functions.

2.1 MARINE MAMMAL HEARING GROUPS

Current data (via direct behavioral and electrophysiological measurements) and predictions (based on inner ear morphology, modeling, behavior, vocalizations, or taxonomy) indicate that not

auditory weighting function and thresholds for LF cetaceans. Accordingly, NMFS may re-evaluate our methodology for LF cetaceans when this updated Southall et al. publication becomes available.

[7] NMFS National Standards 2 web page.

[8] NMFS also requires Peer Review Plans for Highly Influential Scientific Assessments (HISA) and Influential Scientific Information (ISI).

all marine mammal species have equal hearing capabilities, in terms of absolute hearing sensitivity and the frequency band of hearing (Richardson et al. 1995; Wartzok and Ketten 1999; Southall et al. 2007; Au and Hastings 2008). Hearing has been directly measured in some odontocete and pinniped species[9] (see reviews in Southall et al. 2007; Erbe et al. 2016; Finneran 2016). Direct measurements of mysticete hearing are lacking.[10] Thus, hearing predictions for mysticetes are based on other methods including: anatomical studies and modeling (Houser et al. 2001; Parks et al. 2007; Tubelli et al. 2012; Cranford and Krysl 2015[11]); vocalizations[12] (see reviews in Richardson et al. 1995; Wartzok and Ketten 1999; Au and Hastings 2008); taxonomy; and behavioral responses to sound (Dahlheim and Ljungblad 1990; see review in Reichmuth 2007).

To better reflect marine mammal hearing capabilities, Southall et al. (2007) recommended that marine mammals be divided into hearing groups (Table 1). NMFS made the following modifications to the hearing groups proposed in Southall et al. (2007)[13]:

- <u>Division of pinnipeds into PW and OW hearing groups</u>: NMFS subdivided pinnipeds into their two families: Phocidae and Otariidae. Based on a review of the literature, phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä et al. 2006; Kastelein et al. 2009a; Reichmuth et al. 2013). Phocid ears are anatomically distinct from otariid ears in that phocids have larger, more dense middle ear ossicles, inflated auditory bulla, and larger sections of the inner ear (i.e., tympanic membrane, oval window, and round window), which make them more adapted for underwater hearing (Terhune and Ronald 1975; Schusterman and Moore 1978; Kastak and Schusterman 1998; Hemilä et al. 2006; Mulsow et al. 2011; Reichmuth et al. 2013).

- <u>Recategorization of hourglass (*Lagenorhynchus cruciger*) and Peale's (*L. australis*) dolphins from MF cetacean to HF cetacean hearing group:</u> Echolocation data (Kyhn et al. 2009; Kyhn et al. 2010; Tougaard and Kyhn. 2010) indicate that the hourglass and Peale's dolphin produce sounds (i.e., higher mean peak frequency) similar to other narrow band high-frequency cetaceans, such as porpoises, *Kogia*, and *Cephalorhynchus*, and are distinctly different from other *Lagenorhynchus* species. Genetic data also suggest these two species are more closely related to *Cephalorhynchus* species (May-Collado and Agnarsson 2006). Thus, based on this information, NMFS has decided to move these two species from MF cetaceans to HF cetaceans.

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[9] Hearing measurements both in air and underwater have been collected for pinniped species.

[10] There was an unsuccessful attempt to directly measure hearing in a stranded gray whale calf by Ridgway and Carder 2001.

[11] <u>Note</u>: The modeling of Cranford and Krsyl (2015) predicts that the primary mechanism for hearing in LF cetaceans is bone conduction. Additionally, this predictive model was based on the skull geometry of a newborn fin whale.

[12] Studies in other species indicate that perception of frequencies may be broader than frequencies produced (e.g., Luther and Wiley 2009).

[13] NMFS considered dividing LF cetaceans into two separate groups (i.e., some species may have better low frequency hearing than others, like blue and fin whales; Clark and Ellison 2004), but decided there was not enough data to support such a division at this time. NMFS also considered separating sperm whales from other MF cetaceans, but there are not enough data are available to stipulate exactly how to do this. Sperm whale placement within MF cetaceans is considered appropriate based on Ketten (2000), which classified sperm whales as having Type I cochlea, similar to other MF cetaceans.

Table 1: Marine mammal hearing groups.

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz

***** Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

NMFS' modification results in marine mammal hearing groups being defined in this Technical Guidance as depicted in Table 1. Table 1 defines a generalized hearing range each hearing group. This generalized hearing range was determined based on the ~65 dB[14] threshold from the normalized composite audiograms (Figure 4). For LF cetaceans and PW pinnipeds, the ~65 dB threshold resulted in a lower bound that was considered too low to be biologically plausible for these two groups. Instead, for LF cetaceans the lower frequency limit from Southall et al. 2007 was used, while for PW pinnipeds 50 Hz was chosen as a reasonable approximation for the lower frequency limit (relative to otariid pinnipeds)[15].

2.1.1 Application of Marine Mammal Hearing Groups

The application of marine mammal hearing groups occurs throughout the Technical Guidance in two ways. First, thresholds are divided by hearing group to acknowledge that not all marine mammal species have identical hearing or susceptibility to noise-induced hearing loss (NIHL). Outside the generalized hearing range, the risk of auditory impacts from sounds is considered highly unlikely or very low[16] (the exception would be if a sound above/below this range has the potential to cause physical injury, i.e., lung or gastrointestinal tract injury from underwater explosives).

Second, marine mammal hearing groups are used in the establishment of marine mammal auditory weighting functions discussed next.

[14] In humans, functional hearing range is typically defined as 60 dB above the hearing threshold at greatest hearing sensitivity. To account for uncertainty associated with marine mammal hearing, NMFS based the Technical Guidance's generalized hearing range on 65 dB.

[15] Understanding of low-frequency pinniped hearing is limited (i.e., few studies have direct measurements of hearing below 100 Hz).

[16] Animals are able to detect sounds beyond their generalized hearing range by non-auditory mechanisms. However, typically, these sounds have to be extremely loud and would be considered uncomfortable (Wartzok and Ketten 1999). If a sound is on the edge of a hearing group's generalized hearing range and there is the potential for exposure to high sound pressure levels, then consider the potential for detection beyond normal auditory pathways.

2.2 Marine Mammal Auditory Weighting Functions

The ability to hear sounds varies across a species' hearing range. Most mammal audiograms have a typical "U-shape," with frequencies at the bottom of the "U" being those to which the animal is more sensitive, in terms of hearing (i.e. the animal's best hearing range; for example audiogram, see Glossary, Figure F1). Auditory weighting functions best reflect an animal's ability to hear a sound (and do not necessarily reflect how an animal will perceive and behaviorally react to that sound). To reflect higher hearing sensitivity at particular frequencies, sounds are often weighted. For example, A-weighting for humans deemphasize frequencies below 1 kHz and above 6 kHz based on the inverse of the idealized (smoothed) 40-phon equal loudness hearing function across frequencies, standardized to 0 dB at 1 kHz (e.g., Harris 1998). Other types of weighting functions for humans (e.g., B, C, D) deemphasize different frequencies to different extremes (e.g., flattens equal-loudness perception across wider frequencies with increasing received level; for example, C-weighting is uniform from 50 Hz to 5 kHz; ANSI 2011).

Auditory weighting functions have been proposed for marine mammals, specifically associated with PTS onset thresholds expressed in the weighted SEL_{cum} [17] metric, which take into account what is known about marine mammal hearing (Southall et al. 2007; Erbe et al. 2016). The Finneran Technical Report (Finneran 2016) developed marine mammal auditory weighting functions that reflect new data on:

- Marine mammal hearing (e.g., Sills et al. 2014; Sills et al. 2015; Cranford and Krysl, 2015; Kastelein et al. 2015c)

- Marine mammal equal latency contours (e.g., Reichmuth 2013; Wensveen et al. 2014; Mulsow et al. 2015

- Effects of noise on marine mammal hearing (e.g., Kastelein et al. 2012a; Kastelein et al. 2012b; Finneran and Schlundt 2013; Kastelein et al. 2013a; Kastelein et al. 2013b; Popov et al. 2013; Kastelein et al. 2014a; Kastelein et al. 2014b; Popov et al. 2014; Finneran et al. 2015; Kastelein et al., 2015a; Kastelein et al. 2015b; Popov et al. 2015).

This reflects a transition from auditory weighting functions that have previously been more similar to human dB(C) functions (i.e., M-weighting from Southall et al. 2007) to that more similar to human dB(A) functions. These marine mammal auditory weighting functions also provide a more consistent approach/methodology for all hearing groups.

Upon evaluation, NMFS determined that the proposed methodology in Finneran 2016 reflects the scientific literature and incorporated it directly into this Technical Guidance (Appendix A) following an independent peer review (see Appendix C for details on peer review and link to Peer Review Report).

2.2.1 Use of Auditory Weighting Functions in Assessing Susceptibility to Noise-Induced Hearing Loss

Auditory weighting functions are used for human noise standards to assess the overall hazard of noise on hearing. Specifically, human auditory weighting functions provide a "rating that indicates the injurious effects of noise on human hearing" (OSHA 2013). Thus, while these functions are based on regions of equal loudness and best hearing, in the context of human risk assessments, as well as their use in the Technical Guidance, they are meant to reflect the susceptibility of the ear to noise-induced threshold shifts (TSs). Regions of enhanced susceptibility to noise may not

[17] Auditory weighting functions are not to be applied to PTS or TTS onset thresholds expressed as the PK metric (i.e., PK thresholds are flat or unweighted within the generalized hearing range). For more information, please see Section 2.3.2.2.

perfectly mirror a species' region of best hearing (e.g., TTS measurements from bottlenose dolphin, belugas, and Yangtze finless porpoise support this). Thus, within the Technical Guidance, auditory weighting functions are meant to assess risk of NIHL and do not necessarily encompass the entire range of best hearing for every species within the hearing group.

2.2.2 Marine Mammal Auditory Weighting Functions

Frequency-dependent marine mammal auditory weighting functions were derived using data on hearing ability (composite audiograms), effects of noise on hearing, and data on equal latency (Finneran 2016[18]). Separate functions were derived for each marine mammal hearing group (Figures 1 and 2).

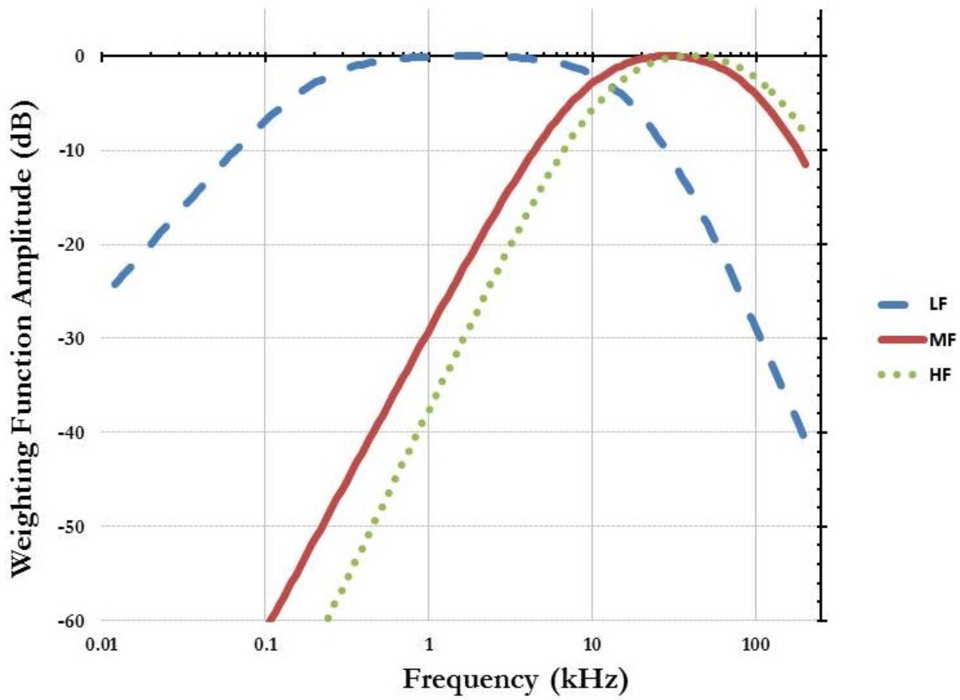

Figure 1: Auditory weighting functions for low-frequency (LF; dashed line), mid-frequency (MF; solid line), and high-frequency (HF; dotted line) cetaceans.

[18] Wright 2015 provides a critique of this methodology. For NMFS' response associated with this critique, see the Federal Register Notice associated with 2016 Technical Guidance (81 FR 51694; August 4, 2016), specifically the section responding to public comments.

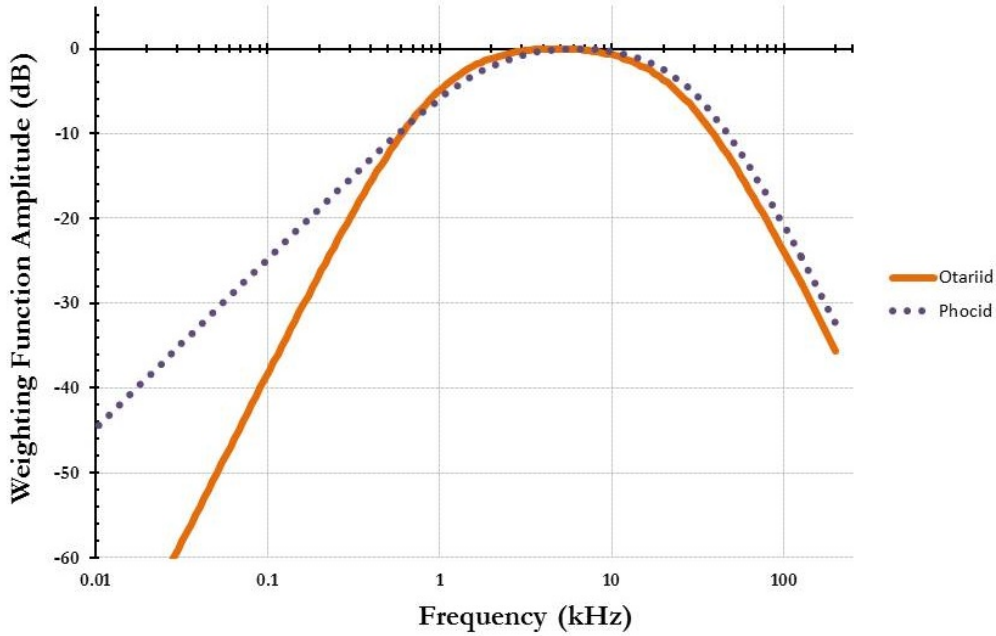

Figure 2: Underwater auditory weighting functions for otariid (OW; solid line) and phocid (PW; dotted line) pinnipeds.

The overall shape of the auditory weighting functions is based on a generic band-pass filter described by Equation 1:

$$W_{aud}(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\} \quad \text{dB} \qquad \textbf{Equation 1}$$

where $W_{aud}(f)$ is the auditory weighting function amplitude in decibels (dB) at a particular frequency (f) in kilohertz (kHz). The function shape is determined by the following auditory weighting function parameters:

- Low-frequency exponent (a): This parameter determines the rate at which the weighting function amplitude declines with frequency at the lower frequencies. As the frequency decreases, the change in amplitude becomes linear with the logarithm of frequency with a slope of $20a$ dB/decade.

- High-frequency exponent (b): Rate at which the weighting function amplitude declines with frequency at the upper frequencies. As the frequency increases, the change in amplitude becomes linear with the logarithm of frequency with a slope of $20b$ dB/decade.

- Low-frequency cutoff (f_1): This parameter defines the lower limit of the band-pass filter (i.e., the lower frequency where weighting function amplitude begins to roll off or decline from the flat, central portion of the function). This parameter is directly dependent on the value of the low-frequency exponent (a).

- High-frequency cutoff (f_2): This parameter defines the upper limit the band-pass filter (i.e., the upper frequency where weighting function amplitude begins to roll off or decline from the flat, central portion of the function). This parameter is directly dependent on the value of the high-frequency exponent (b).

- Weighting function gain (C): This parameter determines the vertical position of the function and is adjusted to set the maximum amplitude of the auditory weighting function to 0 dB.

Finneran (2016) illustrates the influence of each parameter value on the shape of the auditory weighting function (Appendix A, Figure A2).

In association with auditory weighting functions are exposure functions that illustrate how auditory weighting functions relate to auditory thresholds. Auditory exposure functions (Equation 2) are the inversion of Equation 1:

$$E_{\text{aud}}(f) = K - 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{\left[1+(f/f_1)^2\right]^a\left[1+(f/f_2)^2\right]^b}\right\} \qquad \text{dB}$$

Equation 2

where $E_{\text{aud}}(f)$ is the acoustic exposure as a function of frequency (f) and the gain parameter constant (K), which is adjusted to set the minimum value of the curve to the weighted PTS/TTS onset auditory threshold. All other parameters are the same as those in Equation 1. Figure 3 illustrates how the various weighting parameters relate to one another in both the auditory weighting and exposure functions.

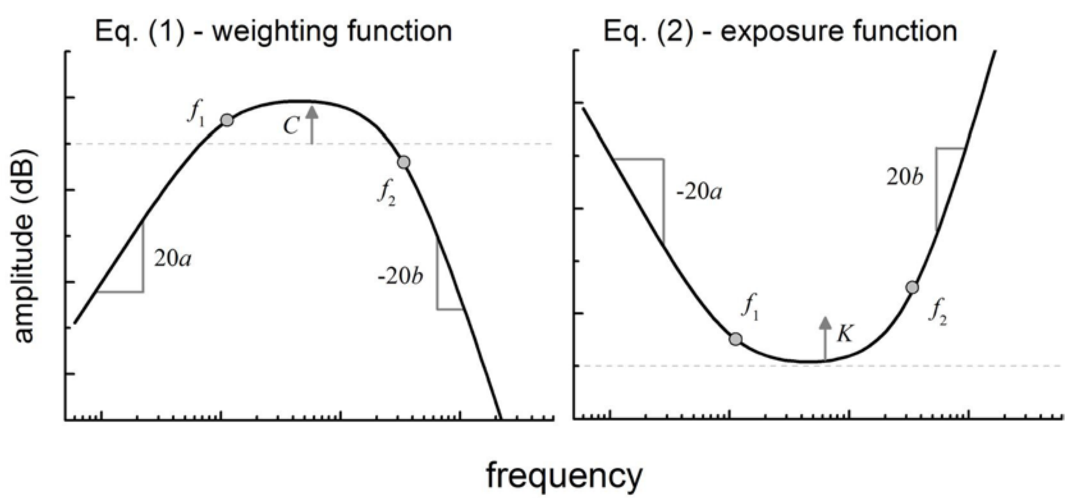

Figure 3: Illustration of function parameter in both auditory weighting functions and exposure functions (from Finneran 2016). Reference to Equations 1 and 2 match those in the Technical Guidance.

Finneran (2016) (Appendix A, Figures A-22 and A-23) provides a comparison of these auditory weighting functions with previously derived weighting functions (Finneran and Jenkins 2012 used in Navy Phase 2 Analysis).

2.2.3 Derivation of Function Parameters

Numeric values associated with auditory weighting function parameters were derived from available data from audiograms (measured and predicted), equal latency contours, and marine mammal TTS data using the following steps from Finneran (2016):

1. Derivation of marine mammal composite audiograms (original and normalized) for each hearing group (Resulting normalized composite audiogram: Figure 4; Data sources: Table 2).

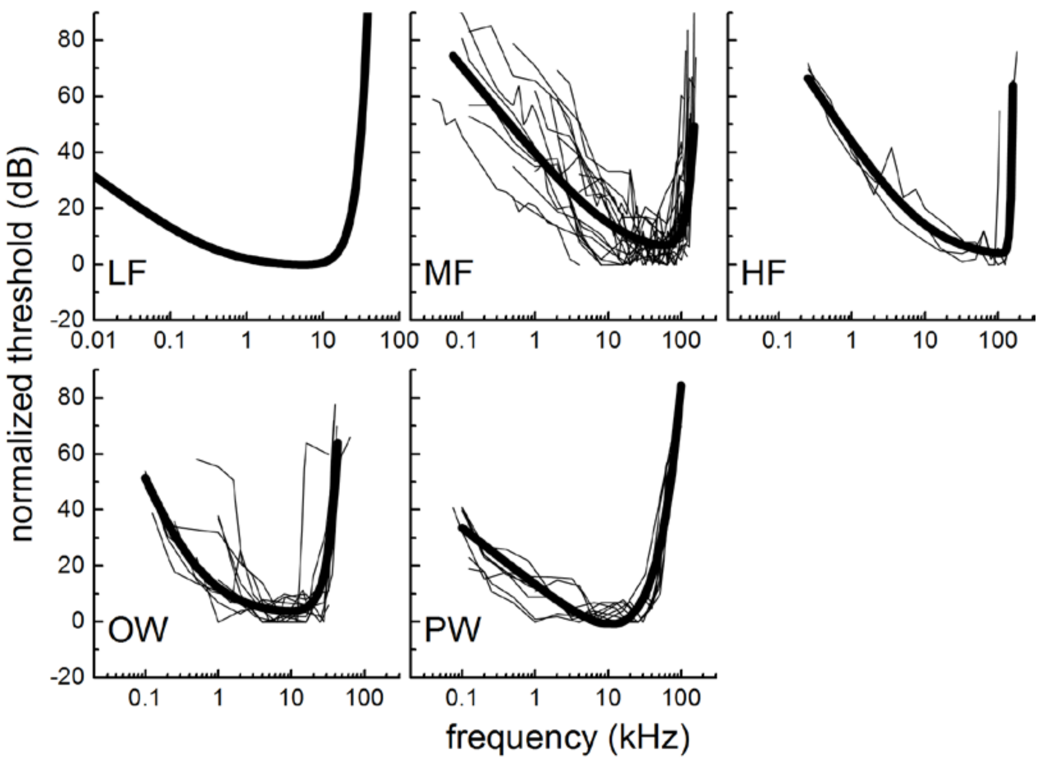

Figure 4: Resulting normalized composite audiograms for low-frequency (LF), mid-frequency (MF), and high-frequency (HF) cetaceans and phocid (PW) and otariid (OW) pinnipeds (from Finneran 2016). For resulting original composite audiogram, see Appendix A, Figure A5.

Table 2: Summary of data available for deriving composite audiograms.†

Hearing Group	Species (number of individuals)	References
Mid-Frequency (MF) Cetaceans	Beluga (9)	White et al. 1978; Awbrey et al. 1988; Johnson et al. 1989; Ridgway et al. 2001; Finneran et al. 2005b
	Bottlenose dolphin (6)	Johnson 1967; Ljungblad et al. 1982; Lemonds 1999; Brill et al. 2001;Schlundt et al. 2008; Finneran et al. 2010a
	False killer whale (1)	Thomas et al. 1988
	Killer whale (8)	Szymanski et al. 1999; Branstetter et al. 2017+
	Risso's dolphin (1)	Nachtigall et al. 1995
	Pacific white-sided dolphin (1)	Tremel et al. 1996
	Striped dolphin (1)	Kastelein et al. 2003
	Tucuxi (1)	Sauerland and Dehnhardt 1998
High-Frequency (HF) Cetaceans	Amazon River dolphin (1)	Jacobs and Hall 1972
	Harbor porpoise (5)	Kastelein et al. 2010; Kastelein et al. 2015c; Kastelein et al. 2017a+
Phocid Pinnipeds (PW) Underwater	Harbor seal (4)	Terhune 1988; Kastelein et al. 2009b; Reichmuth et al. 2013
	Northern elephant seal (1)	Kastak and Schusterman 1999
	Ringed seal (1)	Sills et al. 2015
	Spotted seal (2)	Sills et al. 2014
Otariid Pinnipeds* (OW) Underwater	California sea lion (4)	Mulsow et al. 2012; Reichmuth and Southall 2012; Reichmuth et al. 2013
	Northern fur seal (3)	Moore and Schusterman 1987; Babushina et al. 1991
	Steller sea lion (2)	Kastelein et al. 2005a

† More details on individual subjects are available in Appendix A (Table A2). Some datasets were excluded due to subjects having high-frequency hearing loss or aberrant audiograms. These included subjects from: Møhl 1968; Andersen 1970; Hall and Johnson 1972; Terhune and Ronald 1972; Terhune and Ronald 1975; Thomas et al. 1990; Wang et al. 1992; Babushina 1997; Kastak et al. 2002; Finneran et al. 2005 (Turner); Yuen et al. 2005; Finneran et al. 2007a; Sills et al. 2015 (Natchek). Decisions to exclude data were based on comparison of the individual published audiograms and ambient noise characteristics to those for other individuals of the same or closely related species. The most common reasons for excluding an individual's data were abnormal audiograms featuring high-frequency hearing loss (typically seen in older animals) or "notches" in the audiogram, or data collected in the presence of relatively high ambient noise that resulted in elevated thresholds. Excluding these data ensured that the composite audiograms were not artificially elevated, which could result in unrealistically high thresholds.

+Two publications with behavioral audiograms became available after the Technical Guidance's finalization in 2016. However, upon consideration of these two studies during EO 13795 review of the Technical Guidance, including recommendations from other Federal agencies, NMFS determined it is not practical from an implementation standpoint to add these studies at this time. NMFS will include these studies in the next revision of this document (i.e., Version 3.0). For more detail on these studies, see Section III.

* The otariid pinniped (underwater) hearing group's composite audiogram contains data from a single Pacific walrus (*Odobenus rosmarus*) from Kastelein et al. 2002 and a single sea otter (*Enhydra lutris nereis*) from Ghoul and Reichmuth 2014, which are species under the jurisdiction of the USFWS. However, since marine mammal audiogram data are limited, a decision was made to include all available datasets from in-water groups to derive composite audiograms for this hearing group. For frequencies below 30 kHz, the difference in the composite audiogram with and without these data are < 2 dB. For comparison, see Appendix A, Figure A4.

In deriving marine mammal composite audiograms, NMFS established an informal data hierarchy in terms of assessing these types of data. Specifically, audiograms obtained via behavioral methodologies were determined to provide the most representative (sensitive) presentation of hearing ability (Finneran et al. 2007a), followed by auditory evoked potential (AEP) data,[19] and lastly by mathematical/anatomical models for species where no data are available (i.e., LF cetaceans). Thus, the highest quality data available for a specific hearing group were used.[20]

For LF cetaceans, only two studies were available for consideration (i.e., predicted audiogram for a humpback whale from Houser et al. 2001 and fin whale from Cranford and Krysl 2015), which alone was not enough to derive a predicted audiogram for this entire hearing group. Thus, an alternative approach was used to derive a composite audiogram[21] and associated auditory weighting function for LF cetaceans (i.e., composite audiogram parameters had to be predicted; For specifics, on this process, see Appendix A_1).

2. The low-frequency exponent (a) was defined using the smaller of the low-frequency slope from either the composite audiogram or the lower-frequency slope of the equal latency contours (if available) and then divided by twenty ($s_0/20$). This results in the slope matching the shallower slope of the audiogram.

3. The high-frequency exponent (b) was set equal to two to match the previously derived marine mammal auditory weighting functions from Finneran and Jenkins (2012), since no new TTS measurements were available at higher frequencies and equal latency data at these frequencies are considered highly variable.

4. Low- (f_1) and high-frequency cutoffs (f_2) were defined as the frequencies below and above the frequency of best hearing (f_0) from original data, where the threshold values were ΔT above the threshold at f_0 . These two parameters reflect the hearing group's most susceptible frequency range.

5. To determine ΔT, the auditory exposure function amplitude was calculated for MF and HF cetaceans examining ΔT values ranging from zero to 20 dB. Then, the K gain parameter was adjusted to minimize the mean-squared error (MSE) between the function amplitude (original and normalized composite audiograms) and MF and HF cetacean TTS data. The value of ΔT resulting the lowest MSE was eleven for both the normalized and original data. This value was used for other hearing groups.

6. Hearing groups where TTS data are available (i.e., MF and HF cetaceans and PW and OW pinniped) were used to define K (Step 4 above). For LF cetaceans, where data were

[19] Despite not directly including AEP audiograms in the development of a hearing groups' composite audiogram, these date were evaluated to ensure species were placed within the appropriate hearing group and to ensure a species where only AEP data are available were within the bounds of the composite audiogram for that hearing group. Furthermore, AEP TTS data are presented within the Technical Guidance for comparative purposes alongside TTS data collected by behavioral methods illustrating that the AEP TTS data are within the bounds (the majority of the time above) of those collected by behavioral methods.

[20] Behavioral techniques for obtaining audiograms measure perception of sound by a receiver, while AEP methods measure only neural activity (Jewett and Williston 1971) (i.e., two methodologies are not necessarily equivalent). As a result, behavioral techniques consistently produce lower thresholds than those obtained by AEPs (e.g., Szymanski et al. 1999; Yuen et al. 2005; Houser and Finneran 2006). Currently, there are no means established for "correcting" AEP data so that it may be more comparable to those obtained via behavioral methods (Heffner and Heffner 2003; Finneran 2015; Sisneros et al. 2016; Erbe et al. 2016).

[21] During the third public comment period on the Technical Guidance in March 2016, ambient noise levels from Clark and Ellison 2004 were offered by a group of subject matter experts as additional scientific support to NMFS' LF cetacean weighting function (for direct comparison to NOAA's 2016 LF cetacean weighting function see: Public comment made via Regulations.gov).

not available, TTS onset was estimated by assuming the numeric difference between auditory threshold (Figure 4, original data) and TTS onset at the frequency of best hearing (f_0) would be similar across hearing groups. For LF cetaceans auditory threshold had to be predicted, since no data exist (For specifics on methodology, see Appendix A, Table A7).

7. The weighting function parameter (C) was determined by substituting parameters a, b, f_1, and f_2 in Equation 1 and setting the peak amplitude of the function to zero.

For each hearing group, the resulting numeric values associated with these parameters and resulting weighted TTS onset threshold for non-impulsive sources (weighted SEL_{cum} metric) are listed in Table 3 and resulting auditory weighting functions are depicted in Figures 1 and 2.

Table 3: Summary of auditory weighting and exposure function parameters.

Hearing Group	a	b	f_1 (kHz)	f_2 (kHz)	C (dB)	K (dB)	Weighted TTS onset threshold* (SEL_{cum})
Low-frequency (LF) cetaceans	1.0	2	0.2	19	0.13	179	179 dB
Mid-frequency (MF) cetaceans	1.6	2	8.8	110	1.20	177	178 dB
High-frequency (HF) cetaceans	1.8	2	12	140	1.36	152	153 dB
Phocid pinnipeds (PW) (underwater)	1.0	2	1.9	30	0.75	180	181 dB
Otariid pinnipeds (OW) (underwater)	2.0	2	0.94	25	0.64	198	199 dB

* Determined from minimum value of auditory exposure function and the weighting function at its peak (i.e., mathematically equivalent to $K + C$).

Note: Appendix A, Figure A17 illustrates that the resulting auditory exposure functions (and subsequent weighting functions) are broader than the composite audiograms or audiogram from an individual species. This is important to note because the auditory weighting/exposure functions are derived not just from data associated with the composite audiogram but also account for available TTS onset data.

2.2.4 Application of Marine Mammal Auditory Weighting Functions for PTS Onset Thresholds

The application of marine mammal auditory weighting functions emphasizes the importance of making measurements and characterizing sound sources in terms of their overlap with biologically-important frequencies (e.g., frequencies used for environmental awareness, communication or the detection of predators or prey), and not only the frequencies of interest or concern for the completion of the sound-producing activity (i.e., context of sound source).

If the frequencies produced by a sound source are outside a hearing group's most susceptible hearing range (where the auditory weighting function amplitude is 0), sounds at those frequencies are required to have a higher sound pressure level to produce a similar threshold shift (i.e., PTS onset) as sounds with frequencies in the hearing group's most susceptible hearing range. Because auditory weighting functions take into account a hearing group's differing susceptibility to frequencies, the implementation of these functions typically results in smaller isopleths[22] for

[22] Note: Thresholds associated with a hearing group do not change depending on how much a sound may overlap a group's most susceptible frequency range. Instead, weighting functions affect exposure modeling/analysis via the resulting size of the isopleth (area) associated with the threshold based on how susceptible that particular hearing group

frequencies where the group is less susceptible. Additionally, if the sound source produces frequencies completely outside the generalized hearing range of a given hearing group (i.e., has no harmonics/subharmonics that are capable of producing sound within the hearing range of a hearing group), then the likelihood of the sound causing hearing loss is considered low.[23]

Marine mammal auditory weighting functions are used in conjunction with corresponding weighted SEL_{cum} PTS onset thresholds. If the use of the full auditory weighting function is not possible by an action proponent (i.e., consider auditory weighting function over multiple frequencies for broadband source), NMFS has provided an alternative tool based on a simpler auditory weighting function (See Appendix D).

Tougaard et al. (2015) reviewed the impacts of using auditory weighting functions and various considerations when applying them during the data evaluation and implementation stages (e.g., consequences of using too broad or too narrow of a filter) and suggested some modifications (correction factors) to account for these considerations. However, there are no data to support doing so (i.e., selection would be arbitrary). Moreover, various conservative factors have been accounted for in the development of auditory weighting functions and thresholds: A 6 dB threshold shift was used to represent TTS onset; the methodology does not incorporate exposures where TTS did not occur; and the potential for recovery is not accounted for. Additionally, the means by which NMFS is applying auditory weighting functions is supported and consistent with what has been done for humans (i.e., A-weighted thresholds used in conjunction with A-weighting during implementation).

2.2.4.1 Measuring and Maintaining Full Spectrum for Future Analysis

It is recommended marine mammal auditory weighting functions be applied after sound field measurements[24] have been obtained (i.e., post-processing; it is recommended that auditory weighting functions not be applied beforehand), with the total spectrum of sound preserved for later analysis (i.e., if auditory weighting functions are updated or if there is interest in additional species, then data can still be used). Additionally, it is important to consider measurements that encompass the entire frequency band that a sound source may be capable of producing (i.e., sources often produce sounds, like harmonics/subharmonics, beyond the frequency/band of interest; e.g., Deng et al. 2014; Hastie et al. 2014).

2.3 PTS ONSET THRESHOLDS

Available data from humans and other terrestrial mammals indicate that a 40 dB threshold shift approximates PTS onset (see Ward et al. 1958; Ward et al. 1959; Ward 1960; Kryter et al. 1966; Miller 1974; Ahroon et al. 1996; Henderson et al. 2008). Southall et al. (2007) also recommended this definition of PTS onset.

PTS onset thresholds for marine mammals have not been directly measured and are extrapolated from available TTS onset measurements. Thus, based on cetacean measurements from TTS

is to the sound being modeled. For example, a hearing group could have different size isopleths associated with the same threshold, if one sound was within its most susceptible frequency range and the other was not (i.e., sound in most susceptible hearing range will result in larger isopleth compared to sound outside the most susceptible hearing range).

[23] The potential for sound to damage beyond the level the ear can perceive exists (Akay 1978), which is why the thresholds also include the PK metric, which are flat or unweighted within the generalized hearing range of a hearing group.

[24] Note: Sound field measurements refers to actual field measurements, which are not a requirement of this Technical Guidance, and not to exposure modeling analyses, where it may be impractical due to data storage and cataloging restraints.

studies (see Southall et al. 2007; Finneran 2015; Finneran 2016 found in Appendix A of this Technical Guidance) a threshold shift of 6 dB is considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation[25] in a subject's normal hearing ability and is typically the minimum amount of threshold shift that can be differentiated in most experimental conditions (Finneran et al. 2000; Schlundt et al. 2000; Finneran et al. 2002). Thus, NMFS has set the onset of TTS at the lowest level that exceeds recorded variation (i.e., 6 dB).

There are different mechanisms (e.g., anatomical, neurophysiological) associated with TTS vs. PTS onset, making the relationship between these types of TSs not completely direct. Nevertheless, the only data available for marine mammals, currently and likely in the future, will be from TTS studies (i.e., unlike for terrestrial mammals where direct measurements of PTS exist). Thus, TTS represents the best information available from which PTS onset can be estimated.

The thresholds presented in Table 4 consist of both an acoustic threshold and auditory weighting function for the SEL_{cum} metric (auditory weighting functions are considered not appropriate for PK metric).

NMFS recognizes that the implementation of marine mammal auditory weighting functions represents a new factor for consideration that may exceed the capabilities of some action proponents. Thus, NMFS has developed alternative tools for those who cannot fully apply auditory weighting functions associated with the weighted SEL_{cum} metric (See Appendix D).

2.3.1 Impulsive and Non-Impulsive Source Thresholds

This Technical Guidance divides sources into impulsive and non-impulsive based on physical characteristics at the source, with impulsive sound having physical characteristics making them more injurious[26] (e.g., high peak sound pressures and rapid rise times) than non-impulsive sound sources (terrestrial mammal data: Buck et al. 1984; Dunn et al. 1991; Hamernik et al. 1993; Clifford and Rogers 2009; marine mammal data: reviewed in Southall et al. 2007 and Finneran 2016 that appears as Appendix A of this Technical Guidance).

The characteristics of the sound at a receiver, rather than at the source, are the relevant consideration for determining potential impacts. However, understanding these physical characteristics in a dynamic system with receivers moving over space and time is difficult. Nevertheless, it is known that as sound propagates from the source the characteristics of impulsive sounds that make them more injurious start to dissipate due to effects of propagation (e.g., time dispersion/time spreading; Urick 1983; Sertlek et al. 2014).

[25] Similarly, for humans, NIOSH (1998) regards the range of audiometric testing variability to be approximately 5 dB.

[26] Exposure to impulsive sounds more often lead to mechanical damage of the inner ear, as well as more complex patterns of hearing recovery (e.g., Henderson and Hamernik 1986; Hamernik and Hsueh 1991).

Table 4: Summary of PTS onset thresholds.

Hearing Group	PTS Onset Thresholds* (Received Level)	
	Impulsive	**Non-impulsive**
Low-Frequency (LF) Cetaceans	*Cell 1* $L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	*Cell 2* $L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	*Cell 3* $L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	*Cell 4* $L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	*Cell 5* $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	*Cell 6* $L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 7* $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	*Cell 8* $L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	*Cell 9* $L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	*Cell 10* $L_{E,OW,24h}$: 219 dB

* Dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds are recommended for consideration.

Note: Peak sound pressure level ($L_{p,0\text{-pk}}$) has a reference value of 1 µPa, and weighted cumulative sound exposure level ($L_{E,p}$) has a reference value of 1µPa^{2}s. In this Table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kHz). The subscript associated with weighted cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these thresholds will be exceeded.

For the purposes of this Technical Guidance,[27] sources are divided and defined as the following:

- Impulsive: produce sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; ANSI 2005).

- Non-impulsive: produce sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent) and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI 1995; NIOSH 1998).

Note: The term "impulsive" in this document relates specifically to NIHL and specifies the physical characteristics of an impulsive sound source, which likely gives them a higher potential to cause auditory TTS/PTS. This definition captures how these sound types may be more likely to affect auditory physiology and is not meant to reflect categorizations associated with behavioral disturbance.

[27] If there is unclear, consider the most applicable definition and consult with NMFS.

2.3.2 Metrics

2.3.2.1 Weighted Cumulative Sound Exposure Level (SEL_{cum}) Metric

The weighted SELcum metric takes into account both received level and duration of exposure (ANSI 2013), both factors that contribute to NIHL. Often this metric is normalized to a single sound exposure of one second. NMFS intends for the weighted SELcum metric to account for the accumulated exposure (i.e., weighted SELcum cumulative exposure over the duration of the activity within a 24-h period).

The recommended application of the weighted SEL_{cum} metric is for individual activities/sources. It is not intended for accumulating sound exposure from multiple activities occurring within the same area or over the same time or to estimate the impacts of those exposures to an animal occurring over various spatial or temporal scales. Current data available for deriving thresholds using this metric are based on exposure to only a single source and may not be appropriate for situations where exposure to multiple sources is occurring. As more data become available, the use of this metric can be re-evaluated, in terms of appropriateness, for application of exposure from multiple activities occurring in space and time.

Equal Energy Hypothesis

One assumption made when applying the weighted SEL_{cum} metric is the equal energy hypothesis (EEH), where it is assumed that sounds of equal SEL_{cum} produce an equal risk for hearing loss (i.e., if the weighted SEL_{cum} of two sources are similar, a sound from a lower level source with a longer exposure duration may have similar risks to a shorter duration exposure from a higher level source). As has been shown to be the case with humans and terrestrial mammals (Henderson et al. 1991), the EEH does not always accurately describe all exposure situations for marine mammals due the inherent complexity of predicting TSs (e.g., Kastak et al. 2007; Mooney et al. 2009a; Mooney et al. 2009b; Finneran et al. 2010a; Finneran et al. 2010b; Finneran and Schlundt 2010; Kastelein et al. 2012b; Kastelein et al. 2013b; Kastelein et al. 2014a; Popov et al. 2014).

Factors like sound level (e.g., overall level, sensation level, or level above background), duration, duty cycle (intermittent versus continuous exposure; potential recovery between intermittent periods), number of transient components (short duration and high amplitude), and/or frequency (especially in relation to hearing sensitivity) often are also important factors associated with TSs (e.g., Buck et al. 1984; Clark et al. 1987; Ward 1991; Lataye and Campo 1996). This is especially the case for exposure to impulsive sound sources (Danielson et al. 1991; Henderson et al. 1991; Hamernik et al. 2003), which is why thresholds in this Technical Guidance are also expressed as a PK metric (see next section). However, in many cases the EEH approach functions reasonably well as a first-order approximation, especially for higher-level, short-duration sound exposures such as those that are most likely to result in TTS in marine mammals[28] (Finneran 2015). Additionally, no currently supported alternative method to accumulate exposure is available. If alternative methods become available, they can be evaluated and considered when the Technical Guidance is updated.

Recommended Accumulation Period

To apply the weighted SEL_{cum} metric, a specified accumulation period is needed. Generally, it is predicted that most receivers will minimize the amount of time they remain in the closest ranges to a sound source/activity. Exposures at the closest point of approach are the primary exposures contributing to a receiver's accumulated level (Gedamke et al. 2011). Additionally, several

[28] When possible, it is valuable for action proponents to indicate the exposure conditions under which these thresholds are likely to be exceeded.

important factors determine the likelihood and duration a receiver is expected to be in close proximity to a sound source (i.e., overlap in space and time between the source and receiver). For example, accumulation time for fast moving (relative to the receiver) mobile sources is driven primarily by the characteristics of source (i.e., speed, duty cycle). Conversely, for stationary sources, accumulation time is driven primarily by the characteristics of the receiver (i.e., swim speed and whether transient or resident to the area where the activity is occurring). NMFS recommends a maximum baseline accumulation period of 24 hours, but acknowledges that there may be specific exposure situations where this accumulation period requires adjustment (e.g., if activity lasts less than 24 hours or for situations where receivers are predicted to experience unusually long exposure durations[29]).

After sound exposure ceases or between successive sound exposures, the potential for recovery from hearing loss exists, with PTS resulting in incomplete recovery and TTS resulting in complete recovery. Predicting recovery from sound exposure can be quite complicated. Currently, recovery in wild marine mammals cannot be accurately quantified. However, Finneran et al. (2010a) and Finneran and Schlundt (2013) proposed a model that approximates recovery in bottlenose dolphins and whose applicability to other species and other exposure conditions has yet to be determined. In the development of the Technical Guidance's thresholds, NMFS assumes for intermittent, repeated exposure that there is no recovery between subsequent exposures, although it has been demonstrated in terrestrial mammals (Clark et al. 1987; Ward 1991) and more recently in a marine mammal studies (Finneran et al. 2010b; Kastelein et al. 2014a; Kastelein et al. 2015b), that there is a reduction in damage and hearing loss with intermittent exposures.

Existing NMFS thresholds have only accounted for proximity of the sound source to the receiver, but thresholds in this Technical Guidance (i.e., expressed as weighted SEL_{cum}) now take into account the duration, as well as level of exposure. NMFS recognizes that accounting for duration of exposure, although supported by the scientific literature, adds a new factor, as far as application of this metric to real-world activities and that not all action proponents may have the ability to easily apply this additional component.

NMFS does not provide specifications necessary to perform exposure modeling and relies on the action proponent to determine the model that best represents their activity. However, NMFS acknowledges that different action proponents may have different capabilities and levels of modeling sophistication. NMFS has provided a simple means of approximating exposure for action proponents that are unable to apply various factors into their model (See Appendix D).

NMFS will convene a working group to investigate means for deriving more realistic accumulation periods, especially for stationary sources (anticipated in 2018).

2.3.2.2 Peak Sound Pressure Level (PK) Metric[30]

Sound exposure containing transient components (e.g., short duration and high amplitude; impulsive sounds) can create a greater risk of causing direct mechanical fatigue to the inner ear (as opposed to strictly metabolic) compared to sounds that are strictly non-impulsive (Henderson and Hamernik 1986; Levine et al. 1998; Henderson et al. 2008). Often the risk of damage from these transients does not depend on the duration of exposure. This is the concept of "critical level," where damage switches from being primarily metabolic to more mechanical and short

[29] For example, where a resident population could be found in a small and/or confined area (Ferguson et al. 2015) and/or exposed to a long-duration activity with a large sound source, or where a continuous stationery activity is nearby an area where marine mammals congregate, like a pinniped pupping beach.

[30] Note: Do not confuse peak sound pressure level with *maximum* root mean square sound pressure level.

duration of impulse can be less than the ear's integration time, leading to the potential to damage beyond the level the ear can perceive (Akay 1978).

Human noise standards recognize and provide separate thresholds for impulsive sound sources using the PK metric (Occupational Safety and Health Administration (OSHA) 29 CFR 1910.95; Starck et al. 2003). Thus, weighted SEL_{cum} is not an appropriate metric to capture all the effects of impulsive sounds (i.e., often violates EEH; NIOSH 1998), which is why instantaneous PK level has also been chosen as part of NMFS' dual metric thresholds for impulsive sounds.[31] Auditory weighting is not considered appropriate with the PK metric, as direct mechanical damage associated with sounds having high peak sound pressures typically does not strictly reflect the frequencies an individual species hears best (Ward 1962; Saunders et al. 1985; ANSI 1986; DOD 2004; OSHA 29 CFR 1910.95). Thus, this Technical Guidance recommends that the PK thresholds be considered unweighted/flat-weighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kHz).

2.3.2.3 Comparison Among Metrics

NMFS' existing thresholds were expressed as root-mean-square sound pressure level (RMS SPL), which is a different metric from the PK and weighted SEL_{cum} that are being recommended for the PTS onset thresholds in this Technical Guidance. Thus, NMFS recommends caution when comparing prior thresholds to those presented in this document (i.e., metrics are not directly comparable). For example, a RMS SPL threshold of 180 dB is not equal to a PK threshold of 180 dB. Further, the weighted SEL_{cum} metric incorporates exposure duration and is an energy level with a different reference value (re: $1 \mu Pa^2$-s). Thus, it is not directly comparable to other metrics that describe sound pressure levels (re: 1 μPa)[32].

2.3.3 Development of PTS Onset Thresholds

The development of the PTS onset thresholds consisted of the following procedure described in Finneran 2016 (Appendix A[33]):

1. Identification of available data on marine mammal hearing and noise-induced hearing loss (e.g., Southall et al. 2007; Finneran 2015; Finneran 2016 references listed in available reports/publications).

2. Methodology to derive marine mammal auditory weighting functions (described in more detail in Section 2.2.3 and Appendix A).

3. Evaluation and summary of currently available published data (32 studies found in Table 5) on hearing loss associated with sound exposure in marine mammals.
    - Because no published measurements exist on PTS in marine mammals, TTS onset measurements and associated thresholds were evaluated and summarized to extrapolate to PTS onset thresholds.

[31] For non-impulsive sounds, the weighted SEL_{cum} threshold will likely to result in the largest isopleth, compared to the PK threshold. Thus, for the majority of non-impulsive sounds, the consideration of the PK threshold is unnecessary. However, if a non-impulsive sound has the potential of exceeding the PK threshold associated with impulsive sounds, NMFS recommends these thresholds be considered (i.e., dual metrics).

Publications on how to estimate PK from SEL for seismic airguns and offshore impact pile drivers may be useful to action proponents (Galindo-Romero et al. 2015; Lippert et al. 2015).

[32] For more information and illustrations on metrics, see: Discovery of Sound in the Sea.

[33] Wright 2015 provides a critique of this methodology. For NMFS' response to this critique, see the Federal Register notice associated with the finalized Technical Guidance, specifically the section responding to public comments.

- Studies divided into the following categories:
    - o Temporal Characteristics: Impulsive and Non-impulsive

    - o Marine Mammal Hearing Groups: LF Cetaceans, MF Cetaceans, HF Cetaceans, PW Pinnipeds, and OW Pinniped

4. Determination of TTS onset threshold by individual (RLs, in both PK and SEL_{cum} metrics) based on methodology from Finneran 2016 for impulsive and non-impulsive sounds (Full detail in Appendix A).
    - Non-impulsive sounds:
        - o Only TTS data from behavioral studies were used, since studies using AEP methodology typically result in larger thresholds shifts (e.g., up to 10 dB difference, Finneran et al. 2007a) and are considered to be non-representative (as illustrated in Appendix A, Figure A9)

Table 5: Available underwater marine mammal threshold shift studies.

References in Chronologic Order+	Sound Source (Sound Source Category)	Species (number of individuals^)
Kastak et al. 1999	Octave-band noise (non-impulsive)	California sea lion (1); northern elephant seal (1); harbor seal (1)
Finneran et al. 2000	Explosion simulator (impulsive)*	Bottlenose dolphin (2); beluga (1)
Schlundt et al. 2000	Tones (non-impulsive)	Bottlenose dolphin (5); beluga (2)
Finneran et al. 2002	Seismic watergun (impulsive)	Bottlenose dolphin (1); beluga (1)
Finneran et al. 2003	Arc-gap transducer (impulsive)*	California sea lion (2)
Nachtigall et al. 2003	Octave-band noise (non-impulsive)	Bottlenose dolphin (1)
Nachtigall et al. 2004	Octave-band noise (non-impulsive)	Bottlenose dolphin (1)
Finneran et al. 2005a	Tones (non-impulsive)	Bottlenose dolphin (2)
Kastak et al. 2005	Octave-band noise (non-impulsive)	California sea lion (1); northern elephant seal (1); harbor seal (1)
Finneran et al. 2007a	Tones (non-impulsive)	Bottlenose dolphin (1)
Lucke et al. 2009	Single airgun (impulsive)	Harbor porpoise (1)
Mooney et al. 2009a	Octave-band noise (non-impulsive)	Bottlenose dolphin (1)
Mooney et al. 2009b	Mid-frequency sonar (non-impulsive)	Bottlenose dolphin (1)
Finneran et al. 2010a	Tones (non-impulsive)	Bottlenose dolphin (2)
Finneran et al. 2010b	Tones (non-impulsive)	Bottlenose dolphin (1)
Finneran and Schlundt 2010	Tones (non-impulsive)	Bottlenose dolphin (1)
Popov et al. 2011a	½ octave band noise (non-impulsive)	Yangtze finless porpoise (2)
Popov et al. 2011b	½ octave band noise (non-impulsive)	Beluga (1)
Kastelein et al. 2012a	Octave-band noise (non-impulsive)	Harbor seal (2)
Kastelein et al. 2012b	Octave-band noise (non-impulsive)	Harbor porpoise (1)
Finneran and Schlundt 2013	Tones (non-impulsive)	Bottlenose dolphin (2)
Popov et al. 2013	½ -octave band noise (non-impulsive)	Beluga (2)
Kastelein et al. 2013a	Octave-band noise (non-impulsive)	Harbor seal (1)
Kastelein et al. 2013b	Tone (non-impulsive)	Harbor porpoise (1)
Popov et al. 2014	½ octave band noise (non-impulsive)	Beluga (2)
Kastelein et al. 2014a	1-2 kHz sonar (non-impulsive)	Harbor porpoise (1)
Kastelein et al. 2014b	6.5 kHz tone (non-impulsive)	Harbor porpoise (1)
Kastelein et al. 2015a	Impact pile driving (impulsive)	Harbor porpoise (1)
Kastelein et al. 2015b	6-7 kHz sweeps (non-impulsive)	Harbor porpoise (1)
Finneran et al. 2015	Single airgun producing multiple shots (impulsive)*	Bottlenose dolphin (3)
Popov et al. 2015	½ octave band noise (non-impulsive)	Beluga (1)
Kastelein et al. 2016	Impact pile driving (impulsive)*	Harbor porpoise (2)
Reichmuth et al. 2016	Single airgun (impulsive) *	Ringed seals (2); Spotted seals (2)
Popov et al. 2017	½ octave band noise (non-impulsive)	Beluga (1)
Kastelein et al. 2017b	Simultaneous airguns producing multiple shots (impulsive)	Harbor porpoise (1)
Kastelein et al. 2017c	3.5-4.1 kHz sonar (non-impulsive)	Harbor porpoise (2)

^Note: Some individuals have been used in multiple studies.

*No incidents of temporary threshold shift were recorded in study.

- o TTS onset derived on a per individual basis by combining available data to create single TTS growth curve (e.g., dB TTS/dB noise) by frequency as a function of SEL_{cum}.

- o TTS onset was defined as the SEL_{cum} value from the growth curve interpolated at a value of TTS = 6 dB. Only datasets where data were available with a threshold shift (TS) above and below 6 dB were used to define TTS onset (i.e., extrapolation was not performed on datasets not meeting this criterion).

- o Interpolation was used to estimate SEL_{cum} necessary to induce 6 dB of TTS by hearing group (Appendix A, Figures A10-A13). Note: Appendix A, Figures A18-A20 illustrate available marine mammal TTS data in relation to the composite audiogram and auditory exposure function.

- o Finally, weighted thresholds for TTS onset were determined by the minimum value of the auditory exposure function (Equation 2), which is mathematically equivalent to $K + C$ (Table 6).

Table 6: TTS onset thresholds for non-impulsive sounds.

Hearing Group	K (dB)	C (dB)	Weighted TTS onset acoustic threshold (SEL_{cum})
Low-frequency (LF) cetaceans	179	0.13	179 dB
Mid-frequency (MF) cetaceans	177	1.20	178 dB
High-frequency (HF) cetaceans	152	1.36	153 dB
Phocid pinnipeds (underwater)	180	0.75	181 dB
Otariid pinnipeds (underwater)	198	0.64	199 dB

- Impulsive sounds:
  - o Available TTS data for impulsive sources were weighted based on auditory weighting functions for the appropriate hearing group (MF and HF cetaceans only from two studies: Finneran et al. 2002; Lucke et al. 2009).

  - o For hearing groups, where impulsive TTS onset data did not exist (LF cetaceans and PW and OW pinnipeds), Finneran (2015) derived impulsive TTS onset thresholds using the relationship between non-impulsive TTS onset thresholds and impulsive TTS onset thresholds for MF and HF cetaceans (i.e., similar to what was presented in Southall et al. 2007). Using the mean/median of these data resulted in an 11 dB relationship, which was used as a surrogate for the other hearing groups (i.e., non-impulsive TTS threshold was 11 dB higher than impulsive TTS threshold).

  - o A similar approach was investigated for the PK threshold, resulting in a 45 dB relationship, which was considered unrealistic (approaching cavitation level of water; Southall et al. 2007). Upon further consideration, the auditory system's dynamic range was determined a more appropriate methodology for estimating PK sound pressure thresholds.[34]

    The dynamic range methodology assumes that the PK TTS onset acoustic threshold for MF and HF cetaceans defines the upper end of

[34] Dynamic range is used in human noise standards to define the PK acoustic threshold for impulsive sounds (e.g., 140 dB from OSHA 29 CFR 1910.95). For the purposes of this Technical Guidance, the intent is to relate the threshold of audibility and TTS onset level, not the threshold of pain, as dynamic range is typically defined (Yost 2007).

those hearing groups' dynamic range (i.e., PK threshold: 224 dB for MF cetaceans and PK threshold: 196 dB for HF cetaceans), with the threshold of audibility derived from the frequency of best hearing (f_0) from the composite audiogram (i.e., 54 dB for MF cetaceans and 48 dB for HF cetaceans) defining the lower end of the groups' dynamic range.

This results in a dynamic range of 170 dB for MF cetaceans and 148 dB for HF cetaceans. The median/mean dynamic range from these two hearing groups (i.e., 159 dB) is used as the surrogate dynamic range for LF cetaceans (best hearing at f_0= 54 dB; Resulting in a PK TTS threshold of 213 dB); PW pinnipeds (best hearing at f_0=53 dB; Resulting in a PK TTS threshold of 212 dB); and OW pinnipeds (best hearing at f_0 =67 dB; Resulting in a PK TTS threshold of 226 dB).

5. Extrapolation for PTS onset threshold (in both PK and SEL metrics) based on data from humans and terrestrial mammals, with the assumption that the mechanisms associated with noise-induced TS in marine mammals is similar, if not identical, to that recorded in terrestrial mammals.

   - <u>Non-impulsive sounds</u>:
     - PTS onset thresholds were estimated using TTS growth rates based on those marine mammal studies where 20 dB or more of a TS was induced. This was done to estimate more accurately PTS onset, since using growth rates based on smaller TSs are often shallower than compared to those inducing greater TSs (See Appendix A, Figures A10-A13).

     - PTS onset was derived using the same methodology as TTS onset, with PTS onset defined as the SEL_{cum} value from the fitted curve at a TTS of 40 dB.

     - Offset between TTS and PTS onset thresholds were examined and ranged from 13 to 37 dB (mean/median: 25/25 dB for cetacean data). Thus, based on these data, a conservative 20 dB offset was chosen to estimate PTS onset thresholds from TTS onset thresholds for non-impulsive sources (i.e., 20 dB was added to K to determine PTS onset, assuming the shape of the PTS auditory exposure function is identical to the TTS auditory exposure function for that hearing group).

   - <u>Impulsive sounds</u>: Based on limited available marine mammal impulsive data, the relationships previously derived in Southall et al. (2007), which relied upon terrestrial mammal growth rates (Henderson and Hamernik 1982; Henderson and Hamernik 1986; Price and Wansack 1989; Levine et al. 1998; Henderson et al. 2008), was used to predict PTS onset:

     - Resulting in an approximate 15 dB difference between TTS and PTS onset thresholds in the SEL_{cum} metric.

     - Southall et al. (2007) recommended a 6 dB of TTS/dB of noise growth rate for PK thresholds. This recommendation was based on several factors, including ensuring that the PK acoustic threshold did not unrealistically exceed the cavitation threshold of water. Resulting in an approximate 6 dB difference between TTS and PTS onset thresholds in the PK metric.

III. UPDATING OF ACOUSTIC TECHNICAL GUIDANCE AND THRESHOLDS

Research on the effects of anthropogenic sound on marine mammals has increased dramatically in the last decade and will likely continue to increase in the future. As such, the Technical Guidance will be reviewed periodically and updated as appropriate to reflect the compilation, interpretation, and synthesis of the scientific literature.

NMFS' initial approach for updating current thresholds for protected marine species consisted of providing thresholds for underwater PTS onset for marine mammals via this document. As more data become available, thresholds may be established for additional protected marine species, such as sea turtles and marine fishes. As with this document, public review and outside peer review will be integral to the process.

3.1 PROCEDURE AND TIMELINE FOR UPDATING THE TECHNICAL GUIDANCE

NMFS will continue to monitor and evaluate new data as they become available and periodically convene staff from our various offices, regions, and science centers to update the Technical Guidance as appropriate (anticipating updates to occur on a three to five year cycle). In addition to evaluating new, relevant scientific studies, NMFS will also periodically re-examine basic concepts and definitions (e.g., hearing groups, PTS, TTS, auditory weighting functions), appropriate metrics, temporal and spatial considerations, and other relevant topics. Updates will be posted at Link to Technical Guidance web page.

Since the methodology for deriving composite audiograms and associated marine mammal auditory weighting functions, as well as TTS thresholds is data driven, any new information that becomes available has the potential to cause some amount of change for that specific hearing group but also other hearing groups, if they rely on surrogate data. It may not be feasible to make changes every time a new data point becomes available. Instead, NMFS will periodically examine new data to date and consider the impacts of those studies on the Technical Guidance to determine what revisions/updates may be appropriate. At the same time, there may be special circumstances that merit evaluation of data on a more accelerated timeline (e.g., LF cetacean data that could result in significant changes to the current Technical Guidance).

3.1.1 Consideration for New Scientific Publication

During the Technical Guidance's recent review under EO 13795 (i.e., public comment period; 82 FR 24950; May 31, 2017), several commenters provided information on newly published scientific literature (i.e., 12 publications) for consideration and inclusion in a revised version of the Technical Guidance. NMFS reviewed all literature suggested by commenters. The majority of suggested papers were either already considered within the 2016 Technical Guidance or were not applicable for incorporation (i.e., many newly available marine mammal audiograms were collected via auditory evoked potential (AEP), which cannot be directly incorporated in the current methodology). Of the studies suggested, only the Branstetter et al. 2017 publication, which provides behavioral audiograms for six individual killer whales, was appropriate for consideration within the Technical Guidance. Since the close of the public comment period, a paper providing two new additional behavioral audiograms for harbor porpoise (Kastelein et al. 2017a), a paper examining TTS in harbor porpoise exposed to multiple airgun shots (Kastelein et al. 2017b), and a paper examining TTS in harbor porpoise exposed to mid-frequency sonar playbacks (Kastelein et al. 2017c) were published. These three additional papers are also appropriate for consideration within the Technical Guidance.

The Technical Guidance's methodology (Appendix A) is data driven, meaning every new publication has the potential to result in some change to either the thresholds and/or auditory weighting functions for a single or multiple hearing groups (i.e., those groups whose data are used as surrogates for other hearing groups), and with every change comes a necessary transition period to allow action proponents to adapt to these changes. Thus, there are scientific, as well as practical implications that need consideration before making even a minor a change to the Technical Guidance. One commenter said it best by "The value of a revision of any science-based advice hinges on the balance between the availability of new scientific evidence and the need for a period of stability. The greater the complexity of the advice the greater the need for a long stable period to assimilate that advice before it is updated[35]." The Marine Mammal Commission (MMC) and U.S. Navy offered similar cautions about the practicality of revising the Technical Guidance every time a new study becomes available.

Upon consideration of these most recent studies during our review under EO 13795 and considering recommendations from other Federal agencies and public commenters, NMFS determined it is not practical from an implementation standpoint to add these studies at this time. NMFS will include these studies in the next revision of this document (i.e., Version 3.0) and adhere to our stipulated 3 to 5 year update schedule, where we can evaluate all new relevant publications and make changes in a more predictable manner.

3.1.1.1 Preliminary Analysis of Branstetter et al. 2017, Kastelein et al. 2017a, Kastelein et al. 2017b, and Kastelein et al. 2017c

NMFS conducted a preliminary analysis examining the new data provided in Branstetter et al. 2017, Kastelein et al. 2017a, Kastelein et al. 2017b, and Kastelein et al. 2017c in the context of the Technical Guidance's current MF and HF cetacean composite audiograms (Branstetter et al. 2017; Kastelein et al. 2017a) and HF cetacean TTS/PTS onset thresholds (Kastelein et al. 2017b; Kastelein et al. 2017c).

Branstetter et al. 2017

The Technical Guidance's composite audiogram for MF cetaceans does incorporate behavioral audiograms from two individual killer whales (i.e., Vigga and Yakka from Szymanski et al. 1999). In Figure 3 from the Branstetter et al. 2017 publication, they plot Vigga and Yakka's audiogram data as a comparison to the audiograms obtained to in their study. From this figure and corresponding threshold table (Table 1 in Branstetter et al. 2017), in the killer whale's most sensitive hearing range, the data already included in the Technical Guidance align with Branstetter et al.'s new audiograms, and for most frequencies, Vigga and Yakka have lower thresholds.

Kastelein et al. 2017a

The Technical Guidance's composite audiogram for HF cetaceans does incorporate behavioral audiograms for three harbor porpoises (i.e., PpSH047 and Jerry from Kastelein et al. 2010; ID No. 04 from Kastelein et al. 2015c). In Figure 1 from Kastelein et al. 2017a, they plot their previously published audiograms from these three individuals as a comparison to the two new individual audiograms obtained in this study. Kastelein et al. (2017) concluded from this most recent study "The basic audiograms of the young female and male harbor porpoises in the present study were similar to those of the three previously tested young male harbor porpoises (Fig 1)."

[35] Link to public comment made on Regulations.gov.

Kastelein et al. 2017b

In this study, a harbor porpoise was exposed to either 10 or 20 consecutive shots from two airings simultaneously. A mean threshold shift of 4.4 dB occurred after exposure to a weighted cumulative level of 140.3 dB. The Technical Guidance's TTS onset threshold (weighted SEL_{cum}) for HF cetaceans and impulsive sources is 140 dB, which is consistent with the results from this most recent study. This paper also concludes, "the initial results indicate that the frequency-weighting function proposed by NOAA (NMFS, 2016) provides a reasonably robust measure of low levels of TTS occurring over a range of spectra of impulsive sound sources."

Kastelein et al. 2017c

This study exposed two harbor porpoises to mid-frequency sonar (3.5 to 4.1 kHz) and reported that to induce a 6 dB threshold shift in harbor porpoises an unweighted cumulative level between 175 and 180 dB would be needed. If these data were weighted using the Technical Guidance's auditory weighting function, the values would be ~157.7 and ~162.7 dB SEL_{cum}[36]. The Technical Guidance's TTS onset threshold (weighted SEL_{cum}) for HF cetaceans and non-impulsive sources is 153 dB, which is consistent with the results from this most recent study (i.e., the thresholds from Kastelein et al. 2017c are likely slightly higher than the Technical Guidance because it was an intermittent source allowing for a greater potential for recovery between pauses of the various signal components).

Preliminary Conclusions

Thus, from this preliminary analysis, NMFS concludes that the Branstetter el. 2017 and Kastelein et al. 2017a audiograms are consistent with data already included in the Technical Guidance for these two species (i.e., the data from these two recent studies align with previous data collected and incorporated within the current version of the Technical Guidance). Additionally, the HF cetacean TTS data presented in Kastelein et al. 2017b and Kastelein et al. 2017c are consistent with the HF cetacean thresholds presented in the Technical Guidance.

[36] NMFS contacted the authors of this paper to confirm weighted levels.

APPENDIX A: FINNERAN TECHNICAL REPORT

The entire Finneran Technical Report (Finneran 2016), regarding methodology for deriving auditory weighting functions and thresholds for marine mammal species under NMFS' jurisdiction, is included for reference in Appendix A. Its contents have not been modified by NMFS, other than adding "A" before figures and tables to denote Appendix A and be consistent with the other appendices in the Technical Guidance.

<u>Notes</u>:

a. Literature cited in this section are included at the end of this Appendix (i.e., not all references found in this Appendix are included in the Literature Cited for the Technical Guidance). Additionally, terminology, symbols, and abbreviations used in this appendix may not match those used elsewhere in the Technical Guidance.

b. The derivation of the Technical Guidance's thresholds and auditory weighting functions are from two primary sets of data: 1) Audiogram data (used to derive composite audiograms for each hearing group) and 2) TTS onset data (used to derive auditory weighting functions and TTS onset thresholds by hearing group). For each of these two primary data sets, either data points were derived directly from the published study or if data were originally reported in terms of sound pressure level and duration, they converted to sound exposure level via standard relationships.

c. Since the final Finneran Technical Report was received, an additional TTS study became available (Kastelein et al. 2016). Information regarding this study is added as a footnote by NMFS.

d. After the Technical Guidance's finalization, an additional two TTS studies became available (Kastelein et al. 2017b; Kastelein et al. 2017c). In the Kastelein et al. 2017b study, a harbor porpoise was exposed to either 10 or 20 consecutive shots from two airguns simultaneously. Kastelein et al. 2017c exposed two harbor porpoises to mid-frequency sonar (3.5 to 4.1 kHz). The HF cetacean TTS data (i.e., TTS onset levels) presented in these two most recent studies are consistent with the HF cetacean thresholds presented in the Technical Guidance.

e. Additionally, two behavioral audiogram publications became available after the Technical Guidance's finalization in 2016 (Branstetter et al. 2017; Kastelein et al. 2017a). However, upon consideration of these two studies during EO 13795 review of the Technical Guidance, including recommendations from other Federal agencies (e.g. Navy), NMFS determined it is not practical from an implementation standpoint to add these studies at this time (i.e., Version 2.0). NMFS will include these studies in the next revision of this document (i.e., Version 3.0). From this preliminary analysis, NMFS concludes that the Branstetter el. 2017 and Kastelein et al. 2017a audiograms are consistent with data already included in the Technical Guidance for these two species (i.e., the data from these two recent studies align with previous data collected and incorporated within the current version of the Technical Guidance).

TECHNICAL REPORT 3026
December 2016

Auditory Weighting Functions and TTS/PTS Exposure Functions for Marine Mammals Exposed to Underwater Noise

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ADMINISTRATIVE INFORMATION

This work described in this report was prepared for Commander, U.S. Fleet Forces Command, Norfolk, VA, by the Marine Mammal Scientific & Vet Support Branch (Code 71510) of the Biosciences Division (Code 71500), Space and Naval Warfare Systems Center Pacific (SSC Pacific), San Diego, CA.

Released under authority of
M. J. Xitco, Head
Biosciences Division

EXECUTIVE SUMMARY

The US Navy's Tactical Training Theater Assessment and Planning (TAP) Program addresses environmental challenges that affect Navy training ranges and operating areas. As part of the TAP process, acoustic effects analyses are conducted to estimate the potential effects of Navy activities that introduce high-levels of sound or explosive energy into the marine environment. Acoustic effects analyses begin with mathematical modeling to predict the sound transmission patterns from Navy sources. These data are then coupled with marine species distribution and abundance data to determine the sound levels likely to be received by various marine species. Finally, criteria and thresholds are applied to estimate the specific effects that animals exposed to Navy-generated sound may experience.

This document describes the rationale and steps used to define proposed numeric thresholds for predicting auditory effects on marine mammals exposed to active sonars, other (non-impulsive) active acoustic sources, explosives, pile driving, and air guns for Phase 3 of the TAP Program. Since the derivation of TAP Phase 2 acoustic criteria and thresholds, important new data have been obtained related to the effects of noise on marine mammal hearing. Therefore, for Phase 3, new criteria and thresholds for the onset of temporary and permanent hearing loss have been developed, following a consistent approach for all species of interest and utilizing all relevant, available data. The effects of noise frequency on hearing loss are incorporated by using auditory weighting functions to emphasize noise at frequencies where a species is more sensitive to noise and de-emphasize noise at frequencies where susceptibility is low.

Marine mammals were divided into six groups for analysis: low-frequency cetaceans (group LF: mysticetes), mid-frequency cetaceans (group MF: delphinids, beaked whales, sperm whales), high-frequency cetaceans (group HF: porpoises, river dolphins), sirenians (group SI: manatees), phocids in water (group PW: true seals), and otariids and other non-phocid marine carnivores in water (group OW: sea lions, walruses, otters, polar bears).

For each group, a frequency-dependent weighting function and numeric thresholds for the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) were derived from available data describing hearing abilities of and effects of noise on marine mammals. The resulting weighting function amplitudes are illustrated in Figure AE-1; Table AE-1 summarizes the parameters necessary to calculate the weighting function amplitudes. For Navy Phase 3 analyses, the onset of TTS is defined as a TTS of 6 dB measured approximately 4 min after exposure. PTS is assumed to occur from exposures resulting in 40 dB or more of TTS measured approximately 4 min after exposure. Exposures just sufficient to cause TTS or PTS are denoted as "TTS onset" or "PTS onset" exposures.

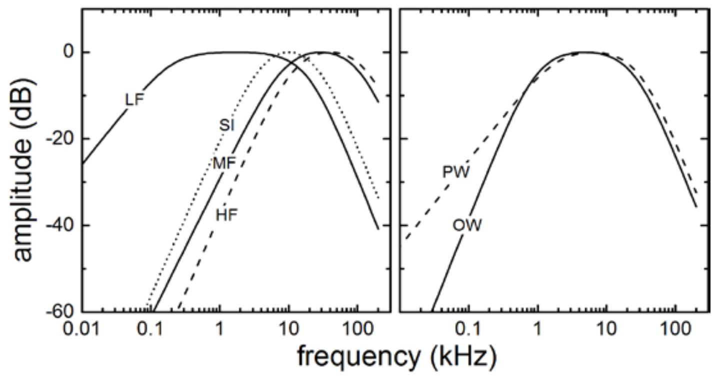

Figure AE-1. **Navy Phase 3 weighting functions for all species groups. Parameters required to generate the functions are provided in Table AE-1.**

Table AE-1. **Summary of weighting function parameters and TTS/PTS thresholds. SEL thresholds are in dB re 1 μPa^{2}s and peak SPL thresholds are in dB re 1 μPa.**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{\left[1+(f/f_1)^2\right]^a\left[1+(f/f_2)^2\right]^b}\right\}$$

						Non-impulsive		Impulse			
						TTS threshold	PTS threshold	TTS threshold		PTS threshold	
Group	*a*	*b*	*f*1 (kHz)	*f*2 (kHz)	*C* (dB)	SEL (weighted)	SEL (weighted)	SEL (weighted)	peak SPL (unweighted)	SEL (weighted)	peak SPL (unweighted)
LF	1	2	0.20	19	0.13	179	199	168	213	183	219
MF	1.6	2	8.8	110	1.20	178	198	170	224	185	230
HF	1.8	2	12	140	1.36	153	173	140	196	155	202
SI	1.8	2	4.3	25	2.62	186	206	175	220	190	226
OW	2	2	0.94	25	0.64	199	219	188	226	203	232
PW	1	2	1.9	30	0.75	181	201	170	212	185	218

To compare the Phase 3 weighting functions and TTS/PTS thresholds to those used in TAP Phase 2 analyses, both the weighting function shape and the weighted threshold values must be taken into account; the weighted thresholds by themselves only indicate the TTS/PTS threshold at the most susceptible frequency (based on the relevant weighting function). In contrast, the TTS/PTS *exposure functions* incorporate both the shape of the weighting function and the weighted threshold value, they provide the best means of comparing the frequency-dependent TTS/PTS thresholds for Phase 2 and 3. Figures AE-2 and AE-3 compare the TTS/PTS exposure functions for non-impulsive sounds (e.g., sonars) and impulsive sounds (e.g., explosions), respectively, used in TAP Phase 2 and Phase 3.

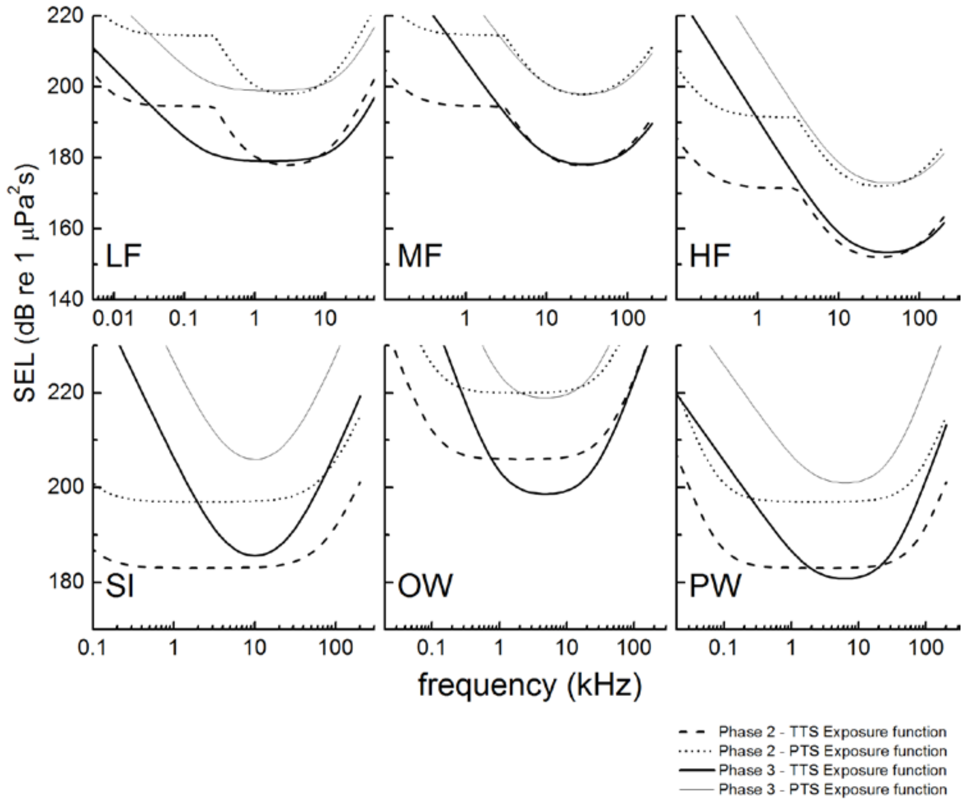

Figure AE-2. **TTS and PTS exposure functions for sonars and other (non-impulsive) active acoustic sources. Heavy solid lines — Navy Phase 3 TTS exposure functions (Table AE-1). Thin solid lines — Navy Phase 3 PTS exposure functions (Table AE-1). Dashed lines — Navy Phase 2 TTS exposure functions. Short dashed lines — Navy Phase 2 PTS exposure functions.**

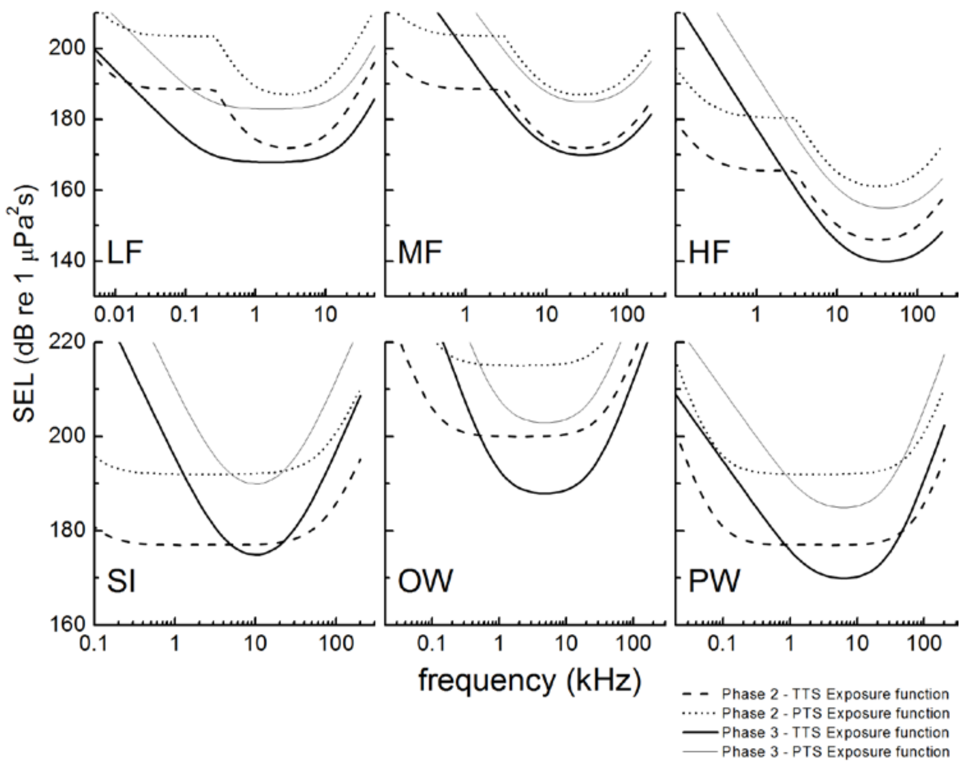

Figure AE-3. **TTS and PTS exposure functions for explosives, impact pile driving, air guns, and other impulsive sources. Heavy solid lines — Navy Phase 3 TTS exposure functions (Table AE-1). Thin solid lines — Navy Phase 3 PTS exposure functions (Table AE-1). Dashed lines — Navy Phase 2 TTS exposure functions. Short dashed lines — Navy Phase 2 PTS exposure functions.**

The most significant differences between the Phase 2 and Phase 3 functions include: (1) Thresholds at low frequencies are generally higher for Phase 3 compared to Phase 2. This is because the Phase 2 weighting functions utilized the "M-weighting" functions at lower frequencies, where no TTS existed at that time. Since derivation of the Phase 2 weighting functions, additional data have been collected to support the use of new functions more similar to human auditory weighting functions. (2) Impulsive TTS/PTS thresholds near the region of best hearing sensitivity are lower for Phase 3 compared to Phase 2.

I. INTRODUCTION

1.1 OVERVIEW

The US Navy's Tactical Training Theater Assessment and Planning (TAP) Program addresses environmental challenges that affect Navy training ranges and operating areas. As part of the TAP process, acoustic effects analyses are conducted to estimate the potential effects of Navy training and testing activities that introduce high-levels of sound or explosive energy into the marine environment. Acoustic effects analyses begin with mathematical modeling to predict the sound transmission patterns from Navy sources. These data are then coupled with marine species distribution and abundance data to determine sound levels likely to be received by various marine species. Finally, criteria and thresholds are applied to estimate the specific effects that animals exposed to Navy-generated sound may experience.

This document describes the rationale and steps used to define proposed numeric thresholds for predicting auditory effects on marine mammals exposed to underwater sound from active sonars, other (non-impulsive) active acoustic sources, explosives, pile driving, and air guns for Phase 3 of the TAP Program. The weighted threshold values and auditory weighting function shapes are summarized in Section 12.

1.2 IMPULSE VS. NON-IMPULSIVE NOISE

When analyzing the auditory effects of noise exposure, it is often helpful to broadly categorize noise as either impulse noise — noise with high peak sound pressure, short duration, fast rise-time, and broad frequency content — or non-impulsive (i.e., steady-state) noise. When considering auditory effects, sonars, other coherent active sources, and vibratory pile driving are considered to be non-impulsive sources, while explosives, impact pile driving, and air guns are treated as impulsive sources. Note that the terms non-impulsive or steady-state do not necessarily imply long duration signals, only that the acoustic signal has sufficient duration to overcome starting transients and reach a steady-state condition. For harmonic signals, sounds with duration greater than approximately 5 to 10 cycles are generally considered to be steady-state.

1.3 NOISE-INDUCED THRESHOLD SHIFTS

Exposure to sound with sufficient duration and sound pressure level (SPL) may result in an elevated hearing threshold (i.e., a loss of hearing sensitivity), called a noise-induced threshold shift (NITS). If the hearing threshold eventually returns to normal, the NITS is called a temporary threshold shift (TTS); otherwise, if thresholds remain elevated after some extended period of time, the remaining NITS is called a permanent threshold shift (PTS). TTS and PTS data have been used to guide the development of safe exposure guidelines for people working in noisy environments. Similarly, TTS and PTS criteria and thresholds form the cornerstone of Navy analyses to predict auditory effects in marine mammals incidentally exposed to intense underwater sound during naval activities.

1.4 AUDITORY WEIGHTING FUNCTIONS

Animals are not equally sensitive to noise at all frequencies. To capture the frequency-dependent nature of the effects of noise, *auditory weighting functions* are used. Auditory weighting functions are mathematical functions used to emphasize frequencies where animals are more susceptible to noise exposure and de-emphasize frequencies where animals are less susceptible. The functions may be thought of as frequency-dependent filters that are applied to a noise exposure before a single, weighted SPL or sound exposure level (SEL) is calculated. The filter shapes are normally "band-pass" in nature; i.e., the function amplitude resembles an inverted "U" when plotted versus frequency. The weighting function amplitude is approximately flat within a limited range of frequencies, called the "pass-band," and declines at frequencies below and above the pass-band.

Auditory weighting functions for humans were based on *equal loudness contours* — curves that show the combinations of SPL and frequency that result in a sensation of equal loudness in a human listener. Equal loudness contours are in turn created from data collected during loudness comparison tasks. Analogous tasks are difficult to perform with non-verbal animals; as a result, equal loudness contours are available for only a single marine mammal (a dolphin) across a limited range of frequencies (2.5 to 113 kHz) (Finneran and Schlundt, 2011). In lieu of performing loudness comparison tests, reaction times to tones can be measured, under the assumption that reaction time is correlated with subjective loudness (Stebbins, 1966; Pfingst et al., 1975). From the reaction time vs. SPL data, curves of equal response latency can be created and used as proxies for equal loudness contours.

Just as human damage risk criteria use auditory weighting functions to capture the frequency-dependent aspects of noise, US Navy acoustic impact analyses use weighting functions to capture the frequency-dependency of TTS and PTS in marine mammals.

1.5 TAP PHASE 3 WEIGHTING FUNCTIONS AND TTS/PTS THRESHOLDS

Navy weighting functions for TAP Phase 2 (Finneran and Jenkins, 2012) were based on the "M-weighting" curves defined by Southall et al. (2007), with additional high-frequency emphasis for cetaceans based on equal loudness contours for a bottlenose dolphin (Finneran and Schlundt, 2011). Phase 2 TTS/PTS thresholds also relied heavily on the recommendations of Southall et al. (2007), with modifications based on preliminary data for the effects of exposure frequency on dolphin TTS (Finneran, 2010; Finneran and Schlundt, 2010) and limited TTS data for harbor porpoises (Lucke et al., 2009; Kastelein et al., 2011).

Since the derivation of TAP Phase 2 acoustic criteria and thresholds, new data have been obtained regarding marine mammal hearing (e.g., Dow Piniak et al., 2012; Martin et al., 2012; Ghoul and Reichmuth, 2014; Sills et al., 2014; Sills et al., 2015), marine mammal equal latency contours (e.g., Reichmuth, 2013; Wensveen et al., 2014; Mulsow et al., 2015), and the effects of noise on marine mammal hearing (e.g., Kastelein et al., 2012b; Kastelein et al., 2012a; Finneran and Schlundt, 2013; Kastelein et al., 2013a; Kastelein et al., 2013b; Popov et al., 2013; Kastelein et al., 2014b; Kastelein et al., 2014a; Popov et al., 2014; Finneran et al., 2015; Kastelein et al., 2015c; Kastelein et al., 2015b; Popov et al., 2015). As a result, new weighting functions and TTS/PTS thresholds have been developed for Phase 3. The new criteria and thresholds are based on all relevant data and feature a consistent approach for all species of interest.

Marine mammals were divided into six groups for analysis. For each group, a frequency-dependent weighting function and numeric thresholds for the onset of TTS and PTS were derived from available data describing hearing abilities and effects of noise on marine mammals. Measured or predicted auditory threshold data, as well as measured equal latency contours, were used to influence the weighting function shape for each group. For species groups for which TTS data are available, the weighting function parameters were adjusted to provide the best fit to the experimental data. The same methods were then applied to other groups for which TTS data did not exist.

II. WEIGHTING FUNCTIONS AND EXPOSURE FUNCTIONS

The shapes of the Phase 3 auditory weighting functions are based on a generic band-pass filter described by

$$W(f) = C + 10\log_{10}\left\{\frac{\left(f/f_1\right)^{2a}}{\left[1+\left(f/f_1\right)^2\right]^a\left[1+\left(f/f_2\right)^2\right]^b}\right\}, \tag{A1}$$

where $W(f)$ is the weighting function amplitude (in dB) at the frequency f (in kHz). The shape of the filter is defined by the parameters C, f_1, f_2, a, and b (Figs. A1 and A2, left panels):

C *weighting function gain* (dB). The value of C defines the vertical position of the curve. Changing the value of C shifts the function up/down. The value of C is often chosen to set the maximum amplitude of W to 0 dB (i.e., the value of C does not necessarily equal the peak amplitude of the curve).

f_1 *low-frequency cutoff* (kHz). The value of f_1 defines the lower limit of the filter pass-band; i.e., the lower frequency at which the weighting function amplitude begins to decline or “roll-off” from the flat, central portion of the curve. The specific amplitude at f_1 depends on the value of a. Decreasing f_1 will enlarge the pass-band of the function (the flat, central portion of the curve).

f_2 *high-frequency cutoff* (kHz). The value of f_2 defines the upper limit of the filter pass-band; i.e., the upper frequency at which the weighting function amplitude begins to roll-off from the flat, central portion of the curve. The amplitude at f_2 depends on the value of b. Increasing f_2 will enlarge the pass-band of the function.

a *low-frequency exponent* (dimensionless). The value of a defines the rate at which the weighting function amplitude declines with frequency at the lower frequencies. As frequency decreases, the change in weighting function amplitude becomes linear with the logarithm of frequency, with a slope of $20a$ dB/decade. Larger values of a result in lower amplitudes at f_1 and steeper rolloffs at frequencies below f_1.

b *high-frequency exponent* (dimensionless). The value of b defines the rate at which the weighting function amplitude declines with frequency at the upper frequencies. As frequency increases, the change in weighting function amplitude becomes linear with the logarithm of frequency, with a slope of $-20b$ dB/decade. Larger values of b result in lower amplitudes at f_2 and steeper rolloffs at frequencies above f_2.

If $a = 2$ and $b = 2$, Eq. (A1) is equivalent to the functions used to define Navy Phase 2 Type I and EQL weighting functions, M-weighting functions, and the human C-weighting function (American National Standards Institute (ANSI), 2001; Southall et al., 2007; Finneran and Jenkins, 2012). The change from fixed to variable exponents for Phase 3 was done to allow the low- and high-frequency rolloffs to match available experimental data. During implementation, the weighting function defined by Eq. (A1) is used in conjunction with a weighted threshold for TTS or PTS expressed in units of SEL.

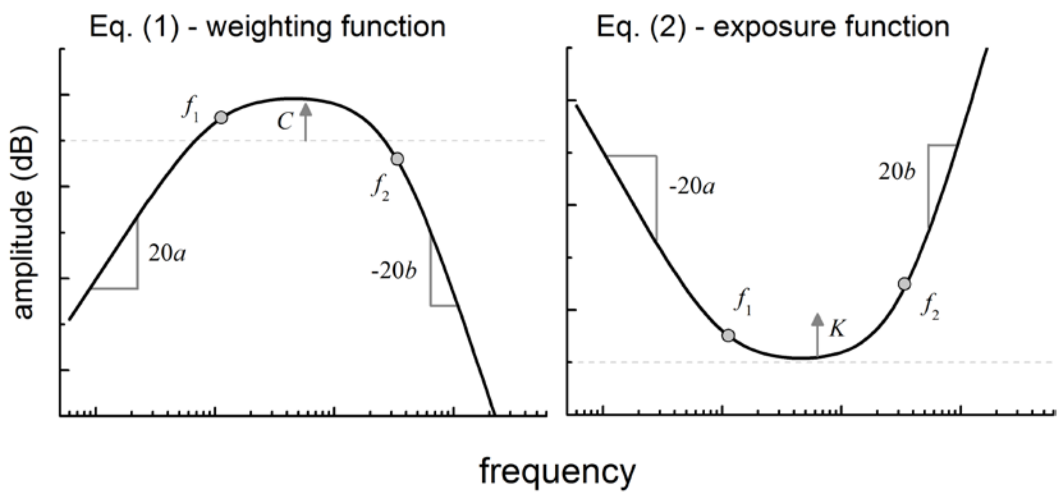

Figure A1. **Examples of (left) weighting function amplitude described by Eq. (A1) and (right) exposure function described by Eq. (A2). The parameters f_1 and f_2 specify the extent of the filter pass-band, while the exponents *a* and *b* control the rate of amplitude change below f_1 and above f_2, respectively. As the frequency decreases below f_1 or above f_2, the amplitude approaches linear-log behavior with a slope magnitude of 20*a* or 20*b* dB/decade, respectively. The constants *C* and *K* determine the vertical positions of the curves.**

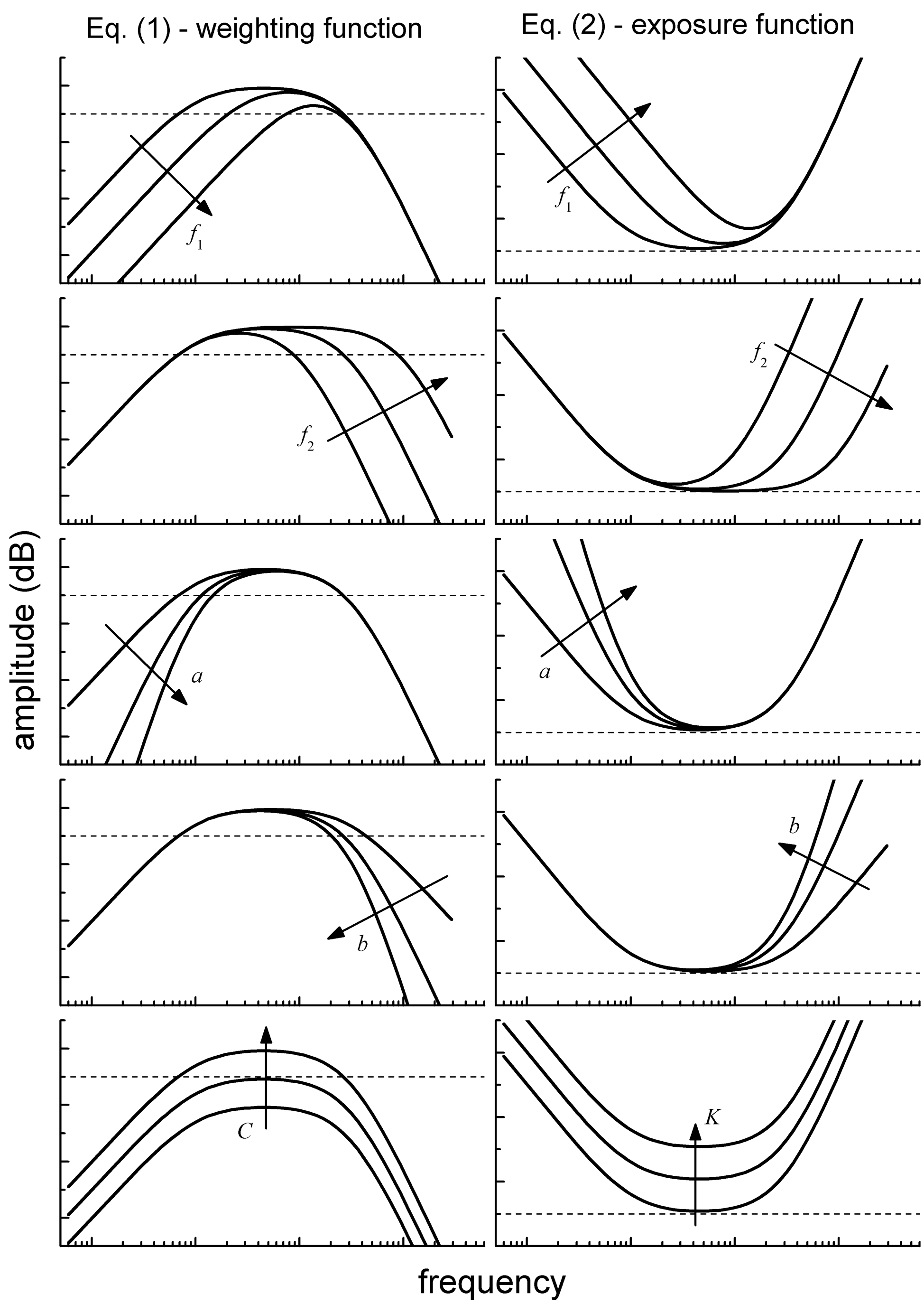

Figure A2. **Influence of parameter values on the resulting shapes of the weighting functions (left) and exposure functions (right). The arrows indicate the direction of change when the designated parameter is increased.**

For developing and visualizing the effects of the various weighting functions, it is helpful to invert Eq. (A1), yielding

$$E(f) = K - 10\log_{10}\left\{\frac{\left(f/f_1\right)^{2a}}{\left[1+\left(f/f_1\right)^2\right]^a\left[1+\left(f/f_2\right)^2\right]^b}\right\}, \qquad \text{(A2)}$$

where $E(f)$ is the acoustic exposure as a function of frequency f, the parameters f_1, f_2, a, and b are identical to those in Eq. (A1), and K is a constant. The function described by Eq. (A2) has a "U-shape" similar to an audiogram or equal loudness/latency contour (Figs. A1 and A2, right panels). If K is adjusted to set the minimum value of $E(f)$ to match the weighted threshold for the onset of TTS or PTS, Eq. (A2) reveals the manner in which the exposure necessary to cause TTS or PTS varies with frequency. Equation (A2) therefore allows the frequency-weighted threshold values to be directly compared to TTS data. The function defined by Eq. (A2) is referred to as an *exposure function*, since the curve defines the acoustic exposure that equates to TTS or PTS as a function of frequency. To illustrate the relationship between weighting and exposure functions, Fig. A3 shows the Navy Phase 2 weighting function [Eq. (A1), left panel] and TTS exposure function [Eq. (A2), right panel] for mid-frequency cetaceans exposed to sonars.

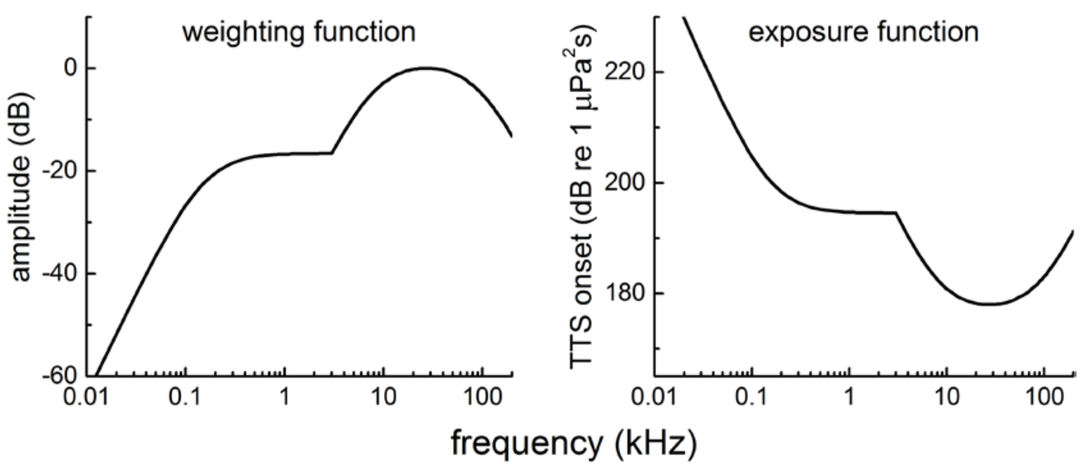

Figure A3. **(left panel) Navy Phase 2 weighting function for the mid-frequency cetacean group. This function was used in conjunction with a weighted TTS threshold of 178 dB re 1 µPa^{2}s. For narrowband signals, the effective, weighted TTS threshold at a particular frequency is calculated by adding the weighting function amplitude at that frequency to the weighted TTS threshold (178 dB re 1 µPa^{2}s). To visualize the frequency-dependent nature of the TTS threshold, the weighting function is inverted and the minimum value set equal to the weighted TTS threshold. This is illustrated in the right panel, which shows the SEL required for TTS onset as a function of frequency. The advantage of this representation is that it may be directly compared to TTS onset data at different exposure frequencies.**

The relationships between Eqs. (A1) and (A2) may be highlighted by defining the function $X(f)$ as

$$X(f) = 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{\left[1+(f/f_1)^2\right]^a\left[1+(f/f_2)^2\right]^b}\right\}. \tag{A3}$$

The peak value of $X(f)$ depends on the specific values of f_1, f_2, a, and b and will not necessarily equal zero. Substituting Eq. (A3) into Eqs. (A1) and (A2) results in

$$W(f) = C + X(f) \tag{A4}$$

and

$$E(f) = K - X(f), \tag{A5}$$

respectively. The maximum of the weighting function and the minimum of the exposure function occur at the same frequency, denoted f_p. The constant C is defined so the weighting function maximum value is 0 dB; i.e., $W(f_p) = 0$, so

$$W(f_p) = 0 = C + X(f_p). \tag{A6}$$

The constant K is defined so that the minimum of the exposure function [i.e., the value of $E(f)$ when $f = f_p$] equals the weighted TTS or PTS threshold, T_{wgt}, so

$$E(f_p) = T_{wgt} = K - X(f_p). \tag{A7}$$

Adding Eqs. (A6) and (A7) results in

$$T_{wgt} = C + K. \tag{A8}$$

The constants C, K, and the weighted threshold are therefore not independent and any one of these parameters can be calculated if the other two are known.

III. METHODOLOGY TO DERIVE FUNCTION PARAMETERS

Weighting and exposure functions are defined by selecting appropriate values for the parameters C, K, f_1, f_2, a, and b in Eqs. (A1) and (A2). Ideally, these parameters would be based on experimental data describing the manner in which the onset of TTS or PTS varied as a function of exposure frequency. In other words, a weighting function for TTS should ideally be based on TTS data obtained using a range of exposure frequencies, species, and individual subjects within each species group. However, at present, there are only limited data for the frequency-dependency of TTS in marine mammals. Therefore, weighting and exposure function derivations relied upon auditory threshold measurements (audiograms), equal latency contours, anatomical data, and TTS data when available.

Although the weighting function shapes are heavily influenced by the shape of the auditory sensitivity curve, the two are not identical. Essentially, the auditory sensitivity curves are adjusted to match the existing TTS data in the frequency region near best sensitivity (step 4 below). This results in "compression" of the auditory sensitivity curve in the region near best sensitivity to allow the weighting function shape to match the TTS data, which show less change with frequency compared to hearing sensitivity curves in the frequency region near best sensitivity.

Weighting and exposure function derivation consisted of the following steps:

1. Marine mammals were divided into six groups based on auditory, ecological, and phylogenetic relationships among species.

2. For each species group, a representative, composite audiogram (a graph of hearing threshold vs. frequency) was estimated.

3. The exponent a was defined using the smaller of the low-frequency slope from the composite audiogram or the low-frequency slope of equal latency contours. The exponent b was set equal to two.

4. The frequencies f_1 and f_2 were defined as the frequencies at which the composite threshold values are ΔT-dB above the lowest threshold value. The value of ΔT was chosen to minimize the mean-squared error between Eq. (2) and the non-impulsive TTS data for the mid- and high-frequency cetacean groups.

5. For species groups for which TTS onset data exist, K was adjusted to minimize the squared error between Eq. (A2) and the steady-state (non-impulsive) TTS onset data. For other species, K was defined to provide the best estimate for TTS onset at a representative frequency. The minimum value of the TTS exposure function (which is not necessarily equal to K) was then defined as the weighted TTS threshold.

6. The constant *C* was defined to set the peak amplitude of the function defined by Eq. (A1) to zero. This is mathematically equivalent to setting C equal to the difference between the weighted threshold and *K* [see Eq. (A8)].

7. The weighted threshold for PTS was derived for each group by adding a constant value (20 dB) to the weighted TTS thresholds. The constant was based on estimates of the difference in exposure levels between TTS onset and PTS onset (i.e., 40 dB of TTS) obtained from the marine mammal TTS growth curves.

8. For the mid- and high-frequency cetaceans, weighted TTS and PTS thresholds for explosives and other impulsive sources were obtained from the available impulse TTS data. For other groups, the weighted SEL thresholds were estimated using the relationship between the steady-state TTS weighted threshold and the impulse TTS weighted threshold for the mid- and high-frequency cetaceans. Peak SPL thresholds were estimated using the relationship between hearing thresholds and the impulse TTS peak SPL thresholds for the mid- and high-frequency cetaceans.

The remainder of this document addresses these steps in detail.

IV. MARINE MAMMAL SPECIES GROUPS

Marine mammals were divided into six groups (Table A1), with the same weighting function and TTS/PTS thresholds used for all species within a group. Species were grouped by considering their known or suspected audible frequency range, auditory sensitivity, ear anatomy, and acoustic ecology (i.e., how they use sound), as has been done previously (e.g., Ketten, 2000; Southall et al., 2007; Finneran and Jenkins, 2012).

4.1 LOW-FREQUENCY (LF) CETACEANS

The LF cetacean group contains all of the mysticetes (baleen whales). Although there have been no direct measurements of hearing sensitivity in any mysticete, an audible frequency range of approximately 10 Hz to 30 kHz has been estimated from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system. A natural division may exist within the mysticetes, with some species (e.g., blue, fin) having better low-frequency sensitivity and others (e.g., humpback, minke) having better sensitivity to higher frequencies; however, at present there is insufficient knowledge to justify separating species into multiple groups. Therefore, a single species group is used for all mysticetes.

4.2 MID-FREQUENCY (MF) CETACEANS

The MF cetacean group contains most delphinid species (e.g., bottlenose dolphin, common dolphin, killer whale, pilot whale), beaked whales, and sperm whales (but not pygmy and dwarf sperm whales of the genus Kogia, which are treated as high-frequency species). Hearing sensitivity has been directly measured for a number of species within this group using psychophysical (behavioral) or auditory evoked potential (AEP) measurements.

4.3 HIGH-FREQUENCY (HF) CETACEANS

The HF cetacean group contains the porpoises, river dolphins, pygmy/dwarf sperm whales, *Cephalorhynchus* species, and some *Lagenorhynchus* species. Hearing sensitivity has been measured for several species within this group using behavioral or AEP measurements. High-frequency cetaceans generally possess a higher upper-frequency limit and better sensitivity at high frequencies compared to the mid-frequency cetacean species.

4.4 SIRENIANS

The sirenian group contains manatees and dugongs. Behavioral and AEP threshold measurements for manatees have revealed lower upper cutoff frequencies and sensitivities compared to the mid-frequency cetaceans.

4.5 PHOCIDS

This group contains all earless seals or "true seals," including all Arctic and Antarctic ice seals, harbor or common seals, gray seals and inland seals, elephant seals, and monk seals. Underwater hearing thresholds exist for some Northern Hemisphere species in this group.

4.6 OTARIIDS AND OTHER NON-PHOCID MARINE CARNIVORES

This group contains all eared seals (fur seals and sea lions), walruses, sea otters, and polar bears. The division of marine carnivores by placing phocids in one group and all others into a second group was made after considering auditory anatomy and measured audiograms for the various species and noting the similarities between the non-phocid audiograms (Fig. A4). Underwater hearing thresholds exist for some Northern Hemisphere species in this group.

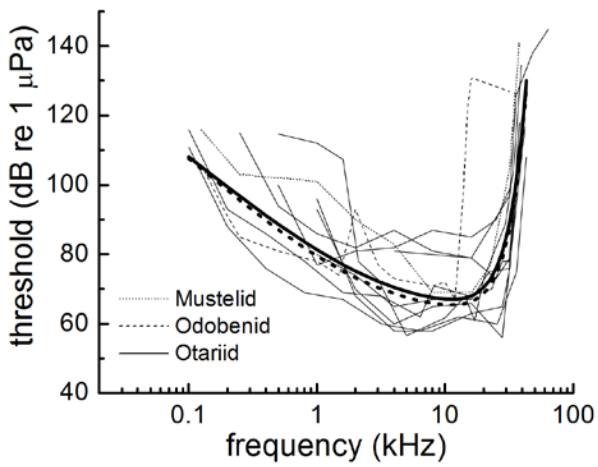

Figure A4. **Comparison of Otariid, Mustelid, and Odobenid psychophysical hearing thresholds measured underwater. The thick, solid line is the composite audiogram based on data for all species. The thick, dashed line is the composite audiogram based on the otariids only.**

Table A1. Species group designations for Navy Phase 3 auditory weighting functions.

Code	Name	Members
LF	Low-frequency cetaceans	Family Balaenidae (right and bowhead whales) Family Balaenopteridae (rorquals) Family Eschrichtiidae (gray whale) Family Neobalaenidae (pygmy right whale)
MF	Mid-frequency cetaceans	Family Ziphiidae (beaked whales) Family Physeteridae (Sperm whale) Family Monodontidae (Irrawaddy dolphin, beluga, narwhal) Subfamily Delphininae (white-beaked/white-sided/ Risso's/bottlenose/spotted/spinner/striped/common dolphins) Subfamily Orcininae (melon-headed whales, false/pygmy killer whale, killer whale, pilot whales) Subfamily Stenoninae (rough-toothed/humpback dolphins) Genus *Lissodelphis* (right whale dolphins) *Lagenorhynchus albirostris* (white-beaked dolphin) *Lagenorhynchus acutus* (Atlantic white-sided dolphin) *Lagenorhynchus obliquidens* (Pacific white-sided dolphin) *Lagenorhynchus obscurus* (dusky dolphin)
HF	High-frequency cetaceans	Family Phocoenidae (porpoises) Family Platanistidae (Indus/Ganges river dolphins) Family Iniidae (Amazon river dolphins) Family Pontoporiidae (Baiji/ La Plata river dolphins) Family Kogiidae (Pygmy/dwarf sperm whales) Genus *Cephalorhynchus* (Commersen's, Chilean, Heaviside's, Hector's dolphins) *Lagenorhynchus australis* (Peale's or black-chinned dolphin) *Lagenorhynchus cruciger* (hourglass dolphin)
SI	Sirenians	Family Trichechidae (manatees) Family Dugongidae (dugongs)
OW	Otariids and other non-phocid marine carnivores (water)	Family Otariidae (eared seals and sea lions) Family Odobenidae (walrus) *Enhydra lutris* (sea otter) *Ursus maritimus* (polar bear)
PW	Phocids (water)	Family Phocidae (true seals)

V. COMPOSITE AUDIOGRAMS

Composite audiograms for each species group were determined by first searching the available literature for threshold data for the species of interest. For each group, all available AEP and psychophysical (behavioral) threshold data were initially examined. To derive the composite audiograms, the following rules were applied:

1. For species groups with three or more behavioral audiograms (all groups except LF cetaceans), only behavioral (no AEP) data were used. Mammalian AEP thresholds are typically elevated from behavioral thresholds in a frequency-dependent manner, with increasing discrepancy between AEP and behavioral thresholds at the lower frequencies where there is a loss of phase synchrony in the neurological responses and a concomitant increase in measured AEP thresholds. The frequency-dependent relationship between the AEP and behavioral data is problematic for defining the audiogram slope at low frequencies, since the AEP data will systematically over-estimate thresholds and therefore over-estimate the low-frequency slope of the audiogram. As a result of this rule, behavioral data were used for all marine mammal groups.

   For the low-frequency cetaceans, for which no behavioral or AEP threshold data exist, hearing thresholds were estimated by synthesizing information from anatomical measurements, mathematical models of hearing, and animal vocalization frequencies (see Appendix A1).

2. Data from an individual animal were included only once at a particular frequency. If data from the same individual were available from multiple studies, data at overlapping frequencies were averaged.

3. Individuals with obvious high-frequency hearing loss for their species or aberrant audiograms (e.g., obvious notches or thresholds known to be elevated for that species due to masking or hearing loss) were excluded.

4. Linear interpolation was performed within the threshold data for each individual to estimate a threshold value at each unique frequency present in any of the data for that species group. This was necessary to calculate descriptive statistics at each frequency without excluding data from any individual subject.

5. Composite audiograms were determined using both the original threshold values from each individual (in dB re 1 μPa) and normalized thresholds obtained by subtracting the lowest threshold value for that subject.

Table A2 lists the individual references for the data ultimately used to construct the composite audiograms (for all species groups except the LF cetaceans). From these data, the median (50th percentile) threshold value was calculated at each frequency and fit by the function

$$T(f) = T_0 + A\log_{10}\left(1 + \frac{F_1}{f}\right) + \left(\frac{f}{F_2}\right)^B, \qquad \text{(A9)}$$

where $T(f)$ is the threshold at frequency f, and T_0, F_1, F_2, A, and B are fitting parameters. The median value was used to reduce the influence of outliers. The particular form of Eq. (A9) was chosen to provide linear-log rolloff with variable slope at low frequencies and a steep rise at high frequencies. The form is similar to that used by Popov et al. (2007) to describe dolphin audiograms; the primary difference between the two is the inclusion of two frequency parameters in Eq. (A9), which allows a more shallow slope in the region of best sensitivity. Equation (A9) was fit to the median threshold data using nonlinear regression (National Instruments LabVIEW 2015). The resulting fitting parameters and goodness of fit values (R^2) are provided in Tables 3 and 4 for the original and normalized data, respectively. Equation (A9) was also used to describe the shape of the estimated audiogram for the LF cetaceans, with the parameter values chosen to provide reasonable thresholds based on the limited available data regarding mysticete hearing (see Appendix A1 for details).

Figures A5 and A6 show the original and normalized threshold data, respectively, as well as the composite audiograms based on the fitted curve. The composite audiograms for each species group are compared in Fig. A6. To allow comparison with other audiograms based on the original threshold data, the lowest threshold for the low-frequency cetaceans was estimated to be 54 dB re 1 μPa, based on the median of the thresholds for the other in-water species groups (MF, HF, SI, OW, PW). From the composite audiograms, the frequency of lowest threshold, f_0, and the slope at the lower frequencies, s_0, were calculated (Table A5). For the species with composite audiograms based on experimental data (i.e., all except LF cetaceans), audiogram slopes were calculated across a frequency range of one decade beginning with the lowest frequency present for each group. The low-frequency slope for LF cetaceans was not based on a curve-fit but explicitly defined during audiogram derivation (see Appendix A1).

Table A2. References, species, and individual subjects used to derive the composite audiograms.

Group	Reference	Species	Subjects
MF	(Finneran et al., 2005b)	*Delphinapterus leucas*	Beethoven
	(Szymanski et al., 1999)	*Orcinus orca*	Yaka, Vigga
	(Nachtigall et al., 1995)	*Grampus griseus*	N/a
	(Kastelein et al., 2003)	*Stenella coeruleoalba*	Meyen
	(Lemonds, 1999)	*Tursiops truncatus*	Itsi Bitsy
	(Brill et al., 2001)	*Tursiops truncatus*	CAS
	(Ljungblad et al., 1982)	*Tursiops truncatus*	12-y male
	(Johnson, 1967)	*Tursiops truncatus*	Salty
	(Sauerland and Dehnhardt, 1998)	*Sotalia fluviatilis*	Paco
	(Johnson et al., 1989)	*Delphinapterus leucas*	2-y female
	(White et al., 1978)	*Delphinapterus leucas*	Edwina, Kojak
	(Awbrey et al., 1988)	*Delphinapterus leucas*	Kojak, female, male
	(Thomas et al., 1988)	*Pseudorca crassidens*	I'a nui hahai
	(Finneran et al., 2010b)	*Tursiops truncatus*	TYH
	(Schlundt et al., 2008)	*Tursiops truncatus*	WEN
	(Ridgway et al., 2001)	*Delphinapterus leucas*	MUK, NOC
	(Tremel et al., 1998)	*Lagenorhynchus obliquidens*	female
HF	(Jacobs and Hall, 1972)	*Inia geoffrensis*	male
	(Kastelein et al., 2002a)**	*Phocoena*	PpSH047
	(Kastelein et al., 2010)	*Phocoena*	Jerry
	(Kastelein et al., 2015a)	*Phocoena*	ID No. 04
SI	(Gaspard et al., 2012)	*Trichechus manatus*	Buffet, Hugh
	(Gerstein et al., 1999)	*Trichechus manatus*	Stormy, Dundee
OW	(Moore and Schusterman, 1987)	*Callorhinus ursinus*	Lori, Tobe
	(Babushina et al., 1991)	*Callorhinus ursinus*	N/a
	(Kastelein et al., 2002b)	*Odobenus rosmarus*	Igor
	(Mulsow et al., 2012)	*Zalophus californianus*	JFN
	(Reichmuth and Southall, 2012)	*Zalophus californianus*	Rio, Sam
	(Reichmuth et al., 2013)	*Zalophus californianus*	Ronan
	(Kastelein et al., 2005)	*Eumetopias jubatus*	EjZH021, EjZH022
	(Ghoul and Reichmuth, 2014)	*Enhydra lutris nereis*	Charlie
PW	(Kastak and Schusterman, 1999)	*Mirounga angustirostris*	Burnyce
	(Terhune, 1988)	*Phoca vitulina*	N/a
	(Reichmuth et al., 2013)	*Phoca vitulina*	Sprouts
	(Kastelein et al., 2009)	*Phoca vitulina*	01, 02
	(Sills et al., 2014)	*Phoca largha*	Amak, Tunu
	(Sills et al., 2015)	*Pusa hispida*	Nayak

** Corrected thresholds from Kastelein et al. (2010) were used.

Table A3. **Composite audiogram parameters values for use in Eq. (A9). For all groups except LF cetaceans, values represent the best-fit parameters from fitting Eq. (A9) to experimental threshold data. For the low-frequency cetaceans, parameter values for Eq. (A9) were estimated as described in Appendix A1.**

Group	T_0 (dB)	F_1 (kHz)	F_2 (kHz)	A	B	R^2
LF	53.19	0.412	9.4	20	3.2	–
MF	46.2	25.9	47.8	35.5	3.56	0.977
HF	46.4	7.57	126	42.3	17.1	0.968
SI	-40.4	3990	3.8	37.3	1.7	0.982
OW	63.1	3.06	11.8	30.1	3.23	0.939
PW	43.7	10.2	3.97	20.1	1.41	0.907

Table A4. **Normalized composite audiogram parameters values for use in Eq. (A9). For all groups except LF cetaceans, values represent the best-fit parameters after fitting Eq. (A9) to normalized threshold data. For the low-frequency cetaceans, parameter values for Eq. (A9) were estimated as described in Appendix A1.**

Group	T_0 (dB)	F_1 (kHz)	F_2 (kHz)	A	B	R^2
LF	-0.81	0.412	9.4	20	3.2	–
MF	3.61	12.7	64.4	31.8	4.5	0.960
HF	2.48	9.68	126	40.1	17	0.969
SI	-109	5590	2.62	38.1	1.53	0.963
OW	2.36	0.366	12.8	73.5	3.4	0.958
PW	-39.6	368	2.21	20.5	1.23	0.907

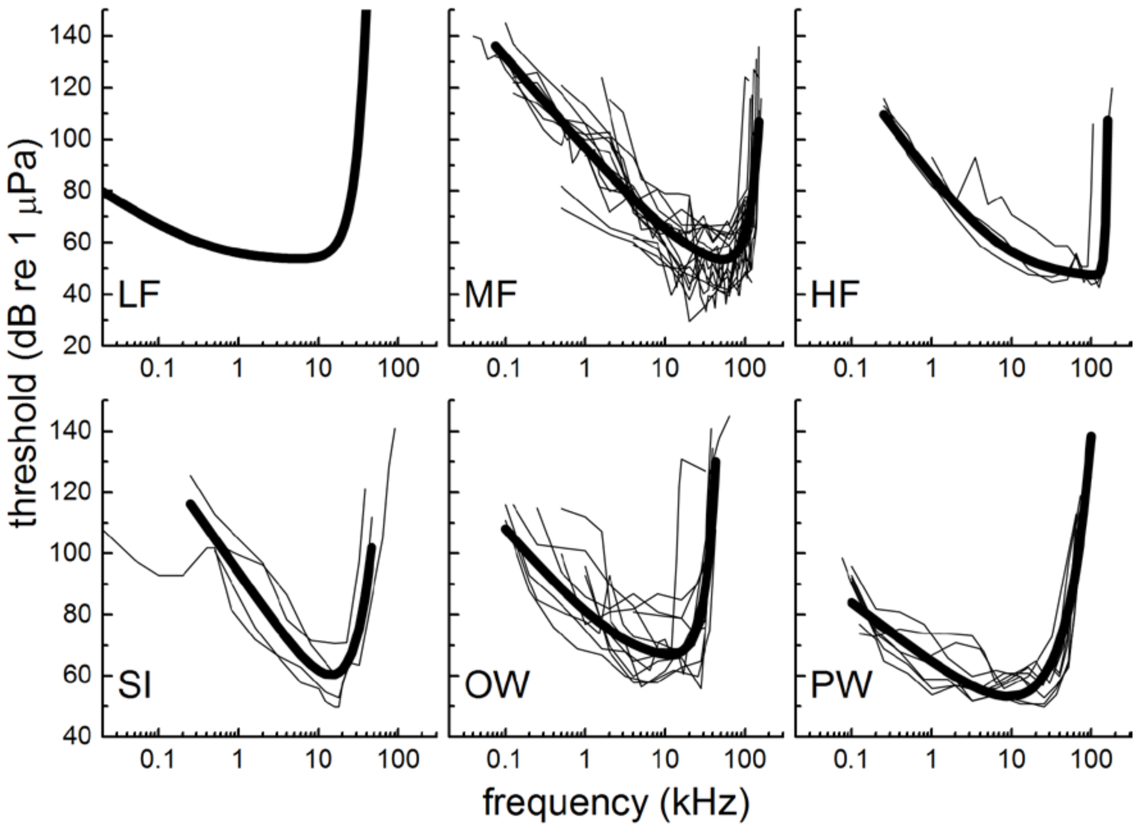

Figure A5. **Thresholds and composite audiograms for the six species groups. Thin lines represent the threshold data from individual animals. Thick lines represent either the predicted threshold curve (LF cetaceans) or the best fit of Eq. (A9) to experimental data (all other groups). Derivation of the LF cetacean curve is described in Appendix A1. The minimum threshold for the LF cetaceans was estimated to be 54 dB re 1 µPa, based on the median of the lowest thresholds for the other groups.**

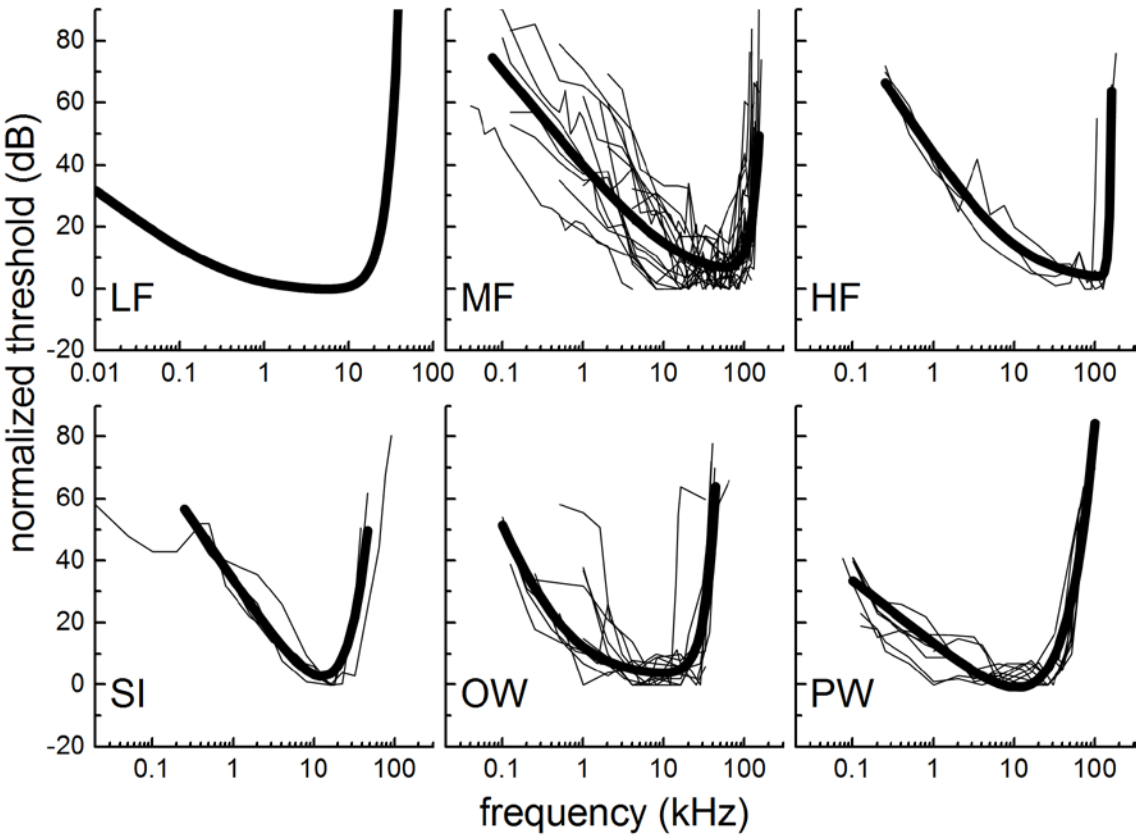

Figure A6. **Normalized thresholds and composite audiograms for the six species groups. Thin lines represent the threshold data from individual animals. Thick lines represent either the predicted threshold curve (LF cetaceans) or the best fit of Eq. (A9) to experimental data (all other groups). Thresholds were normalized by subtracting the lowest value for each individual data set (i.e., within-subject). Composite audiograms were then derived from the individually normalized thresholds (i.e., the composite audiograms were not normalized and may have a minimum value ≠ 0). Derivation of the LF cetacean curve is described in Appendix A1.**

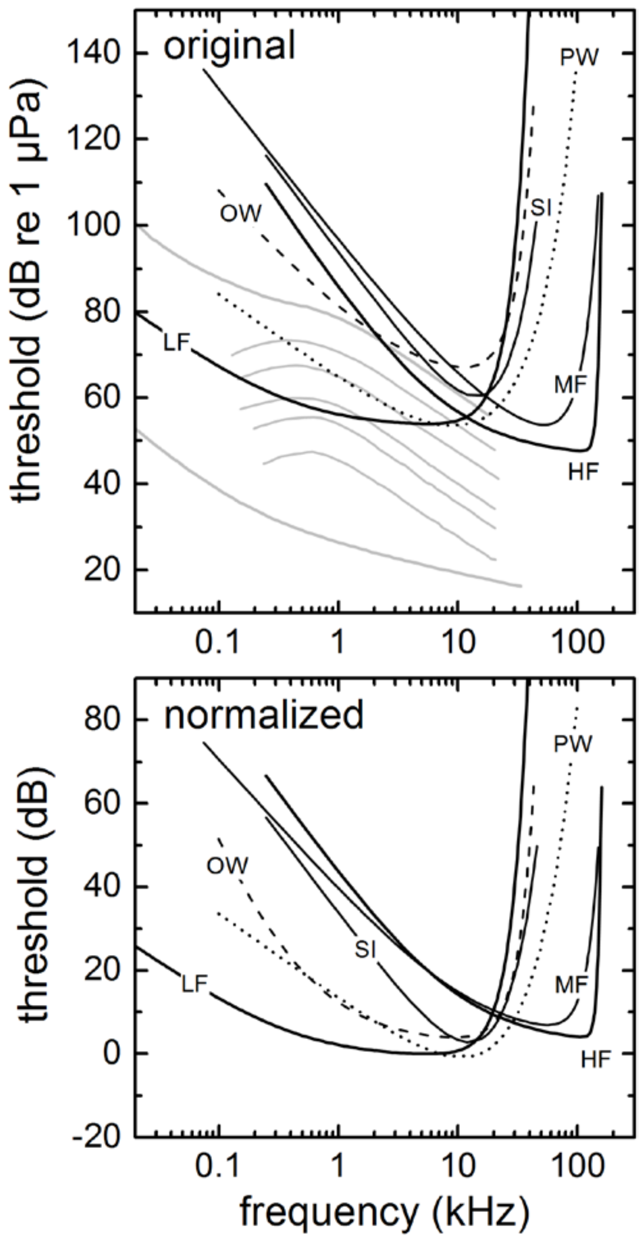

Figure A7. **Composite audiograms for the various species groups, derived with the original data (upper) and normalized data (lower). The gray lines in the upper left panel represent ambient noise spectral density levels (referenced to the left ordinate, in dB re 1 μPa^2/Hz) corresponding to the limits of prevailing noise and various sea-state conditions, from 0.5 to 6 (National Research Council (NRC), 2003).**

Table A5. Frequency of best hearing (f_0) and the magnitude of the low-frequency slope (s_0) derived from composite audiograms and equal latency contours. For the species with composite audiograms based on experimental data (i.e., all except LF cetaceans), audiogram slopes were calculated across a frequency range of one decade beginning with the lowest frequency present for each group. The low-frequency slope for LF cetaceans was not based on a curve-fit but explicitly defined during audiogram derivation (see Appendix A1). Equal latency slopes were calculated from the available equal latency contours (Fig. A8).

Group	Original data composite audiogram		Normalized data composite audiogram		Equal latency curves
	f_0 (kHz)	s_0 (dB/decade)	f_0 (kHz)	s_0 (dB/decade)	s_0 (dB/decade)
LF	5.6	20	5.6	20	—
MF	55	35	58	31	31
HF	105	37	105	36	50
SI	16	36	12	37	—
OW	12	27	10	39	—
PW	8.6	19	13	20	—

VI. EQUAL LOUDNESS DATA

Finneran and Schlundt (2011) conducted a subjective loudness comparison task with a bottlenose dolphin and used the resulting data to derive equal loudness contours and auditory weighting functions. The weighting functions agreed closely with dolphin TTS data over the frequency range 3 to 56 kHz (Finneran and Schlundt, 2013); however, the loudness data only exist for frequencies between 2.5 kHz and 113 kHz and cannot be used to estimate the shapes of loudness contours and weighting functions at lower frequencies.

VII. EQUAL LATENCY DATA

Reaction times to acoustic tones have been measured in several marine mammal species and used to derive equal latency contours and weighting functions (Fig. A8, Wensveen et al., 2014; Mulsow et al., 2015). Unlike the dolphin equal loudness data, the latency data extend to frequencies below 1 kHz and may be used to estimate the slopes of auditory weighting functions at lower frequencies.

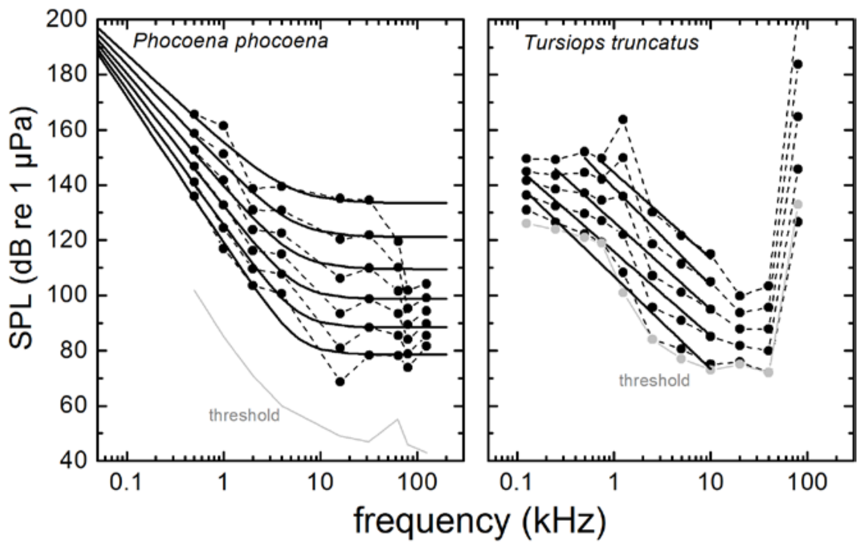

Figure A8. Underwater marine mammal equal latency contours are available for *Phocoena phocoena* (Wensveen et al., 2014) and *Tursiops truncatus* (Mulsow et al., 2015). The slopes for the contours at low frequencies were obtained from the literature (*Phocoena phocoena*) or calculated from the best linear-log fits to the lower frequency data. The slope of the contour passing through an SPL approximately 40 dB above the threshold at f_0 was selected as the most appropriate based on: (1) human A-weighting, (2) observations that the relationship between equal latency and loudness can break down at higher sensation levels, and (3) for many data sets the slopes increase at higher SPLs rather than decrease as expected. The resulting slopes are listed in Table A5.

VIII. TTS DATA

8.1 NON-IMPULSIVE (STEADY-STATE) EXPOSURES – TTS

For weighting function derivation, the most critical data required are TTS onset exposure levels as a function of exposure frequency. These values can be estimated from published literature by examining TTS as a function of SEL for various frequencies.

To estimate TTS onset values, only TTS data from psychophysical (behavioral) hearing tests were used. Studies have shown differences between the amount of TTS from behavioral threshold measurements and that determined using AEP thresholds (Fig. A9). TTS determined from AEP thresholds is typically larger than that determined behaviorally, and AEP-measured TTS of up to ~ 10 dB has been observed with no corresponding change in behavioral thresholds (e.g., Finneran et al., 2007). Although these data suggest that AEP amplitudes and thresholds provide more sensitive indicators (than behavioral thresholds) of the auditory effects of noise, Navy acoustic impact analyses use TTS both as an indicator of the disruption of behavioral patterns that are mediated by the sense of hearing and to predict when the onset of PTS is likely to occur. Navy analyses assume that exposures resulting in a NITS > 40 dB measured a few minutes after exposure will result in some amount of residual PTS. This is based on relationships observed in early human TTS studies utilizing psychophysical threshold measurements. To date, there have been no reports of PTS in a marine mammal whose initial behavioral threshold shift was 40 dB or less; however, behavioral shifts of 35 to 40 dB have required multiple days to recover, suggesting that these exposures are near those capable of resulting in PTS. In contrast, studies utilizing AEP measurements in marine mammals have reported TTSs of 45 dB that recovered in 40 min and 60 dB that recovered in < 24 h, suggesting that these exposures were not near those capable of resulting in PTS (Popov et al., 2013).

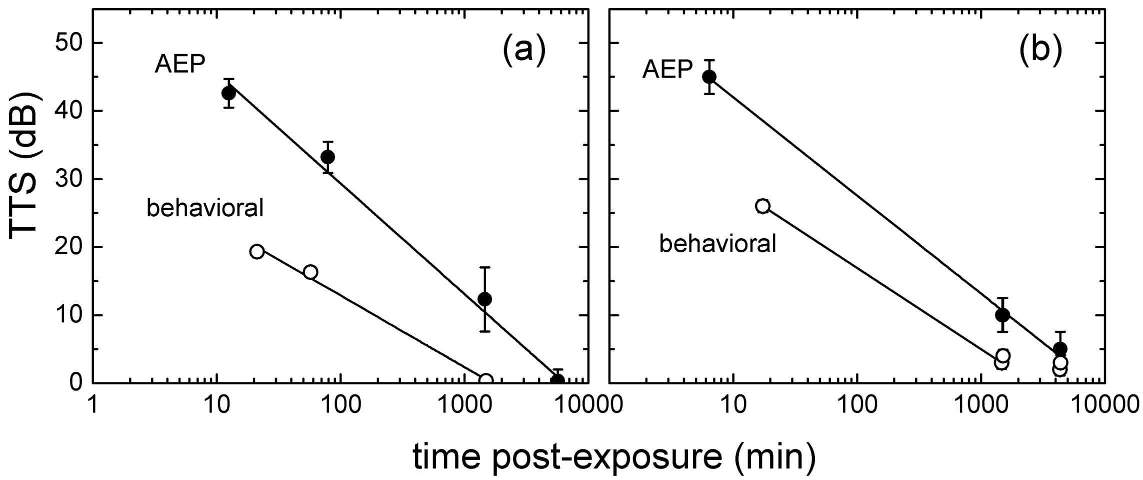

Figure A9. TTS measured using behavioral and AEP methods do not necessarily agree, with marine mammal studies reporting larger TTS obtained using AEP methods. For the data above, thresholds were determined using both techniques before and after the same noise exposure. Hearing thresholds were measured at 30 kHz. Behavioral thresholds utilized FM tones with 10% bandwidth. AEP thresholds were based on AM tones with a modulation frequency of 1.05 kHz. Noise exposures consisted of (a) a single, 20-kHz tone with duration of 64 s and SPL of 185 dB re 1 μPa (SEL = 203 dB re 1 $\mu Pa^2 s$) and (b) three 16-s tones at 20 kHz, with mean SPL = 193 dB re 1 μPa (cumulative SEL = 210 dB re 1 $\mu Pa^2 s$). Data from Finneran et al. (2007).

To determine TTS onset for each subject, the amount of TTS observed after exposures with different SPLs and durations were combined to create a single TTS growth curve as a function of SEL. The use of (cumulative) SEL is a simplifying assumption to accommodate sounds of various SPLs, durations, and duty cycles. This is referred to as an “equal energy” approach, since SEL is related to the energy of the sound and this approach assumes exposures with equal SEL result in equal effects, regardless of the duration or duty cycle of the sound. It is well-known that the equal energy rule will over-estimate the effects of intermittent noise, since the quiet periods between noise exposures will allow some recovery of hearing compared to noise that is continuously present with the same total SEL (Ward, 1997). For continuous exposures with the same SEL but different durations, the exposure with the longer duration will also tend to produce more TTS (e.g., Kastak et al., 2007; Mooney et al., 2009; Finneran et al., 2010b). Despite these limitations, however, the equal energy rule is still a useful concept, since it includes the effects of both noise amplitude and duration when predicting auditory effects. SEL is a simple metric, allows the effects of multiple noise sources to be combined in a meaningful way, has physical significance, and is correlated with most TTS growth data reasonably well — in some cases even across relatively large ranges of exposure duration (see Finneran, 2015). The use of cumulative SEL for Navy sources will always over-estimate the effects of intermittent or interrupted sources, and the majority of Navy sources feature durations shorter than the exposure durations typically utilized in marine mammal TTS studies, therefore the use of (cumulative) SEL will tend to over-estimate the effects of many Navy sound sources.

Marine mammal studies have shown that the amount of TTS increases with SEL in an accelerating fashion: At low exposure SELs, the amount of TTS is small and the growth curves have shallow slopes. At higher SELs, the growth curves become steeper and approach linear relationships with the noise SEL. Accordingly, TTS growth data were fit with the function

$$t(L) = m_1 \log_{10}\left[1 + 10^{(L-m_2)/10}\right], \tag{A10}$$

where t is the amount of TTS, L is the SEL, and m_1 and m_2 are fitting parameters. This particular function has an increasing slope when $L < m_2$ and approaches a linear relationship for $L > m_2$ (Maslen, 1981). The linear portion of the curve has a slope of $m_1/10$ and an x-intercept of m_2. After fitting Eq. (10) to the TTS growth data, interpolation was used to estimate the SEL necessary to induce 6 dB of TTS — defined as the "onset of TTS" for Navy acoustic impact analyses. The value of 6 dB has been historically used to distinguish non-trivial amounts of TTS from fluctuations in threshold measurements that typically occur across test sessions. Extrapolation was not performed when estimating TTS onset; this means only data sets with exposures producing TTS both above and below 6 dB were used.

Figures A10 to A13 show all behavioral and AEP TTS data to which growth curves defined by Eq. (A10) could be fit. The TTS onset exposure values, growth rates, and references to these data are provided in Table A6.

8.2 NON-IMPULSIVE (STEADY-STATE) EXPOSURES – PTS

Since no studies have been designed to intentionally induce PTS in marine mammals (but see Kastak et al., 2008), onset-PTS levels for marine mammals must be estimated. Differences in auditory structures and sound propagation and interaction with tissues prevent direct application of numerical thresholds for PTS in terrestrial mammals to marine mammals; however, the inner ears of marine and terrestrial mammals are analogous and certain relationships are expected to hold for both groups. Experiments with marine mammals have revealed similarities between marine and terrestrial mammals with respect to features such as TTS, age-related hearing loss, ototoxic drug-induced hearing loss, masking, and frequency selectivity (e.g., Nachtigall et al., 2000; Finneran et al., 2005b). For this reason, relationships between TTS and PTS from marine and terrestrial mammals can be used, along with TTS onset values for marine mammals, to estimate exposures likely to produce PTS in marine mammals (Southall et al., 2007).

A variety of terrestrial and marine mammal data sources (e.g., Ward et al., 1958; Ward et al., 1959; Ward, 1960; Miller et al., 1963; Kryter et al., 1966) indicate that threshold shifts up to 40 to 50 dB may be induced without PTS, and that 40 dB is a conservative upper limit for threshold shift to prevent PTS; i.e., for impact analysis, 40 dB of NITS is an upper limit for reversibility and that any additional exposure will result in some PTS. This means that 40 dB of TTS, measured a few minutes after exposure, can be used as a conservative estimate for the onset of PTS. An exposure causing 40 dB of TTS is therefore considered equivalent to PTS onset.

To estimate PTS onset, TTS growth curves based on more than 20 dB of measured TTS were extrapolated to determine the SEL required for a TTS of 40 dB. The SEL difference between TTS onset and PTS onset was then calculated. The requirement that the maximum amount of TTS must be at least 20 dB was made to avoid over-estimating PTS onset by using growth curves based on small amounts of TTS, where the growth rates are shallower than at higher amounts of TTS.

8.3 IMPULSIVE EXPOSURES

Marine mammal TTS data from impulsive sources are limited to two studies with measured TTS of 6 dB or more: Finneran et al. (2002) reported behaviorally-measured TTSs of 6 and 7 dB in a beluga exposed to single impulses from a seismic water gun (unweighted SEL = 186 dB re 1 $\mu Pa^2 s$, peak SPL = 224 dB re 1 μPa) and Lucke et al. (2009) reported AEP-measured TTS of 7 to 20 dB in a harbor porpoise exposed to single impulses from a seismic air gun [Fig. A12(f), TTS onset = unweighted SEL of 162 dB re 1 $\mu Pa^2 s$ or peak SPL of 195 dB re 1 μPa]. The small reported amounts of TTS and/or the limited distribution of exposures prevent these data from being used to estimate PTS onset.

In addition to these data, Kastelein et al. (2015c)[37] reported behaviorally-measured mean TTS of 4 dB at 8 kHz and 2 dB at 4 kHz after a harbor porpoise was exposed to a series of impulsive sounds produced by broadcasting underwater recordings of impact pile driving strikes through underwater sound projectors. The exposure contained 2760 individual impulses presented at an interval of 1.3 s (total exposure time was 1 h). The average single-strike, unweighted SEL was approximately 146 dB re 1 $\mu Pa^2 s$ and the cumulative (unweighted) SEL was approximately 180 dB re 1 $\mu Pa^2 s$. The pressure waveforms for the simulated pile strikes exhibited significant "ringing" not present in the original recordings and most of the energy in the broadcasts was between 500 and 800 Hz, near the resonance of the underwater sound projector used to broadcast the signal. As a result, some questions exist regarding whether the fatiguing signals were representative of underwater pressure signatures from impact pile driving.

Several impulsive noise exposure studies have also been conducted without measurable (behavioral) TTS. Finneran et al. (2000) exposed dolphins and belugas to single impulses from an "explosion simulator" (maximum unweighted SEL = 179 dB re 1 $\mu Pa^2 s$, peak SPL = 217 dB re 1 μPa) and Finneran et al. (2015) exposed three dolphins to sequences of 10 impulses from a seismic air gun (maximum unweighted cumulative SEL = 193 to 195 dB re 1 $\mu Pa^2 s$, peak SPL =196 to 210 dB re 1 μPa) without measurable TTS. Finneran et al. (2003) exposed two sea lions to single impulses from an arc-gap

[37] Footnote added by NMFS: Since the NMFS received this version of the Finneran Technical Report, another TTS study became available (Kastelein et al. 2016). In this study, two harbor porpoises were exposed to playbacks of impact pile driving strikes. Neither individual had a TTS of 6 dB after exposure. Kastelein et al. 2016 estimated TTS onset to occur at SEL_{cum} 175 dB (unweighted).

transducer with no measurable TTS (maximum unweighted SEL = 163 dB re 1 μPa^{2}s, peak SPL = 203 dB re 1 μPa). Reichmuth et al. (2016) exposed two spotted seals (*Phoca largha*) and two ringed seals (*Pusa hispida*) to single impulses from a 10 in^3 sleeve air gun with no measurable TTS (maximum unweighted SEL = 181 dB re 1 μPa^{2}s, peak SPL ~ 203 dB re 1 μPa).

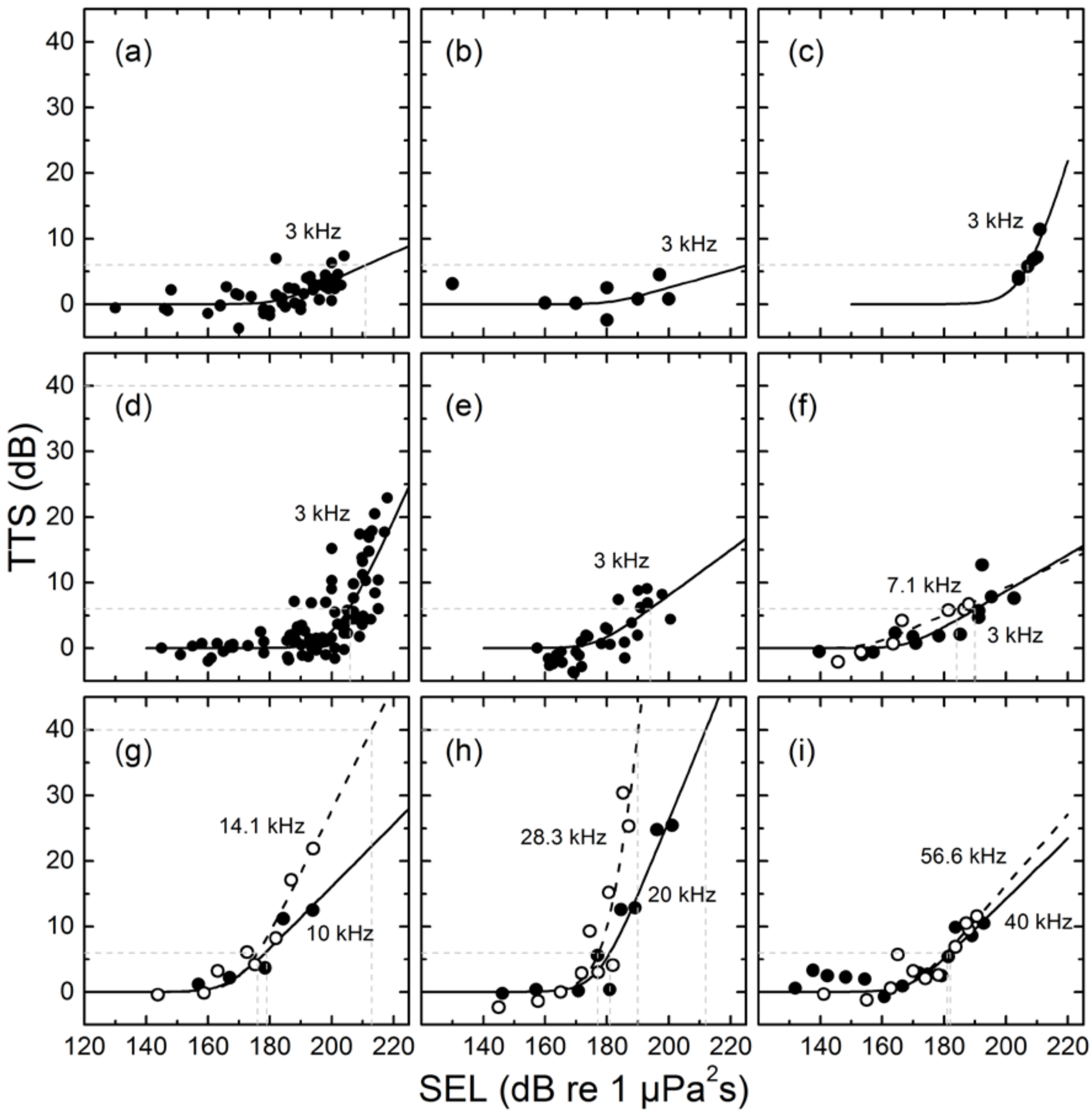

Figure A10. **TTS growth data for mid-frequency cetaceans obtained using behavioral methods. Growth curves were obtained by fitting Eq. (A10) to the TTS data as a function of SEL. Onset TTS was defined as the SEL value from the fitted curve at a TTS = 6 dB, for only those datasets that bracketed 6 dB of TTS. Onset PTS was defined as the SEL value from the fitted curve at a TTS = 40 dB, for only those datasets with maximum TTS > 20 dB. Frequency values within the panels indicate the exposure frequencies. Solid lines are fit to the filled symbols; dashed lines are fit to the open symbols. See Table A6 for explanation of the datasets in each panel. Frequencies listed in each panel denote the exposure frequency.**

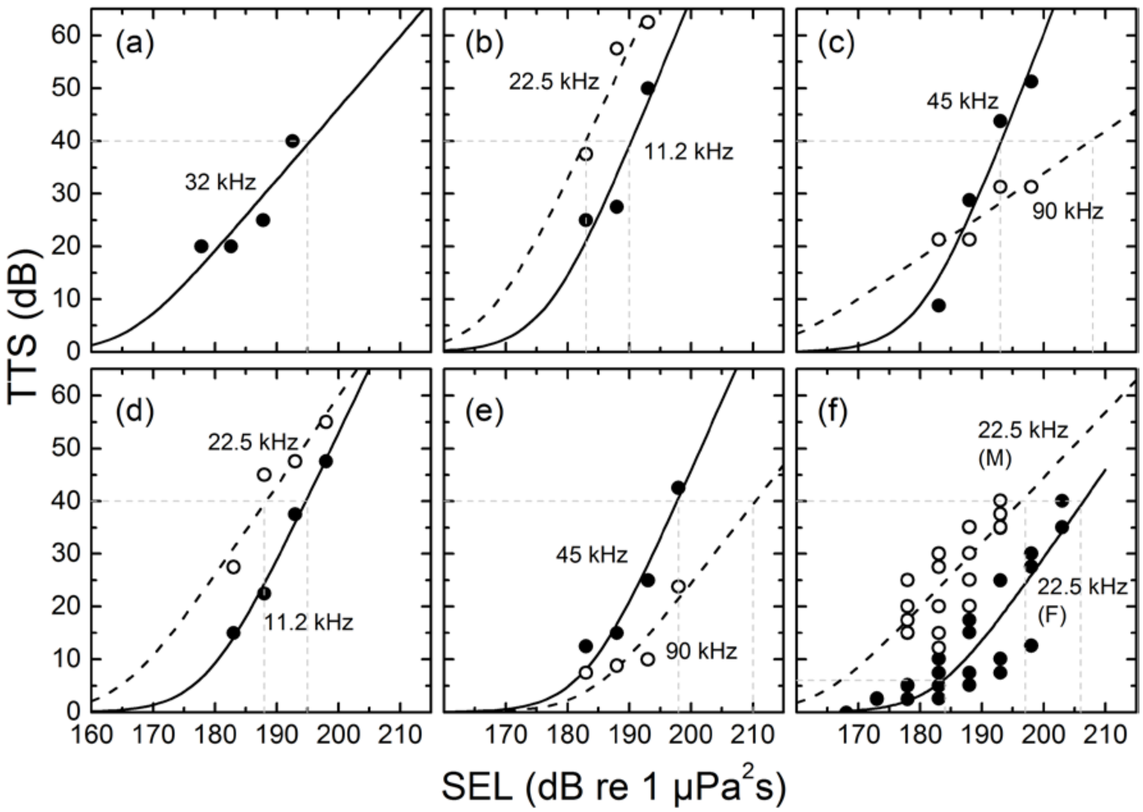

Figure A11. **TTS growth data for mid-frequency cetaceans obtained using AEP methods. Growth curves were obtained by fitting Eq. (A10) to the TTS data as a function of SEL. Onset TTS was defined as the SEL value from the fitted curve at a TTS = 6 dB, for only those datasets that bracketed 6 dB of TTS. Onset PTS was defined as the SEL value from the fitted curve at a TTS = 40 dB, for only those datasets with maximum TTS > 20 dB. Frequency values within the panels indicate the exposure frequencies. Solid lines are fit to the filled symbols; dashed lines are fit to the open symbols. See Table A6 for explanation of the datasets in each panel.**

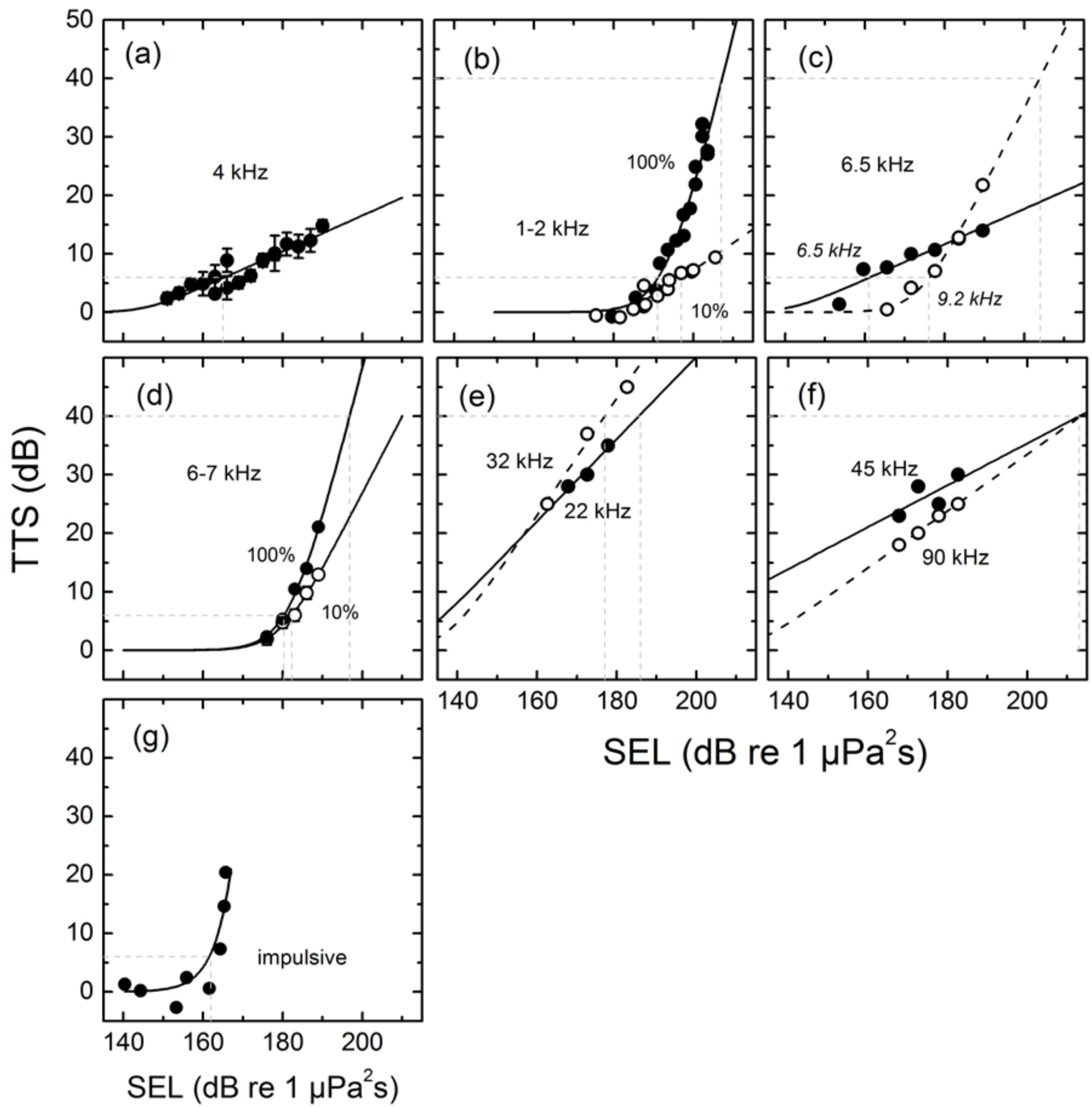

Figure A12. **TTS growth data for high-frequency cetaceans obtained using behavioral and AEP methods. Growth curves were obtained by fitting Eq. (A10) to the TTS data as a function of SEL. Onset TTS was defined as the SEL value from the fitted curve at a TTS = 6 dB, for only those datasets that bracketed 6 dB of TTS. Onset PTS was defined as the SEL value from the fitted curve at a TTS = 40 dB, for only those datasets with maximum TTS > 20 dB. The exposure frequency is specified in normal font; italics indicate the hearing test frequency. Percentages in panels (b), (d) indicate exposure duty cycle (duty cycle was 100% for all others). Solid lines are fit to the filled symbols; dashed lines are fit to the open symbols. See Table A6 for explanation of the datasets in each panel.**

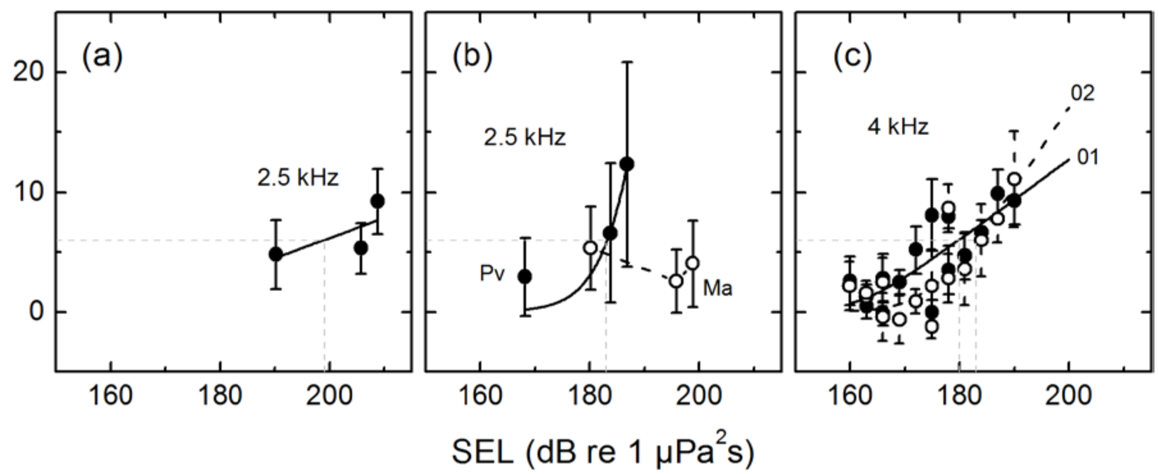

Figure A13. **TTS growth data for pinnipeds obtained using behavioral methods. Growth curves were obtained by fitting Eq. (A10) to the TTS data as a function of SEL. Onset TTS was defined as the SEL value from the fitted curve at a TTS = 6 dB, for only those datasets that bracketed 6 dB of TTS. Frequency values within the panels indicate the exposure frequencies. Numeric values in panel (c) indicate subjects 01 and 02. Solid lines are fit to the filled symbols; dashed lines are fit to the open symbols. See Table A6 for explanation of the datasets in each panel.**

Table A6. **Summary of marine mammal TTS growth data and onset exposure levels. Only those data from which growth curves could be generated are included. TTS onset values are expressed in SEL, in dB re 1 μPa^{2}s. Tests featured continuous exposure to steady-state noise and behavioral threshold measurements unless otherwise indicated.**

Group	Species	Subject	Freq. (kHz)	Min TTS (dB)	Max TTS (dB)	TTS Onset (dB SEL)	TTS growth rate (dB/dB)	PTS Onset (dB SEL)	TTS-PTS offset (dB)	Notes	Reference	Figure
MF	*Tursiops truncatus*	BEN	3	0	7	211*	0.21	—	—	TTS onset higher than subsequent test	(Finneran et al., 2005a)	10(a)
MF	*Tursiops truncatus*	NAY	3	0	5	—	0.13	—	—		(Finneran et al., 2005a)	10(b)
MF	*Tursiops truncatus*	BLU	3	4	11	207*	1.5	—	—	intermittent	(Finneran et al., 2010a)	10(c)
MF	*Tursiops truncatus*	BLU	3	0	23	206*	1.0	240	34	TTS onset higher than subsequent tests	(Finneran et al., 2010b)	10(d)
MF	*Tursiops truncatus*	TYH	3	0	9	194	0.35	—	—		(Finneran et al., 2010b)	10(e)
MF	*Tursiops truncatus*	BLU	3 7.1 10 14.1 20 28.3	0 0 1 0 0 0	13 7 13 22 25 30	190 184 179 176 181 177	0.28 0.21 0.48 0.95 1.2 4.5	— — — 213 212 190	— — — 37 31 13		(Finneran and Schlundt, 2013)	10(f) 10(f) 10(g) 10(g) 10(h) 10(h)
MF	*Tursiops truncatus*	TYH	40 56.6	0 0	11 12	182 181	0.46 1.1	— —	— —		(Finneran and Schlundt, 2013)	10(i) 10(i)
MF	*Delphinapterus leucas*	N/a	32	20	40	—	1.4	195	—	AEP	(Popov et al., 2011b)	11(a)

Group	Species	Subject	Freq. (kHz)	Min TTS (dB)	Max TTS (dB)	TTS Onset (dB SEL)	TTS growth rate (dB/dB)	PTS Onset (dB SEL)	TTS-PTS offset (dB)	Notes	Reference	Figure
MF	*Delphinapterus leucas*	female	11.2 22.5 45 90	25 38 9 21	50 63 51 31	— — — —	2.8 2.5 3.0 0.8	190 183 193 208	— — — —	AEP	(Popov et al., 2013)	11(b) 11(b) 11(c) 11(c)
MF	*Delphinapterus leucas*	male	11.2 22.5 45 90	15 28 13 8	48 55 42 24	— — — —	2.5 1.7 2.7 1.5	195 188 198 210	— — — —	AEP	(Popov et al., 2013)	11(d) 11(d) 11(e) 11(e)
MF	*Delphinapterus leucas*	female	22.5	0	40	184*	1.7	206	22	AEP	(Popov et al., 2014)	11(f)
MF	*Delphinapterus leucas*	male	22.5	12	40	—	1.2	197	—	AEP	(Popov et al., 2014)	11(f)
HF	*Phocoena phocoena*	02	4	2	15	165	0.3	—	—		(Kastelein et al., 2012a)	12(a)
HF	*Phocoena phocoena*	02	~1.5 ~1.5	0 0	32 7	191 197*	2.8 0.4	207 —	16 —	100% duty cycle 10% duty cycle	(Kastelein et al., 2014b)	12(b) 12(b)
HF	*Phocoena phocoena*	02	6.5 6.5	1 0	13 22	161 176*	0.3 1.3	— 204	— 28	6.5 kHz test freq. 9.2 kHz test freq.	(Kastelein et al., 2014a)	12(c) 12(c)
HF	*Phocoena phocoena*	02	~6.5 ~6.5	2 2	21 13	180* 182*	2.7 1.3	197 —	17 —	100% duty cycle 10% duty cycle	(Kastelein et al., 2015b)	12(d) 12(d)
HF	*Neophocaena phocaenoides*	male	22 32	28 25	35 45	— —	0.7 1.0	186 177	— —	AEP	(Popov et al., 2011a)	12(e)
HF	*Neophocaena phocaenoides*	female	45 90	23 18	30 25	— —	0.36 0.48	213 213	— —	AEP	(Popov et al., 2011a)	12(f)
HF	*Phocoena phocoena*	Eigil	impulse	0	20	162	**	—	—	AEP	(Lucke et al., 2009)	12(g)

Group	Species	Subject	Freq. (kHz)	Min TTS (dB)	Max TTS (dB)	TTS Onset (dB SEL)	TTS growth rate (dB/dB)	PTS Onset (dB SEL)	TTS-PTS offset (dB)	Notes	Reference	Figure
OW	*Zalophus californianus*	Rio	2.5	5	9	199	0.17	—	—		(Kastak et al., 2005)	13(a)
PW	*Phoca vitulina*	Sprouts	2.5	3	12	183	6.4	—	—		(Kastak et al., 2005)	13(b)
PW	*Mirounga angustirostris*	Burnyce	2.5	3	5	—	—	—	—		(Kastak et al., 2005)	13(b)
PW	*Phoca vitulina*	01	4	0	10	180	0.33	—	—		(Kastelein et al., 2012b)	13(c)
PW	*Phoca vitulina*	02	4	0	11	183*	0.68	—	—	TTS_{16}	(Kastelein et al., 2012b)	13(c)

* SELs not used in subsequent analyses to optimize ΔT or define K for TTS or PTS exposure functions. Reasons for exclusion include: (i) another data set resulted in a lower onset TTS at the same frequency, (ii) the data set featured a duty cycle less than 100%, (iii) TTS values were measured at times significantly larger than 4 min, (iv) data were obtained from AEP testing, or (v) a lower TTS onset was found at a different hearing test frequency (also see Notes).

** Distribution of data did not support an accurate estimate for growth rate (the standard error was four orders of magnitude larger than the slope estimate)

IX. TTS EXPOSURE FUNCTIONS FOR SONARS

Derivation of the weighting function parameters utilized the exposure function form described by Eq. (A2), so that the shapes of the functions could be directly compared to the TTS onset data (Table A6) when available. The function shapes were first determined via the parameters a, b, f_1, and f_2, then the gain constant K was determined for each group to provide the best fit to the TTS data or estimated TTS onset value at a particular frequency.

9.1 LOW- AND HIGH-FREQUENCY EXPONENTS (a, b)

The high-frequency exponent, b, was fixed at $b = 2$. This was done to match the previous value used in the Phase 2 functions, since no new TTS data are available at the higher frequencies and the equal latency data are highly variable at the higher frequencies.

The low-frequency exponent, a, was defined as $a = s_0/20$, where s_0 is the lower of the slope of the audiogram or equal latency curves (in dB/decade) at low frequencies (Table A5). This causes the weighting function slope to match the shallower slope of the audiogram or equal latency contours at low frequencies. In practice, the audiogram slopes were lower than the equal latency slopes for all groups except the mid-frequency cetaceans (group MF).

9.2 FREQUENCY CUTOFFS (f_1, f_2)

The frequency cutoffs f_1 and f_2 were defined as the frequencies below and above the frequency of best hearing (f_0, Table A5) where the composite audiogram thresholds values were ΔT-dB above the threshold at f_0 (Fig. A14). If $\Delta T = 0$, the weighting function shape would match the shape of the inverse audiogram. Values of $\Delta T > 0$ progressively "compress" the weighting function, compared to the audiogram, near the frequency region of best sensitivity. This compression process is included to match the marine mammal TTS data, which show less change in TTS onset with frequency than would be predicted by the audiogram in the region near best sensitivity.

To determine ΔT, the exposure function amplitude defined by Eq. (A2) was calculated for the mid- and high-frequency cetaceans using ΔT values that varied from 0 to 20 dB. For each ΔT value, the constant K was adjusted to minimize the mean-squared error between the function amplitude and the TTS data (Fig. A15). This process was performed using composite audiograms based on both the original and normalized threshold data. Fits were performed using only TTS data resulting from continuous exposures (100% duty cycle). If hearing was tested at multiple frequencies after exposure, the lowest TTS onset value was used.

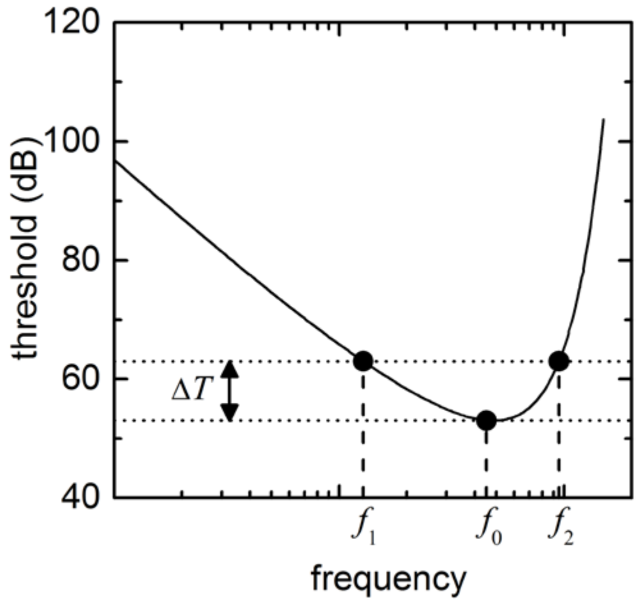

Figure A14. **The cutoff frequencies f_1 and f_2 were defined as the frequencies below and above f_0 at which the composite audiogram values were ΔT-dB above the threshold at f_0 (the lowest threshold).**

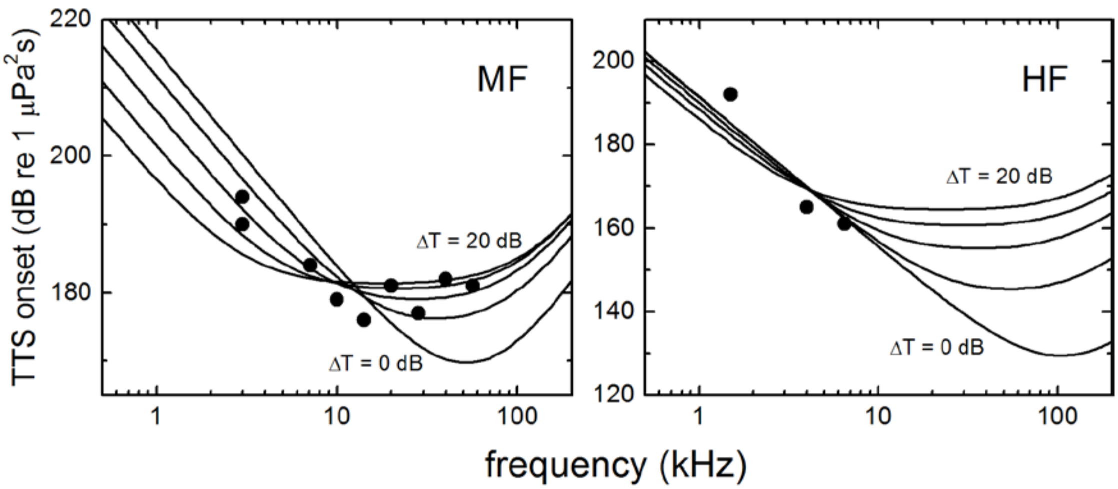

Figure A15. **Effect of ΔT adjustment on the TTS exposure functions for the mid-frequency cetaceans (left) and high-frequency cetaceans (right). To calculate the exposure functions, a and b were defined as $a = s_0/20$ and $b = 2$. ΔT was then varied from 0 to 20. At each value of ΔT, K was adjusted to minimize the squared error between the exposure function and the onset TTS data (symbols). As ΔT increases, f_1 decreases and f_2 increases, causing the pass-band of the function to increase and the function to "flatten".**

For the original and normalized data, the errors between the best-fit exposure functions and the TTS data for the MF and HF cetaceans were squared, summed, and divided by the total number of TTS data points (12). This provided an overall mean-squared error (MSE) for the original and normalized data as a function of ΔT (Fig. A16). The conditions (ΔT value and original/normalized threshold audiograms) resulting in the lowest MSE indicated the best fit of the exposure functions to the TTS data. For the MF and HF cetacean data, the lowest MSE occurred with the normalized threshold data with ΔT = 9 dB. **Therefore, f_1 and f_2 for the remaining species groups were defined using composite audiograms based on normalized thresholds with ΔT = 9 dB.**

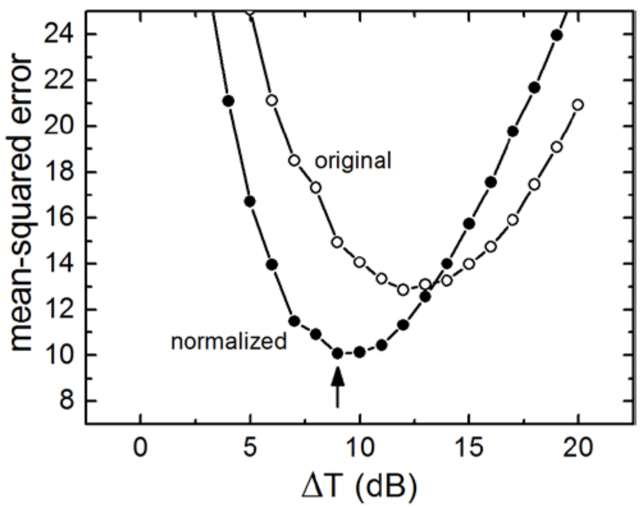

Figure A16. **Relationship between ΔT and the resulting mean-squared error (MSE) between the exposure functions and onset TTS data. The MSE was calculated by adding the squared errors between the exposure functions and TTS data for the MF and HF cetacean groups, then dividing by the total number of TTS data points. This process was performed using the composite audiograms based on original and normalized threshold data and ΔT values from 0 to 20. The lowest MSE value was obtained using the audiograms based on normalized thresholds with ΔT = 9 dB (arrow).**

9.3 GAIN PARAMETERS *K* AND *C*

The gain parameter *K* was defined to minimize the squared error between the exposure function and the TTS data for each species group. Note that *K* is not necessarily equal to the minimum value of the exposure function.

For the low-frequency cetaceans and sirenians, for which no TTS data exist, TTS onset at the frequency of best hearing (f_0) was estimated by assuming that, at the frequency of best hearing, the numeric difference between the auditory threshold (in dB SPL) and the onset of TTS (in dB SEL) would be similar to that observed in the other species groups. Table A7 summarizes the onset TTS and composite threshold data for the MF, HF, OW, and PW groups. For these groups, the median difference between the TTS onset and composite audiogram threshold at f_0 was 126 dB. In the absence of data, the hearing threshold at f_0 for the LF group was set equal to the median threshold at f_0 for the other groups (MF, HF, SI, OW, PW, median = 54 dB re 1 μPa). The TTS onset value at f_0 is therefore 180 dB re 1 μPa^2s for the low-frequency cetaceans (Table A7). For the sirenians, the lowest threshold was 61 dB re 1 μPa, making the onset TTS estimate 187 dB re 1 $\mu Pa^2 s$ (Table A7).

Table A7. Differences between composite threshold values (Fig. A5) and TTS onset values at the frequency of best hearing (f_0) for the in-water marine mammal species groups. The values for the low-frequency cetaceans and sirenians were estimated using the median difference (126) from the MF, HF, OW, and PW groups.

Group	f_0 (kHz)	Threshold at f_0 (dB re 1 μPa)	TTS onset at f_0 (dB re 1 $\mu Pa^2 s$)	Difference	Estimated difference	Estimated TTS onset at f_0 (dB re 1 $\mu Pa^2 s$)
LF	5.6	54			126	180
MF	55	54	179	125		
HF	105	48	156	108		
SI	16	61			126	187
OW	12	67	199	132		
PW	8.6	53	181	128		

Once K was determined, the weighted threshold for onset TTS was determined from the minimum value of the exposure function. Finally, the constant C was determined by substituting parameters a, b, f_1, and f_2 into Eq. (A1), then adjusting C so the maximum amplitude of the weighting function was 0 dB; this is equivalent to the difference between the weighted TTS threshold and K [see Eqs. (A3)–(A8)].

Table A8 summarizes the various function parameters, the weighted TTS thresholds, and the goodness of fit values between the TTS exposure functions and the onset TTS data. The various TTS exposure functions are presented in Figs. A17–A20.

Table A8. Weighting function and TTS exposure function parameters for use in Eqs. (A1) and (A2) for steady-state exposures. R^2 values represent goodness of fit between exposure function and TTS onset data (Table A6).

Group	a	b	f_1 (kHz)	f_2 (kHz)	K (dB)	C (dB)	Weighted TTS threshold (dB SEL)	R^2
LF	1	2	0.20	19	179	0.13	179	—
MF	1.6	2	8.8	110	177	1.20	178	0.825
HF	1.8	2	12	140	152	1.36	153	0.864
SI	1.8	2	4.3	25	183	2.62	186	—
OW	2	2	0.94	25	198	0.64	199	—
PW	1	2	1.9	30	180	0.75	181	0.557

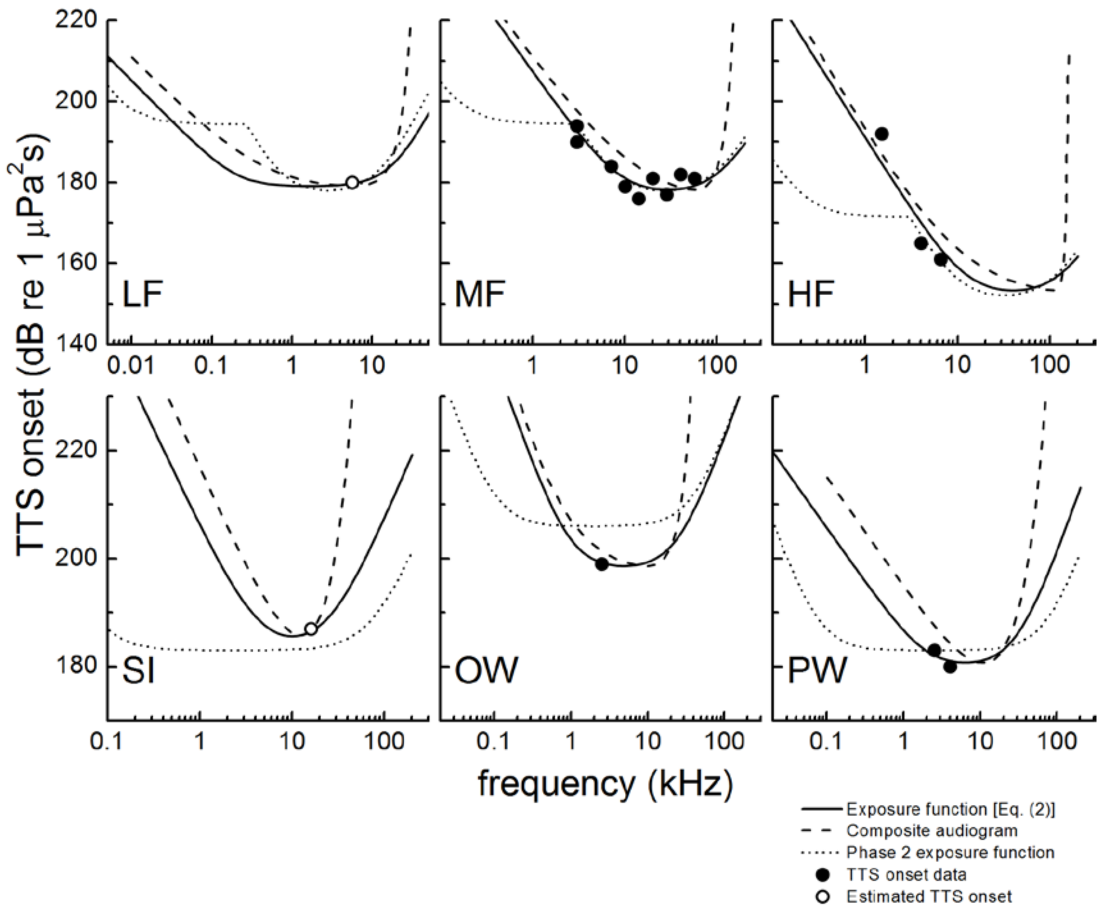

Figure A17. **Exposure functions (solid lines) generated from Eq. (A2) with the parameters specified in Table A7. Dashed lines — (normalized) composite audiograms used for definition of parameters *a*, f_1, and f_2. A constant value was added to each audiogram to equate the minimum audiogram value with the exposure function minimum. Short dashed line — Navy Phase 2 exposure functions for TTS onset for each group. Filled symbols — onset TTS exposure data (in dB SEL) used to define exposure function shape and vertical position. Open symbols — estimated TTS onset for species for which no TTS data exist.**

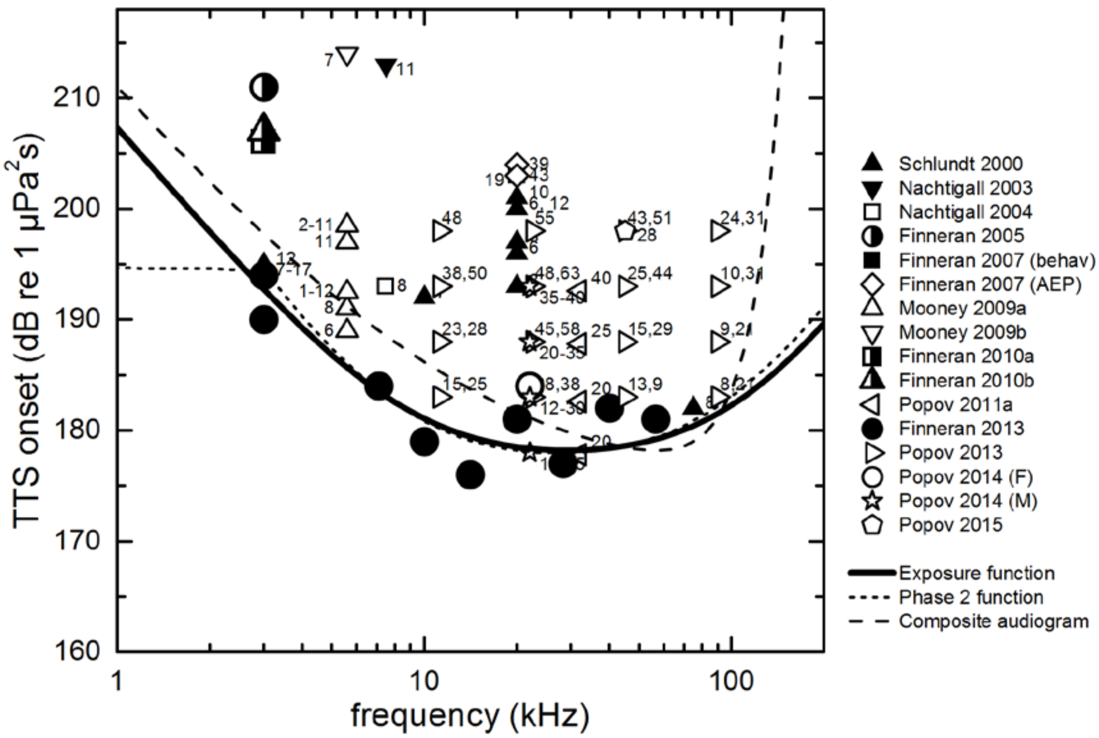

Figure A18. **Mid-frequency cetacean exposure function, (normalized) composite audiogram, and Phase 2 exposure functions compared to mid-frequency cetacean TTS data. Large symbols with no numeric values indicate onset TTS exposures. Smaller symbols represent specific amounts of TTS observed, with numeric values giving the amount (or range) or measured TTS. Filled and half-filled symbols — behavioral data. Open symbols — AEP data.**

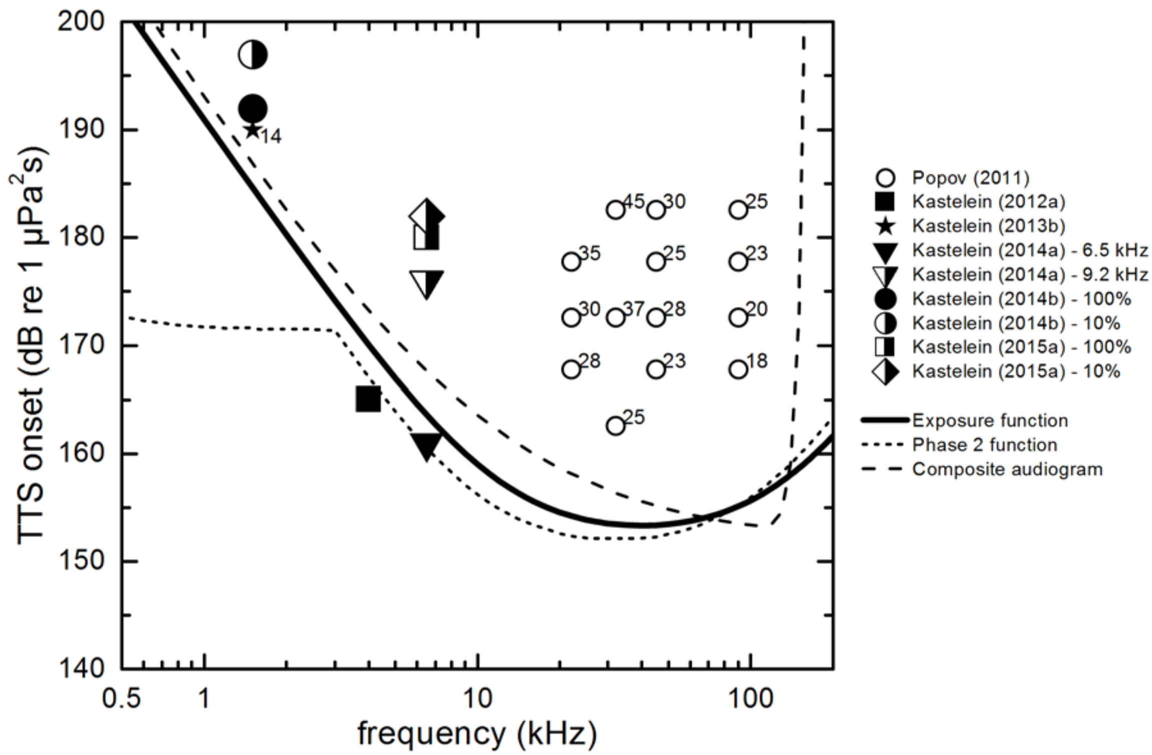

Figure A19. **High-frequency cetacean TTS exposure function, (normalized) composite audiogram, and Phase 2 exposure functions compared to high-frequency cetacean TTS data. Large symbols with no numeric values indicate onset TTS exposures. Smaller symbols represent specific amounts of TTS observed, with numeric values giving the amount (or range) or measured TTS. Filled and half-filled symbols — behavioral data. Open symbols — AEP data.**

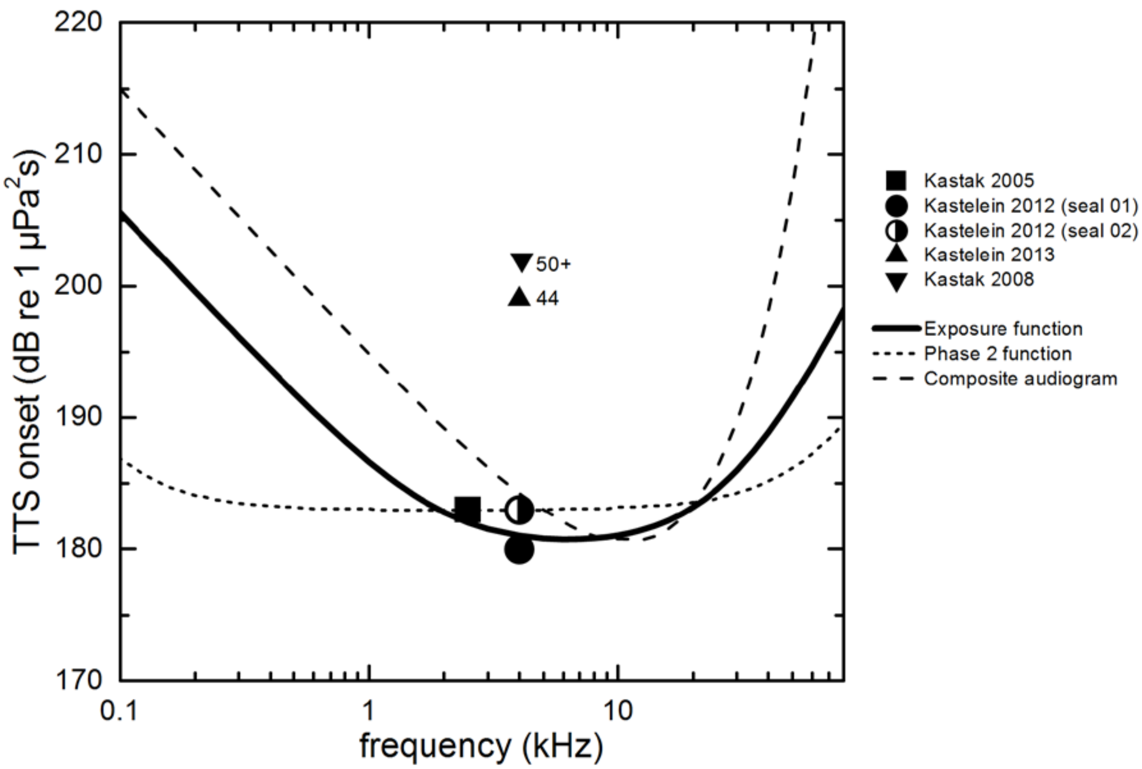

Figure A20. **Phocid (underwater) exposure function, (normalized) composite audiogram, and Phase 2 exposure functions compared to phocid TTS data. Large symbols with no numeric values indicate onset TTS exposures. Smaller symbols represent specific amounts of TTS observed, with numeric values giving the amount (or range) or measured TTS.**

X. PTS EXPOSURE FUNCTIONS FOR SONARS

As in previous acoustic effects analyses (Southall et al., 2007; Finneran and Jenkins, 2012), the shape of the PTS exposure function for each species group is assumed to be identical to the TTS exposure function for that group. Thus, definition of the PTS function only requires the value for the constant *K* to be determined. This equates to identifying the increase in noise exposure between the onset of TTS and the onset of PTS.

For Phase 2, Navy used a 20-dB difference between TTS onset and PTS onset for cetaceans and a 14-dB difference for phocids, otariids, odobenids, mustelids, ursids, and sirenians (Finneran and Jenkins, 2012). The 20-dB value was based on human data (Ward et al., 1958) and the available marine mammal data, essentially following the extrapolation process proposed by Southall et al. (2007). The 14-dB value was based on a 2.5 dB/dB growth rate reported by Kastak et al. (2007) for a California sea lion tested in air.

For Phase 3, a difference of 20 dB between TTS onset and PTS onset is used for all species groups. This is based on estimates of exposure levels actually required for PTS (i.e., 40 dB of TTS) from the marine mammal TTS growth curves (Table 6), which show differences of 13 to 37 dB (mean = 24, median = 22, *n* = 9) between TTS onset and PTS onset in marine mammals. These data show most differences between TTS onset and PTS onset are larger than 20 dB and all but one value are larger than 14 dB.

The value of *K* for each PTS exposure function and the weighted PTS threshold are therefore determined by adding 20 dB to the *K*-value for the TTS exposure function or the TTS weighted threshold, respectively (see Table A10).

XI. TTS/PTS EXPOSURE FUNCTIONS FOR EXPLOSIVES

The shapes of the TTS and PTS exposure functions for explosives and other impulsive sources are identical to those used for sonars and other active acoustic sources (i.e., steady-state or non-impulsive noise sources). Thus, defining the TTS and PTS functions only requires the values for the constant *K* to be determined.

Phase 3 analyses for TTS and PTS from underwater detonations and other impulsive sources follow the approach proposed by Southall et al. (2007) and used in Phase 2 analyses (Finneran and Jenkins, 2012), where a weighted SEL threshold is used in conjunction with an unweighted peak SPL threshold. The threshold producing the greater range for effect is used for estimating the effects of the noise exposure.

Peak SPL and SEL thresholds for TTS were based on TTS data from impulsive sound exposures that produced 6 dB or more TTS for the mid- and high-frequency cetaceans (the only groups for which data are available). The peak SPL thresholds were taken directly from the literature: 224 and 196 dB re 1 μPa, for the mid- and high-frequency cetaceans, respectively (Table A9). The SEL-based thresholds were determined by applying the Phase 3 weighting functions for the appropriate species groups to the exposure waveforms that produced TTS, then calculating the resulting weighted SELs. When this method is applied to the exposure data from Finneran et al. (2002) and Lucke et al. (2009), the SEL-based weighted TTS thresholds are 170 and 140 dB re 1 $\mu Pa^2 s$ for the mid- and high-frequency cetaceans, respectively (Table A9). Note that the data from Lucke et al. (2009) are based on AEP measurements and may thus under-estimate TTS onset; however, they are used here because of the very limited nature of the impulse TTS data for marine mammals and the likelihood that the high-frequency cetaceans are more susceptible than the mid-frequency cetaceans (i.e., use of the mid-frequency cetacean value is not appropriate). Based on the limited available data, it is reasonable to assume that the exposures described by Lucke et al. (2009), which produced AEP-measured TTS of up to 20 dB, would have resulted in a behavioral TTS of at least 6 dB.

The harbor porpoise data from Kastelein et al. (2015c) were not used to derive the high-frequency cetacean TTS threshold, since the largest observed TTS was only 4 dB. However, these data provide an opportunity to check the TTS onset proposed for the high-frequency cetacean group. Kastelein et al. (2015c) provide a representative frequency spectrum for a single, simulated pile driving strike at a specific measurement location. When the high-frequency cetacean weighting function is applied to this spectrum and the 1/3-octave SELs combined across frequency, the total weighted SEL for a single strike is found to be 114 dB re 1 $\mu Pa^2 s$. For 2760 impulses, the cumulative, weighted SEL would then be 148 dB re 1 $\mu Pa^2 s$. The average SEL in the pool was reported to be 9 dB lower than the SEL at the measurement position, thus the average, cumulative weighted SEL would be approximately 139 dB re 1 $\mu Pa^2 s$, which compares favorably to the high-frequency cetacean TTS threshold of 140 dB re 1 $\mu Pa^2 s$ derived from the Lucke et al. (2009) air gun data.

For species groups for which no impulse TTS data exist, the weighted SEL thresholds were estimated using the relationship between the steady-state TTS weighted threshold and the impulse TTS weighted threshold for the groups for which data exist (the mid- and high-frequency cetaceans):

$$G_s - G_i = \overline{C}_s - \overline{C}_i, \tag{A11}$$

where G indicates thresholds for a species group for which impulse TTS data are not available, $\overline{C}$ indicates the median threshold for the groups for which data exist, the subscript s indicates a steady-state threshold, and the subscript i indicates an impulse threshold (note that since data are only available for the mid- and high-frequency cetaceans the median and mean are identical). Equation (A11) is equivalent to the relationship used by Southall et al. (2007), who expressed the relationship as $\overline{C}_s - G_s = \overline{C}_i - G_i$. For the mid- and high-frequency cetaceans, the steady-state TTS thresholds are 178 and 153 dB re 1 μPa^{2}s, respectively, and the impulse TTS thresholds are 170 and 140 dB re 1 μPa^{2}s, respectively, making $\overline{C}_s - \overline{C}_i$ = 11 dB. Therefore, for each of the remaining groups the SEL-based impulse TTS threshold is 11 dB below the steady-state TTS threshold (Table A9).

To estimate peak SPL-based thresholds, Southall et al. (2007) used Eq. (A11) with peak-SPL values for the impulse thresholds and SEL-based values for the steady-state thresholds. For the mid- and high-frequency cetaceans, the steady-state (SEL) TTS thresholds are 178 and 153 dB re 1 μPa^{2}s, respectively, and the peak SPL, impulse TTS thresholds are 224 and 196 dB re 1 μPa, respectively, making $\overline{C}_s - \overline{C}_i$ = -44 dB. Based on this relationship, the peak SPL-based impulse TTS threshold (in dB re 1 μPa) would be 44 dB above the steady-state TTS threshold (in dB re 1 μPa^{2}s), making the peak SPL thresholds vary from 222 to 243 dB re 1 μPa. Given the limited nature of the underlying data, and the relatively high values for some of these predictions, for Phase 3 analyses impulsive peak SPL thresholds are estimated using a "dynamic range" estimate based on the difference (in dB) between the impulsive noise, peak SPL TTS onset (in dB re 1 μPa) and the hearing threshold at f_0 (in dB re 1 μPa) for the groups for which data are available (the mid- and high-frequency cetaceans). For the mid-frequency cetaceans, the hearing threshold at f_0 is 54 dB re 1 μPa and the peak SPL TTS threshold is 224 dB re 1 μPa, resulting in a dynamic range of 170 dB. For the high-frequency cetaceans, the hearing threshold at f_0 is 48 dB re 1 μPa and the peak SPL-based TTS threshold is 196 dB re 1 μPa, resulting in a dynamic range of 148 dB. The median dynamic range for the mid- and high-frequency cetaceans is therefore 159 dB (since there are only two values, the mean and median are equal). For the remaining species groups, the impulsive peak SPL-based TTS thresholds are estimated by adding 159 dB to the hearing threshold at f_0 (Table A9).

Since marine mammal PTS data from impulsive noise exposures do not exist, onset-PTS levels for impulsive exposures were estimated by adding 15 dB to the SEL-based TTS threshold and adding 6 dB to the peak pressure based thresholds. These relationships were derived by Southall et al. (2007) from impulse noise TTS growth rates in chinchillas. The appropriate frequency weighting function for each functional hearing group is applied only when using the SEL-based thresholds to predict PTS.

Table A9. **TTS and PTS thresholds for explosives and other impulsive sources. SEL thresholds are in dB re 1 μPa²s and peak SPL thresholds are in dB re 1 μPa.**

Group	Hearing threshold at f_0	TTS threshold		PTS threshold	
	SPL (dB SPL)	SEL (weighted) (dB SEL)	peak SPL (dB SPL)	SEL (weighted) (dB SEL)	peak SPL (dB SPL)
LF	54	168	213	183	219
MF	54	170	224	185	230
HF	48	140	196	155	202
SI	61	175	220	190	226
OW	67	188	226	203	232
PW	53	170	212	185	218

XII. SUMMARY

Figure A21 illustrates the shapes of the various Phase 3 auditory weighting functions. Table A10 summarizes the parameters necessary to calculate the weighting function amplitudes using Eq. (A1).

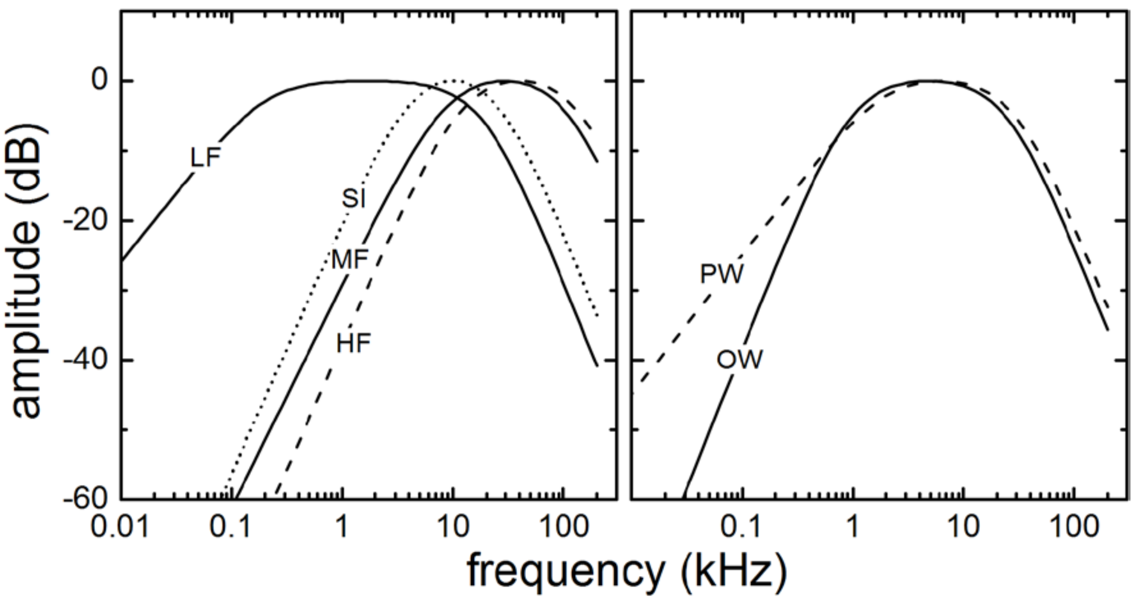

Figure A21. Navy Phase 3 weighting functions for marine mammal species groups exposed to underwater sound. Parameters required to generate the functions are provided in Table A10.

Table A10. Summary of weighting function parameters and TTS/PTS thresholds. SEL thresholds are in dB re 1 µPa²s and peak SPL thresholds are in dB re 1 µPa.

$W(f)=C+10\log_{10}\left\{\frac{(f/f_1)^{2a}}{\left[1+(f/f_1)^2\right]^a\left[1+(f\right.}\right.$						Non-impulsive		Impulse			
						TTS threshold	PTS threshold	TTS threshold		PTS threshold	
Group	*a*	*b*	f_1 (kHz)	f_2 (kHz)	*C* (dB)	SEL (weighted)	SEL (weighted)	SEL (weighted)	peak SPL (unweighted)	SEL (weighted)	peak SPL (unweighted)
LF	1	2	0.20	19	0.13	179	199	168	213	183	219
MF	1.6	2	8.8	110	1.20	178	198	170	224	185	230
HF	1.8	2	12	140	1.36	153	173	140	196	155	202
SI	1.8	2	4.3	25	2.62	186	206	175	220	190	226
OW	2	2	0.94	25	0.64	199	219	188	226	203	232
PW	1	2	1.9	30	0.75	181	201	170	212	185	218

To properly compare the TTS/PTS criteria and thresholds used by Navy for Phase 2 and Phase 3, both the weighting function shape and weighted threshold values must be taken into account; the weighted thresholds by themselves only indicate the TTS/PTS threshold at the most susceptible frequency (based on the relevant weighting function). Since the exposure functions incorporate both the shape of the weighting function and the weighted threshold value, they provide the best means of comparing the frequency-dependent TTS/PTS thresholds for Phase 2 and 3 (Figs A22 and A23).

The most significant differences between the Phase 2 and Phase 3 functions include the following:

(1) Thresholds at low frequencies are generally higher for Phase 3 compared to Phase 2. This is because the Phase 2 weighting functions utilized the "M-weighting" functions (Southall et al., 2007) at lower frequencies, where no TTS existed at that time. Since derivation of the Phase 2 thresholds, additional data have been collected (e.g., Kastelein et al., 2012a; Kastelein et al., 2013b; Kastelein et al., 2014b) to support the use of exposure functions that continue to increase at frequencies below the region of best sensitivity, similar to the behavior of mammalian audiograms and human auditory weighting functions.

(2) In the frequency region near best hearing sensitivity, the Phase 3 underwater thresholds for otariids and other marine carnivores (group OW) are lower than those used in Phase 2. In Phase 2, the TTS onset for the otariids was taken directly from the published literature (Kastak et al., 2005); for Phase 3, the actual TTS data from Kastak et al. (2005) were fit by a TTS growth curve using identical methods as those used with the other species groups.

(3) Impulsive TTS/PTS thresholds near the region of best hearing sensitivity are lower for Phase 3 compared to Phase 2.

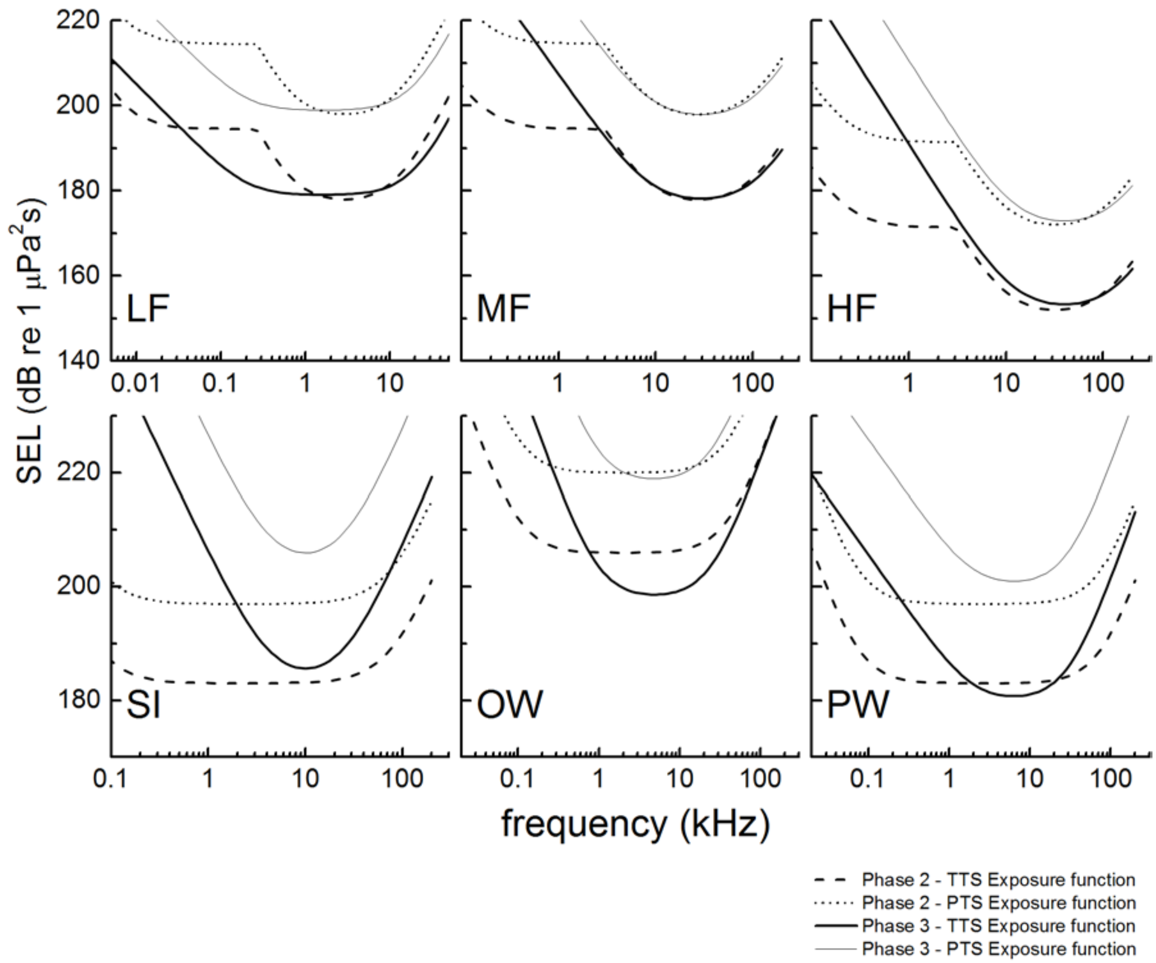

Figure A22. TTS and PTS exposure functions for sonars and other (non-impulsive) active acoustic sources. Heavy solid lines — Navy Phase 3 TTS exposure functions (Table A10). Thin solid lines — Navy Phase 3 PTS exposure functions for TTS (Table A10). Dashed lines — Navy Phase 2 TTS exposure functions. Short dashed lines — Navy Phase 2 PTS exposure functions.

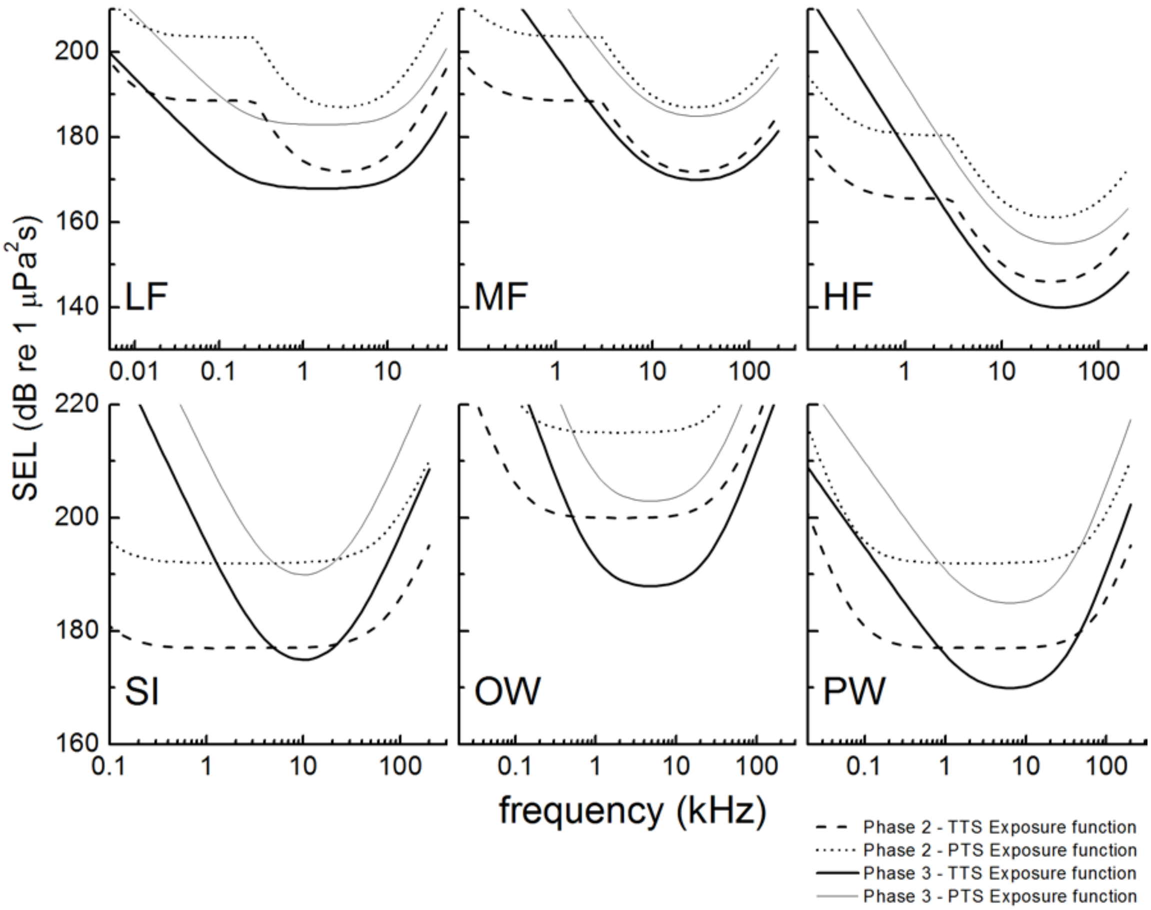

Figure A23. **TTS and PTS exposure functions for explosives, impact pile driving, air guns, and other impulsive sources. Heavy solid lines — Navy Phase 3 TTS exposure functions (Table A10). Thin solid lines — Navy Phase 3 PTS exposure functions for TTS (Table A10). Dashed lines — Navy Phase 2 TTS exposure functions. Short dashed lines — Navy Phase 2 PTS exposure functions.**

APPENDIX A1. ESTIMATING A LOW-FREQUENCY CETACEAN AUDIOGRAM

A1.1. BACKGROUND

Psychophysical and/or electrophysiological auditory threshold data exist for at least one species within each hearing group, except for the low-frequency (LF) cetacean (i.e., mysticete) group, for which no direct measures of auditory threshold have been made. For this reason, an alternative approach was necessary to estimate the composite audiogram for the LF cetacean group.

The published data sources available for use in estimating mysticete hearing thresholds consist of: cochlear frequency-place maps created from anatomical measurements of basilar membrane dimensions (e.g., Ketten, 1994; Parks et al., 2007); scaling relationships between inter-aural time differences and upper-frequency limits of hearing (see Ketten, 2000); finite element models of head-related and middle-ear transfer functions (Tubelli et al., 2012; Cranford and Krysl, 2015); a relative hearing sensitivity curve derived by integrating cat and human threshold data with a frequency-place map for the humpback whale (Houser et al., 2001); and measurements of the source levels and frequency content of mysticete vocalizations (see review by Tyack and Clark, 2000). These available data sources are applied here to estimate a mysticete composite audiogram. Given that these data are limited in several regards and are quite different from the type of data supporting composite audiograms in other species, additional sources of information, such as audiograms from other marine mammals, are also considered and applied to make conservative extrapolations at certain decision points.

Mathematical models based on anatomical data have been used to predict hearing curves for several mysticete species (e.g., Ketten and Mountain, 2009; Cranford and Krysl, 2015). However, these predictions are not directly used to derive the composite audiogram for LF cetaceans for two primary reasons:

> (1) There are no peer-reviewed publications that provide a complete description of the mathematical process by which frequency-place maps based on anatomical measurements were integrated with models of middle-ear transfer functions and/or other information to derive the predicted audiograms presented in several settings by Ketten/Mountain (e.g., Ketten and Mountain, 2009). As a result, the validity of the resulting predicted audiograms cannot be independently evaluated, and these data cannot be used in the present effort.
>
> (2) Exclusion of the Ketten/Mountain predicted audiograms leaves only the Cranford/Krysl predicted fin whale hearing curve (Cranford and Krysl, 2015). However, this curve cannot be used by itself to predict hearing thresholds for all mysticetes because:
>
> (a) The Cranford/Krysl model is based on sound transmission through the head to the ear of the fin whale, but does not include the sensory receptors of the cochlea. There is therefore no way to properly predict the upper cutoff of

hearing and the shape of the audiogram at frequencies above the region of best predicted sensitivity.

(b) The audiogram does not possess the typical shape one would expect for an individual with normal hearing based on measurements from other mammals. Specifically, the "hump" in the low-frequency region and the shallow roll-off at high frequencies do not match patterns typically seen in audiometric data from other mammals with normal hearing. Given these considerations, the proposed audiogram cannot be considered representative of all mysticetes without other supporting evidence. Although the specific numeric thresholds from Cranford and Krysl (2015) are not directly used in the revised approach explained here, the predicted thresholds are still used to inform the LF cetacean composite audiogram derivation.

Vocalization data also cannot be used to directly estimate auditory sensitivity and audible range, since there are many examples of mammals that vocalize below the frequency range where they have best hearing sensitivity, and well below their upper hearing limit. However, it is generally expected that animals have at least some degree of overlap between the auditory sensitivity curve and the predominant frequencies present in conspecific communication signals. Therefore vocalization data can be used to evaluate, at least at a general level, whether the composite audiogram is reasonable; i.e., to ensure that the predicted thresholds make sense given what we know about animal vocalization frequencies, source levels, and communication range.

The realities of the currently available data leave only a limited amount of anatomical data and finite element modeling results to guide the derivation of the LF cetacean composite audiogram, supplemented with extrapolations from the other marine mammal species groups where necessary and a broad evaluation of the resulting audiogram in the context of whale bioacoustics.

A1.2. AUDIOGRAM FUNCTIONAL FORM AND REQUIRED PARAMETERS

Navy Phase 3 composite audiograms are defined by the equation

$$T(f) = T_0 + A\log_{10}\left(1 + \frac{F_1}{f}\right) + \left(\frac{f}{F_2}\right)^B, \qquad \text{(A1.1)}$$

where $T(f)$ is the threshold at frequency f, and T_0, F_1, F_2, A, and B are constants. To understand the physical significance and influence of the parameters T_0, F_1, F_2, A, and B, Eq. (A1.1) may be viewed as the sum of three individual terms:

$$T(f) = T_0 + L(f) + H(f), \qquad \text{(A1.2)}$$

where

$$L(f) = A\log_{10}\left(1 + \frac{F_1}{f}\right), \tag{A1.3}$$

and

$$H(f) = \left(\frac{f}{F_2}\right)^B. \tag{A1.4}$$

The first term, T_0, controls the vertical position of the curve; i.e., T_0 shifts the audiogram up and down.

The second term, $L(f)$, controls the low-frequency behavior of the audiogram. At low frequencies, when $f < F_1$, Eq. (A1.3) approaches

$$L(f) = A\log_{10}\left(\frac{F_1}{f}\right), \tag{A1.5}$$

which can also be written as

$$L(f) = A\log_{10} F_1 - A\log_{10} f. \tag{A1.6}$$

Equation (A.6) has the form of $y(x) = b - Ax$, where $x = \log_{10} f$; i.e., Eq. (A.6) describes a linear function of the logarithm of frequency. This means that, as frequency gets smaller and smaller, Eq. (A.3) — the low-frequency portion of the audiogram function — approaches a linear function with the logarithm of frequency, and has a slope of $-A$ dB/decade. As frequency increases towards F_1, $L(f)$ asymptotically approaches zero.

The third term, $H(f)$, controls the high-frequency behavior of the audiogram. At low frequencies, when $f << F_2$, Eq. (A1.4) has a value of zero. As f increases, $H(f)$ exponentially grows. The parameter F_2 defines the frequency at which the thresholds begin to exponentially increase, while the factor B controls the rate at which thresholds increase. Increasing F_2 will move the upper cutoff frequency to the right (to higher frequencies). Increasing B will increase the "sharpness" of the high-frequency increase.

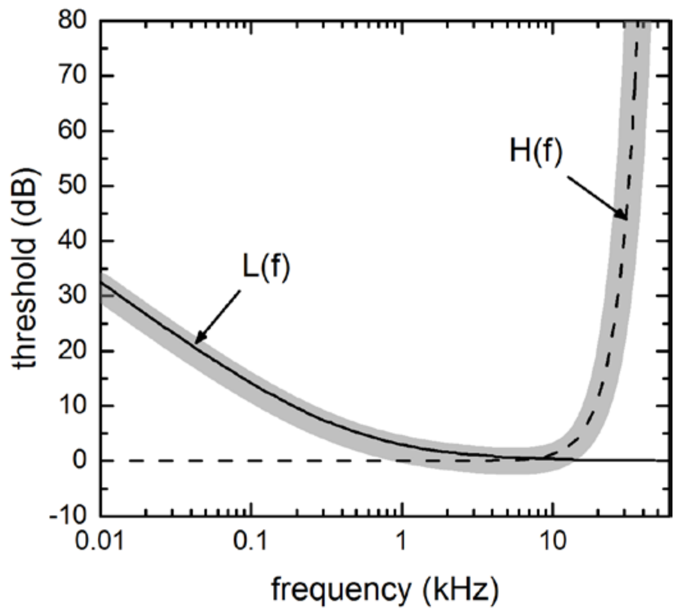

FIGURE A1.1. **Relationship between estimated threshold, T(f), (thick, gray line), low-frequency term, L(f), (solid line), and high-frequency term, H(f), (dashed line).**

A1.3. Estimating Audiogram Parameters

To derive a composite mysticete audiogram using Eq. (A1.1), the values of T_0, F_1, F_2, A, and B must be defined. The value for T_0 is determined by either adjusting T_0 to place the lowest threshold value to zero (to obtain a normalized audiogram), or to place the lowest expected threshold at a specific SPL (in dB re 1 µPa). For Navy Phase 3 analyses, the lowest LF cetacean threshold is defined to match the median threshold of the in-water marine mammal species groups (MF cetaceans, HF cetaceans, sirenians, otariids and other marine carnivores in water, and phocids in water; median = 54 dB re 1 µPa). The choices for the other parameters are informed by the published information regarding mysticete hearing.

The constant A is defined by assuming a value for the low-frequency slope of the audiogram, in dB/decade. Most mammals for which thresholds have been measured have low-frequency slopes ~30 to 40 dB/decade. However, finite element models of middle ear function in fin whales (Cranford and Krysl, 2015) and minke whales (Tubelli et al., 2012) suggest lower slopes, of ~25 or 20 dB/decade, respectively. **We therefore conservatively assume that A = 20 dB/decade.**

To define F_1, we first define the variable T' as the maximum threshold tolerance within the frequency region of best sensitivity (i.e., within the frequency range of best sensitivity, thresholds are within T' dB of the lowest threshold). Further, let f' be the lower frequency bound of the region of best sensitivity. When $f = f'$, $L(f) = T'$, and Eq. (A1.3) can then be solved for F_1 as a function of f', T', and A:

$$F_1 = f'\left(10^{T'/A} - 1\right). \qquad \text{(A1.7)}$$

Anatomically-based models of mysticete hearing have resulted in various estimates for audible frequency ranges and frequencies of best sensitivity. Houser et al. (2001) estimated best sensitivity in humpback whales to occur in the range of 2 to 6 kHz, with thresholds within 3 dB of best sensitivity from ~1.4 to 7.8 kHz. For right whales, Parks et al. (2007) estimated the audible frequency range to be 10 Hz to 22 kHz. For minke whales, Tubelli et al. (2012) estimated the most sensitive hearing range, defined as the region with thresholds within 40 dB of best sensitivity, to extend from 30 to 100 Hz up to 7.5 to 25 kHz, depending on the specific model used. Cranford and Krysl (2015) predicted best sensitivity in fin whales to occur at 1.2 kHz, with thresholds within 3-dB of best sensitivity from ~1 to 1.5 kHz. Together, these model results broadly suggest best sensitivity (thresholds within ~3 dB of the lowest threshold) from ~1 to 8 kHz, and thresholds within ~40 dB of best sensitivity as low as ~30 Hz and up to ~25 kHz.

Based on this information, we assume LF cetacean thresholds are within 3 dB of the lowest threshold over a frequency range of 1 to 8 kHz, therefore T' = 3 dB and f' = 1 kHz, resulting in **F_1 = 0.41 kHz** [Eq. (A1.7)]. In other words, we define F_1 so that thresholds are ≤ 3 dB relative to the lowest threshold when the frequency is within the region of best sensitivity (1 to 8 kHz).

To define the high-frequency portion of the audiogram, the values of B and F_2 must be estimated. To estimate B for LF cetaceans, we take the median of the B values from the composite audiograms for the other in-water marine mammal species groups (MF cetaceans, HF cetaceans, sirenians, otariids and other marine carnivores in water, and phocids in water). **This results in B = 3.2 for the LF cetaceans.** Once B is defined, F_2 is adjusted to achieve a threshold value at 30 kHz of 40 dB relative to the lowest threshold. **This results in F_2 = 9.4 kHz. Finally, T_0 is adjusted to set the lowest threshold value to 0 dB for the normalized curve, or 54 dB re 1 µPa for the non-normalized curve; this results in T_0 = -0.81 and 53.19 for the normalized and non-normalized curves, respectively.**

The resulting composite audiogram is shown in Fig. A1.2. For comparison, predicted audiograms for the fin whale (Cranford and Krysl, 2015), and humpback whale (Houser et al., 2001) are included. The LF cetacean composite audiogram has lowest threshold at 5.6 kHz, but the audiogram is fairly shallow in the region of best sensitivity, and thresholds are within 1 dB of the lowest threshold from ~1.8 to 11 kHz, and within 3 dB of the lowest threshold from ~0.75 to 14 kHz. Low-frequency (< ~500 Hz) thresholds are considerably lower than those predicted by Cranford and Krysl (2015). High-frequency thresholds are also substantially lower than those predicted for the fin whale, with thresholds at 30 kHz only 40 dB above best hearing thresholds, and those at 40 kHz approximately 90 dB above best threshold. The resulting LF composite audiogram appears reasonable in a general sense relative the predominant frequencies present in mysticete conspecific vocal communication signals. While some species (e.g., blue whales) produce some extremely low (e.g., 10 Hz) frequency call components, the majority of mysticete social calls occur in the few tens of Hz to few kHz range, overlapping reasonably well with the predicted auditory sensitivity shown in the composite audiogram (within ~0 to 30 dB of predicted best sensitivity). A general pattern of some social calls containing energy shifted below the region of best hearing sensitivity is well-documented in other low-frequency species including many phocid seals (see Wartzok and Ketten, 1999) and some terrestrial mammals, notably the Indian elephant (Heffner and Heffner, 1982).

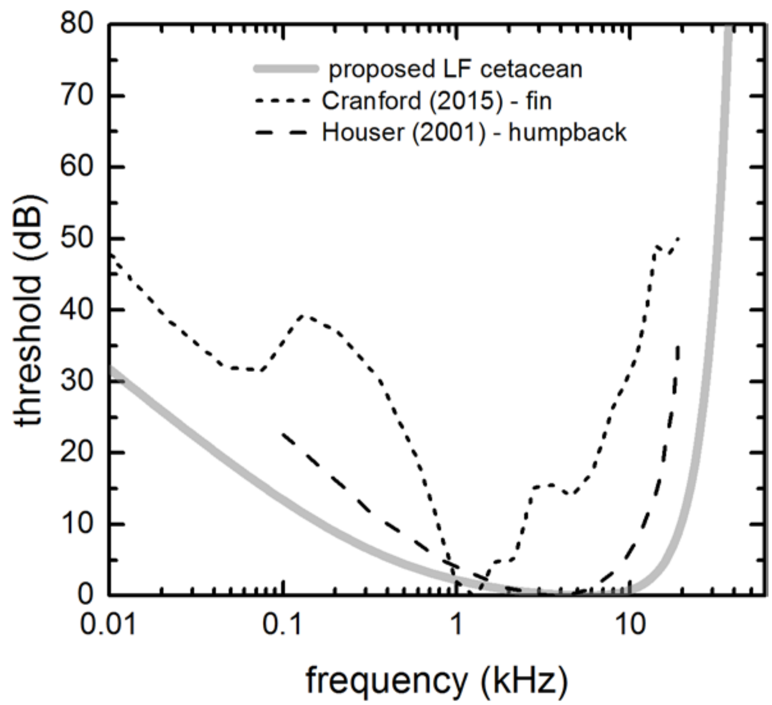

FIGURE A1.2. **Comparison of proposed LF cetacean thresholds to those predicted by anatomical and finite-element models.**

XIII. REFERENCES

American National Standards Institute (ANSI) (**2001**). "Design Response of Weighting Networks for Acoustical Measurements," ANSI S1.42-2001 (Acoustical Society of America). 14 pp.

Awbrey, F.T., Thomas, J.A., and Kastelein, R.A. (**1988**). "Low-frequency underwater hearing sensitivity in belugas, *Delphinapterus leucas*," J. Acoust. Soc. Am. 84, 2273-2275.

Babushina, E.S., Zaslavsky, G.L., and Yurkevich, L.I. (**1991**). "Air and underwater hearing of the northern fur seal - audiograms and auditory frequency discrimination," Biofizika 36, 904-907.

Brill, R.L., Moore, P.W.B., and Dankiewicz, L.A. (**2001**). "Assessment of dolphin (*Tursiops truncatus*) auditory sensitivity and hearing loss using jawphones," J. Acoust. Soc. Am. 109, 1717-1722.

Cranford, T.W. and Krysl, P. (**2015**). "Fin whale sound reception mechanisms: Skull vibration enables low- frequency hearing," PLoS ONE 10, 1-17.

Dow Piniak, W.E., Eckert, S.A., Harms, C.A., and Stringer, E.M. (**2012**). "Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise."

Finneran, J.J. (**2010**). "Auditory weighting functions and frequency-dependent effects of sound in bottlenose dolphins (*Tursiops truncatus*)," (Office of Naval Research (ONR), Washington, DC).

Finneran, J.J. (**2015**). "Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996 to 2015," J. Acoust. Soc. Am. 138, 1702-1726.

Finneran, J.J. and Schlundt, C.E. (**2010**). "Frequency-dependent and longitudinal changes in noise-induced hearing loss in a bottlenose dolphin (*Tursiops truncatus*)," J. Acoust. Soc. Am. 128, 567-570.

Finneran, J.J. and Schlundt, C.E. (**2011**). "Subjective loudness level measurements and equal loudness contours in a bottlenose dolphin (*Tursiops truncatus*)," J. Acoust. Soc. Am. 130, 3124-3136.

Finneran, J.J. and Jenkins, A.K. (**2012**). "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis," (SSC Pacific, San Diego, CA).

Finneran, J.J. and Schlundt, C.E. (**2013**). "Effects of fatiguing tone frequency on temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*)," J. Acoust. Soc. Am. 133, 1819-1826.

Finneran, J.J., Dear, R., Carder, D.A., and Ridgway, S.H. (**2003**). "Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer," J. Acoust. Soc. Am. 114, 1667-1677.

Finneran, J.J., Carder, D.A., Schlundt, C.E., and Ridgway, S.H. (**2005a**). "Temporary threshold shift (TTS) in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones," J. Acoust. Soc. Am. 118, 2696-2705.

Finneran, J.J., Schlundt, C.E., Branstetter, B., and Dear, R.L. (**2007**). "Assessing temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) using multiple simultaneous auditory evoked potentials," J. Acoust. Soc. Am. 122, 1249–1264.

Finneran, J.J., Carder, D.A., Schlundt, C.E., and Dear, R.L. (**2010a**). "Temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) exposed to intermittent tones," J. Acoust. Soc. Am. 127, 3267-3272.

Finneran, J.J., Carder, D.A., Schlundt, C.E., and Dear, R.L. (**2010b**). "Growth and recovery of temporary threshold shift (TTS) at 3 kHz in bottlenose dolphins (*Tursiops truncatus*)," J. Acoust. Soc. Am. 127, 3256-3266.

Finneran, J.J., Schlundt, C.E., Dear, R., Carder, D.A., and Ridgway, S.H. (**2002**). "Temporary shift in masked hearing thresholds (MTTS) in odontocetes after exposure to single underwater impulses from a seismic watergun," J. Acoust. Soc. Am. 111, 2929-2940.

Finneran, J.J., Schlundt, C.E., Branstetter, B.K., Trickey, J., Bowman, V., and Jenkins, K. (**2015**). "Effects of multiple impulses from a seismic air gun on bottlenose dolphin hearing and behavior," J. Acoust. Soc. Am. 137, 1634-1646.

Finneran, J.J., Schlundt, C.E., Carder, D.A., Clark, J.A., Young, J.A., Gaspin, J.B., and Ridgway, S.H. (**2000**). "Auditory and behavioral responses of bottlenose dolphins (*Tursiops truncatus*) and a beluga whale (*Delphinapterus leucas*) to impulsive sounds resembling distant signatures of underwater explosions," J. Acoust. Soc. Am. 108, 417-431.

Finneran, J.J., Carder, D.A., Dear, R., Belting, T., McBain, J., Dalton, L., and Ridgway, S.H. (**2005b**). "Pure tone audiograms and possible aminoglycoside-induced hearing loss in belugas (*Delphinapterus leucas*)," J. Acoust. Soc. Am. 117, 3936-3943.

Gaspard, J.C., III, Bauer, G.B., Reep, R.L., Dziuk, K., Cardwell, A., Read, L., and Mann, D.A. (**2012**). "Audiogram and auditory critical ratios of two Florida manatees (*Trichechus manatus latirostris*)," J. Exp. Biol. 215, 1442-1447.

Gerstein, E.R., Gerstein, L., Forsythe, S.E., and Blue, J.E. (**1999**). "The underwater audiogram of the West Indian manatee (*Trichechus manatus*)," J. Acoust. Soc. Am. 105, 3575-3583.

Ghoul, A. and Reichmuth, C. (**2014**). "Hearing in the sea otter (Enhydra lutris): auditory profiles for an amphibious marine carnivore," Journal of comparative physiology. A, Neuroethology, sensory, neural, and behavioral physiology 200, 967-981.

Heffner, R.S. and Heffner, H.E. (**1982**). "Hearing in the elephant (*Elephas maximus*): Absolute sensitivity, frequency discrimination, and sound localization," Journal of Comparative and Physiological Psychology 96, 926-944.

Houser, D.S., Helweg, D.A., and Moore, P.W.B. (**2001**). "A bandpass filter-bank model of auditory sensitivity in the humpback whale," Aquatic Mammal. 27, 82-91.

Jacobs, D.W. and Hall, J.D. (**1972**). "Auditory thresholds of a fresh water dolphin, *Inia geoffrensis Blainville*," J. Acoust. Soc. Am. 51, 530-533.

Johnson, C.S. (**1967**). "Sound detection thresholds in marine mammals," in *Marine Bioacoustics*, edited by W.N. Tavolga (Pergamon Press, Oxford), pp. 247-260.

Johnson, C.S., McManus, M.W., and Skaar, D. (**1989**). "Masked tonal hearing thresholds in the beluga whale," J. Acoust. Soc. Am. 85, 2651-2654.

Kastak, D. and Schusterman, R.J. (**1999**). "In-air and underwater hearing sensitivity of a northern elephant seal (*Mirounga angustirostris*)," Canadian Journal of Zoology 77, 1751-1758.

Kastak, D., Southall, B.L., Schusterman, R.J., and Kastak, C.R. (**2005**). "Underwater temporary threshold shift in pinnipeds: effects of noise level and duration," J. Acoust. Soc. Am. 118, 3154-3163.

Kastak, D., Mulsow, J., Ghoul, A., and Reichmuth, C. (**2008**). "Noise-induced permanent threshold shift in a harbor seal," J. Acoust. Soc. Am. 123, 2986(A).

Kastak, D., Reichmuth, C., Holt, M.M., Mulsow, J., Southall, B.L., and Schusterman, R.J. (**2007**). "Onset, growth, and recovery of in-air temporary threshold shift in a California sea lion (*Zalophus californianus*)," J. Acoust. Soc. Am. 122, 2916–2924.

Kastelein, R., Gransier, R., van Mierlo, R., Hoek, L., and de Jong, C. (**2011**). "Temporary hearing threshold shifts and recovery in a harbor porpoise (*Phocoena phocoena*) and harbor seals (*Phoca vitulina*) exposed to white noise in a 1/1 octave band around 4 kHz," J. Acoust. Soc. Am. 129, 2432 (A).

Kastelein, R.A., Gransier, R., and Hoek, L. (**2013a**). "Comparative temporary threshold shifts in a harbor porpoise and harbor seal, and severe shift in a seal," J. Acoust. Soc. Am. 134, 13-16.

Kastelein, R.A., Hagedoorn, M., Au, W.W.L., and de Haan, D. (**2003**). "Audiogram of a striped dolphin (*Stenella coeruleoalba*)," J. Acoust. Soc. Am. 113, 1130-1137.

Kastelein, R.A., van Schie, R., Verboom, W.C., and de Haan, D. (**2005**). "Underwater hearing sensitivity of a male and a female Steller sea lion (*Eumetopias jubatus*)," J. Acoust. Soc. Am. 118, 1820-1829.

Kastelein, R.A., Wensveen, P., Hoek, L., and Terhune, J.M. (**2009**). "Underwater hearing sensitivity of harbor seals (*Phoca vitulina*) for narrow noise bands between 0.2 and 80 kHz," J. Acoust. Soc. Am. 126, 476–483.

Kastelein, R.A., Hoek, L., de Jong, C.A.F., and Wensveen, P.J. (**2010**). "The effect of signal duration on the underwater detection thresholds of a harbor porpoise (*Phocoena phocoena*) for single frequency-modulated tonal signals between 0.25 and 160 kHz," J. Acoust. Soc. Am. 128, 3211- 3222.

Kastelein, R.A., Gransier, R., Hoek, L., and Olthuis, J. (**2012a**). "Temporary threshold shifts and recovery in a harbor porpoise (*Phocoena phocoena*) after octave-band noise at 4 kHz," J. Acoust. Soc. Am. 132, 3525-3537.

Kastelein, R.A., Gransier, R., Hoek, L., and Rambags, M. (**2013b**). "Hearing frequency thresholds of a harbor porpoise (*Phocoena phocoena*) temporarily affected by a continuous 1.5 kHz tone," J. Acoust. Soc. Am. 134, 2286-2292.

Kastelein, R.A., Schop, J., Gransier, R., and Hoek, L. (**2014a**). "Frequency of greatest temporary hearing threshold shift in harbor porpoises (*Phocoena phocoena*) depends on the noise level," J. Acoust. Soc. Am. 136, 1410-1418.

Kastelein, R.A., Schop, J., Hoek, L., and Covi, J. (**2015a**). "Hearing thresholds of a harbor porpoise (*Phocoena phocoena*) for narrow-band sweeps," J. Acoust. Soc. Am. 138, 2508-2512.

Kastelein, R.A., Gransier, R., Schop, J., and Hoek, L. (**2015b**). "Effects of exposure to intermittent and continuous 6–7 kHz sonar sweeps on harbor porpoise (*Phocoena phocoena*) hearing," J. Acoust. Soc. Am. 137, 1623-1633.

Kastelein, R.A., Gransier, R., Marijt, M.A.T., and Hoek, L. (**2015c**). “Hearing frequency thresholds of harbor porpoises (*Phocoena phocoena*) temporarily affected by played back offshore pile driving sounds,” J. Acoust. Soc. Am. 137, 556-564.

Kastelein, R.A., Bunskoek, P., Hagedoorn, M., Au, W.W.L., and de Haan, D. (**2002a**). “Audiogram of a harbor porpoise (*Phocoena phocoena*) measured with narrow-band frequency-modulated signals,” J. Acoust. Soc. Am. 112, 334-344.

Kastelein, R.A., Mosterd, P., van Santen, B., Hagedoorn, M., and de Haan, D. (**2002b**). “Underwater audiogram of a Pacific walrus (*Odobenus rosmarus divergens*) measured with narrow-band frequency-modulated signals,” J. Acoust. Soc. Am. 112, 2173-2182.

Kastelein, R.A., Gransier, R., Hoek, L., Macleod, A., and Terhune, J.M. (**2012b**). “Hearing threshold shifts and recovery in harbor seals (*Phoca vitulin*a) after octave-band noise exposure at 4 kHz,” J. Acoust. Soc. Am. 132, 2745-2761.

Kastelein, R.A., Hoek, L., Gransier, R., Rambags, M., and Claeys, N. (**2014b**). “Effect of level, duration, and inter-pulse interval of 1-2 kHz sonar signal exposures on harbor porpoise hearing,” J. Acoust. Soc. Am. 136, 412-422.

Ketten, D.R. (**1994**). “Functional analyses of whale ears: adaptations for underwater hearing,” in *IEEE Proceedings in Underwater Acoustics*, pp. 264-270.

Ketten, D.R. (**2000**). “Cetacean ears,” in *Hearing by Whales and Dolphins*, edited by W. Au, A.N. Popper, and R.R. Fay (Springer-Verlag, New York), pp. 43-108.

Ketten, D.R. and Mountain, D. (**2009**). “Final report: modeling minke whale hearing,” (submitted to E&P Sound and Marine Life Programme).

Kryter, K.D., Ward, W.D., Miller, J.D., and Eldredge, D.H. (**1966**). “Hazardous exposure to intermittent and steady-state noise,” J. Acoust. Soc. Am. 39, 451-464.

Lemonds, D.W. (**1999**). “Auditory filter shapes in an Atlantic bottlenose dolphin (*Tursiops truncatus*),” University of Hawaii (PhD). 74 pp.

Ljungblad, D.K., Scroggins, P.D., and Gilmartin, W.G. (**1982**). “Auditory thresholds of a captive Eastern Pacific bottle-nosed dolphin, *Tursiops* spp.,” J. Acoust. Soc. Am. 72, 1726-1729.

Lucke, K., Siebert, U., Lepper, P.A., and Blanchet, M.-A. (**2009**). “Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli,” J. Acoust. Soc. Am. 125, 4060–4070.

Martin, K.J., Alessi, S.C., Gaspard, J.C., Tucker, A.D., Bauer, G.B., and Mann, D.A. (**2012**). “Underwater hearing in the loggerhead turtle (*Caretta caretta*): a comparison of behavioral and auditory evoked potential audiograms,” J. Exp. Biol. 215, 3001-3009.

Maslen, K.R. (**1981**). “Towards a better understanding of temporary threshold shift of hearing,” Applied Acoustics 14, 281-318.

Miller, J.D., Watson, C.S., and Covell, W.P. (**1963**). “Deafening effects of noise on the cat,” Acta Oto-Laryngologica Supplement 176, 1-88.

Mooney, T.A., Nachtigall, P.E., Breese, M., Vlachos, S., and Au, W.W.L. (**2009**). “Predicting temporary threshold shifts in a bottlenose dolphin (*Tursiops truncatus*): The effects of noise level and duration,” J. Acoust. Soc. Am. 125, 1816-1826.

Moore, P.W.B. and Schusterman, R.J. (**1987**). "Audiometric assessment of northern fur seals, *Callorhinus ursinus*," Mar. Mammal Sci. 3, 31-53.

Mulsow, J., Houser, D.S., and Finneran, J.J. (**2012**). "Underwater psychophysical audiogram of a young male California sea lion (*Zalophus californianus*)," J. Acoust. Soc. Am. 131, 4182-4187.

Mulsow, J., Schlundt, C.E., Brandt, L., and Finneran, J.J. (**2015**). "Equal latency contours for bottlenose dolphins (*Tursiops truncatus*) and California sea lions (*Zalophus californianus*)," J. Acoust. Soc. Am. 138, 2678-2691.

Nachtigall, P.E., Lemonds, D.W., and Roitblat, H.L. (**2000**). "Psychoacoustic studies of dolphin and whale hearing," in *Hearing by Whales and Dolphins*, edited by W.W.L. Au, A.N. Popper, and R.R. Fay (Springer, New York, NY), pp. 330-363.

Nachtigall, P.E., Au, W.W.L., Pawloski, J., and Moore, P.W.B. (**1995**). "Risso's dolphin (*Grampus griseus*) hearing thresholds in Kaneohe Bay, Hawaii," in *Sensory Systems of Aquatic Mammals*, edited by R.A. Kastelein, J.A. Thomas, and P.E. Nachtigall (DeSpil, Woerden, The Netherlands), pp. 49-53.

National Research Council (NRC) (**2003**). *Ocean Noise and Marine Mammals* (National Academies Press, Washington, DC). 219 pp.

Parks, S.E., Ketten, D.R., O'Malley, J.T., and Arruda, J. (**2007**). "Anatomical predictions of hearing in the North Atlantic right whale," The Anatomical Record 290, 734–744.

Pfingst, B.E., Hienz, R., Kimm, J., and Miller, J. (**1975**). "Reaction-time procedure for measurement of hearing. I. Suprathreshold functions," J. Acoust. Soc. Am. 57, 421-430.

Popov, V.V., Supin, A.Y., Rozhnov, V.V., Nechaev, D.I., and Sysueva, E.V. (**2014**). "The limits of applicability of the sound exposure level (SEL) metric to temporal threshold shifts (TTS) in beluga whales, *Delphinapterus leucas*," J. Exp. Biol. 217, 1804-1810.

Popov, V.V., Nechaev, D.I., Sysueva, E.V., Rozhnov, V.V., and Supin, A.Y. (**2015**). "Spectrum pattern resolution after noise exposure in a beluga whale, *Delphinapterus leucas*: Evoked potential study," J. Acoust. Soc. Am. 138, 377-388.

Popov, V.V., Supin, A.Y., Wang, D., Wang, K., Dong, L., and Wang, S. (**2011a**). "Noise-induced temporary threshold shift and recovery in Yangtze finless porpoises *Neophocaena phocaenoides asiaeorientalis*," J. Acoust. Soc. Am. 130, 574-584.

Popov, V.V., Supin, A.Y., Pletenko, M.G., Tarakanov, M.B., Klishin, V.O., Bulgakova, T.N., and Rosanova, E.I. (**2007**). "Audiogram variability in normal bottlenose dolphins (*Tursiops truncatus*)," Aquatic Mammal. 33, 24-33.

Popov, V.V., Klishin, V.O., Nechaev, D.I., Pletenko, M.G., Rozhnov, V.V., Supin, A.Y., Sysueva, E.V., and Tarakanov, M.B. (**2011b**). "Influence of acoustic noises on the white whale hearing thresholds," Doklady Biological Sciences 440, 332-334.

Popov, V.V., Supin, A.Y., Rozhnov, V.V., Nechaev, D.I., Sysuyeva, E.V., Klishin, V.O., Pletenko, M.G., and Tarakanov, M.B. (**2013**). "Hearing threshold shifts and recovery after noise exposure in beluga whales *Delphinapterus leucas*," J. Exp. Biol. 216, 1587-1596.

Reichmuth, C. (**2013**). "Equal loudness contours and possible weighting functions for pinnipeds," J. Acoust. Soc. Am. 134, 4210 (A).

Reichmuth, C. and Southall, B.L. (**2012**). “Underwater hearing in California sea lions (*Zalophus californianus*): Expansion and interpretation of existing data,” Mar. Mammal Sci. 28, 358-363.

Reichmuth, C., Holt, M.M., Mulsow, J., Sills, J.M., and Southall, B.L. (**2013**). “Comparative assessment of amphibious hearing in pinnipeds,” Journal of Comparative and Physiology A 199, 491-507.

Reichmuth, C., Ghoul, A., Rouse, A., Sills, J., and Southall, B. (**2016**). “Temporary threshold shift not measured in spotted or ringed seals exposed to single airgun impulses,” J. Acoust. Soc. Am. (in review).

Ridgway, S.H., Carder, D.A., Kamolnick, T., Smith, R.R., Schlundt, C.E., and Elsberry, W.R. (**2001**). “Hearing and whistling in the deep sea: depth influences whistle spectra but does not attenuate hearing by white whales (*Delphinapterus leucas*) (Odontoceti, Cetacea),” J. Exp. Biol. 204, 3829- 3841.

Sauerland, M. and Dehnhardt, G. (**1998**). “Underwater audiogram of a tucuxi (*Sotalia fluviatilis guianensis*),” J. Acoust. Soc. Am. 103, 1199-1204.

Schlundt, C.E., Finneran, J.J., Branstetter, B.K., Dear, R.L., Houser, D.S., and Hernandez, E. (**2008**). “Evoked potential and behavioral hearing thresholds in nine bottlenose dolphins (*Tursiops truncatus*),” J. Acoust. Soc. Am. 123, 3506(A).

Sills, J.M., Southall, B.L., and Reichmuth, C. (**2014**). “Amphibious hearing in spotted seals (*Phoca largha*): underwater audiograms, aerial audiograms and critical ratio measurements,” J. Exp. Biol. 217, 726-734.

Sills, J.M., Southall, B.L., and Reichmuth, C. (**2015**). “Amphibious hearing in ringed seals (Pusa hispida): underwater audiograms, aerial audiograms and critical ratio measurements,” J Exp Biol 218, 2250- 2259.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A., and Tyack, P.L. (**2007**). “Marine mammal noise exposure criteria: initial scientific recommendations,” Aquatic Mammal. 33, 411-521.

Stebbins, W.C. (**1966**). “Auditory reaction time and the derivation of equal loudness contours for the monkey,” Journal of the Experimental Analysis of Behavior 9, 135-142.

Szymanski, M.D., Bain, D.E., Kiehl, K., Pennington, S., Wong, S., and Henry, K.R. (**1999**). “Killer whale (*Orcinus orca*) hearing: Auditory brainstem response and behavioral audiograms,” J. Acoust. Soc. Am. 106, 1134-1141.

Terhune, J.M. (**1988**). “Detection thresholds of a harbour seal to repeated underwater high-frequency, short-duration sinusoidal pulses,” Canadian Journal of Zoology 66, 1578-1582.

Thomas, J., Chun, N., Au, W., and Pugh, K. (**1988**). “Underwater audiogram of a false killer whale (*Pseudorca crassidens*),” J. Acoust. Soc. Am. 84, 936-940.

Tremel, D.P., Thomas, J.A., Ramierez, K.T., Dye, G.S., Bachman, W.A., Orban, A.N., and Grimm, K.K. (**1998**). “Underwater hearing sensitivity of a Pacific white-sided dolphin, *Lagenorhynchus obliquidens*,” Aquatic Mammal. 24, 63-69.

Tubelli, A.A., Zosuls, A., Ketten, D.R., Yamato, M., and Mountain, D.C. (**2012**). “A prediction of the minke whale (*Balaenoptera acutorostrata*) middle-ear transfer function,” J. Acoust. Soc. Am. 132, 3263-3272.

Tyack, P.L. and Clark, C.W. (**2000**). “Communication and acoustic behavior of dolphins and whales,” in *Hearing by Whales and Dolphins*, edited by W.W.L. Au, A.N. Popper, and R.R. Fay (Springer, New York), pp. 156-224.

Ward, W.D. (**1960**). “Recovery from high values of temporary threshold shift,” J. Acoust. Soc. Am. 32, 497-500.

Ward, W.D. (**1997**). “Effects of high-intensity sound,” in *Encyclopedia of Acoustics*, edited by M.J. Crocker (Wiley, New York, NY), pp. 1497-1507.

Ward, W.D., Glorig, A., and Sklar, D.L. (**1958**). “Dependence of temporary threshold shift at 4 kc on intensity and time,” J. Acoust. Soc. Am. 30, 944-954.

Ward, W.D., Glorig, A., and Sklar, D.L. (**1959**). “Temporary Threshold Shift from Octave-Band Noise: Applications to Damage-Risk Criteria,” J. Acoust. Soc. Am. 31, 522-528.

Wartzok, D. and Ketten, D. (**1999**). “Marine mammal sensory systems,” in *The Biology of Marine Mammals*, edited by J.E. Reynolds and S.A. Rommel (Smithsonian Institution Press, Washington, DC).

Wensveen, P.J., Huijser, L.A.E., Hoek, L., and Kastelein, R.A. (**2014**). “Equal latency contours and auditory weighting functions for the harbour porpoise (*Phocoena phocoena*),” J. Exp. Biol. 217, 359-369.

White, M.J., Norris, J., Ljungblad, D.K., Baron, K., and di Sciara, G.N. (**1978**). “Auditory thresholds of two beluga whales (*Delphinapterus leucas*),” (Hubbs Sea World Research Institute, San Diego).

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-01-0188

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
December 2016	Final	

4. TITLE AND SUBTITLE

Auditory Weighting Functions and TTS/PTS Exposure Functions for Marine Mammals Exposed to Underwater Noise

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHORS

J. J. Finneran

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

SSC Pacific
53560 Hull Street
San Diego, CA 92152–5001

8. PERFORMING ORGANIZATION REPORT NUMBER

TR 3026

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Commander, U.S. Fleet Forces Command
1562 Mitscher Ave
Norfolk, Va 23551

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

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14. ABSTRACT

The U.S. Navy's Tactical Training Theater Assessment and Planning (TAP) Program addresses environmental challenges that affect Navy training ranges and operating areas. As part of the TAP process, acoustic effects analyses are conducted to estimate the potential effects of Navy activities that introduce high-levels of sound or explosive energy into the marine environment. Acoustic effects analyses begin with mathematical modeling to predict the sound transmission patterns from Navy sources. These data are then coupled with marine species distribution and abundance data to determine the sound levels likely to be received by various marine species. Finally, criteria and thresholds are applied to estimate the specific effects that animals exposed to Navy-generated sound may experience.

This document describes the rationale and steps used to define proposed numeric thresholds for predicting auditory effects on marine mammals exposed to active sonars, other (non-impulsive) active acoustic sources, explosives, pile driving, and air guns for Phase 3 of the TAP Program. Since the derivation of TAP Phase 2 acoustic criteria and thresholds, important new data have been obtained related to the effects of noise on marine mammal hearing. Therefore, for Phase 3, new criteria and thresholds for the onset of temporary and permanent hearing loss have been developed, following a consistent approach for all species of interest and utilizing all relevant, available data. The effects of noise frequency on hearing loss are incorporated by using auditory weighting functions to emphasize noise at frequencies where a species is more sensitive to noise and de-emphasize noise at frequencies where susceptibility is low.

15. SUBJECT TERMS

marine mammal hearing; acoustic effects analyses; mathematical modeling; sound transmission patterns from Navy sources; proposed numeric thresholds; noise frequency; auditory weighting functions

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			J. J. Finneran
					19B. TELEPHONE NUMBER *(Include area code)*
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Standard Form 298 (Rev. 8/98)
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APPENDIX B: RESEARCH RECOMMENDATIONS FOR IMPROVED THRESHOLDS

In compiling, interpreting, and synthesizing the scientific literature to produce thresholds for this Technical Guidance, it is evident that additional data would be useful for future iterations of this document, since many data gaps still exist (Table B1). The need for the Technical Guidance to identify critical data gaps was also recommended during the initial peer review and public comment period.

Table B1: Summary of currently available marine mammal data.

Hearing Group	Audiogram Data/Number of Species	TTS Data/Number of Species	Sound Sources for TTS Studies
LF Cetaceans	Predictive modeling/2 species	None/0 species	None
MF Cetaceans	Behavioral/8 species	Behavioral/2 species	Octave-band noise; Tones; Mid-frequency sonar; Explosion simulator; Watergun; Airgun
HF Cetaceans	Behavioral/2 species	Behavioral/1 species	Tones, Mid-frequency sonar; Impact pile driver; Airgun*
PW Pinnipeds	Behavioral/5 species	Behavioral/2 species	Octave-band noise; Impact pile driver
OW Pinnipeds	Behavioral/3 species	Behavioral/1 species	Octave-band noise; Arc-gap transducer

* Data collected using AEP methodology (directly incorporated in Technical Guidance, since only data set available).

Below is a list of research recommendations that NMFS believes would help address current data gaps. Some of these areas of recommended research have been previously identified in other publications/reports (e.g., NRC 1994; NRC 2000; Southall et al. 2007; Southall et al. 2009; Hawkins et al. 2014;[38] Houser and Moore 2014; Lucke et al. 2014; Popper et al. 2014;[39] Williams et al. 2014; Erbe et al. 2016; Lucke et al. 2016). Note: Just because there may not be enough information to allow for quantifiable modifications to thresholds associated with many of these recommendations, does not mean these recommendations cannot be incorporated as qualitative considerations within the comprehensive effects analysis.

I. SUMMARY OF RESEARCH RECOMMENDATIONS

1.1 LOW-FREQUENCY CETACEAN HEARING

As previously stated, direct measurements of LF cetacean hearing are lacking. Therefore, hearing predictions for these species are based on other methods (e.g., anatomical studies, predictive models, vocalizations, taxonomy, and behavioral responses to sound). Thus, additional

[38] Although, Hawkins et al. 2014 identifies research gaps for fishes and invertebrates, many of the research recommendations can also be considered for other species, like marine mammals.

[39] Although, Popper et al. 2014 identifies research gaps for fishes and sea turtles, many of the research recommendations can also be considered for other species, like marine mammals.

data[40] collected would be extremely valuable to furthering the understanding of hearing ability within this hearing group and validating other methods for approximating hearing ability. For example, data collected on either stranded or animals associated with subsistence hunts would be extremely useful in confirming current predictions of LF cetacean hearing ability and would allow for the development of more accurate auditory weighting functions (e.g., Do species that vocalize at ultra-low frequencies, like blue and fin whales, have dramatically different hearing abilities than other mysticete species?). Until direct measurements can be made, predictive models based on anatomical data will be the primary means of approximating hearing abilities, with validation remaining a critical component of any modeling exercise (e.g., Cranford and Krysl 2014).

1.2 Hearing Diversity Among Species and Auditory Pathways

A better understanding of hearing diversity among species within a hearing group is also needed (e.g., Mooney et al. 2014) to comprehend how representative certain species (e.g., bottlenose dolphins, harbor porpoise, harbor seals) are of their hearing group as a whole. For example, are there certain species more susceptible to hearing loss from sound (i.e., all members of HF cetaceans), or are there additional delineations needed among the current hearing groups (e.g., deep diving species, etc.)? Having more data from species within a hearing group would also help identify if additional hearing groups are needed. This is especially the case for HF cetaceans where data are only available from four individuals of two species and those individuals have a lower hearing threshold compared to all other hearing groups.

Additionally, having a more complete understanding of how sound enters the heads/bodies of marine mammals and its implication on hearing and impacts of noise among various species is another area of importance (e.g., bone conduction mechanism in mysticetes: Cranford and Krysl 2015; previously undescribed acoustic pathways in odontocetes: Cranford et al. 2008; Cranford et al. 2010; filtering/amplification of transmission pathway: Cranford and Krysl 2012; directional hearing: Renaud and Popper 1975; Au and Moore 1984; Kastelein et al. 2005b).

1.3 Representativeness of Captive Individuals

Data from Castellote et al. (2014), from free-ranging belugas in Alaska, indicate that of the seven healthy individuals tested (3 females/4 males; 1 subadult/6 adults), all had hearing abilities “similar to those of belugas measured in zoological settings.” Similarly, data from Ruser et al. (2017) reported that harbor porpoise live-stranded (15 individuals both males and females; subadults and adults) and wild individuals incidentally caught in pound nets (12 both males and females; subadult and adults) had “the shape of the hearing curve is generally similar to previously published results from behavioral trials.” Thus, from these studies, it appears that for baseline hearing measurements, captive individuals may be appropriate surrogates for free-ranging animals. Additionally, Mulsow et al. (2011) measured aerial hearing abilities of seven stranded California sea lions and found a high degree of intersubject variability but that high-frequency hearing limits were consistent with previously tested captive individuals. However, these are currently the only studies of their kind,[41] and more research is needed to examine if this trend is applicable to other species (Lucke et al. 2016).

1.3.1 Impacts of Age on Hearing

[40] Data should be collected under appropriate permits or authorizations.

[41] NMFS is aware that additional baseline hearing measurements have been recorded for additional free-ranging belugas by Castellote et al. with the analysis still in process. Furthermore, NMFS is aware that audiogram (AEP) data are often obtained during marine mammal stranding events exists, but these have yet to be published.

Hearing loss can result from a variety of factors beyond anthropogenic noise, including exposure to ototoxic compounds (chemicals poisonous to auditory structures), disease and infection, and heredity, as well as a natural part of aging (Corso 1959; Kearns 1977; WGSUA 1988; Yost 2007). High-frequency hearing loss, presumably a normal process of aging that occurs in humans and other terrestrial mammals, has also been demonstrated in captive cetaceans (Ridgway and Carder 1997; Yuen et al. 2005; Finneran et al. 2005b; Houser and Finneran 2006; Finneran et al. 2007b; Schlundt et al. 2011) and in stranded individuals (Mann et al. 2010). Thus, the potential impacts of age on hearing can be a concern when extrapolating from older to younger individuals.

Few studies have examined this phenomenon in marine mammals, particularly in terms of the potential impact of aging on hearing ability and TSs:

- Houser and Finneran (2006) conducted a comprehensive study of the hearing sensitivity of the U.S. Navy bottlenose dolphin population (i.e., tested 42 individuals from age four to 47 years; 28 males/14 females). They found that high-frequency hearing loss typically began between the ages of 20 and 30 years. However, the frequencies where this species is most susceptible to noise-induced hearing loss (i.e., 10 to 30 kHz) are the frequencies where the lowest variability exists in mean thresholds between individuals of different ages.

- Houser et al. (2008) measured hearing abilities of 13 Pacific bottlenose dolphins, ranging in age from 1.5 to 18 years. The authors' reported that "Variability in the range of hearing and age-related reductions in hearing sensitivity and range of hearing were consistent with those observed in Atlantic bottlenose dolphins."

- Mulsow et al. (2014) examined aerial hearing thresholds for 16 captive sea lions, from age one to 26 years, and found that only the two 26-year old individuals had hearing classified as "aberrant" compared to other individuals (i.e., high-frequency hearing loss), which were deemed to have similar hearing abilities to previously measured individuals.

- Additionally, for harbor seals, similar exposure levels associated with TTS onset were found in Kastelein et al. 2012a for individuals of four to five years of age compared to that used in Kastak et al. 2005, which was 14 years old and for belugas in Popov et al. 2014 for an individual of 2 years of age compared to those used in Schlundt et al. 2000, which were 20 to 22 years old or 29 to 31 years old.

From these limited data, it appears that age may not be a significant complicating factor, in terms of assessing TSs for animals of different ages. Nevertheless, additional data are needed to confirm if these data are representative for all species (Lucke et al. 2016).

1.4 ADDITIONAL TTS MEASUREMENTS WITH MORE SPECIES AND/OR INDIVIDUALS

Currently, TTS measurements only exist for four species of cetaceans (bottlenose dolphins, belugas, harbor porpoises, and Yangtze finless porpoise) and three species of pinnipeds (Northern elephant seal, harbor seal, and California sea lion). Additionally, the existing marine mammal TTS measurements are from a limited number of individuals within these species. Having more data from a broader range of species and individuals would be useful to confirm how representative current individuals are of their species and/or entire hearing groups (Lucke et al. 2016). For example, TTS onset thresholds for harbor porpoise (HF cetacean) are much lower compared to other odontocetes (MF cetaceans), and it would be useful to know if all HF cetaceans share these lower TTS onset thresholds or if harbor porpoises are the exception.

Measured underwater hearing of two captive spotted seals (Sills et al. 2014) and two captive ringed seals (Sills et al. 2015) found these species' hearing abilities are comparable to harbor seals. Thus, harbor seals, where TTS data are available, are an appropriate surrogate for ice seal species. As more data become available, this assumption will be re-evaluated.

Finally, cetaceans are often used as surrogates for pinnipeds when no direct data exist. Having more information on the appropriateness of using cetaceans as surrogates for pinnipeds would be useful (i.e., Is there another mammalian group more appropriate?).

1.5 SOUND EXPOSURE TO MORE REALISTIC SCENARIOS

Most marine mammal TTS measurements are for individuals exposed to a limited number of sound sources (i.e., mostly tones and octave-band noise[42]) in laboratory settings. Measurements from exposure to actual sound sources (opposed to tones or octave-band noise) under more realistic exposure conditions (e.g., more realistic exposure durations and/or scenarios, including multiple pulses/pile strikes and at frequencies below 1 kHz where most anthropogenic noise occurs) are needed.

1.5.1 Frequency and Duration of Exposure

In addition to received level, NMFS recognizes that other factors, such as frequency and duration of exposure, are also important to consider within the context of PTS onset thresholds (Table B2). However, there are not enough data to establish numerical thresholds based on these added factors (beyond what has already been included in this document, in terms of marine mammal auditory weighting functions and SEL_{cum} thresholds). When more data become available, it may be possible to incorporate these factors into quantitative assessments.

Further, it has been demonstrated that exposure to lower-frequency broadband sounds has the potential to cause TSs at higher frequencies (e.g., Lucke et al. 2009; Kastelein et al. 2015a; Kastelein et al. 2016). The consideration of duty cycle (i.e., energy per unit time) is another important consideration in the context of exposure duration (e.g., Kastelein et al. 2015b). Having a better understanding of these phenomena would be helpful.

1.5.2 Multiple Sources

Further, a better understanding of the effects of multiple sources and multiple activities on TS, as well as impacts from long-term exposure is needed. Studies on terrestrial mammals indicate that exposure scenarios from complex exposures (i.e., those involving multiple types of sound sources) result in more complicated patterns of NIHL (e.g., Ahroon et al. 1993).

[42] More recent studies (e.g., Lucke et al. 2009; Mooney et al. 2009b; Kastelein et al. 2014a; Kastelein et al. 2014b; Kastelein et al. 2015a; Kastelein et al. 2015b; Finneran et al. 2015; Kastelein et al. 2016; Kastelein et al. 2017b; Kastelein et al. 2017c) have used exposures from more realistic sources, like airguns, impact pile drivers, or tactical sonar.

Table B2: Additional factors for consideration (frequency and duration of exposure) in association with PTS onset thresholds.

I. Frequency*: <u>General Trend Identified</u>: 1) Growth of TS: Growth rates of TS (dB of TTS/dB noise) are higher for frequencies where hearing is more sensitive (e.g., Finneran and Schlundt 2010; Finneran and Schlundt 2013; Kastelein et al. 2014a; Kastelein et al. 2015b)
II. Duration: <u>General Trends Identified</u>: 1) Violation of EEH: Non-impulsive, intermittent exposures require higher SEL_{cum} to induce a TS compared to continuous exposures of the same duration (e.g., Mooney et al. 2009a; Finneran et al. 2010b; Kastelein et al. 2014a) 2) Violation of EEH: Exposures of longer duration and lower levels induce a TTS at a lower level than those exposures of higher level (below the critical level) and shorter duration with the same SEL_{cum} (e.g., Kastak et al. 2005; Kastak et al. 2007; Mooney et al. 2009b; Finneran et al. 2010a; Kastelein et al. 2012a; Kastelein et al. 2012b) 3) Recovery from a TS: With the same SEL_{cum}, longer exposures require longer durations to recover (e.g., Mooney et al. 2009b; Finneran et al. 2010a) 4) Recovery from a TS: Intermittent exposures recover faster compared to continuous exposures of the same duration (e.g., Finneran et al. 2010b; Kastelein et al. 2014a; Kastelein et al. 2015b)
III. Cumulative Exposure: <u>General Trend Identified:</u> 1) Animals may be exposed to multiple sound sources and stressors, beyond acoustics, during an activity, with the possibility of the possibility of additive or synergistic effects (e.g., Sih et al. 2004; Rohr et al. 2006; Chen et al. 2007; Lucke et al. 2016; NRC 2016)

* Frequency-dependent hearing loss and overall hearing ability within a hearing group is taken into account, quantitatively, with auditory weighting functions.

1.5.3 Possible Protective Mechanisms

Nachtigall and Supin (2013) reported that a false killer whale was able to reduce its hearing sensitivity (i.e., conditioned dampening of hearing) when a loud sound was preceded by a warning signal. Nachtigall and Supin (2014) reported a similar finding in a bottlenose dolphin, a beluga (Nachtigall et al. 2016a), and in harbor porpoises (Nacthigall et al. 2016b). Further studies showed that conditioning is associated with the frequency of the warning signal (Nachtigall and Supin 2015), as well as if an animal is able to anticipate when a loud sound is expected to occur after a warning signal (Nachtigall et al. 2016c).

Additionally, Finneran et al. (2015) observed two of the three dolphins in their study displayed “anticipatory” behavior (e.g., head movement) during an exposure sequence to multiple airgun shots. It is unknown if this behavior resulted in some mitigating effects of the exposure. Popov et al. (2016) investigated the impact of prolonged sound stimuli (i.e., 1500 s continuous pip successions vs. 500-msec pip trains) on the beluga auditory system and found that auditory adaptation occurred during exposure (i.e., decrease in amplitude of rate following response associated with evoked potentials) at levels below which TTS onset would likely be induced. The amount of amplitude reduction depended on stimulus duration, with higher reductions occurring during prolonged stimulation. The authors also caution that adaptation will vary with sound parameters. Finneran (2018) confirmed that bottlenose dolphins can “self mitigate” when warned of an upcoming exposure and that mechanism for this mitigation occurs in the cochlea or auditory nerve.

In the wild, potential protective mechanisms have been observed, with synchronous surfacing associated with exposure to playbacks of tactical sonar recorded in long-finned pilot whales (Miller et al. 2012). However, it is unclear how effective this behavior is in reducing received levels (Wensveen et al. 2015).

Thus, marine mammals may have multiple means of reducing or ameliorating the effects noise exposure. However, at this point, directly incorporating them into a comprehensive effects analysis that anticipates the likelihood of exposure ahead of an activity is difficult. More information on these mechanisms, especially associated with real-world exposure scenarios, would be useful.

1.5.4 Long-Term Consequences of Exposure

Kujawa and Liberman (2009) found that with large, but recoverable noise-induced thresholds shifts (maximum 40 dB TS measured by auditory brainstem response (ABR)), sound could cause delayed cochlear nerve degeneration in mice. Further, Lin et al. (2011) reported a similar pattern of neural degeneration in mice after large but recoverable noise-induced TSs (maximum ~50 dB TS measured by ABR), which suggests a common phenomenon in all mammals. The long-term consequences of this degeneration remain unclear.

Another study reported impaired auditory cortex function (i.e., behavioral and neural discrimination of sound in the temporal domain (discriminate between pulse trains of various repetition rates)) after sound exposure in rats that displayed no impairment in hearing (Zhou and Merzenich 2012). Zheng (2012) found reorganization of the neural networks in the primary auditory cortex (i.e., tonotopic map) of adult rats exposed to low-level noise, which suggests an adaptation to living in a noisy environment (e.g., noise exposed rats performed tasks better in noisy environment compared to control rats). Heeringa and van Dijk (2014) reported firing rates in the inferior colliculus of guinea pigs had a different recovery pattern compared to ABR thresholds. Thus, it is recommended that there be additional studies to look at these potential effects in marine mammals (Tougaard et al. 2015).

Finally, it is also important to understand how repeated exposures resulting in TTS could potentially lead to PTS (e.g., Kastak et al. 2008; Reichmuth 2009). For example, occupational noise standards, such as those from the Occupational Safety & Health Administration (OSHA), consider the impact of noise exposure over a lifetime of exposure (e.g., 29 CFR Part 1926 over 40 years). Similar, longer-term considerations are needed for marine mammals.

1.6 Impacts of Noise-Induced Threshold Shifts on Fitness

When considering noise-induced thresholds shifts, it is important to understand that hearing is more than merely the mechanical process of the ear and neural coding of sound (detection). It also involves higher processing and integration with other stimuli (perception) (Yost 2007; Alain and Berstein 2008). Currently, more is known about the aspects of neural coding of sounds compared to the higher-level processing that occurs on an individual level.

Typically, effects of noise exposure resulting in energetic (Williams et al. 2006; Barber et al. 2010) and fitness consequences (increased mortality or decreased reproductive success) are deemed to have the potential to affect a population/stock (NRC 2005; Southall et al. 2007; SMRU Marine 2014) or as put by Gill et al. 2001 “From a conservation perspective, human disturbance of wildlife is important only if it affects survival or fecundity and hence causes a population to decline." The number of individuals exposed and the location and duration of exposure are important factors, as well. To determine whether a TS will result in a fitness consequence requires one to consider several factors.

First, one has to consider the likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS (e.g., realistic exposure scenarios). Richardson et al. (1995) hypothesized that "Disturbance effects are likely to cause most marine mammals to avoid any 'zone of discomfort or nonauditory effects' that may exist" and that "The greatest risk of immediate hearing damage might be if a powerful source were turned on suddenly at full power while a mammal was nearby." It is uncertain how frequently individuals in the wild are experiencing situations where TSs are likely from individual sources (Richardson et al.1995; Erbe and Farmer 2000; Erbe 2002; Holt 2008; Mooney et al. 2009b).

In determining the severity of a TS, it is important to consider the magnitude of the TS, time to recovery (seconds to minutes or hours to days), the frequency range of the exposure, the frequency range of hearing and vocalization for the particular species (i.e., how animal uses sound in the frequency range of anthropogenic noise exposure; e.g., Kastelein et al. 2014b), and their overlap (e.g., spatial, temporal, and spectral). Richardson et al. (1995) noted, "To evaluate the importance of this temporary impairment, it would be necessary to consider the ways in which marine mammals use sound, and the consequences if access to this information were impaired." Thus, exposure to an anthropogenic sound source, may affect individuals and species differently (Sutherland 1996).

Finally, different degrees of hearing loss exist: ranging from slight/mild to moderate and from severe to profound (Clark 1981), with profound loss being synonymous with deafness (CDC 2004; WHO 2015). For hearing loss in humans, Miller (1974) summarized "any injury to the ear or any change in hearing threshold level that places it outside the normal range constitutes a hearing impairment. Whether a particular impairment constitutes a hearing handicap or a hearing disability can only be judged in relation to an individual's life pattern or occupation." This statement can translate to considering effects of hearing loss in marine mammals, as well (i.e., substituting "occupation" for "fitness").

Simply because a hearing impairment may be possible does not necessarily mean an individual will experience a disability in terms of overall fitness consequence. However, there needs to be a better understanding of the impacts of repeated exposures. As Kight and Swaddle (2011) indicate "Perhaps the most important unanswered question in anthropogenic noise research – and in anthropogenic disturbance research, in general – is how repeated exposure over a lifetime cumulatively impacts an individual, both over the short- (e.g. condition, survival) and long- (e.g., reproductive success) term." Thus, more research is needed to understand the true consequences of noise-induced TSs (acute and chronic) to overall fitness.

1.7 Behavior of Marine Mammals Under Exposure Conditions with the Potential to Cause Hearing Impacts

Although assessing the behavioral response of marine mammals to sound is outside the scope of this document, understanding these reactions, especially in terms of exposure conditions having the potential to cause NIHL is critical to be able to predict exposure better. Understanding marine mammal responses to anthropogenic sound exposure presents a set of unique challenges, which arise from the inherent complexity of behavioral reactions. Responses can depend on numerous factors, including intrinsic, natural extrinsic (e.g., ice cover, prey distribution), or anthropogenic, as well as the interplay among factors (Archer et al. 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, hearing sensitivity, sex, age, reproductive status, geographic location, season, health, social behavior, or context.

Severity of behavioral responses can also vary depending on characteristics associated with the sound source (e.g., whether it is moving or stationary, number of sound sources, distance from the source) or the potential for the source and individuals to co-occur temporally and spatially (e.g., persistence or recurrence of the sound in specific areas; how close to shore, region where animals may be unable to avoid exposure, propagation characteristics that are either enhancing or reducing exposure) (Richardson et al. 1995; NRC 2003; Wartzok et al. 2004; NRC 2005; Southall et al. 2007; Bejder et al. 2009).

Further, not all species or individuals react identically to anthropogenic sound exposure. There may be certain species-specific behaviors (e.g., fight or flight responses; particularly behaviorally sensitive species) that make a species or individuals of that species more or less likely to react to anthropogenic sound. Having this information would be useful in improving the recommended accumulations period (i.e., 24 h) and understanding situations where individuals are more likely to be exposed to noise over longer durations and are more at risk for NIHL, either temporary or permanent.

1.8 CHARACTERISTICS OF SOUND ASSOCIATED WITH NIHL AND IMPACTS OF PROPAGATION

It is known as sound propagates through the environment various physical characteristics change (e.g., frequency content with lower frequencies typically propagating further than higher frequencies; pulse length due to reverberation or multipath propagation in shallow and deep water). Having a better understanding of the characteristics of a sound that makes it injurious (e.g., peak pressure amplitude, rise time, pulse duration, etc.; Henderson and Hamernik 1986; NIOSH 1998) and how those characteristics change under various propagation conditions would be extremely helpful in the application of appropriate thresholds and be useful in supporting a better understanding as to how sounds could possess less injurious characteristics further from the source (e.g., transition range).

Further, validation and/or comparison of various propagation and exposure models for a variety of sources would be useful to regulators, who with thresholds that are more complex will be faced with evaluating the results from a multitude of models. This would also allow for a more complete comparison to the methodologies provided in this Technical Guidance. This would allow for a determination of how precautionary these methodologies are under various scenarios and allow for potential refinement.

1.9 NOISE-INDUCED THRESHOLD SHIFT GROWTH RATES AND RECOVERY

TS growth rate data for marine mammals are limited, with higher growth rates for frequencies where hearing is more sensitive (Finneran and Schlundt 2010; Finneran and Schlundt 2013; Kastelein et al. 2015b). Understanding how these trends vary with exposure to more complex sound sources (e.g., broadband impulsive sources) and among various species would be valuable.

Understanding recovery after sound exposure is also an important consideration. Currently, there is a lack of recovery data for marine mammals, especially for exposure to durations and levels expected under real-world scenarios. Thus, additional marine mammal noise-induced recovery data would be useful. A better understanding of likely exposure scenarios, including the potential for recovery, including how long after noise exposure recovery is likely to occur, could also improve the recommended baseline accumulation period.

1.10 METRICS AND TERMINOLOGY

Sound can be described using a variety of metrics, with some being more appropriate for certain sound types or effects compared with others (e.g., Coles et al. 1968; Hamernik et al. 2003; Madsen 2005; Davis et al. 2009; Zhu et al. 2009). A better understanding of the most appropriate metrics for establishing thresholds and predicting impacts to hearing would be useful in confirming the value of providing dual metric thresholds using the PK and weighted SEL_{cum} metrics for impulsive sources. As science advances, additional or more appropriate metrics may be identified and further incorporated by NMFS. However, caution is recommended when comparing sound descriptions in different metrics (i.e., they are not directly comparable). Additionally, the practicality of measuring and applying metrics is another important consideration.

Further, the Technical Guidance's thresholds are based on the EEH, which is known to be inaccurate in some situations. Popov et al. 2014 suggested that RMS SPL multiplied by log duration better described their data than the EEH. Thus, better means of describing the interaction between SPL and duration of exposure would be valuable.

Finally, in trying to define metrics and certain terms (e.g., impulsive and non-impulsive) within the context of the Technical Guidance, NMFS often found difficulties due to lack of universally accepted standards and common terminology. Within the Technical Guidance, NMFS has tried to adopt terminology, definitions, symbols, and abbreviations that reflect those of the American National Standards Institute (ANSI) or more appropriately the more recent International Organization for Standardization (ISO)[43]. Thus, NMFS encourages the further development of appropriate standards for marine application.

1.11 EFFECTIVE QUIET

"Effective quiet" is defined as the maximum sound pressure level that will fail to produce any significant TS in hearing despite duration of exposure and amount of accumulation (Ward et al. 1976; Ward 1991). Effective quiet can essentially be thought of as a "safe exposure level" (i.e., risks for TS are extremely low or nonexistent) in terms of hearing loss[44] (Mills 1982; NRC 1993) and is frequency dependent (Ward et al. 1976; Mills 1982). Effective quiet is an important consideration for the onset TTS and PTS thresholds expressed by the weighted SEL_{cum} metric because if not taken into consideration unrealistically low levels of exposure with long enough exposure durations could accumulate to exceed current weighted SEL_{cum} thresholds, when the likelihood of an actual TS is extremely low (e.g., humans exposed to continuous levels of normal speech levels throughout the day are not typically subjected to TTS from this type of exposure).

Currently, defining effective quiet for marine mammals is not possible due to lack of data. However, a study by Popov et al. 2014 on belugas exposed to half-octave noise centered at 22.5 kHz indicates that effective quiet for this exposure scenario and species might be around 154 dB. In Finneran's (2015) review of NIHL in marine mammals, effective quiet is predicted to vary by species (e.g., below 150 to 160 dB for bottlenose dolphins and belugas; below 140 dB for Yangtze finless porpoise; 124 dB for harbor porpoise; and 174 dB for California sea lions).

As more data become available, they would be useful in contributing to the better understanding of appropriate accumulations periods for the weighted SEL_{cum} metric and NIHL, as well as the potential of low-level (e.g., Coping et al. 2014; Schuster et al. 2015), continuously operating sources (e.g., alternative energy tidal, wave, or wind turbines) to induce noise-induced hearing loss.

[43] This version (2.0) of Technical Guidance is more reflective of ISO 18405 (ISO 2017). ISO 18405 is the preferred standard because it was developed specifically for underwater acoustics, compared with standards developed for airborne acoustics that use different conventions.

[44] Note: "Effective quiet" only applies to hearing loss and not to behavioral response (i.e., levels below "effective quiet" could result in behavioral responses). It also is separate consideration from defining "quiet" areas (NMFS 2009).

1.12 Translating Biological Complexity into Practical Application

Although, not a specific research recommendation, practical application of science is an important consideration. As more is learned about the potential effects of sound on marine mammals, the more complex future thresholds are likely to become. For example, before the 2016 Technical Guidance, NMFS primarily relied on two generic thresholds for assessing auditory impacts, with one for cetaceans (SPL RMS 180 dB) and one for pinnipeds (SPL RMS 190 dB). In this document, these two simple thresholds have now been replaced by ten PTS onset thresholds (with dual metrics for impulsive sounds), including the addition of auditory weighting functions. Although, these thresholds better represent the current state of knowledge, they have created additional challenges for implementation. Practical application always needs to be weighed against making thresholds overly complicated (cost vs. benefit considerations). The creation of tools to help ensure action proponents, as well as managers apply complex thresholds correctly, is a critical need.

Additionally, there is always a need for basic, practical acoustic training opportunities for action proponents and managers (most acoustic classes available are for students within an academic setting and not necessarily those who deal with acoustics in a more applied manner). Having the background tools and knowledge to be able to implement the Technical Guidance is critical to this document being a useful and effective tool in assessing the effects of noise on marine mammal hearing.

APPENDIX C: TECHNICAL GUIDANCE REVIEW PROCESSES: PEER REVIEW, PUBLIC COMMENT, AND REVIEW UNDER EXECUTIVE ORDER 13795

The Technical Guidance (NMFS 2016a) before its finalization in 2016 went through several stages of peer review and public comment. Additionally, this document underwent further review under E0 13795.

I. PEER REVIEW PROCESS

The President's Office Management and Budget (OMB 2005) states, "Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. It is a form of deliberation involving an exchange of judgments about the appropriateness of methods and the strength of the author's inferences. Peer review involves the review of a draft product for quality by specialists in the field who were not involved in producing the draft."

The peer review of this document was conducted in accordance with NOAA's Information Quality Guidelines[45] (IQG), which were designed for "ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the agency" (with each of these terms defined within the IQG). Further, the IQG stipulate that "To the degree that the agency action is based on science, NOAA will use (a) the best available science and supporting studies (including peer-reviewed science and supporting studies when available), conducted in accordance with sound and objective scientific practices, and (b) data collected by accepted methods or best available methods." Under the IQG and in consistent with OMB's Final Information Quality Bulletin for Peer Review (OMB Peer Review Bulletin (OMB 2005), the Technical Guidance was considered a Highly Influential Scientific Assessments (HISA),[46] and peer review was required before it could be disseminated by the Federal Government. OMB (2005) notes "Peer review should not be confused with public comment and other stakeholder processes. The selection of participants in a peer review is based on expertise, with due consideration of independence and conflict of interest."

The peer review of the Technical Guidance (NMFS 2016a) consisted of three independent reviews covering various aspects of the document: 1) There was an initial peer review of the entire draft Guidance in 2013, 2) a second peer review in March/April 2015 that focused on newly available science from the Finneran Technical Report (Finneran 2016; See Appendix A), and 3) a third peer review in April 2015 in response to public comments received during the initial public comment period, which focused on a particular technical section relating to the proposed application of impulsive and non-impulsive PTS onset thresholds based on physical characteristics at the source and how those characteristics change with range.[47] Upon completion of the three peer reviews, NMFS was required to post and respond to all peer reviewer comments received via three separate Peer Review Reports.

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[45] NOAA's Information Quality Guidelines.

[46] "Its dissemination could have a potential impact of more than $500 million in any one year on either the public or private sector; or that the dissemination is novel, controversial, or precedent-setting; or that it has significant interagency interest" (OMB 2005). The Technical Guidance is not a regulatory action subject to a cost-benefit analysis under Executive Orders12866 and 13563. The Technical Guidance was classified as a HISA because it was novel and precedent setting, not due to the potential financial implications.

[47] Note: Upon evaluation of public comment received during the Technical Guidance's second public comment period (July 2015), NMFS decided to postpone implementing this methodology until more data were available to support its use.

1.1 2013 Initial Peer Review (Associated with 2013 Draft Guidance)

For the initial peer review of this document (July to September 2013), potential qualified peer reviewers were nominated by a steering committee put together by the MMC. The steering committee consisted of MMC Commissioners and members of the Committee of Scientific Advisors (Dr. Daryl Boness, Dr. Douglas Wartzok, and Dr. Sue Moore).

Nominated peer reviewers were those with expertise marine mammalogy, acoustics/bioacoustics, and/or acoustics in the marine environment. Of the ten nominated reviewers, four volunteered, had no conflicts of interest, had the appropriate area of expertise,[48] and were available to complete an individual review (Table C1). The focus of the peer review was on the scientific/technical studies that have been applied and the manner that they have been applied in this document.

Table C1: Initial peer review panel.

Name	Affiliation
Dr. Paul Nachtigall	University of Hawaii
Dr. Doug Nowacek	Duke University
Dr. Klaus Lucke*	Wageningen University and Research (The Netherlands)
Dr. Aaron Thode	Scripps Institution of Oceanography

* Present affiliation: Curtin University (Australia).

Peer reviewers' comments and NMFS' responses to the comments, from this initial peer review, can be found at: Link to Technical Guidance's Peer Review Plan.

1.2 2015 Second Peer Review (Review of the Finneran Technical Report)

For their Phase 3 Acoustic Effects Analysis, the U.S. Navy provided NMFS with a technical report, by Dr. James Finneran, describing their proposed methodology for updating auditory weighting functions and subsequent numeric thresholds for predicting auditory effects (TTS/PTS thresholds) on marine animals exposed to active sonars, other (non-impulsive) active acoustic sources, explosives, pile driving, and air guns utilized during Navy training and testing activities.

Upon evaluation, NMFS preliminarily determined that the proposed methodology, within the Finneran Technical Report (Finneran 2016), reflected the scientific literature and decided to incorporate it into the Technical Guidance. Before doing so, we commissioned an independent peer review of the Finneran Technical Report (i.e. second peer review). Note: Reviewers were not asked to review the entire Technical Guidance document.

For the second peer review (March to April 2015), NMFS again requested the assistance of the MMC to nominate peer reviewers. As with the initial peer review, potential qualified peer reviewers were nominated by a steering committee put together by the MMC, which consisted of MMC Commissioners and members of the Committee of Scientific Advisors (Dr. Daryl Boness, Dr. Douglas Wartzok, and Dr. Sue Moore).
Nominated peer reviewers were those with expertise[49] specifically in marine mammal hearing (i.e., behavior and/or AEP) and/or noise-induced hearing loss. Of the twelve nominated

[48] Reviewer credentials are posted at: Link to Technical Guidance's Peer Review Plan.

[49] Reviewer credentials are posted at: Link to Technical Guidance's Peer Review Plan.

reviewers, four volunteered, had not conflicts of interest, had the appropriate area of expertise, and were available to complete an individual review of the Finneran Technical Report (Table C2).

Table C2: Second peer review panel.

Name	Affiliation
Dr. Whitlow Au	University of Hawaii
Dr. Colleen Le Prell	University of Florida*
Dr. Klaus Lucke	Curtin University (Australia)
Dr. Jack Terhune	University of New Brunswick (Canada)

*Affiliation during initial review (Affiliation during follow-up peer review: The University of Texas at Dallas.

Peer reviewers' comments and NMFS' responses to the comments, from the second peer review, can be found at: Link to Technical Guidance's Peer Review Plan.

1.2.1 2016 Follow-Up to Second Peer Review

Concurrent with the Technical Guidance's third public comment period (see Section 2.3 of this appendix), a follow-up peer review was conducted. The focus of this peer review was whether the 2016 Proposed Changes to the Technical Guidance, associated with the third public comment period, would substantially change any of the peer reviewers' comments provided during their original review (i.e., peer reviewers were not asked to re-review the Finneran Technical Report). Additionally, peer reviewers were not asked to comment on any potential policy or legal implications of the application of the Technical Guidance, or on the amount of uncertainty that is acceptable or the amount of precaution that should be embedded in any regulatory analysis of impacts.

All four previous peer reviewers were available to perform the follow-up peer review. Peer reviewers' comments and NMFS' responses to the comments, from this follow-up peer review, can be found at: Link to Technical Guidance's Peer Review Plan.

1.3 2015 Third Peer Review (Review of Transition Range Methodology)

During the Technical Guidance's initial public comment period, NMFS received numerous comments relating to how the Technical Guidance classifies acoustic sources based on characteristics at the source (i.e., non-impulsive vs. impulsive). Many expressed concern that as sound propagates through the environment and eventually reaches a receiver (i.e., marine mammal) that physical characteristics of the sound may change and that NMFS' categorization may not be fully reflective of real-world scenarios. Thus, NMFS re-evaluated its methodology for categorizing sound sources to reflect these concerns. Thus, a third peer review focused on particular technical section relating to the Technical Guidance's proposed application of impulsive and non-impulsive PTS onset thresholds based on physical characteristics at the source and how those characteristics change with range (i.e., transition range). Note: Reviewers were not asked to review the entire Technical Guidance document.

Since the focus of the third peer review was focused on the physical changes a sound experiences as it propagates through the environment, the Acoustical Society of America's Underwater Technical Council was asked to nominate peer reviewers with expertise in underwater sound propagation and physical characteristics of impulsive sources, especially high explosives, seismic airguns, and/or impact pile drivers. Of the six nominated reviewers, two volunteered, were available, had no conflicts of interest, and had the appropriate area of expertise[50] to complete an individual review of the technical section (Table C3).

Additionally, NMFS wanted peer reviewers with expertise in marine and terrestrial mammal noise-induced hearing loss to review this technical section and ensure the proposed methodology was ground-truthed in current biological knowledge. Thus, NMFS re-evaluated peer reviewer nominees previously made by the MMC for the first and second peer reviews. From this list, two reviewers volunteered, were available, had no conflicts of interest, and had the appropriate area of expertise to serve as peer reviewers (Table C3).

Table C3: Third peer review panel.

Name	Affiliation
Dr. Robert Burkard	University at Buffalo
Dr. Peter Dahl*	University of Washington
Dr. Colleen Reichmuth+	University of California Santa Cruz
Dr. Kevin Williams*	University of Washington

* Peer reviewers with expertise in underwater acoustic propagation.

+ Dr. Reichmuth was an alternate on the MMC original peer reviewer nomination list.

Peer reviewers' comments and NMFS' responses to the comments, from the third peer review, can be found at: Link to Technical Guidance's Peer Review Plan.

Note: In response to public comments made during the second public comment period, NMFS decided to withdraw its proposed transition range methodology until more data can be collected to better support this concept (i.e., see Appendix B: Research Recommendations).

1.4 CONFLICT OF INTEREST DISCLOSURE

Each peer reviewer (i.e., initial, second, and third peer review) completed a conflict of interest disclosure form. It is essential that peer reviewers of NMFS influential scientific information (ISI) or HISA not be compromised by any significant conflict of interest. For this purpose, the term "conflict of interest" means any financial or other interest which conflicts with the service of the individual because it (1) could significantly impair the individual's objectivity or (2) could create an unfair competitive advantage for any person or organization. No individual can be appointed to review information subject to the OMB Peer Review Bulletin if the individual has a conflict of interest that is relevant to the functions to be performed.

The following website contains information on the peer review process including: the charge to peer reviewers, peer reviewers' names, peer reviewers' individual reports, and NMFS' response to peer reviewer reports.

II. PUBLIC COMMENT PERIODS

In addition to the peer review process, NMFS recognizes the importance of feedback from action proponents/stakeholders and other members of the public. The focus of the public comment process was on both the technical aspects of the document, as well as the implementation of the science in NMFS' policy decisions under the various applicable statutes. The first two public

[50] Reviewer Credentials.

comment periods were held after the peer review to ensure the public received the most scientifically sound product for review and comment. A third public focused comment period was held after incorporation of recommendations made by NMFS and Navy scientists (SSC-PAC) during further evaluation of the Finneran Technical Report after the second public comment period. During this third public comment period, there was a concurrent follow-up peer review. See section 1.2.1 above.

2.1 2013/2014 Initial Public Comment Period (Associated with 2013 Draft Technical Guidance)

A public meeting/webinar was held to inform interested parties and solicit comments on the first publicly available version of the Draft Technical Guidance. The meeting/webinar was held on January 14, 2014, in the NOAA Science Center in Silver Spring, Maryland. The presentation and transcript from this meeting is available electronically.

This public comment period was advertised via the Federal Register and originally lasted 30 days, opening on December 27, 2013 (NMFS 2013). During this 30-day period, multiple groups requested that the public comment period be extended beyond 30 days. Thus, the public comment period was extended an additional 45 days and closed on March 13, 2014 (NMFS 2014).

2.1.1 Summary of Public Comments Received

A total of 129[51] comments were received from individuals, groups, organizations, and affiliations. Twenty-eight of these were in the form of a letter, spreadsheet, or individual comment submitted by representatives of a group/organization/affiliation (some submitted on behalf of an organization and/or as an individual). Those commenting included: 11 members of Congress; eight state/federal/international government agencies; two Alaskan native groups; seven industry groups; five individual subject matter experts; a scientific professional organization; 12 non-governmental organizations; an environmental consulting firm; and a regulatory watchdog group. Each provided substantive comments addressing technical aspects or issues relating to the implementation of thresholds, which were addressed in the Final Technical Guidance or related Federal Register Notice.[52]

Of those not mentioned above, an additional 101 comments were submitted in the form of a letter or individual comment. Twelve of these comments specifically requested an extension of the original 30-day public comment period (a 45-day extension to original public comment period was granted). The remaining 89 comments were not directly applicable to the Technical Guidance (e.g., general concern over impacts of noise on marine mammals from various industry or military activities) and were not further addressed. Specific comments can be viewed on Regulations.gov.

NMFS' responses to substantive comments made during the initial public comment period were published in the Federal Register located on the following web site in conjunction with the Final Technical Guidance.

[51] Of this number, one comment was directed to the Federal Communications Commission (i.e., not meant for the Technical Guidance) and one commenter submitted their comments twice. In addition, one comment was not included in this total, nor posted because it contained threatening language.

[52] With the updates made to the Technical Guidance as a result of the second and third peer reviews, some of the comments made during the initial public comment period were no longer relevant and as such were not addressed.

2.2 2015 Second Public Comment Period (Associated with 2015 Draft Technical Guidance)

Because of the significant changes made to the Draft Technical Guidance from the two additional peer reviews, NMFS proposed a second 45-day public comment, which occurred in the summer of 2015. Notice of this public comment period was published in the Federal Register on July 31, 2015, and closed September 14, 2015 (NMFS 2015).

2.2.1 Summary of Public Comments Received

A total of 20 comments were received from individuals, groups, organizations, and affiliations in the form of a letter or individual comment submitted by representatives of a group/organization/affiliation (some submitted on behalf of an organization and/or as an individual). Those commenting included: two federal agencies; four industry groups; seven subject matter experts; a scientific professional organization; seven non-governmental organizations; two Alaskan native groups; an environmental consulting firm; and a regulatory watchdog group. Each provided substantive comments addressing technical aspects and/or issues relating to the implementation of thresholds, which were addressed in the Final Technical Guidance or related Federal Register Notice.

Of those not mentioned above, an additional four comments were submitted in the form of a letter or individual comment. One of these comments specifically requested an extension of the 45-day public comment period, while the remaining three comments were not directly applicable to the Technical Guidance (e.g., general concern over impacts of noise on marine mammals from various industry or military activities) and were not further addressed. Specific comments can be viewed on Regulations.gov.

NMFS responses to substantive comments made during the second public comment period were published in the Federal Register located on the following web site in conjunction with the Final Technical Guidance: Link to Technical Guidance web page.

2.3 2016 Third Public Comment Period (Associated with 2016 Proposed Changes From Draft Technical Guidance)[53]

While NMFS was working to address public comments and finalize the Technical Guidance, after the second public comment period, the Finneran Technical Report was further evaluated internally by NMFS, as well as externally by Navy scientists (SSC-PAC). As a result, several recommendations/modifications were suggested.

The recommendations included:

- Modification of methodology to establish predicted the composite audiogram and weighting/exposure functions for LF cetaceans
- Modification of the methodology used to establish thresholds for LF cetaceans
- Movement of the white-beaked dolphin (*Lagenorhynchus albirostris*) from MF to HF cetaceans[54]

[53] Concurrent with this third public comment period, NMFS requested that the peer reviewers of the Finneran Technical Report review the Draft Technical Guidance's proposed changes and indicate if the revisions would significantly alter any of the comments made during their original review (i.e., follow-up to second peer review).

[54] Upon re-evaluation and considering comments made during the third public comment period, it was decided this move was not fully supported (i.e., move not supported to the level of that of the other two species in this family). Thus, this species remains a MF cetacean.

- Inclusion of a newly published harbor porpoise audiogram (HF cetacean) from Kastelein et al. 2015c

- The exclusion of multiple data sets, based on expert evaluation, from the phocid pinniped auditory weighting function

- Removal of PK thresholds for non-impulsive sounds

- Use of dynamic range to predict PK thresholds for hearing groups where impulsive data did not exist.

After consideration of these recommendations, NMFS proposed to update the Draft Technical Guidance to reflect these suggested changes and solicited public comment on the revised sections of the document via a focused 14-day public comment period. This public comment period was advertised via the Federal Register and opened on March 16, 2016, and closed March 30, 2016 (NMFS 2016b).

2.3.1 Summary of Public Comments Received

A total of 20[55] comments were received from individuals, groups, organizations, and affiliations in the form of a letter or individual comment submitted by representatives of a group/organization/affiliation (some submitted on behalf of an organization and/or as an individual). Those commenting included: two federal agencies; seven industry groups; three subject matter experts; a scientific professional organization; and nine non-governmental organizations. Each provided substantive comments addressing technical aspects and/or issues relating to the implementation of thresholds, which were addressed in the Final Technical Guidance or related Federal Register Notice.

Of those not mentioned above, an additional comment was submitted from a member of the public in the form of an individual comment. Three of these comments specifically requested an extension[56] of the 14-day public comment period. Specific comments can be viewed on Regulations.gov.

NMFS responses to substantive comments made during the third public comment period were published in the Federal Register located on the following web site in conjunction with the Final Technical Guidance.

2.4 Changes to Technical Guidance as a Result of Public Comments

Public comment provided NMFS with valuable input during the development of the Technical Guidance. As a result of public comments, numerous changes were incorporated in the Final Technical Guidance, with the most significant being:

- Re-examination and consideration of LF auditory weighting function and thresholds throughout the public comment process

[55] One group of commenters had trouble in submitting their public comments via regulations.gov. As a result, their duplicate comments were submitted three times and were counted toward this total of 20 public comments.

[56] The majority of the 20 comments received requested an extension of the public comment period. Three comments were from industry groups that only requested an extension and never provided additional comments (i.e., others in additional to requesting an extension provided substantive comments).

- Updated methodology (dynamic range) for approximating PK thresholds for species where TTS data from impulsive sources were not available

- Removal of PK thresholds for non-impulsive sources

- Addition of an appendix providing research recommendations

- Adoption of a consistent accumulation period (24-h)

- More consistent means of defining generalized hearing range for each marine mammal hearing group based on ~65 dB threshold from the normalized composite audiogram.

- Modification to reflect ANSI standard symbols and abbreviations.

- Withdraw of the proposed transition range methodology (July 2015 Draft) until more data can be collected to better support this concept. Instead, this concept has been moved to Research Recommendations (Appendix B).

- Replacement of alternative thresholds with weighting factor adjustments (WFAs) that more accurately allow those incapable of fully implementing the auditory weighting functions to implement this concept (Technical Guidance; Appendix D).

III. REVIEW UNDER EXECUTIVE ORDER 13795

Presidential Executive Order (EO) 13795, Implementing an America-First Offshore Energy Strategy (82 FR 20815; April 28, 2017), stated in section 2 that “It shall be the policy of the United States to encourage energy exploration and production, including on the Outer Continental Shelf, in order to maintain the Nation’s position as a global energy leader and foster energy security and resilience for the benefit of the American people, while ensuring that any such activity is safe and environmentally responsible.” Section 10 of the EO called for a review of the 2016 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Technical Guidance; NMFS 2016a) as follows: “The Secretary of Commerce shall review [Technical Guidance] for consistency with the policy set forth in Section 2 of this order and, after consultation with the appropriate Federal agencies, take all steps permitted by law to rescind or revise that guidance, if appropriate.”

3.1 REVIEW OF 2016 TECHNICAL GUIDANCE UNDER EO 13795

3.1.1 2017 Public Comment Period

To assist the Secretary in carrying out that directive under EO 13795, NMFS held a 45-day public comment period (82 FR 24950; May 31, 2017) to solicit comments on the Technical Guidance (NMFS 2016a) for consistency with the EO’s policy.

3.1.1.1 Summary of Comments Received

NMFS received 62 comments directly related to the 2016 Technical Guidance.[57] Comments were submitted by Federal agencies (Bureau of Ocean Energy Management (BOEM), U.S. Navy,

[57] NMFS received an additional 137 comments during the Technical Guidance’s public comment period relating to an overlapping public comment period for “Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Geophysical Surveys in the Atlantic Ocean” (82 FR 26244). Thus, the majority (approximately 70%) of public comments NMFS received during the Technical Guidance’s public comment period related to the proposed action of oil and gas activity in the Atlantic.

MMC), oil and gas industry representatives, Members of Congress, subject matter experts, non-governmental organizations, a foreign statutory advisory group, a regulatory advocacy group, and members of the public (Table C4).

Table C4: Summary of commenters

Commenter Category	Specific Commenter
U.S. Federal agencies	Bureau of Ocean Energy Management; Marine Mammal Commission; U.S. Navy
Members of Congress*	22 members
Oil & gas industry representatives	American Petroleum Institute/International Association of Geophysical Contractors/Alaska Oil and Gas Association/National Ocean Industries Association
Non-Governmental Organization	Natural Resources Defense Council/The Human Society of the US/Whale and Dolphin Conservation; Ocean Conservation Research
Regulatory advocacy group	Center for Regulatory Effectiveness
Foreign statutory advisor Group	Joint Nature Conservation Committee
Subject matter experts (SME)	Marine scientist/mammologist; Geophysicist/Geochemist; Acoustician
General public	47 members

; indicates separate comments, while / indicates comments submitted together.

* Letter sent directly to Secretary Ross (i.e., not submitted to Regulations.gov).

Most of the comments (85%) recommended no changes to the Technical Guidance, and no public commenter suggested rescinding the Technical Guidance. The U.S. Navy, Marine Mammal Commission, Members of Congress, and subject matter experts expressed support for the Technical Guidance's thresholds and weighting functions as reflecting the best available science. The remaining comments (15%) focused on additional scientific publications for consideration or recommended revisions to improve implementation of the Technical Guidance. All public comments received during this review can be found at: Regulations.gov.

3.1.2 2017 Federal Interagency Consultation

Further, to assist the Secretary in carrying out the directive under EO 13795, NMFS invited, via letter, 15 Federal agencies to participate in an in-person meeting (i.e., Interagency Consultation) on September 25, 2017, at NMFS Headquarters in Silver Spring, Maryland, to serve as a formal forum to discuss this document and provide additional comments. Ten of the eleven[58] expected Federal agencies participated in this meeting (Table C5).

[58] The U.S Fish & Wildlife Service, U.S. Coast Guard, and The U.S. Environmental Protection Agency declined NMFS' invitation to participate. U.S. Department of Energy did not reply.

Table C5: Ten Federal agency attendees*

Bureau of Ocean Energy Management	National Science Foundation
Department of State	U.S. Air Force
Federal Highway Administration	U.S. Army Corps of Engineers
Marine Mammal Commission	U.S. Geological Survey+
National Park Service	U.S. Navy

*Bureau of Safety and Environmental Enforcement did not attend.
+USGS participated via webinar/teleconference.

3.1.2.1 Summary of Interagency Comments

At the Federal Interagency Consultation, none of the Federal agencies recommended rescinding the Technical Guidance. Federal agencies were supportive of the Technical Guidance's thresholds and auditory weighting functions and the science behind their derivation and were appreciative of the opportunity to provide input. Comments received at the meeting focused on improvements to implementation of the Technical Guidance and recommendations for future working group discussions to address implementation of the Technical Guidance based on any new scientific information as it becomes available.

3.2 Revisions to the 2016 Technical Guidance as a Result of Review Under EO 13795

NMFS acknowledges the importance of supporting sustainable ocean use, such as energy exploration and production on the Outer Continental Shelf, provided activities are conducted in a safe and environmentally responsible manner. Our development and implementation of the Technical Guidance are consistent with allowing activities vital to our nation's security and economy to proceed, including those mentioned in EO 13795, and allows for decisions to be made based upon the best available information.

The EO 13795 review process provided NMFS the opportunity to acquire valuable feedback from the public/stakeholders and Federal agencies on the 2016 Technical Guidance and its implementation, since its finalization. During both NMFS' public comment period and Federal Interagency Consultation, neither the public/stakeholders nor Federal agencies recommended the 2016 Technical Guidance (NMFS 2016a) be rescinded. Most comments were supportive of the thresholds and auditory weighting functions within 2016 Technical Guidance. Of those providing comments, most offered recommendations for improving the clarity of the document and facilitating implementation.

During both the public comment period and the Federal Interagency Consultation, three key topic areas were raised: (1) the limited scientific data on the impacts of sound on LF cetacean hearing; (2) the need to determine the accumulation period for all species of marine mammals; and (3) the need to improve the 2016 Technical Guidance's optional User Spreadsheet tool. Commenters also encouraged the agency to establish working groups to address these data gaps and future needs.

NMFS' evaluation of comments received during this process affirms that the Technical Guidance is based on the best available science. Nevertheless, based on consideration of comments received and per the approval of the Secretary of Commerce, NMFS made the following revisions to the 2016 Technical Guidance and/or companion User Spreadsheet tool to improve implementation and facilitate its use by action proponents, thereby further advancing the policy in section 2 of EO. 13795 (as reflected in this 2018 Technical Guidance, Version 2.0):

- To promote a more realistic assessment of the potential impacts of sound on marine mammal hearing, using the Technical Guidance, NMFS will re-evaluate implementation of the default 24-h accumulation period and plans to convene a working group later in 2018 to investigate means for deriving more realistic accumulation periods.

- To understand further the impacts of sound on hearing of LF cetaceans, a marine mammal group where no direct data on hearing exists, NMFS plans to convene a working group later in 2018 to explore this topic. NMFS will incorporate any changes that may result from the working group's efforts in future updates to the Technical Guidance.

- NMFS created a new User Manual for NMFS' User Spreadsheet tool that provides detailed instructions and examples on how to use this optional tool. This new User Manual (NMFS 2018) is available at: Link to Technical Guidance web page. NMFS plans to submit the User Manual for public comment later in 2018 to gain input from stakeholders and inform future versions of the User Manual.

- NMFS issued an updated optional User Spreadsheet tool to provide PTS onset isopleths associated with the Technical Guidance's PK thresholds associated with impulsive sources, so action proponents will not have to perform this calculation separately. The modified version (Version 2.0) of the optional User Spreadsheet tool is available at: Link to Technical Guidance web page.

- NMFS issued an updated optional User Spreadsheet tool to include a custom sheet for vibratory pile driving activities to facilitate the ease of assessing PTS onset for this commonly used sound source. Custom tabs for multiple and single explosives/detonations were also added to the updated optional User Spreadsheet tool. These custom tabs, within the optional User Spreadsheet tool (Version 2.0), are available at: Link to Technical Guidance web page.

- NMFS summarized and conducted a preliminary analysis of the relevant scientific literature published since the 2016 Technical Guidance's finalization (Section 3.1.1).

- NMFS modified the Technical Guidance threshold's symbols and glossary to be more reflective of the International Organization for Standardization (ISO) 2017 Underwater Acoustics – Terminology standard (ISO 18405), which was specifically developed for underwater acoustics.

- Appendix A has been updated to include the Navy's finalized version (Technical Report 3026, December 2016) of their Technical Report that NMFS used to derive the Technical Guidance's thresholds and auditory weighting functions.

- To increase understanding of how regulatory programs use and recommend the use of the Technical Guidance, which would facilitate implementation and thereby further advance the Policy in section 2 of EO 13795, NMFS is developing a separate document describing how the Technical Guidance is used in the MMPA incidental take authorization process to estimate "take" and inform mitigation decisions.. This document, once available, will be found at: Link to Incidental Take Authorization web page.

Note: Several comments received during both the public comment period and Federal Interagency Consultation were beyond the scope of the Technical Guidance and/or its review under section 10 of EO 13795. However, NMFS is evaluating these recommendations and determining the best way to address them via other means outside this review.

APPENDIX D: ALTERNATIVE METHODOLOGY

I. INTRODUCTION

This Appendix is provided to assist action proponents in the application of thresholds presented in this Technical Guidance. Since the adoption of NMFS' original thresholds for assessing auditory impacts (i.e., RMS SPL: 180 dB for cetaceans; 190 dB for pinnipeds), the understanding of the effects of noise on marine mammal hearing has greatly advanced (e.g., Southall et al. 2007; Finneran 2015; Finneran 2016) making it necessary to re-examine the current state of science and our thresholds. However, NMFS recognizes in updating our thresholds to reflect the scientific literature, they have become more complex.

This Appendix provides a set of alternative tools, examples, and weighting factor adjustments (WFAs) to allow action proponents with different levels of exposure modeling capabilities to be able to apply NMFS' thresholds for the onset of PTS for all sound sources. These tools are incorporated in NMFS' optional User Spreadsheet tool, with examples provided in the recently developed User Spreadsheet Manual (NMFS 2018)[59].

There is no obligation to use the optional User Spreadsheet tool, and the use of more sophisticated exposure modeling or consideration of additional action- or location-specific factors, if possible, is encouraged.

II. WEIGHTING FACTOR ADJUSTMENT ASSOCIATED WITH SEL_{CUM} THRESHOLDS

Numerical criteria presented in the Technical Guidance consist of both an acoustic threshold and auditory weighting function associated with the SEL_{cum} metric. NMFS recognizes that the implementation of marine mammal auditory weighting functions represents a new factor for consideration, which may extend beyond the capabilities of some action proponents. Thus, NMFS has developed simple weighting factor adjustments (WFA) for those who cannot fully apply auditory weighting functions associated with the SEL_{cum} metric.

WFAs consider marine mammal auditory weighting functions by focusing on a single frequency. This will typically result in similar, if not identical, predicted exposures for narrowband sounds or higher predicted exposures for broadband sounds, since only one frequency is being considered, compared to exposures associated with the ability to fully incorporate the Technical Guidance's auditory weighting functions.

WFAs use the same thresholds contained in the Technical Guidance and allow adjustments to be made for each hearing group based on source-specific information.

NMFS has provided a companion User Spreadsheet tool and User Manual for the User Spreadsheet tool to help action proponents incorporate WFAs to determine isopleths for PTS onset associated with their activity: Link to Technical Guidance web page.

2.1 APPLICATION FOR NARROWBAND SOUNDS

For narrowband sources, the selection of the appropriate frequency for consideration associated with WFAs is straightforward. WFAs for a narrowband sound would take the auditory weighting

[59] The most recent version of the optional User Spreadsheet tool and companion User Manual (NMFS 2018) is available at: Link to Technical Guidance web page.

function amplitude, for each hearing group, associated with the particular frequency of interest and use it to make an adjustment to reflect the hearing's group susceptibility to that narrowband sound.

As an example, a 1 kHz narrowband sound would result in the following WFAs:

- LF cetaceans: -0.06 dB
- MF cetaceans: -29.11 dB
- HF cetaceans: -37.55 dB
- Phocid pinnipeds: -5.90 dB
- Otariid pinnipeds: -4.87 dB

As this example illustrates, WFAs always result in zero or a negative dB amplitude. Additionally, the more a sound's frequency is outside a hearing group's most susceptible range (most susceptible range is where the weighting function amplitude equal zero), the more negative WFA that results (i.e., in example above 1 kHz is outside the most susceptible range for MF and HF cetaceans but in the most susceptible range for LF cetaceans; Figure D1). Further, the more negative WFA that results will lead to a smaller effect distance (isopleth) compared to a less negative or zero WFA. In other words, considering an identical weighted SEL_{cum} acoustic threshold, a more negative WFA (i.e., source outside most susceptible frequency range) will result in a smaller effect distance (isopleth) compared to one that is less negative or closer to zero (i.e., source inside most susceptible frequency range; Figure D2).

Note: NMFS reminds action proponents to be aware and consider that sources may not always adhere to manufacturer specifications and only produce sound within the specified frequency (i.e., often sources are capable of producing sounds, like harmonics and subharmonics, outside their specified bands; Deng et al. 2014; Hastie et al. 2014). If it is unclear whether a source is narrowband or not, please consult with NMFS.

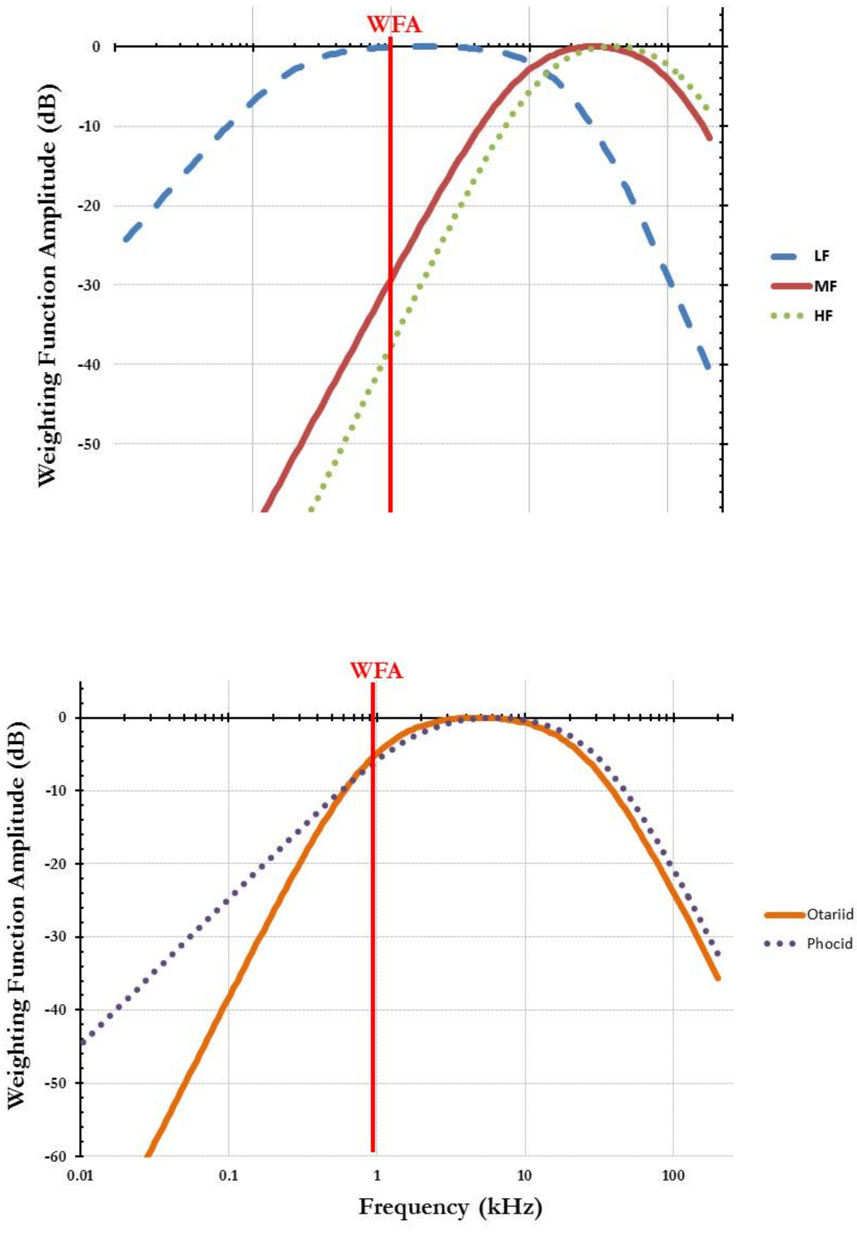

Figure D1: **Example illustrating concept of weighting factor adjustment at 1 kHz (solid red line) with cetacean (top) and pinniped (bottom) auditory weighting functions.**

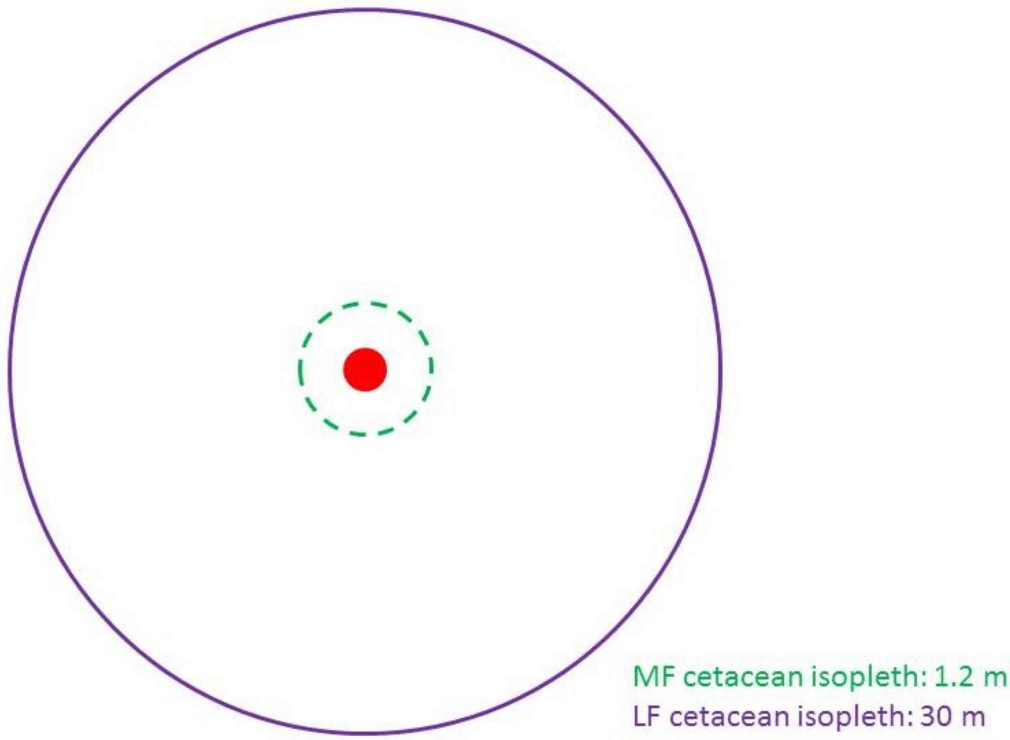

Figure D2: Simple example illustrating concept of weighting factor adjustment on isopleths for LF and MF cetaceans using hypothetical 1 kHz narrowband, intermittent source represented by the red dot (RMS source level of 200 dB; 1-second ping every 2 minutes). For a non-impulsive source, the PTS onset weighted SEL_{cum} threshold for LF cetaceans is 199 dB, while for MF cetaceans is 198 dB. Despite LF cetaceans having a higher PTS onset threshold than MF cetaceans, the isopleth associated with LF cetaceans (30 m solid purple circle) is larger than that for MF cetaceans (1.2 m dashed green circle) based on 1 kHz being within LF cetacean's most susceptible frequency range vs. outside the most susceptible frequency range for MF cetaceans (isopleths not to scale).

2.2 APPLICATION FOR BROADBAND SOUNDS

For broadband sources, the selection of the appropriate frequency for consideration associated with WFAs is more complicated. The selection of WFAs associated with broadband sources is similar to the concept used for to determine the 90% total cumulative energy window (5 to 95%) for consideration of duration associated with the RMS metric and impulsive sounds (Madsen 2005) but considered in the frequency domain, rather than the time domain. This is typically referred to as the 95% frequency contour percentile (Upper frequency below which 95% of total cumulative energy is contained; Charif et al. 2010).

NMFS recognizes the consideration of WFAs may be new for action proponents and have provided representative "default" values for various broadband sources (see associated User Spreadsheet tool and User Manual for User Spreadsheet tool).

2.2.1 Special Considerations for Broadband Source

Since the intent of WFAs is to broadly account for auditory weighting functions below the 95% frequency contour percentile, it is important that only frequencies on the "left side" of the auditory weighting function be used to make adjustments (i.e., frequencies below those where the auditory weighting function amplitude is zero[60] or below where the function is essentially flat; resulting in every frequency below the WFA always having a more negative amplitude than the chosen WFA) (Figure D3). It is inappropriate to use WFAs for frequencies on the "right side" of the auditory weighting function (i.e., frequencies above those where the auditory weighting function amplitude is zero). For a frequency on the "right side" of the auditory weighting function (Table D1), any adjustment is inappropriate and WFAs cannot be used (i.e., an action proponent would be advised to not use auditory weighting functions and evaluate its source as essentially unweighted; see "Use" frequencies in Table D1, which will result in a auditory weighting function amplitude of 0 dB).

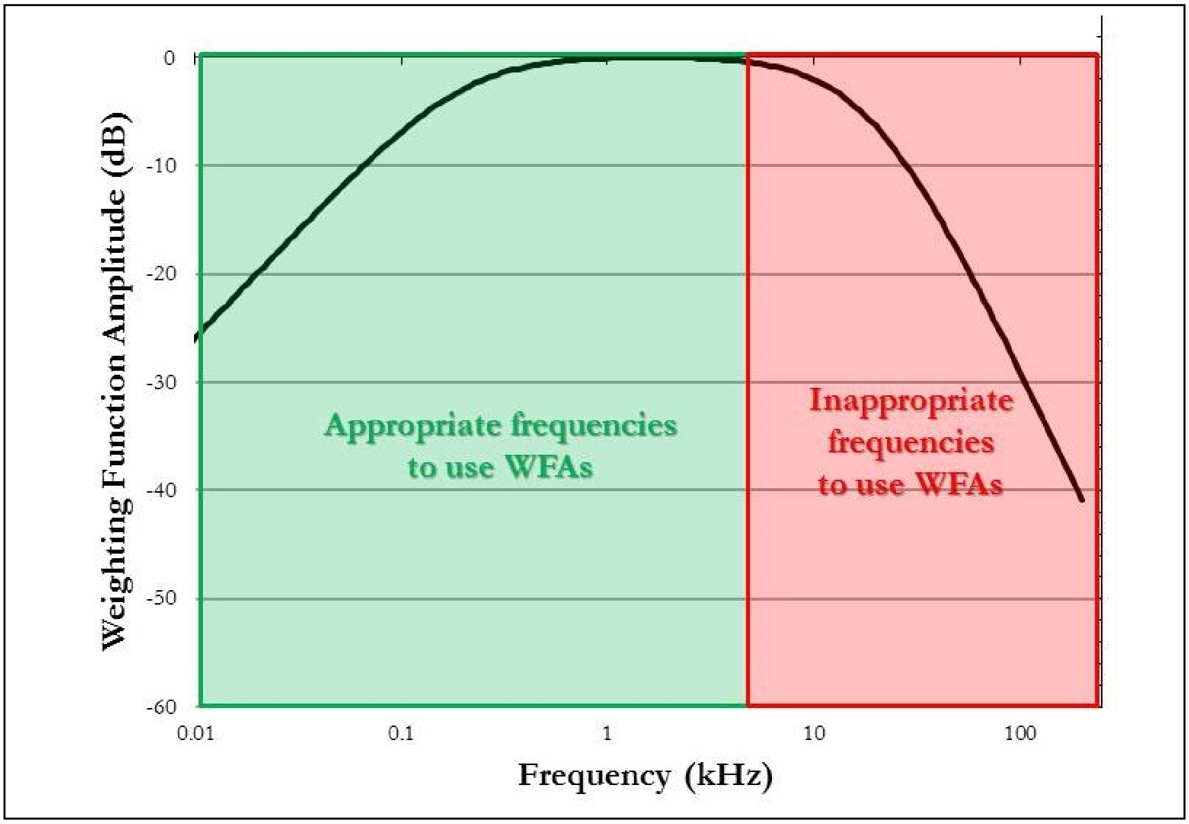

Figure D3: Example auditory weighting function illustrating where the use of weighting factor adjustments are (Green: "left side") and are not (Red: "right side") appropriate for broadband sources.

[60] A criteria of a -0.4 dB weighting function amplitude from the Technical Guidance's auditory weighting function was used to determine the demarcation between appropriate and inappropriate frequencies to use the WFAs.

Table D1: Applicability of weighting factor adjustments for frequencies associated with broadband sounds

Hearing Group	Applicable Frequencies	Non-Applicable Frequencies*
Low-Frequency Cetaceans (LF)	4.8 kHz and lower	Above 4.8 kHz (Use: 1.7 kHz)
Mid-Frequency Cetaceans (MF)	43 kHz and lower	Above 43 kHz (Use: 28 kHz)
High-Frequency Cetaceans (HF)	59 kHz and lower	Above 59 kHz (Use: 42 kHz)
Phocid Pinnipeds (PW)	11 kHz and lower	Above 11 kHz (Use: 6.2 kHz)
Otariid Pinnipeds (OW)	8.5 kHz and lower	Above 8.5 kHz (Use: 4.9 kHz)

* With non-applicable frequencies, users input the "use" frequency in the User Spreadsheet tool, which will result in an auditory weighting function amplitude of 0 dB (i.e., unweighted).

2.3 OVERRIDING THE WEIGHTING FACTOR ADJUSTMENT

An action proponent is not obligated to use WFAs. If an action proponent has data or measurements depicting the spectrum of their sound source, they may use these data to override the User Spreadsheet WFA output. By including a source's entire spectrum, this will allow an action proponent to incorporate the Technical Guidance's marine mammal auditory weighting functions over the entire broadband frequency range of the source, rather than just for one frequency via the WFA. As a result, overriding the optional User Spreadsheet's WFA with a sound sources' spectrum will result in more realistic (i.e., likely smaller) isopleths. NMFS is currently evaluating whether surrogate spectrum are available and applicable for particular sound sources, if an applicant does not have data of their own to use.

As an example, Figure 118 in Appendix D of the Final Environmental Impact Statement for Gulf of Mexico OCS Proposed Geological and Geophysical Activities (BOEM 2017) provides a generic spectrum for an 8000 in^3 airgun array (Figure D4).

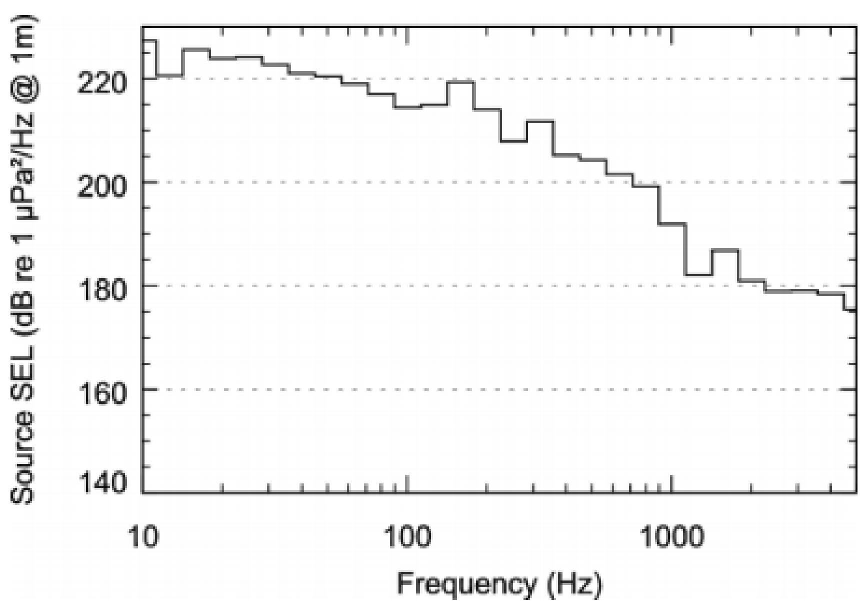

Figure D4: Maximum one-third octave band source level in the horizontal plane for a generic 8000 in^3 seismic array (BOEM 2017)

Table D2 provides a comparison of the dB adjustment between using the BOEM 2017 spectrum used to override the optional User Spreadsheet tool's default WFA and the direct use of the default WFA. As NMFS has stated previously, the more factors an action proponent can incorporate in their modeling, the more realistic results expected.

Table D2: Comparison of adjustment (dB) associated with incorporating entire broadband spectrum vs. default, single frequency WFA for a seismic array.

Weighting	LF cetacean	MF cetacean	HF cetacean	PW pinniped	OW pinniped
Default WFA (1 kHz)	-0.06 dB	-29.11 dB	-37.55 dB	-5.90 dB	-4.87 dB
Seismic array spectrum (BOEM 2017)*	-12.7 dB	-57.4 dB	-65.7 dB	-28.7 dB	-33.6 dB

* BOEM 2017 spectrum digitized using WebPlotDigitizer: Link to WebPlotDigitizer web page.

III. MODELING CUMULATIVE SOUND EXPOSURE LEVELS

To apply the PTS onset thresholds expressed as the weighted SEL_{cum} metric, a specified accumulation period is necessary. Generally, it is predicted that most receivers will minimize their time in the closest ranges to a sound source/activity and that exposures at the closest point of approach are the primary exposures contributing to a receiver's accumulated level (Gedamke et al. 2011). Additionally, several important factors determine the likelihood and duration of time a receiver is expected to be in close proximity to a sound source (i.e., overlap in space and time between the source and receiver). For example, accumulation time for fast moving (relative to the receiver), mobile source, is driven primarily by the characteristics of source (i.e., transit speed, duty cycle). Conversely, for stationary sources, accumulation time is driven primarily by the characteristics of the receiver (i.e., swim speed and whether species is transient or resident to the area where the activity is occurring). For all sources, NMFS recommends a baseline accumulation period of 24-h, but acknowledges that there may be specific exposure situations where this accumulation period requires an adjustment (e.g., if activity lasts less than 24 hours or for situations where receivers are predicted to experience unusually long exposure durations[61]).

Previous NMFS thresholds only accounted for the proximity of the sound source to the receiver, but thresholds in the Technical Guidance (i.e., expressed as weighted SEL_{cum}) now take into account the duration of exposure. NMFS recognizes that accounting for duration of exposure, although supported by the science literature, adds a new factor, as far as the application of this metric to real-world activities and that all action proponents may not have the ability to easily incorporate this additional component. NMFS does not provide specifications necessary to perform exposure modeling and relies on the action proponent to determine the model that best represents their activity.

3.1 MORE SOPHISTICATED MODELS

Because of the time component associated with the weighted $SEL_{cum\ metric}$, the use of different types of models to predict sound exposure may necessitate different approaches in evaluating likely effects in the context of the PTS onset thresholds. All marine mammals and some sources move in space and time, however, not all models are able to simulate relative source and receiver movement. Additionally, some models are able to predict the received level of sound at each modeled animal (often called animats) and accumulate sound at these receivers while incorporating the changing model environment.

[61] For example, where a resident population could be found in a small and/or confined area (Ferguson et al. 2015) and/or exposed to a long-duration activity with a large sound source, or there could be a continuous stationery activity nearby an area where marine mammals congregate, like a pinniped pupping beach.

Models that are more sophisticated may allow for the inclusion of added details to achieve more realistic results based on the accumulation of sound (e.g. information on residence time of individuals, swim speeds for transient species, or specific times when activity temporarily ceases). Alternatively, there may be case-specific circumstances where the accumulation time needs to be modified to account for situations where animals are expected to be in closer proximity to the source over a significantly longer amount of time, based on activity, site, and species-specific information (e.g., where a resident population could be found in a small and/or confined area (Ferguson et al. 2015) and a long-duration activity with a large sound source, or a continuous stationery activity nearby a pinniped pupping beach).

3.2 LESS SOPHISTICATED MODELS

For action proponents unable to incorporate animal and/or source movement, it may not be realistic to assume that animals will remain at a constant distance from the source accumulating acoustic energy for 24 hours. Thus, alternative methods are needed, which can provide a distance from the source where exposure exceeding a threshold is expected to occur and can be used in the same manner as distance has been used to calculate exposures above previous NMFS thresholds. NMFS proposes two alternative methods: one for mobile sources and one for stationary sources.

3.2.1 Mobile Sources[62]

3.2.1.1 Linear Equivalents Used in Appendix

In underwater acoustics, equations/derivations are typically expressed in terms of logarithmic terms (i.e., levels). These equations can be further simplified by introducing linear equivalents of the levels (i.e., factors) related by multiplication instead of by addition. For example, source level[63] (SL) is replaced by the "source factor" $10^{\mathrm{SL}/(10\ \mathrm{dB})}$ (Ainslie 2010). In this appendix, the following linear equivalents are used:

- Sound exposure ($\mathcal{E}$) = $10^{\mathrm{SEL}/(10\ \mathrm{dB})}$ μPa²s
- Mean-square sound pressure ($\overline{p^2}$) = $10^{\mathrm{SPL}/(10\ \mathrm{dB})}$ μPa²
- Source factor ($\mathcal{S}$) = $10^{\mathrm{SL}/(10\ \mathrm{dB})}$ μPa²m²
- Energy source factor[64] ($\mathcal{S}_E$) = $10^{\mathrm{SL}_E/(10\ \mathrm{dB})}$μPa² m²s

Both source level and energy source level (and their corresponding factors) are evaluated and reported in the direction producing the maximum SL.

[62] The methodology for mobile sources presented in this Appendix underwent peer review via the publication process (Sivle et al. 2014) but did not undergo a separate peer review. It is an optional tool for the application of the thresholds presented in the Technical Guidance.

[63] For definition of SL, see Ainslie 2010. SL ≡ $10\log_{10}[p(s)^2 s^2/(1\ \mu\mathrm{Pa}^2\ \mathrm{m}^2)]$ dB (Ainslie writes this as SL ≡ $10\log_{10} p^2 s^2$ dB re 1 μPa²s m².) For a point source, s is a small distance from the source, where distortions due to absorption, refraction, reflection, or diffraction are negligible and $p(s)$ is the RMS sound pressure at that distance. For a large (i.e., finite) source, p is the hypothetical sound pressure that would exist at distance s from a point source with the same far-field radiant intensity as the true source. For further clarification, see ISO 2017, entry 3.3.2.1 "source level."

[64] For definition of SL_E, see Ainslie 2010. SL_E ≡ $10\log_{10}[E(s)s^2/(1\ \mu\mathrm{Pa}^2\ \mathrm{m}^2\ \mathrm{s})]$ dB (Ainslie writes this as SL_E ≡$10\log_{10} E(s)s^2$ dB 1 μPa² m²s). For a point source, s is a small distance from the source, where distortions due to absorption, refraction, reflection, or diffraction are negligible and $E(s)$ is the unweighted sound exposure at that distance. For a large (i.e., finite) source, E is the hypothetical sound exposure that would exist at distance s from a point source with the same duration and far-field radiant intensity as the true source. For further clarification, see ISO 2017, entry 3.3.2.2 "energy source level."

3.2.1.2 "Safe Distance" Methodology

Cumulative sound exposure can be computed using a simple equation, assuming a constant received sound pressure level (SPL) that does not change over space and time[65] (Equation D1.; e.g., Urick 1983; ANSI 1986; Madsen 2005):

$$SEL_{cum} = SPL + 10 \log_{10} (\text{duration of exposure, expressed in seconds}) \text{ dB}$$

Equation D1

However, if one assumes a stationary receiver and a source moving at a constant speed in a constant direction, then exposure changes over space and time (i.e., greatest rate of accumulation at closest point of approach).

An alternative approach for modeling moving sources is the concept of a "safe distance" (R_0), which is defined by Sivle et al. (2014) as "the distance from the source beyond which a threshold[66] for that metric (SPL_0 or SEL_0) is not exceeded." This concept allows one to determine at what distance from a source a receiver would have to remain in order not to exceed a predetermined exposure threshold (i.e., E_0 which equals the weighted SEL_{cum} PTS onset threshold in this Technical Guidance) and is further illustrated in Figure D5.

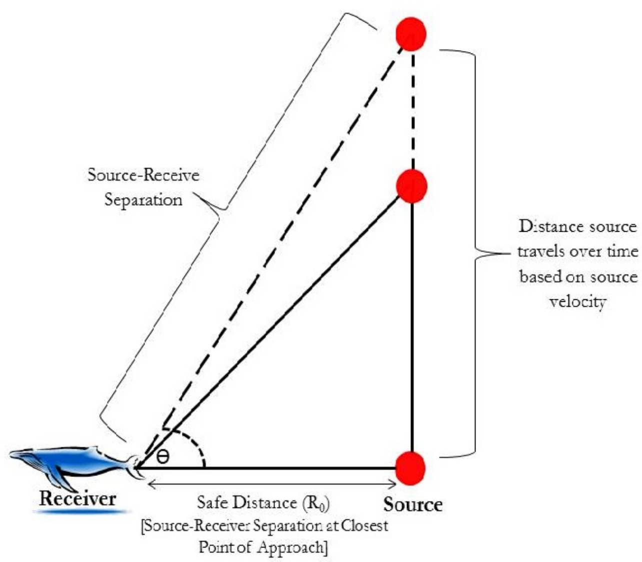

Figure D5: Illustration of the concept for mobile sources, with each red dot representing the source traveling over time. As the source travels further from the receiver, the source-receiver separation increases (i.e., hypotenuse gets longer).

This methodology accounts for several factors, including source level, duty cycle, and transit speed of the source and is independent of exposure duration (Equations D2a[67],b).

[65] Equation D1 assumes a constant source-receiver separation distance.

[66] The threshold considered by Sivle et al. 2014 was associated with behavioral reactions.

[67] This equation matches Equation 3 from Sivle et al. (2014), but is written in a simpler manner.

a

$$R_0 = \frac{\pi}{E_0 v} SD$$

Equations D2a,b

For impulsive sources, SD is replaced with S_E/τ:

b

$$R_0 = \frac{\pi}{E_0 v}\frac{S_E}{\tau}$$

where:

S = source factor ($10^{SL/(10\text{ dB})}$ µPa^{2}m^2)
D =duty cycle (pulse duration x repetition rate)
v= transit speed
E_0 =exposure threshold ($10^{SEL_0/(10\text{ dB})}$ µPa^{2}s)
S_E = energy source factor ($10^{SL_E/(10\text{ dB})}$µPa^{2}m^{2}s)
τ = 1/repetition rate

R_0 represents the exposure isopleth calculated using NMFS' thresholds. Thus, area calculations and exposure calculations would be performed in the same manner[68] action proponents have previously used (e.g., determine area covered over a 24-h period multiplied by the density of a marine mammal species).

This approach considers four factors:

1. Source level (direct relationship: as source level increases, so does R_0; higher source level results is a greater accumulation of energy).

2. Duty cycle (direct relationship: as duty cycle increases, so does R_0; higher duty cycle results in more energy within a unit of time and leads a greater accumulation of energy).

3. Source transit speed (inverse relationship: as transit speed decreases, R_0 increases or vice versa; a faster transit speed results in less energy within a unit of time and leads to a lower accumulation of energy, while a slower transit speed will result in a greater accumulation of energy).

4. Exposure threshold (inverse relationship: as the exposure threshold decreases, R_0 increases or vice versa; a higher exposure threshold result in needing more energy to exceed it compared to a lower threshold).

The action proponent is responsible for providing information on factors one through three above, while factor four is the PTS onset acoustic threshold (expressed as weighted SEL_{cum} metric) provided within the Technical Guidance.

For this approach to be applicable to a broad range of activities, the following assumptions[69] are made:

[68] Note: "Take" calculations are typically based on speed expressed in kilometers per hour, duration of an exposure expressed in hours (i.e., 24 hours), isopleths expressed in kilometers, and animal density expresses as animals per square kilometers. Thus, units would need to be converted to use Equations D2a,b.

[69] If any of these assumptions are violated and there is concern that the isopleth produced is potentially underestimated, it is recommended action proponents contact NMFS to see if any there are any appropriate adjustments that can be made (e.g., addition of a buffer, etc.). If not, the action proponent is advised to pursue other methodology capable of more accurately modeling exposure.

- Action proponents that are unable to apply full auditory weighting functions will rely on WFAs. This will create larger isopleths, for broadband sources, compared to action proponents capable of fully applying auditory weighting functions. Note: Action proponents can override the WFA if spectral data for their sound source is available (See Section 2.3 of this Appendix).

- The movement of the source is simple (i.e., source moves at a constant speed and in a constant direction). Caution is recommended if the source has the potential to move in a manner where the same group of receivers could be exposed to multiple passes from the source.

- Minimal assumptions are made about the receivers. They are considered stationary and assumed to not move up or down within the water column. There is no avoidance and the receiver accumulates sound via one pass of the source (i.e., receiver is not exposed to multiple passes from the source). Because this methodology only examines one pass of the source relative to receiver, this method is essentially time-independent (i.e., action proponent does not need to specify how long an activity occurs within a 24-h period).

  - These assumptions are appropriate for sources that are expected to move much faster than the receiver does. Further, assuming receivers do not avoid the source or change position vertically or horizontally in the water column will result in more exposures exceeding the thresholds compared to those receivers that would avoid or naturally change positions in the water column over time. Caution is recommended if the receiver has the potential to follow or move with the sound source.

- Distance (i.e., velocity x change over time) between "pulses" for intermittent sources is small compared with R_0, and the distance between "pulses" for intermittent sources is consistent. This assumption is appropriate for intermittent sources with a predictable duty cycle. If the duty cycle decreases, R_0 will become larger, while if the duty cycle increases, it will become smaller. Further, for intermittent sources, it is assumed there is no recovery in hearing threshold between pulses.

- Sound propagation is simple (i.e., approach uses spherical spreading[70]: 20 log R, with no absorption). NMFS recognizes that this might not be appropriate for all activities, especially those occurring in shallow water (i.e., sound could propagate further than predicted by this model)[71]. Thus, modifications to the R_0 predicted may be necessary in these situations.

Despite these assumptions, this approach offers a better approximation of the source-receiver distance over space and time for various mobile sources than choosing a set accumulation period for all sources, which assumes a fixed source-receiver distance over that time.

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[70] Assuming spherical spreading allows for Equations D2a,b to remain simplified (i.e., assuming another spreading model results in more complicated equations that are no longer user-friendly nor as easy to implement).

[71] Note: Many moving sources, like seismic airguns or sonar, can be highly-directional (i.e., most of time sound source is directed to the ocean floor, with less sound propagating horizontally, compared to the vertical direction), which is not accounted for with this methodology. Additionally, many higher-frequency sounds, like sonar, are also attenuated by absorption, which is also taken into account in this model. These, among other factors, are recommended for consideration when evaluating whether spherical spreading is potentially resulting in an underestimation of exposure.

Ainslie and Von Benda-Beckmann (2013) investigated the effect various factors had on the derivation of R_0 and found exposures were highest for stationary receivers in the path of a source, compared to mobile receivers swimming away from the source. However, the authors did acknowledge, if the receivers actively swam toward the source, cumulative exposure would increase. Uncertainty associated with R_0 was found to be primarily driven by the exposure threshold (i.e., Technical Guidance's thresholds). Increasing duty cycle of the source or reducing speed (either source or receiver) will result in an increased R_0 (Sivle et al. 2014)

NMFS has provided a companion User Spreadsheet tool and User Manual for the User Spreadsheet tool to help action proponents use this methodology to determine isopleths for PTS onset associated with their activity (Link to Technical Guidance web page).

3.2.2 Stationary Sources

If there is enough information to accurately predict the travel speed of a receiver past a stationary sound source (including the assumption that the receiver swims on a straight trajectory past the source), then the mobile source approach can be modified for stationary sources (i.e., transit speed of the source is replaced by speed of the receiver). However, NMFS acknowledges that characteristics of the receiver are less predictable compared to those of the source (i.e., velocity and travel path), which is why the mobile source approach may not be appropriate for stationary sources and an alternate method is provided below.

An alternative approach is to calculate the accumulated isopleth associated with a stationary sound source within a 24-h period. For example, if vibratory pile driving was expected to occur over ten hours within a 24-h period, then the isopleth would be calculated by adding area with each second the source is producing sound. This is a highly conservative means of calculating an isopleth because it assumes that animals on the edge of the isopleth (in order to exceed a threshold) will remain there for the entire time of the activity.

For stationary, impulsive sources with high source levels (i.e., impulsive pile driving associated with large piles, stationary airguns associated with vertical seismic profiling (VSPs), and large explosives) accumulating over a 24-h period, depending on how many strikes or shots occur, could lead to unrealistically large isopleths associated with PTS onset. For these situations, action proponents are advised to contact NMFS for possible applicable alternative methods.

NMFS has provided a companion User Spreadsheet tool and User Manual (NMFS 2018) for the User Spreadsheet tool to help action proponents wanting to use this methodology to determine isopleths for PTS onset associated with their activity (Link to Technical Guidance web page).

APPENDIX E: GLOSSARY

95% Frequency contour percentile: Upper frequency below which 95% of total cumulative energy is contained (Charif et al. 2010).

Accumulation period: The amount of time a sound accumulates for the SEL_{cum} metric.

Acoustic threshold: An acoustic threshold in this document identifies the level of sound, after which exceeded, NMFS anticipates a change in auditory sensitivity (temporary or permanent threshold shift).

Ambient noise: All-encompassing sound at a given place, usually a composite of sound from many sources near and far (ANSI 1994).

Animat: A simulated marine mammal.

Anthropogenic: Originating (caused or produced by) from human activity.

Audible: Heard or capable of being heard. Audibility of sounds depends on level, frequency content, and can be reduced in the presence of other sounds (Morfey 2001)

Audiogram: A graph depicting hearing threshold as a function of frequency (ANSI 1995; Yost 2007) (Figure E1).

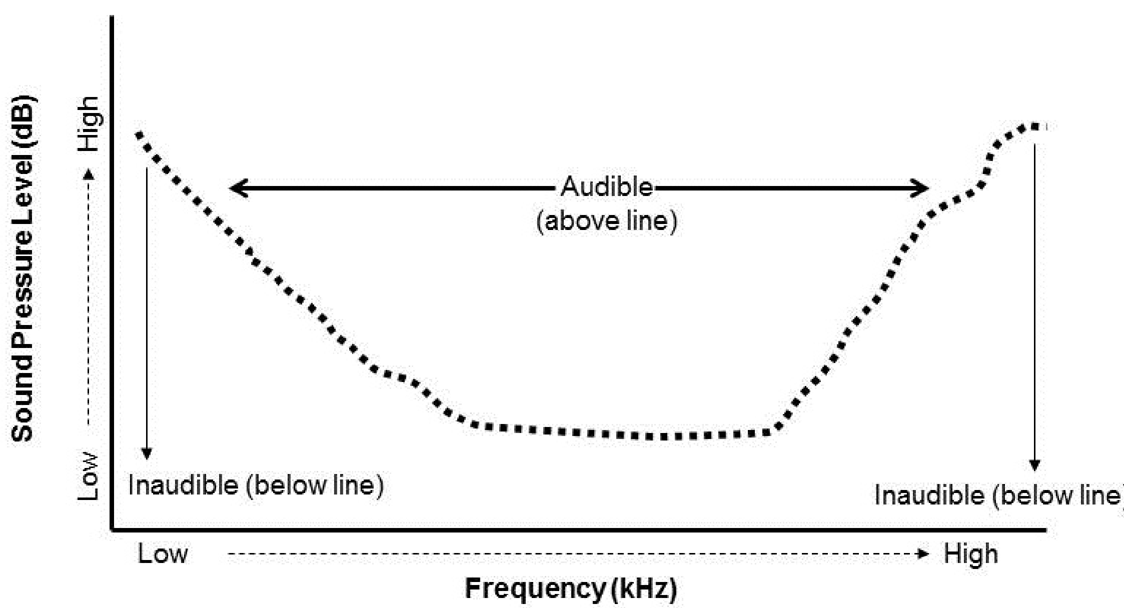

Figure E1. Example audiogram.

Auditory adaptation: Temporary decrease in hearing sensitivity occurring during the presentation of an acoustic stimulus (opposed to auditory fatigue which occurs post-stimulation) (ANSI 1995).

Auditory bulla: The ear bone in odontocetes that houses the middle ear structure (Perrin et al. 2009).

Auditory weighting function: Auditory weighting functions take into account what is known about marine mammal hearing sensitivity and susceptibility to noise-induced hearing loss and can be applied to a sound-level measurement to account for frequency-dependent hearing (i.e.,. an expression of relative loudness as perceived by the ear)(Southall et al. 2007; Finneran 2016). Specifically, this function represents a specified frequency-dependent characteristic of hearing sensitivity in a particular animal, by which an acoustic quantity is adjusted to reflect the importance of that frequency dependence to that animal (ISO 2017). Similar to OSHA (2013), marine mammal auditory weighting functions in this document are used to reflect the risk of noise exposure on hearing and not necessarily capture the most sensitive hearing range of every member of the hearing group.

Background noise: Total of all sources of interference in a system used for the production, detection, measurement, or recording of a signal, independent of the presence of the signal (ANSI 2013).

Band-pass filter: A filter that passes frequencies within a defined range without reducing amplitude and attenuates frequencies outside that defined range (Yost 2007).

Bandwidth: Bandwidth (Hz or kHz) is the range of frequencies over which a sound occurs or upper and lower limits of frequency band (ANSI 2005). Broadband refers to a source that produces sound over a broad range of frequencies (for example, seismic airguns), while narrowband or tonal sources produce sounds over a more narrow frequency range, typically with a spectrum having a localized a peak in amplitude (for example, sonar) (ANSI 1986; ANSI 2005).

Bone conduction: Transmission of sound to the inner ear primarily by means of mechanical vibration of the cranial bones (ANSI 1995).

Broadband: See “bandwidth”.

Cetacean: Any number of the order Cetacea of aquatic, mostly marine mammals that includes whales, dolphins, porpoises, and related forms; among other attributes they have a long tail that ends in two transverse flukes (Perrin et al. 2009).

Cochlea: Spirally coiled, tapered cavity within the temporal bone, which contains the receptor organs essential to hearing (ANSI 1995). For cetaceans, based on cochlear measurements two cochlea types have been described for echolocating odontocetes (type I and II) and one cochlea type for mysticetes (type M). Cochlea type I is found in species like the harbor porpoise and Amazon river dolphin, which produce high-frequency echolocation signals. Cochlea type II is found in species producing lower frequency echolocation signals (Ketten 1992).

Continuous sound: A sound whose sound pressure level remains above ambient sound during the observation period (ANSI 2005).

Critical level: The level at which damage switches from being primarily metabolic to more mechanical; e.g., short duration of impulse can be less than the ear’s integration time, leading for the potential to damage beyond level the ear can perceive (Akay 1978).

Cumulative sound exposure level (SEL_{cum}; re: 1μPa^{2}s): Level of acoustic energy accumulated over a given period of time or event (EPA 1982) or specifically, ten times the logarithm to the base ten of the ratio of a given time integral of squared instantaneous frequency-weighted sound pressure over a stated time interval or event to the reference sound exposure (ANSI 1995; ANSI 2013). Within the Technical Guidance, this metric is weighted based on the document’s marine mammal auditory weighting functions.

Deafness: A condition caused by a hearing loss that results in the inability to use auditory information effectively for communication or other daily activities (ANSI 1995).

Decibel (dB): One-tenth of a bel. Unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power (ANSI 2013).

dB/decade: This unit is typically used to describe roll-off, where a decade is a 10-times increase in frequency (roll-off can also be described as decibels per octave, where an octave is 2-times increase in frequency)

Duty cycle: On/off cycle time or proportion of time signal is active (calculated by: pulse length x repetition rate). A continuous sound has a duty cycle of 1 or 100%.

Dynamic range of auditory system: Reflects the range of the auditory system from the ability to detect a sound to the amount of sound tolerated before damage occurs (i.e., the threshold of pain minus the threshold of audibility) (Yost 2007). For the purposes of this document, the intent is relating the threshold of audibility and TTS onset levels, not the threshold of pain.

Effective quiet: The maximum sound pressure level that will fail to produce any significant threshold shift in hearing despite duration of exposure and amount of accumulation (Ward et al. 1976; Ward 1991).

Endangered Species Act (ESA): The Endangered Species Act of 1973 (16. U.S.C 1531 et. seq.) provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend.

NOAA's National Marine Fisheries Service and the U.S. Fish and Wildlife Service (USFWS) share responsibility for implementing the ESA.

Energy Source Level (SL_E): The time-integrated squared signal sound pressure level measured in a given radian direction, corrected for absorption, and scaled to a reference distance (1 m) (adapted from Morfey 2001).

Equal Energy Hypothesis (EEH): Assumption that sounds of equal energy produce the equal risk for hearing loss (i.e., if the cumulative energy of two sources are similar, a sound from a lower level source with a longer exposure duration may have similar risks to a shorter duration exposure from a higher level source) (Henderson et al. 1991).

Equal latency: A curve that describe the frequency-dependent relationships between sound pressure level and reaction time and are similar in shape to equal loudness contours in humans (loudness perception can be studied under the assumption that sounds of equal loudness elicit equal reaction times; e.g., Liebold and Werner 2002).

Equal-loudness contour: A curve or curves that show, as a function of frequency, the sound pressure level required to cause a given loudness for a listener having normal hearing, listening to a specified kind of sound in a specified manner (ANSI 2013).

Far-field: The acoustic field sufficiently distant from a distributed source that the sound pressure decreases linearly with increasing distance (neglecting reflections, refraction, and absorption) (ANSI 2013).

Fitness: Survival and lifetime reproductive success of an individual.

Frequency: The number of periods occurring over a unit of time (unless otherwise stated, cycles per second or hertz) (Yost 2007).

Functional hearing range: There is no standard definition of functional hearing arrange currently available. "Functional" refers to the range of frequencies a group hears without incorporating non-acoustic mechanisms (Wartzok and Ketten 1999). Southall et al. 2007 defined upper and lower limits of the functional hearing range as ~60-70 dB above the hearing threshold at greatest hearing sensitivity (based on human and mammalian definition of 60 dB[72]).

Fundamental frequency: Frequency of the sinusoid that has the same period as the periodic quantity (Yost 2007; ANSI 2013). First harmonic of a periodic signal (Morfey 2001).

Harmonic: A sinusoidal quantity that has a frequency which is an integral multiple of the fundamental frequency of the periodic quantity to which it is related (Yost 2007; ANSI 2013).

Hearing loss growth rates: The rate of threshold shift increase (or growth) as decibel level or exposure duration increase (expressed in dB of temporary threshold shift/dB of noise).Growth rates of threshold shifts are higher for frequencies where hearing is more sensitive (Finneran and Schlundt 2010). Typically in terrestrial mammals, the magnitude of a threshold shift increases with increasing duration or level of exposure, until it becomes asymptotic (growth rate begins to level or the upper limit of TTS; Mills et al. 1979; Clark et al. 1987; Laroche et al. 1989; Yost 2007).

Hertz (Hz): Unit of frequency corresponding to the number of cycles per second. One hertz corresponds to one cycle per second.

Impulsive sound: Sound sources that produce sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; ANSI 2005). They can occur in repetition or as a single event. Examples of impulsive sound sources include: explosives, seismic airguns, and impact pile drivers.

Information Quality Guidelines (IQG): Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554), directs the Office of Management and Budget (OMB) to issue government-wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies." OMB issued guidelines directing each federal agency to issue its own guidelines. Link to NOAA's Information Quality Guidelines

Integration time (of the ear): For a signal to be detected by the ear, it must have some critical amount of energy. The process of summing the power to generate the required energy is completed over a particular integration time. If the duration of a signal is less than the integration time required for detection, the power of the signal must be increased for it to be detected by the ear (Yost 2007).

Intermittent sound: Interrupted levels of low or no sound (NIOSH 1998) or bursts of sounds separated by silent periods (Richardson and Malme 1993). Typically, intermittent sounds have a more regular (predictable) pattern of bursts of sounds and silent periods (i.e., duty cycle).

Isopleth: A line drawn through all points having the same numerical value. In the case of sound, the line has equal sound pressure or exposure levels.

Kurtosis: Statistical quantity that represents the impulsiveness ("peakedness") of the event; specifically the ratio of fourth- order central moment to the squared second-order central moment (Hamernik et al. 2003; Davis et al. 2009).

[72] In humans, functional hearing is typically defined as frequencies at a threshold of 60 to 70 dB and below (Masterson et al. 1969; Wartzok and Ketten 1999), with normal hearing in the most sensitive hearing range considered 0 dB (i.e., 60 to 70 dB above best hearing sensitivity).

Linear interpolation: A method of constructing new data points within the range of a discrete set of known data points, with linear interpolation being a straight line between two points.

Marine Mammal Protection Act (MMPA): The Marine Mammal Protection Act (16. U.S.C. 1361 et. seq.)was enacted on October 21, 1972 and MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. NOAA's National Marine Fisheries Service and the U.S. Fish and Wildlife Service (USFWS) share responsibility for implementing the MMPA.

Masking: Obscuring of sounds of interest by interfering sounds, generally of the similar frequencies (Richardson et al. 1995).

Mean-squared error (MSE): In statistics, this measures the average of the squares of the "errors," that is, the difference between the estimator and what is estimated.

Mean-square sound pressure: Integral over a specified time interval of squared sound pressure, divided by the duration of the time interval for a specified frequency range (ISO 2017).

Multipath propagation: This phenomenon occurs whenever there is more than one propagation path between the source and receiver (i.e., direct path and paths from reflections off the surface and bottom or reflections within a surface or deep-ocean duct; Urick 1983).

Mysticete: The toothless or baleen (whalebone) whales, including the rorquals, gray whale, and right whale; the suborder of whales that includes those that bulk feed and cannot echolocate (Perrin et al. 2009).

Narrowband: See "bandwidth".

National Marine Sanctuaries Act (NMSA): The National Marine Sanctuaries Act (16 U.S.C. 1431 et. seq.) authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. Day-to-day management of national marine sanctuaries has been delegated by the Secretary of Commerce to NOAA's Office of National Marine Sanctuaries.

National Standard 2 (NS2): The Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et. seq.) is the principal law governing marine fisheries in the U.S. and includes ten National Standards to guide fishery conservation and management. One of these standards, referred to as National Standard 2 (NS2), guides scientific integrity and states "(fishery) conservation and management measures shall be based upon the best scientific information available.

Non-impulsive sound: Sound sources that produce sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent) and typically do not have a high peak sound pressure with rapid rise time that impulsive sounds do. Examples of non-impulsive sound sources include: marine vessels, machinery operations/construction (e.g., drilling), certain active sonar (e.g. tactical), and vibratory pile drivers.

Octave: The interval between two sounds having a basic frequency ratio of two (Yost 2007). For example, one octave above 400 Hz is 800 Hz. One octave below 400 Hz is 200 Hz.

Odontocete: The toothed whales, including sperm and killer whales, belugas, narwhals, dolphins and porpoises; the suborder of whales including those able to echolocate (Perrin et al. 2009).

Omnidirectional: Receiving or transmitting signals in all directions (i.e., variation with direction is designed to be as small as possible).

One-third octave (base 10): The frequency ratio corresponding to a decidecade or one tenth of a decade (ISO 2017).

Otariid: The eared seals (sea lions and fur seals), which use their foreflippers for propulsion (Perrin et al. 2009).

Peak sound pressure level (PK; re: 1 μPa): The greatest magnitude of the sound pressure, which can arise from a positive or negative sound pressure, during a specified time, for a specific frequency range (ISO 2017).

Perception: Perception is the translation of environmental signals to neuronal representations (Dukas 2004).

Permanent threshold shift (PTS): A permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. The amount of permanent threshold shift is customarily expressed in decibels (ANSI 1995; Yost 2007). Available data from humans and other terrestrial mammals indicate that a 40 dB threshold shift approximates PTS onset (see Ward et al. 1958, 1959; Ward 1960; Kryter et al. 1966; Miller 1974; Ahroon et al. 1996; Henderson et al. 2008).

Phocid: A family group within the pinnipeds that includes all of the "true" seals (i.e. the "earless" species). Generally used to refer to all recent pinnipeds that are more closely related to *Phoca* than to otariids or the walrus (Perrin et al. 2009).

Pinniped: Seals, sea lions and fur seals (Perrin et al. 2009).

Pulse duration: For impulsive sources, window that makes up 90% of total cumulative energy (5%-95%) (Madsen 2005)

Propagation loss: Reduction in magnitude of some characteristic of a signal between two stated points in a transmission system (for example the reduction in the magnitude of a signal between a source and a receiver) (ANSI 2013).

Received level: The level of sound measured at the receiver.

Reference pressure: See sound pressure level.

Repetition rate: Number of pulses of a repeating signal in a specific time unit, normally measured in pulses per second.

Rise time: The time interval a signal takes to rise from 10% to 90% of its highest peak (ANSI 1986; ANSI 2013).

Roll-off: Change in weighting function amplitude (-dB) with changing frequency.

Root-mean-square sound pressure level (RMS SPL; re: 1 μPa): Ten times the logarithm to the base 10 of the ratio of the mean-square sound pressure to the specified reference value in decibels (ISO 2017).

Sensation level (dB): The pressure level of a sound above the hearing threshold for an individual or group of individuals (ANSI 1995; Yost 2007).

Sound: An alteration in pressure propagated by the action of elastic stresses in an elastic medium and that involves local compression and expansion of the medium (ISO 2017).

Sound Exposure Level (SEL_{cum}; re: $1 \mu Pa^2 s$): A measure of sound level that takes into account the duration of the signal. Ten times the logarithm to the base 10 of the ration of a given time integral of squared instantaneous frequency-weighted sound pressure over a stated time interval or event to the product of the squared reference sound pressure and reference duration of one second (ANSI 2013).

Sound Pressure Level (SPL): A measure of sound level that represents only the pressure component of sound. Ten times the logarithm to the base 10 of the ratio of time-mean-square pressure of a sound in a stated frequency band to the square of the reference pressure (1 µPa in water) (ANSI 2013).

Source Level (SL): Sound pressure level measured in a given radian direction, corrected for absorption, and scaled to a reference distance (Morfey 2001). For underwater sources, the sound pressure level of is measured in the far-field and scaled to a standard reference distance (1 meter) away from the source (Richardson et al. 1995; ANSI 2013).

Spatial: Of or relating to space or area.

Spectral/spectrum: Of or relating to frequency component(s) of sound. The spectrum of a function of time is a description of its resolution into components (frequency, amplitude, etc.). The spectrum level of a signal at a particular frequency is the level of that part of the signal contained within a band of unit width and centered at a particular frequency (Yost 2007).

Spectral density levels: Level of the limit, as the width of the frequency band approaches zero, of the quotient of a specified power-like quantity distributed within a frequency band, by the width of the band (ANSI 2013).

Subharmonic: Sinusoidal quantity having a frequency that is an integral submultiple of the fundamental frequency of a periodic quantity to which it is related (ANSI 2013).

Temporal: Of or relating to time.

Temporary threshold shift (TTS): A temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. The amount of temporary threshold shift is customarily expressed in decibels (ANSI 1995, Yost 2007). Based on data from cetacean TTS measurements (see Southall et al. 2007 for a review), a TTS of 6 dB is considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Schlundt et al. 2000; Finneran et al. 2000; Finneran et al. 2002).

Threshold (of audibility): The threshold of audibility (auditory threshold) for a specified signal is the minimum effective sound pressure level of the signal that is capable of evoking an auditory sensation in a specified fraction of trials (either physiological or behavioral) (Yost 2007). It recommended that this threshold be defined as the lowest sound pressure level at which responses occur in at least 50% of ascending trials. (ANSI 2009).

Threshold shift: A change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. The amount of threshold shift is customarily expressed in decibels (ANSI 1995, Yost 2007).

Tone: A sound wave capable of exciting an auditory sensation having pitch. A pure tone is a sound sensation characterized by a single pitch (one frequency). A complex tone is a sound sensation characterized by more than one pitch (more than one frequency) (ANSI 2013).

Uncertainty: Lack of knowledge about a parameter's true value (Bogen and Spears 1987; Cohen et al. 1996).

Variability: Differences between members of the populations that affects the magnitude of risk to an individual (Bogen and Spears 1987; Cohen et al. 1996; Gedamke et al. 2011).

LITERATURE CITED

Ahroon, W.A., R.P. Hamerik, and R.I. Davis. 1993. Complex noise exposures: An energy analysis. Journal of the Acoustical Society of America 93:997-1006.

Ahroon, W.A., R.P. Hamernik, and S.-F., Lei. 1996. The effects of reverberant blast waves on the auditory system. Journal of the Acoustical Society of America 100:2247-2257.

Ainslie, M.A. 2010. Principles of Sonar Performance Modeling. New York: Springer.

Ainslie, M. A., and A.M. Von Benda-Beckmann. 2013. Optimal soft start and shutdown procedures or stationary or moving sound sources. Proceedings of Meetings on Acoustics, 17: 070077.

Akay, A. 1978.A review of impact noise. Journal of the Acoustical Society of America 64:977-987.

Alain, C., and L.J. Berstein. 2008. From sound to meaning: The role of attention during auditory scene analysis. Current Opinion in Otolaryngology & Head and Neck Surgery 16:485-489.

Andersen, S. 1970. Auditory sensitivity of the harbour porpoise *Phocoena phocoena*. Investigations on Cetacea 2:255-259.

ANSI (American National Standards Institute). 1986. Methods of Measurement for Impulse Noise (ANSI S12.7-1986). New York: Acoustical Society of America.

ANSI (American National Standards Institute). 1995. Bioacoustical Terminology (ANSI S3.20-1995).New York: Acoustical Society of America.

ANSI (American National Standards Institute). 2005. Measurement of Sound Pressure Levels in Air (ANSI S1.13-2005). New York: Acoustical Society of America.

ANSI (American National Standards Institute). 2009. Methods for Manual Pure-Tone Threshold Audiometry (ANSI 3.21-2009). New York: Acoustical Society of America.

ANSI (American National Standards Institute). 2011. Design Response of Weighting Networks for Acoustical Measurements (ANSI S1.42-2011). New York: Acoustical Society of America.

ANSI (American National Standards Institute). 2013. Acoustic Terminology (ANSI S1.1-2013). New York: Acoustical Society of America.

Archer, F.I., S.L. Mesnick, and A.C. Allen. 2010. Variation and predictors of vessel-response behavior in a tropical dolphin community. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-457. La Jolla, California: NMFS Southwest Fisheries Science Center.

Au, W.W.L., and P.W.B. Moore.1984. Receiving beam patterns and directivity indices of the Atlantic bottlenose dolphin *Tursiops truncatus*. Journal of the Acoustical Society of America 75:255-262.

Au, W.W.L., and M.C. Hastings. 2008. Principles of Marine Bioacoustics. New York: Springer.

Awbrey, F.T., J.A Thomas, and R.A. Kastelein. 1988. Low-frequency underwater hearing sensitivity in belugas, *Delphinapterus leucas*. Journal of the Acoustical Society of America. 84:2273-2275.

Babushina, E.S. 1997. Audiograms of the Caspian seal under water and in air. Sensory Systems 11:67-71.

Babushina, E.S., G.L. Zaslavsky, and L.I. Yurkevich. 1991. Air and underwater hearing of the northern fur seal: Audiograms, frequency and differential thresholds. Biofizika 36:909-913.

Barber, J.R., K.R. Crooks, and K.M. Fristrup. 2010. The costs of chronic noise exposure for terrestrial organisms. Trends in Ecology and Evolution 25:180-189.

Bejder, L., A. Samuels, H. Whitehead, H Finn, and S. Allen. 2009. Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. Marine Ecology Progress Series 395:177-185.

BOEM (Bureau of Ocean Energy Management). 2017. Gulf of Mexico OCS Proposed Geological and Geophysical Activities. Final Environmental Impact Statement, OCS EIS/EA BOEM 2017-051. New Orleans, Louisiana: Department of the Interior.

Bogen, K.T., and R.C. Spear. 1987. Integrating uncertainty and interindividual variability in environmental risk assessment. Risk Analysis 7:427-436.

Bransetter, B.K., J. St. Leger, D. Acton, J. Steward, D. Houser, and J.J. Finneran, and K. Jenkins. 2017. Killer whale (*Orcinus orca*) behavioral audiograms. Journal of the Acoustical Society of America 141:2387–2398.

Brill, R.L., P.W.B. Moore, and L.A. Dankiewicz. 2001. Assessment of dolphin (*Tursiops truncatus*) auditory sensitivity and hearing loss using jawphones. Journal of the Acoustical Society of America. 109:1717-1722.

Buck, K., A. Dancer, and R. Franke. 1984. Effect of the temporal pattern of a given noise dose on TTS in guinea pigs. Journal of the Acoustical Society of America 76:1090-1097.

Castellote, M. T.A. Mooney, L. Quakenbush, R. Hobbs, C. Goertz, and E. Gaglione. 2014. Baseline hearing abilities and variability in wild beluga whales (*Delphinapterus leucas*). The Journal of Experimental Biology 217:1682-1691.

CDC (Centers for Disease Control and Prevention). 2004. Hearing Loss. Atlanta, Georgia: Department of Health and Human Services.

Chen, C.J., Y.T. Dai, Y.M. Sun, Y.C. Lin, and Y.J. Juang. 2007. Evaluation of auditory fatigue in combined noise, heat, and workload exposure. Industrial Health 45:527-534.

Charif, R.A., A.M. Waack, and L.M. Strickman. 2010. Raven Pro 1.4 User's Manual. Ithaca, New York: Cornell Lab of Ornithology.

Clark, J.G 1981. Uses and abuses of hearing loss classification. ASHA 23:493-500.

Clark, C.W., and W.T. Ellison. 2004. Potential use of low-frequency sound by baleen whales for probing the environment: Evidence from models and empirical measurements. Pages 564-581 in J.A. Thomas, C.F. Moss, and M. Vater, eds. Echolocation in Bats and Dolphins. Chicago: University of Chicago Press.

Clark, W.W., B.A. Bohne, and F.A. Boettcher. 1987. Effect of periodic rest on hearing loss and cochlear damage following exposure to noise. Journal of the Acoustical Society of America 82:1253-1264.

Clifford, R.E., and R.A. Rogers. 2009. Impulse noise: Theoretical solutions to the quandary of cochlear protection. Annals of Otology, Rhinology & Laryngology 118:417-427.

Cohen, J.T., M.A. Lampson, and T.S. Bowers. 1996. The use of two-stage Monte Carlo simulation techniques to characterize variability and uncertainty in risk analysis. Human and Ecological Assessment 2:939-971.

Coles, R.R.A., G.R. Garinther, D.C. Hodge, and C.G. Rice.1968. Hazardous exposure to impulse noise. Journal of the Acoustical Society of America 43:336-343.

Coping, A., H. Battey, J. Brown-Saracino, M. Massaua, and C. Smith. 2014. An international assessment of the environmental effects of marine energy development. Ocean & Coastal Management 99:3-13.

Corso, J.F. 1959. Age and sex differences in pure-tone thresholds. Journal of the Acoustical Society of America 31:498-507.

Cranford, T.W., and P. Krysl. 2012. Acoustic function in the peripheral auditory system of Cuvier's beaked whale (*Ziphius cavirostris*). Pages 69-72 in A.N. Popper and A. Hawkins, eds. The Effects of Noise on Aquatic Life. New York: Springer.

Cranford, T.W. and P. Krysl. 2015. Fin whale sound reception mechanisms: Skull vibration enables low frequency hearing. PLOS ONE 10:1-17.

Cranford, T.W., P. Krysl, and J.A. Hildebrand. 2008. Acoustic pathways revealed: Simulated sound transmission and reception in Cuvier's beaked whale (*Ziphius cavirostris*). Bioinspiration & Biomimetics 3:1-10.

Cranford, T.W., P. Krysl, and M. Amundin. 2010. A new acoustic portal into the odontocete ear and vibrational analysis of the tympanoperiotic complex. PLOS ONE 5:e1 1927.

Cranford, T.W., V. Trijoulet, C.R. Smith, and P. Krysl. 2014. Validation of a vibroacoustic finite element model using bottlenose dolphin simulations: the dolphin biosonar beam is focused in stages. Bioacoustics 23:161-194.

Dahlheim, M.E., and D.K. Ljungblad. 1990. Preliminary hearing study on gray whales (*Eschrichtius robustus*) in the field. Pages 335-346 in J. Thomas and R. Kastelein, eds. Sensory Abilities of Cetaceans. New York: Plenum Press.

Danielson, R., D. Henderson, M.A. Gratton, L. Bianchai, and R. Salvi. 1991. The importance of "temporal pattern" in traumatic impulse noise exposures Journal of the Acoustical Society of America 90:209-218.

Davis, R.I., W. Qiu, and R.P. Hamernik. 2009. Role of the kurtosis statistic in evaluating complex noise exposures for the protection of hearing. Ear & Hearing 30:628-634.

Deng, Z.D., B.L. Southall, T.J. Carlson, J. Xu, J.J. Martinez, M.A. Weiland, J. M. Ingraham. 2014. 200 kHz commercial sonar systems generate lower frequency side lobes audible to some marine mammals. PLOS ONE 9:e95315.

DOD (Department of Defense). 2004. Department of Defense Instruction: DOD Hearing Conservation Program (HCP). Washington, D.C.: Department of Defense.

Dukas, R. 2004. Causes and consequences of limited attention. Brain, Behavior and Evolution 63:197-210.

Dunn, D.E., R.R. Davis, C.J. Merry, and J.R. Franks. 1991. Hearing loss in the chinchilla from impact and continuous noise exposure. Journal of the Acoustical Society of America 90:1979-1985.

EPA (Environmental Protection Agency). 1982. Guidelines for Noise Impact Analysis (EPA Report Number 550/9-82-105).Washington, D.C.: Office of Noise Abatement and Control.

Erbe, C. 2002. Underwater noise of whale-watching boats and potential effects on killer whales (*Orcinus orca*), based on an acoustic impact model. Marine Mammal Science 18:394-418.

Erbe, C., and D.M. Farmer. 2000. Zones of impact around icebreakers affecting beluga whales in the Beaufort Sea. Journal of the Acoustical Society of America 108:1332-1340.

Erbe, C., C. Reichmuth, K. Cunningham, K. Lucke, and R. Dooling. 2016. Communication masking in marine mammals: A review and research strategy. Marine Pollution Bulletin 103:15-38.

Ferguson, M.C., C. Curtice, J. Harrison, and S.M. Van Parijs. 2015. Biologically Important Areas for cetaceans within U.S. waters – Overview and rationale. Aquatic Mammals 41:2-16.

Finneran, J.J. 2018. Conditioned attenuation of auditory brainstem responses in dolphins warned of an intense noise exposure: Temporal and spectral patterns Journal of the Acoustical Society of America 143:795-810.

Finneran, J.J. 2015. Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996 to 2015. Journal of the Acoustical Society of America 138:1702-1726.

Finneran, J.J. 2016. Auditory Weighting Functions and TTS/PTS Exposure Functions for Marine Mammals Exposed to Underwater Noise, Technical Report 3026, December 2016. San Diego: Systems Center Pacific.

Finneran, J.J. and A.K. Jenkins. 2012. Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis. San Diego, California: SPAWAR Systems Center Pacific.

Finneran, J.J., and C.E. Schlundt. 2010. Frequency-dependent and longitudinal changes in noise-induced hearing loss in a bottlenose dolphin (*Tursiops truncatus*). Journal of the Acoustical Society of America 128:567-570.

Finneran, J.J., and C.E. Schlundt. 2013. Effects of fatiguing tone frequency on temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*). Journal of the Acoustical Society of America 133:1819-1826.

Finneran, J.J., C.E. Schlundt, D.A. Carder, J.A. Clark, J.A. Young, J.B. Gaspin, and S.H. Ridgway. 2000. Auditory and behavioral responses of bottlenose dolphins (*Tursiops truncatus*) and a beluga whale (*Delphinapterus leucas*) to impulsive sounds resembling distant signatures of underwater explosions. Journal of the Acoustical Society of America 108:417-431.

Finneran, J.J., C.E. Schlundt, R. Dear, D.A. Carder, and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 111:2929-2940.

Finneran, J. J., R. Dear, D.A. Carder, and S.H. Ridgway. 2003. Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer. Journal of the Acoustical Society of America 114:1667-1677.

Finneran, J.J., D.A. Carder, C.E. Schlundt, and S.H. Ridgway. 2005a. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. Journal of the Acoustical Society of America 118:2696-2705.

Finneran, J.J., D.A. Carder, R. Dear, T. Belting, J. McBain, L. Dalton, and S.H. Ridgway. 2005b. Pure tone audiograms and possible aminoglycoside-induced hearing loss in belugas (*Delphinapterus leucas*). Journal of the Acoustical Society of America 117:3936–3943.

Finneran, J.J., C.E. Schlundt, B. Branstetter, and R.L. Dear. 2007a. Assessing temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) using multiple simultaneous auditory evoked potentials. Journal of the Acoustical Society of America 122:1249–1264.

Finneran, J.J., H.R. London, and D.S. Houser. 2007b. Modulation rate transfer functions in bottlenose dolphins (*Tursiops truncatus*) with normal hearing and high-frequency hearing loss. Journal of Comparative Physiology, Part A 193:835–843.

Finneran, J.J., D.A. Carder, C.E. Schlundt, and R.L. Dear. 2010a. Growth and recovery of temporary threshold shift at 3 kHz in bottlenose dolphins: Experimental data and mathematical models. Journal of the Acoustical Society of America 127:3256-3266.

Finneran, J.J., D.A. Carder, C.E. Schlundt, and R.L. Dear. 2010b. Temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) exposed to intermittent tones. Journal of the Acoustical Society of America 127:3267-3272.

Finneran, J.J., C.E. Schlundt, B.K. Branstetter, J.S. Trickey, V. Bowman, and K. Jenkins. 2015. Effects of multiple impulses from as seismic airgun on bottlenose dolphin hearing and behavior. Journal of the Acoustical Society of America 137:1634-1646.

Francis, R.I.C.C., and R. Shotton. 1997. “Risk” in fisheries management: A review. Canadian Journal of Fisheries and Aquatic Science 54:1699–1715.

Galindo-Romero, M., T. Lippert, and A.N. Gavrilov. 2015. Empirical estimation of peak pressure levels in anthropogenic impulsive noise. Part I: Airgun arrays signals. Journal of the Acoustical Society of America 138:EL540-EL544.

Gedamke, J., N. Gales, and S. Frydman. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: The effect of uncertainty and individual variation. Journal of the Acoustical Society 129:496-506.

Gerstein, E.R., L. Gerstein, S.E. Forsythe, J.E Blue. 1999. The underwater audiogram of the West Indian manatee (*Trichechus manatus*). Journal of the Acoustical Society of America 105: 3575-3583.

Ghoul, A., and C. Reichmuth. 2014. Hearing in the sea otter (*Enhydra lutris*): auditory profiles for an amphibious marine carnivore. Journal of Comparative Physiology A. 200:967-981.

Gill, J.A., K. Norris, and W.J. Sutherland. 2001. Why behavioural responses may not reflect the population consequences of human disturbance. Biological Conservation 97:265-268.

Hall, J.D., and C.S. Johnson. 1972. Auditory Thresholds of a Killer Whale *Orcinus orca* Linnaeus. Journal of the Acoustical Society of America 51:515-517.

Hamernik, R.P., and K.D. Hsueh. 1991. Impulse noise: Some definitions, physical acoustics and other considerations. Journal of the Acoustical Society of America 90:189-196.

Hamernik, R.P., W.A. Ahroon, and K.D. Hseuh. 1991. The energy spectrum of an impulse: Its relation to hearing loss. Journal of the Acoustical Society of America 90:197-204.

Hamernik, R.P., W.A. Ahroon, K.D. Hsueh, S.F. Lei, and R.I. Davis. 1993. Audiometric and histological differences between the effects of continuous and impulsive noise exposures. Journal of the Acoustical Society of America 93:2088-2095.

Hamernik, R.P., W. Qiu, and B. Davis. 2003. The effects of the amplitude distribution of equal energy exposures on noise-induced hearing loss: The kurtosis metric. Journal of the Acoustical Society of America 114:386-395.

Harris, C.M., 1998. Handbook of Acoustical Measurements and Noise Control. Woodbury, N.Y.: Acoustical Society of America.

Harwood, J., and K. Stokes. 2003. Coping with uncertainty in ecological advice: lessons from fisheries. Trends in Ecology and Evolution 18:617-622.

Hastie, G.D., C. Donovan, T. Götz, and V.M. Janik. 2014. Behavioral responses by grey seals (*Halichoerus grypus*) to high frequency sonar. Marine Pollution Bulletin 79:205-210.

Hawkins, A.D., A.E. Pembroke, and A.N. Popper. 2014. Information gaps in understanding the effects of noise on fishes and invertebrates. Reviews in Fish Biology and Fisheries. Published online: 12 September.

Heeringa, A.N., and P. van Dijk. 2014. The dissimilar time course of temporary threshold shifts and reduction of inhibition in the inferior colliculus following intense sound exposure. Hearing Research 312:38-47.

Heffner, H.E., and R.S. Heffner. 2003. Audition. Pages 413-440 in Davis, S., ed. Handbook of Research Methods in Experimental Psychology. New York: Blackwell.

Hemilä, S., S. Nummela, A. Berta, and T. Reuter. 2006. High-frequency hearing in phocid and otariid pinnipeds: An interpretation based on inertial and cochlear constraints (L). Journal of the Acoustical Society of America 120:3463-3466.

Henderson, D., and R.P. Hamernik.1982. Asymptotic threshold shift from impulse noise. Pages 265-298 in Hamernik, R.P., D. Henderson, and R. Salvi, eds. New Perspectives on Noise-Induced Hearing Loss. New York: Raven Press.

Henderson, D., and R.P. Hamernik. 1986. Impulse noise: Critical review. Journal of the Acoustical Society of America 80:569-584.

Henderson, D., B. Hu, and E. Bielefeld. 2008. Patterns and mechanisms of noise-induced cochlear pathology. Pages 195-217 in Schacht, J., A.N. Popper, and R.R Fay, eds. Auditory Trauma, Protection, and Repair. New York: Springer.

Henderson, D., M. Subramaniam, M.A. Grattona, and S.S. Saunders. 1991. Impact noise: The importance of level, duration, and repetition rate. Journal of the Acoustical Society of America 89:1350-1357.

HESS (High Energy Seismic Survey). 1999. High energy seismic survey review process and interim operational guidelines for marine surveys offshore Southern California. Prepared for The California State Lands Commission and The United States Minerals Management Service Pacific Outer Continental Shelf Region. Camarillo, California: High Energy Seismic Survey Team.

Holt, M.M. 2008. Sound exposure and Southern Resident killer whales (*Orcinus orca*)*:* A review of current knowledge and data gaps. NOAA Technical Memo.NMFS-NWFSC-89. U.S. Seattle, Washington: Department of Commerce.

Houser, D.S., and J.J. Finneran. 2006. Variation in the hearing sensitivity of a dolphin population determined through the use of evoked potential audiometry. Journal of the Acoustical Society of America 120:4090–4099.

Houser, D.S. and P.W. Moore. 2014. Report on the current status and future of underwater hearing research. San Diego, California: National Marine Mammal Foundation.

Houser, D.S., D.A. Helweg, and P.W.B. Moore. 2001. A bandpass filter-bank model of auditory sensitivity in the humpback whale. Aquatic Mammals 27:82-91.

Houser, D.S., A. Gomez-Rubio, and J.J. Finneran. 2008. Evoked potential audiometry of 13 Pacific bottlenose dolphins (*Tursiops truncatus gilli*). Marine Mammal Science 24:28-41.

ISO (International Organization for Standardization). 2017. Underwater Acoustics-Terminology, ISO 18405. Geneva, Switzerland: International Organization for Standardization.

Jacobs, D.W. J.D. and Hall. 1972. Auditory thresholds of a fresh water dolphin, *Inia geoffrensis Blainville*. Journal of the Acoustical Society of America. 51:530-533.

Jewett, D.L., and J.S. Williston. 1971. Auditory-evoked far fields averaged from the scalps of humans. Brain 94: 681-696.

Johnson, C.S. 1967. Sound detection thresholds in marine mammals. Pages 247-260 in Marine Bioacoustics, edited by W.N. Tavolga. Oxford: Pergamon Press.

Johnson, C.S., M.W. McManus, and D. Skaar. 1989. Masked tonal hearing thresholds in the beluga whale. Journal of the Acoustical Society of America. 85:2651-2654.

Kastak, D., and R.J. Schusterman. 1998. Low-frequency amphibious hearing in pinnipeds: Methods, measurements, noise, and ecology. Journal of the Acoustical Society of America 103:2216-2228.

Kastak, D., and R.J. Schusterman. 1999. In-air and underwater hearing sensitivity of a northern elephant seal (*Mirounga angustirostris*). Canadian Journal of Zoology 77:1751-1758.

Kastak, D., R.J. Schusterman, B.L. Southall, and C.J. Reichmuth. 1999. Underwater temporary threshold shift induced by octave-band noise in three species of pinniped. Journal of the Acoustical Society of America 106:1142-1148.

Kastak, D., and R.J. Schusterman. 2002. Changes in auditory sensitivity with depth in a free-diving California sea lion (*Zalophus californianus*). Journal of the Acoustical Society of America 112:329-333.

Kastak, D., B.L. Southall, R.J. Schusterman, and C. Reichmuth Kastak. 2005. Underwater temporary threshold shift in pinnipeds: Effects of noise level and duration. Journal of the Acoustical Society of America 118:3154-3163.

Kastak, D., J. Mulsow, A. Ghoul, and C. Reichmuth. 2008. Noise-induced permanent threshold shift in a harbor seal. Journal of the Acoustical Society of America 123:2986.

Kastak, D., C. Reichmuth, M.M. Holt, J. Mulsow, B.L. Southall, and R.J. Schusterman. 2007. Onset, growth, and recovery of in-air temporary threshold shift in a California sea lion (*Zalophus californianus*). Journal of the Acoustical Society of America, 122:2916- 2924.

Kastelein, R.A., P. Mosterd, B. van Santen, M. Hagedoorn, and D. de Haan. 2002. Underwater audiogram of a Pacific walrus (*Odobenus rosmarus divergens*) measured with narrow-band frequency-modulated signals. Journal of the Acoustical Society of America 112:2173-2182.

Kastelein, R.A., M. Hagedoorn, W.W.L. Au, and D. de Haan, D. 2003. Audiogram of a striped dolphin (*Stenella coeruleoalba*). Journal of the Acoustical Society of America 113:1130-1137.

Kastelein, R.A., R. van Schie, W.C. Verboom, and D. de Haan. 2005a.Underwater hearing sensitivity of a male and a female Steller sea lion (*Eumetopias jubatus*). Journal of the Acoustical Society of America 118:1820-1829.

Kastelein, R.A., M. Janssen, W.C. Verboom, and D. de Haan. 2005b. Receiving beam patterns in the horizontal plane of a harbor porpoise (*Phocoena phocoena*). Journal of the Acoustical Society of America 118:1172-1179.

Kastelein, R.A., W.C. Verboom, and J.M. Terhune. 2009a. Underwater detection of tonal signals between 0.125 and 100 kHz by harbor seals (*Phoca vitulina*). Journal of the Acoustical Society of America, 125:1222-1229.

Kastelein, R.A., P. Wensveen, L. Hoek, and J.M. Terhune. 2009b. Underwater hearing sensitivity of harbor seals (*Phoca vitulina*) for narrow noise bands between 0.2 and 80 kHz. Journal of the Acoustical Society of America 126:476–483.

Kastelein, R.A., L. Hoek, C.A.F. de Jong, and P.J. Wensveen. 2010. The effect of signal duration on the underwater detection thresholds of a harbor porpoise (*Phocoena phocoena*) for single frequency-modulated tonal signals between 0.25 and 160 kHz. Journal of the Acoustical Society of America 128:3211-3222.

Kastelein, R.A., R. Gransier, L. Hoek, A. Macleod, and J.M. Terhune. 2012a. Hearing threshold shifts and recovery in harbor seals (*Phoca vitulina*) after octave-band noise exposure at 4 kHz. Journal of the Acoustical Society of America 132:2745-2761.

Kastelein, R.A., R. Gransier, L. Hoek, and J. Olthuis. 2012b. Temporary hearing threshold shifts and recovery in a harbor porpoise (*Phocoena phocoena*) after octave-band noise at 4 kHz. Journal of the Acoustical Society of America 132:3525-3537.

Kastelein, R.A., R. Gransier, and L. Hoek. 2013a. Comparative temporary threshold shifts in a harbor porpoise and harbor seal, and severe shift in a seal (L). Journal of the Acoustical Society of America 134:13-16.

Kastelein, R.A. R. Gransier, L. Hoek, and M. Rambags. 2013b. Hearing frequency thresholds of harbor porpoise (*Phocoena phocoena*) temporarily affected by a continuous 1.5 kHz tone. Journal of the Acoustical Society of America 134:2286-2292.

Kastelein, R.A., L. Hoek, R. Gransier, M. Rambags, and N. Claeys. 2014a. Effects of level, duration, and inter-pulse interval of 1-2 kHz sonar signal exposures on harbor porpoise hearing. Journal of the Acoustical Society of America 136:412-422.

Kastelein, R.A., J. Schop, R. Gransier, and L. Hoek. 2014b. Frequency of greatest temporary hearing threshold shift in harbor porpoise (*Phocoena phocoena*) depends on the noise level. Journal of the Acoustical Society of America 136:1410-1418.

Kastelein, R.A., R. Gransier, M.A.T. Marijt, and L. Hoek. 2015a. Hearing frequency thresholds of harbor porpoises (*Phocoena phocoena*) temporarily affected by play back offshore pile driving sounds. Journal of the Acoustical Society of America 137:556-564.

Kastelein, R.A., R. Gransier, J. Schop, and L. Hoek. 2015b. Effects of exposure to intermittent and continuous 6-7 kHz sonar sweeps on harbor porpoise (*Phocoena phocoena*) hearing. Journal of the Acoustical Society of America 137:1623-1633.

Kastelein, R.A., J. Schop, L. Hoek, and J. Covi. 2015c. Hearing thresholds of a harbor porpoise (*Phocoena phocoena*) for narrow-band sweeps. Journal of the Acoustical Society of America 138: 2508–2512.

Kastelein, R.A., L. Helder-Hoek, J. Covi, and R. Gransier. 2016. Pile driving playback sound and temporary threshold shift in harbor porpoises (*Phocoena phocoena*): Effect of exposure duration. Journal of the Acoustical Society of America 139:2842-2851.

Kastelein, R.A., R. Gransier, L. Hoek, and A. Macleod, and J.M. Terhune. Unpublished. Auditory and behavioral responses of two harbor seals (*Phoca vitulina*) to playbacks of offshore pile driving sounds, phase1: Behavioral response in one seal, but no TTS.

Kastelein, R.A., L. Helder-Hoek, and S. Van de Voorde. 2017a. Hearing thresholds of a male and a female harbor porpoise (*Phocoena phocoena*). Journal of the Acoustical Society of America 142: 1006–1010.

Kastelein, R.A. L. Helder-Hoek, S. Van de Voorde, A.M. von Benda-Beckmann, F.-P.A. Lam, E. Jansen, C.A.F. de Jong, and M.A. Ainslie. 2017b. Temporary hearing threshold shift in a harbor porpoise (*Phocoena phocoena*) after exposure to multiple airgun sounds. Journal of the Acoustical Society of America 142: 2430-2442.

Kastelein, R.A., L. Helder-Hoek, and S. Van de Voorde. 2017c. Effects of exposure to sonar playback sounds (3.5-4.1 kHz) on harbor porpoise (*Phocoena phocoena*) hearing. Journal of the Acoustical Society of America 142: 1965-1975.

Kearns, J.R. 1977. Presbycusis. Canadian Family Physician 23:96-100.

Ketten, D. 2000. Cetacean ears. Pages 43-108 In: W.W.L Au, A.N. Popper, and R.R. Fay, eds. Hearing by Whales and Dolphins. New York: Springer.

Kight, C.R., and J.P. Swaddle. 2011. How and why environmental noise impacts animals: An integrative, mechanistic review. Ecology Letters 14:1052-1061.

Kryter, K.D., W.D. Ward, J.D. Miller, and D.H. Eldredge. 1966. Hazardous Exposure to Intermittent and Steady-State Noise. Journal of the Acoustical Society of America 39:451-464.

Kujawa, S.G., and M.C. Liberman. 2009. Adding insult to injury: Cochlear nerve degeneration after "temporary" noise-induced hearing loss. The Journal of Neuroscience 29:14077-14085.

Kyhn, L.A., J. Tougaard, F. Jensen, M. Wahlberg, K. Beedholm, and P.T. Madsen. 2009. Feeding at a high pitch: Source parameters of narrow band high-frequency clicks from echolocating off-shore hourglass dolphins and coastal Hector's dolphins. Journal of the Acoustical Society of America 125:1783-1791.

Kyhn, L.A., F.H. Jensen, K. Beedholm, J. Tougaard, M. Hansen, and P.T. Madsen. 2010. Echolocation in sympatric Peale's dolphins (*Lagenorhynchus australis*) and Commerson's dolphins (*Cephalorhynchus commersonii*) producing narrow-band high-frequency clicks. The Journal of Experimental Biology 213:1940-1949.

Laroche, C., R. Hétu, and S. Poireir. 1989. The growth of and recovery from TTS in human subjects exposed to impact noise. Journal of the Acoustical Society of America 85:1681-1690.

Lataye, R., and P. Campo. 1996. Applicability of the L_{eq} as a damage-risk criterion: An animal experiment. Journal of the Acoustical Society of America 99:1621-1632.

Leibold, L. J., and Werner, L. A. 2002. Relationship between intensity and reaction time in normal-hearing infants and adults. Ear & Hearing. 23:92-97.

Lemonds, D.W. 1999. Auditory filter shapes in an Atlantic bottlenose dolphin (*Tursiops truncatus*). Ph.D. Dissertation, University of Hawaii. 74 pp.

Levine, S., P. Hofstetter, X.Y. Zheng, and D. Henderson. 1998. Duration and peak level as co-factors in hearing loss from exposure to impact noise. Scandinavian Audiology Supplementum 48:27-36.

Lin, H.W., A.C. Furman, S.G. Kujawa, and M.C. Liberman. 2011. Primary neural degeneration in the guinea pig cochlea after reversible noise-induced threshold shift. Journal of the Association for Research in Otolaryngology 12:605-616.

Lippert, T., M. Galindo-Romero, A.N. Gavrilov, and O. von Estorff. 2015. Empirical estimation of peak pressure level from sound exposure level. Part II: Offshore impact pile driving noise. Journal of the Acoustical Society of America 138:EL287-EL292.

Ljungblad, D.K., P.D. Scroggins, and W.G. Gilmartin. 1982. Auditory thresholds of a captive Eastern Pacific bottle-nosed dolphin, *Tursiops* spp. Journal of the Acoustical Society of America. 72:1726-1729.

Lucke, K., U. Siebert, P.A. Lepper, and M-A.Blanchet. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. Journal of the Acoustical Society of America 125:4060-4070.

Lucke, K., E. Winter, F.-P. Lam, G. Scowcroft, A. Hawkins, and A.N. Popper. 2014. Report of the Workshop on International Harmonisation of Approaches to Define Underwater Noise Exposure Criteria (Budapest, Hungary 17th August 2013). Wageningen, The Netherlands: IMARES - Institute for Marine Resources & Ecosystem Studies.

Lucke, K., A.N. Popper, A.D. Hawkins, T. Akamatsu, M. André, B.K. Branstetter, M. Lammers, C.A. Radford, A.L. Stansbury, and T.A. Mooney. 2016. Auditory sensitivity in aquatic animals. Journal of the Acoustical Society of America 139:3097-3101.

Ludwig, D., R. Hilborn, and C. Waters. 1993. Uncertainty, resource exploitation, and conservation: Lessons from history. Science 260:17-36.

Luther, D.A., and R.H. Wiley. 2009. Production and perception of communicatory signals in a noisy environment. Biology Letters 5:183-187.

Madsen, P.T. 2005. Marine mammals and noise: Problems with root mean square sound pressure levels for transients. Journal of the Acoustical Society of America 117:3952–3957.

Mann, D., G. Bauer, R. Reep, J. Gaspard, K. Dziuk, and L. Read. 2009. Auditory and tactile detection by the West Indian manatee. St. Petersburg, Florida: Fish and Wildlife Research Institute.

Mann, D., M. Hill-Cook, C. Manire, D. Greenhow, E. Montie, J. Powell, R. Wells, G. Bauer, P. Cunningham-Smith, R. Lingenfelser, R. DiGiovanni, A. Stone, M. Brodsky, R. Stevens, G. Kieffer, and P. Hoetjes. 2010. Hearing loss in stranded odontocete dolphins and whales. PLOS ONE 5:13824.

Maslen, K. R. 1981. Towards a better understanding of temporary threshold shift of hearing. Applied Acoustics 14: 281–318.

Masterson, B., H. Heffner, and R. Ravizza. 1969. The evolution of human hearing. Journal of the Acoustical Society of America 45:966-985.

May-Collado, L., and I. Agnarsson. 2006. Cytochrome *b* and Bayesian inference of whale phylogeny. Molecular Phylogenetics and Evolution 38:344-354.

Miller, J.D. 1974. Effects of noise on people. Journal of the Acoustical Society of America 56:729 764.

Miller, P.J.O., P.H. Kvadsheim, F.-P. Lam, P.J. Wensveen, R. Antunes, A.C. Alves, F. Visser, L. Kleivane, P.L. Tyack, and L.D. Sivle. 2012. The severity of behavioral changes observed during experimental exposures of killer (*Orcinus orca*), long-finned pilot (*Globicephala melas*), and sperm (P*hyseter macrocephalus*) whales to naval sonar. Aquatic Mammals 38:362-401.

Mills, J.H. 1982. Effects of noise on auditory sensitivity, psychophysical tuning curves, and suppression. Pages 249-263 in R.P. Hamernik, D. Henderson, and R. Salvi, eds. New Perspectives on Noise-Induced Hearing Loss. New York: Raven Press.

Mills, J.H., R.M. Gilbert, and W.Y. Adkins. 1979. Temporary threshold shifts in humans exposed to octave bands of noise for 16 to 24 hours. Journal of the Acoustical Society of America 65:1238-1248.

Møhl, B. 1968. Auditory sensitivity of the common seal in air and water. Journal of Auditory Research 8:27-38.

Mooney, T.A., P.E. Nachtigall, and S. Vlachos.2009a. Sonar-induced temporary hearing loss in dolphins. Biology Letters5:565-567.

Mooney, T.A., P.E. Nachtigall, M. Breese, S. Vlachos, and W.W.L. Au. 2009b. Predicting temporary threshold shifts in a bottlenose dolphin (*Tursiops truncatus*): The effects of noise level and duration. Journal of the Acoustical Society of America 125:1816-1826.

Mooney, T.A., S. Li, D.R. Ketten, K. Wang, and D. Wang. 2014. Hearing pathways in the Yangtze finless porpoise, *Neophocaena asiaeorientalis*. The Journal of Experimental Biology 217:444-452.

Moore, P.W.B., and R.J. Schusterman. 1987. Audiometric assessment of northern fur seals, *Callorhinus ursinus*. Marine Mammal Science 3:31-53.

Morfey, C.L. 2001. Dictionary of Acoustics. New York: Academic Press.

Mulsow, J., C. Reichmuth, F. Gulland, D.A.S. Rosen, and J.J. Finneran. 2011. Aerial audiograms of several California sea lions (*Zalophus californianus*) and Steller sea lions (*Eumetopias jubatus*) measured using single and multiple simultaneous auditory steady-state response methods. The Journal of Experimental Biology 214:1138-1147.

Mulsow, J., D.S. Houser, and J.J. Finneran. 2012. Underwater psychophysical audiogram of a young male California sea lion (*Zalophus californianus*). Journal of the Acoustical Society of America. 131:4182-4187.

Mulsow, J., D. Houser, and J.J. Finneran. 2014. Aerial hearing thresholds and detection of hearing loss in male California sea lions (*Zalophus californianus*) using auditory evoked potentials. Marine Mammal Science 30:1383-1400.

Mulsow, J., C.E. Schlundt, L. Brandt, and J.J. Finneran. 2015. Equal latency contours for bottlenose dolphins (*Tursiops truncatus*) and California sea lions (*Zalophus californianus*). Journal of the Acoustical Society of America 138: 2678–2691.

Nachtigall, P.E., and A.Y. Supin. 2013. A false killer whale reduces its hearing sensitivity when a loud sound is preceded by a warning. The Journal of Experimental Biology 216:3062-3070.

Nachtigall, P.E., and A.Y. Supin. 2014. Conditioned hearing sensitivity in a bottlenose dolphin (*Tursiops truncatus*). The Journal of Experimental Biology 217:2806-2813.

Nachtigall, P.E., and A.Y. Supin. 2015. Conditioned frequency-dependent hearing sensitivity reduction in a bottlenose dolphin (*Tursiops truncatus*). The Journal of Experimental Biology 218:999-1005.

Nachtigall, P.E., W.W.L. Au, J. Pawloski, and P.W.B. Moore. 1995. Risso's dolphin (*Grampus griseus*) hearing thresholds in Kaneohe Bay, Hawaii. Pages 49-53 in Sensory Systems of Aquatic Mammals, edited by R.A. Kastelein, J.A. Thomas, and P.E. Nachtigall. The Netherlands: DeSpil, Woerden.

Nachtigall, P.E., J.L. Pawloski, and W.W. L. Au. 2003. Temporary threshold shifts and recovery following noise exposure in the Atlantic bottlenose dolphin (*Tursiops truncatus*). Journal of the Acoustical Society of America 113:3425-3429.

Nachtigall, P.E., A. Ya. Supin, J.L. Pawloski, and W.W.L. Au. 2004. Temporary threshold shifts after noise exposure in the bottlenose dolphin (*Tursiops truncatus*) measured using auditory evoked potentials. Marine Mammal Science 20:673-687.

Nachtigall, P.E., T.A. Mooney, K.A. Taylor, L.A. Miller, M.H. Rasmussen, T. Akamatsu, J. Teilmann, M. Linnenschmidt, and G.A. Vikingsson. 2008. Shipboard measurements of the hearing of the white-beaked dolphin *Lagenorhynchus albirostris*. The Journal of Experimental Biology 211:642-647.

Nachtigall, P.E., A. Ya Supin, J.-A. Estaban, and A.F. Pacini. 2016a. Learning and extinction of conditioned hearing sensation change in the beluga whale (*Delphinapterus leucas*). Journal of Comparative Physiology, Part A 202: 105-113.

Nachtigall, P.E., A. Ya Supin, A.F. Pacini, and R.A. Kastelein. 2016b. Conditioned hearing sensitivity change in the harbor porpoise (*Phocoena phocoena*). Journal of the Acoustical Society of America 140: 960–967.

Nachtigall, P.E., A.Ya. Supin, A.B. Smith, and A.F. Pacini. 2016c. Expectancy and conditioned hearing levels in the bottlenose dolphin (*Tursiops truncatus*). Journal of Experimental Biology 219:844-850.

NIOSH (National Institute for Occupational Safety and Health). 1998. Criteria for a recommended standard: Occupational noise exposure. Cincinnati, Ohio: United States Department of Health and Human Services.

NMFS (National Marine Fisheries Service). 2009. Endangered and Threatened Species: Designation of Critical Habitat for Cook Inlet Beluga Whale. Federal Register 74(230):63080-63095.

NMFS (National Marine Fisheries Service). 2013. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals—Acoustic thresholds for Onset of Permanent and Temporary Threshold Shifts. Federal Register 78(249):78,822-78,823.

NMFS (National Marine Fisheries Service). 2014. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals—Acoustic thresholds for Onset of Permanent and Temporary Threshold Shifts. Federal Register 79(19):4672-4673.

NMFS (National Marine Fisheries Service). 2015. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals—Acoustic thresholds for Onset of Permanent and Temporary Threshold Shifts. Federal Register 80(147):45642-45643.

NMFS (National Marine Fisheries Service). 2016a. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts, NOAA Technical Memorandum NMFS-OPR-55. Washington, D.C.: U.S. Department of Commerce, NOAA.

NMFS (National Marine Fisheries Service). 2016b. Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals—Acoustic thresholds for Onset of Permanent and Temporary Threshold Shifts. Federal Register 81(51):14095-14096.

NMFS (National Marine Fisheries Service). 2018. Manual for Optional User Spreadsheet (Version 1.1) for: 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing. Silver Spring, Maryland: Office of Protected Resources, National Marine Fisheries Service.

NOAA (National Oceanic and Atmospheric Administration).1998. Incidental taking of marine mammals; Acoustic harassment. Federal Register 63(143):40103.

NOAA (National Oceanic and Atmospheric Administration). 2013. Magnuson-Stevens Act Provisions, National Standard 2-Scientific Information. Federal Register 78(139):43066-43090.

NOAA (National Oceanic and Atmospheric Administration). 2014. Taking and Importing Marine Mammals; Precision Strike Weapon and Air-to-Surface Gunnery Training and Testing Operations at Eglin Air Force Base, FL. Federal Register 79(47):13568-13591.

NRC (National Research Council). 1993. Hazardous Exposure to Steady-State and Intermittent Noise. Washington, D.C.: National Academy Press.

NRC (National Research Council). 1994. Low-Frequency Sound and Marine Mammals: Current Knowledge and Research Needs. Washington, D.C.: National Academy Press.

NRC (National Research Council). 2000. Low-Frequency Sound and Marine Mammals: Progress Since 1994. Washington, D.C.: National Academy Press.

NRC (National Research Council). 2003. Ocean Noise and Marine Mammals. Washington, D.C.: National Academies Press.

NRC (National Research Council). 2004. Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management. Washington, D.C.: National Academy Press.

NRC (National Research Council). 2005. Marine Mammal Populations and Ocean Noise. Washington, D.C.: National Academies Press.

NRC (National Research Council). 2016. Approaches to Understanding the Cumulative Effects of Stressors on Marine Mammals. Washington, D.C.: National Academies Press.

OMB (Office of Management and Budget). 2005. Final information quality bulletin for peer review. Federal Register 70(10):2664-2677.

OSHA (Occupational Safety & Health Administration). 2013. OSHA Technical Manual. Washington, D.C.: United States Department of Labor.

Parks, S., D.R. Ketten, J.T. O'Malley, and J. Arruda.2007. Anatomical Predictions of Hearing in the North Atlantic Right Whale. The Anatomical Record 290:734-744.

Perrin, W.F., B. Würsig, and J.G.M. Thewissen (Eds). 2008. Encyclopedia of Marine Mammals (Second Edition).San Diego, California: Elsevier.

Popper, A.N., A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, M.B. Halvorsen, S. Løkkeborg, P.H. Rogers, B.L. Southall, D.G. Zeddies, and W.N. Tavolga. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1. New York: Springer.

Popov, V.V., A.Y. Supin, D. Wang, K. Wang, L. Dong, and S. Wang. 2011a. Noise-induced temporary threshold shift and recovery in Yangtze finless porpoises *Neophocaena phocaenoides asiaeorientalis*. Journal of the Acoustical Society of America 130:574-584.

Popov, V.V., V.O. Klishin, D.I. Nechaev, M.G. Pletenko, V.V. Rozhnov, A.Y. Supin, E.V. Sysueva, and M.B. Tarakanov. 2011b. Influence of acoustic noises on the white whale hearing thresholds. Doklady Biological Sciences 440:332-334.

Popov, V.V., A. Ya Supin, V. V Rozhnov, D.I. Nechaev, E.V. Sysuyeva, V.O. Klishin, M.G. Pletenko, and M.B. Tarakanov. 2013. Hearing threshold shifts and recovery after noise exposure in beluga whales, *Delphinapterus leucas*. The Journal of Experimental Biology 216:1587-1596.

Popov, V.V., A.Ya Supin, V.V. Rozhnov, D.I. Nechaev, and E.V. Sysueva. 2014. The limits of applicability of the sound exposure level (SEL) metric to temporal threshold shifts (TTS) in beluga whales, *Delphinapterus leucas*. The Journal of Experimental Biology 217:1804-1810.

Popov, V.V., D.I. Nechaev, E.V. Sysueva, V.V. Rozhnov, and A.Ya. Supin. 2015. Spectrum pattern resolution after noise exposure in a beluga whale, *Delphinapterus leucas*: Evoked potential study. Journal of the Acoustical Society of America 138:377-388.

Popov, V.V., E.V. Sysueva, D.I. Nechaev, V.V. Rozhnov, and A.Ya. Supin. 2016. Auditory evoked potentials in the auditory system of a beluga whale *Delphinapterus leucas* to prolonged sound stimuli. Journal of the Acoustical Society of America 139:1101-1109.

Popov, V.V., E.V. Sysueva, D.I. Nechaev, V.V. Rozhnov, and A.Ya. Supin. 2017. Influence of fatiguing noise on auditory evoked responses to stimuli of various levels in a beluga whale, *Delphinapterus leucas*. The Journal of Experimental Biology 220:1090-1096.

Price, G.R., and S. Wansack.1989. Hazard from intense midrange impulses. Journal of the Acoustical Society of America 86:2185-2191.

Punt, A.E., and G.P. Donovan. 2007. Developing management procedures that are robust to uncertainty: lessons from the International Whaling Commission. International Council for the Exploration of the Sea Journal of Marine Science 64:603-612.

Reichmuth, C. 2007. Assessing the hearing capabilities of mysticete whales. A proposed research strategy for the Joint Industry Programme on Sound and Marine Life on 12 September.

Reichmuth, C. 2013. Equal loudness contours and possible weighting functions for pinnipeds. Journal of the Acoustical Society of America 134: 4210.

Reichmuth, C., and B.L. Southall**.** 2012. Underwater hearing in California sea lions (*Zalophus californianus*): Expansion and interpretation of existing data. Marine Mammal Science 28: 358-363.

Reichmuth, C., M.M. Holt, J. Mulsow, J.M. Sills, and B.L. Southall.2013. Comparative assessment of amphibious hearing in pinnipeds. Journal of Comparative Physiology A 199:491-507.

Reichmuth, C., A. Ghoul, J.M. Sills, A. Rouse, and B.L. Southall. 2016. Low-frequency temporary threshold shift not observed in spotted or ringed seals exposed to single air gun impulses. Journal of the Acoustical Society of America 140: 2646–2658.

Renaud, D.L., and A.N. Popper. 1975. Sound localization by the bottlenose porpoise (*Tursiops truncatus*). Journal of Experimental Biology 63:569-585.

Richardson, W.J., and C.I. Malme. 1993. Man-made noise and behavioral responses. Pages 631-700. In Burns, J.J., J.J. Montague, and C.J. Cowles, eds. The Bowhead Whale. The Society for Marine Mammalogy, Special Publication Number 2.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. Marine mammals and noise. New York: Academic Press.

Ridgway, S.H., and P.L. Joyce. 1975. Studies on seal brain by radiotelemetry. Rapports et Proces-Verbaux des Reunions Conseil International pour L'Exploration de la Mer 169:81-91.

Ridgway, S.H., and D.A. Carder. 1997. Hearing deficits measured in some *Tursiops truncatus*, and discovery of a deaf/mute dolphin. Journal of the Acoustical Society of America 101:590-594.

Ridgway, S. and D.A. Carder. 2001. Assessing hearing and sound production in cetacean species not available for behavioral audiograms: experiences with sperm, pygmy sperm, and gray whales. Aquatic Mammals 27:267-276.

Ridgway, S.H., D.A. Carder, T. Kamolnick, R.R. Smith, R.R., C.E. Schlundt, and W.R. Elsberry. 2001. Hearing and whistling in the deep sea: depth influences whistle spectra but does not attenuate hearing by white whales (*Delphinapterus leucas*) (Odontoceti, Cetacea). J. Exp. Biol. 204:3829-3841.

Rohr, J.R., J.L. Kerby, and A. Sih. 2006. Community ecology as a framework for predicting contaminant effects. Trends in Ecology and Evolution 21:606-613.

Ruser., A., M. Dähne, A. van Neer, K. Lucke, J. Sundermeyer, U. Siebert, D.S. Houser, J.J. Finneran, E. Everaarts, J. Meerbeek, R. Dietz, S. Sveegaard, and J. Teilmann.2016. Assessing auditory evoked potentials of wild harbor porpoises (*Phocoena phocoena*). Journal of the Acoustical Society of America 140: 442–452.

Sauerland, M., and G. Dehnhard. 1998. Underwater audiogram of a tucuxi (*Sotalia fluviatilis guianensis*). Journal of the Acoustical Society of America. 103:1199-1204.

Saunders, J.C., S.P. Dear, and M.E. Schneider. 1985. The anatomical consequences of acoustic injury: A review and tutorial. Journal of the Acoustical Society of America 78:833-860.

Schlundt, C.E., J.J. Finneran, D.A. Carder, and S.H. Ridgway. 2000. Temporary shift in masked hearing thresholds of bottlenose dolphins, *Tursiops truncatus*, and white whales, *Delphinapterus leucas*, after exposure to intense tones. Journal of the Acoustical Society of America 107:3496-3508.

Schlundt, C.E., J.J. Finneran, B.K. Branstetter, R.L. Dear, D.S. Houser, and E. Hernandez. 2008. Evoked potential and behavioral hearing thresholds in nine bottlenose dolphins (*Tursiops truncatus*). Journal of the Acoustical Society of America. 123:3506.

Schlundt, C.E., R.L. Dear, D.S. Houser, A.E. Bowles, T. Reidarson, and J.J. Finneran. 2011. Auditory evoked potentials in two short-finned pilot whales (*Globicephala macrorhynchus*). Journal of the Acoustical Society of America 129:1111-1116.

Schuster, E., L. Bulling, and J. Köppel. 2015. Consolidating the state of knowledge: A synoptical review of wind energy's wildlife effects. Environmental Management 56:300-331.

Schusterman, R.J., and P.W. Moore. 1978. The upper limit of underwater auditory frequency discrimination in the California sea lion. Journal of the Acoustical Society of America 63:1591-1595.

Schusterman, R.J., R.F. Balliet, and J. Nixon. 1972. Underwater audiogram of the California sea lion by the conditioned vocalization technique. Journal of the Experimental Analysis of Behavior 17:339-350.

SEAMARCO. 2011. Temporary hearing threshold shifts and recovery in a harbor porpoise and two harbor seals after exposure to continuous noise and playbacks of pile driving sounds. SEAMARCO Ref: 2011/01. Harderwijk, The Netherlands: SEAMARCO (Sea Mammal Research Company).

Sertlek, H.O., H. Slabbekoorn, C.J. Ten Cate, and M.A. Ainslie. 2014. Insights into the calculation of metrics for transient sources in shallow water. Proceedings of Meetings on Acoustics 17:070076.

Sih, A., A.M. Bell, and J.L. Kerby. 2004. Two stressors are far deadlier than one. Trends in Ecology and Evolution 19:274-276.

Sills, J.M., B.L. Southall, and C. Reichmuth. 2014. Amphibious hearing in spotted seals (*Phoca largha*): Underwater audiograms, aerial audiograms and critical ratio measurements. The Journal of Experimental Biology 217:726-734.

Sills, J.M., B.L. Southall, and C. Reichmuth. 2015. Amphibious hearing in ringed seals (*Pusa hispida*): Underwater audiogram, aerial audiograms and critical ratio measurements. The Journal of Experimental Biology 218:2250-2259.

Sisneros, J.A., A.N. Popper, A.D. Hawkins, and R.R. Fay. 2016. Auditory evoked potential audiograms compared with behavioral audiograms in aquatic animals. Pages 1049-1056. In A.N. Popper and A. Hawkins (eds.) The Effects of Noise on Aquatic Life II. New York: Springer.

Sivle, L.D., P.H. Kvadsheim, and M.A. Ainslie. 2014. Potential for population-level disturbance by active sonar in herring. ICES Journal of Marine Science 72: 558-567.

SMRU Marine. 2014. The Interim Population Consequences of Disturbance (PCOD) framework. Link to SMRU PCoD web page.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33:411-521.

Southall, B., J. Berkson, D. Bowen, R. Brake, J. Eckman, J. Field, R. Gisiner, S. Gregerson, W. Lang, J. Lewandowski, J. Wilson, and R. Winokur. 2009. Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. federal agencies. Washington, D.C.: Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology.

Starck, J., E. Toppila, and I. Pyykkö. 2003. Impulse noise and risk criteria. Noise & Health 5:63-73.

Sutherland, W.J. 1996. From Individual Behaviour to Population Ecology. New York: Oxford University Press.

Szymanski, M.D., D.E. Bain, K. Kiehl, S. Pennington, S. Wong, and K.R. Henry, K.R. 1999. Killer whale (*Orcinus orca*) hearing: Auditory brainstem response and behavioral audiograms. Journal of the Acoustical Society of America 106:1134-1141.

Terhune, J.M. 1988. Detection thresholds of a harbour seal to repeated underwater high-frequency, short-duration sinusoidal pulses. Canadian Journal of Zoology 66:1578-1582.

Terhune, J.M., and K. Ronald. 1972. The harp seal, *Pagophilus groenlandicus* (Erxleban, 1777). III. The underwater audiogram. Canadian Journal of Zoology 50:565-569.

Terhune, J.M., and K. Ronald.1975. Underwater hearing sensitivity of two ringed seals (*Pusa hispida*). Canadian Journal of Zoology 53:227-231.

Thomas, J., N. Chun, W. Au, and K. Pugh. 1988. Underwater audiogram of a false killer whale (*Pseudorca crassidens*). Journal of the Acoustical Society of America. 84:936-940.

Thomas, J., P. Moore, R. Withrow, and M. Stoermer. 1990. Underwater audiogram of a Hawaiian monk seal (*Monachus schauinslandi*). Journal of the Acoustical Society of America 87:417-420.

TNO (Netherlands Organisation for Applied Scientific Research). 2011. Standard for measurement and monitoring of underwater noise, Part I: physical quantities and their units. TNO-DV 2011 C235. M.A. Ainslie (ed.). The Hague, The Netherlands: TNO.

Tougaard, J., and L.A. Kyhn. 2010. Echolocation sounds of hourglass dolphins (*Lagenorhynchus cruciger*) are similar to narrow band high-frequency echolocation sounds of the dolphin genus *Cephalorhynchus*. Marine Mammal Science 26:239-245.

Tougaard, J., A.J. Wright, and P.T. Madsen. 2015. Cetacean noise criteria revisited in the light of proposed exposure limits for harbour porpoise. Marine Pollution Bulletin 90: 196-208.

Tremel, D.P., J.A. Thomas, K.T. Ramirez, G.S. Dye, W.A. Bachman, A.N. Orban, and K.K. Grimm. 1998. Underwater hearing sensitivity of a Pacific white-sided dolphin, *Lagenorhynchus obliquidens*. Aquatic Mammals 24:63-69.

Tubelli, A., A. Zosuls, D. Ketten, M. Yamato, and D.C. Mountain. 2012. A prediction of the minke whale (*Balaenoptera acutorostrata*) middle-ear transfer function. Journal of the Acoustical Society of America 132: 3263-3272.

Urick, R.J. 1983. Principles of Underwater Sound. New York, New York: McGraw-Hill Book Company.

Wang, D., K. Wang, Y. Xiao, and G. Sheng. 1992. Auditory sensitivity of a Chinese river dolphin *Lipotes vexillifer*. Pages 213-221 In J.A. Thomas, R.A. Kastelein, and A.Y. Supin (eds.) Marine Mammal Sensory Systems. New York: Plenum Press.

Ward, W.D. 1960. Recovery from high values of temporary threshold shift. Journal of the Acoustical Society of America 32:497-500.

Ward, W.D. 1962. Damage-risk criteria for line spectra. Journal of the Acoustical Society of America 341610-1619.

Ward, W.D. 1991. The role of intermittence in PTS. Journal of the Acoustical Society of America 90:164-169.

Ward, W.D. 1997. Effects of high-intensity sound. Pages 1497-1507 In M.J. Crocker (ed.) Encyclopedia of Acoustics, Volume III. New York: John Wiley & Sons.

Ward, W.D., A. Glorig, and D.L. Sklar. 1958. Dependence of temporary threshold shift at 4 kc on intensity and time. Journal of the Acoustical Society of America 30:944-954.

Ward, W.D., A. Glorig, and D.L. Sklar. 1959. Temporary threshold shift from octave-band noise: Application to damage-risk criteria. Journal of the Acoustical Society of America 31:522-528.

Ward, W.D., E.M. Cushing, and E.M. Burns. 1976. Effective quiet and moderate TTS: Implications for noise exposure standards. Journal of the Acoustical Society of America 59:160-165.

Wartzok, D., and D.R. Ketten. 1999. Marine mammal sensory systems. Pages 117-175 in J.E. Reynolds III and S.A. Rommel, eds. Biology of Marine Mammals. Washington, D.C.: Smithsonian Institution Press.

Wartzok, D., A.N. Popper, J. Gordon, and J. Merrill. 2004. Factors affecting the responses of marine mammals to acoustic disturbance. Marine Technology Society Journal 37:4-13.

Wensveen, P.J., L.A.E. Huijser, L. Hoek, and R.A. Kastelein. 2014. Equal latency contours and auditory weighting functions for the harbour porpoise (*Phocoena phocoena*). The Journal of Experimental Biology 217:359-369.

Wensveen, P.J., A.M. von Benda-Beckmann, M.A. Ainslie, F.-P. Lam, P.H. Kvadsheim, P.L. Tyack, and P.J.O. Miller. 2015. How effectively do horizontal and vertical response strategies of long-finned pilot whales reduce sound exposure from naval sonar? Marine Environmental Research 106:68-81.

WGSUA (Working Group on Speech Understanding and Aging). 1988. Speech understanding and aging. Journal of the Acoustical Society of America 83:859-895.

White, M.J., J. Norris, D.K. Ljungblad, K. Baron, and G.N. di Sciara. 1978. Auditory thresholds of two beluga whales (*Delphinapterus leucas*). San Diego: Hubbs Sea World Research Institute.

WHO (World Health Organization). 2015. Deafness and hearing impairment. Fact Sheet N°300. March. Geneva, Switzerland: World Health Organization.

Williams, R., D. Lusseau, and P.S. Hammond. 2006. Estimating relative energetic costs of human disturbance to killer whales (*Orcinus orca*). Biological Conservation 133:301-311.

Williams, R., E. Ashe, L. Blight, M. Jasny, and L. Nowlan. 2014. Marine mammals and ocean noise: Future directions and information needs with respect to science, policy and law in Canada. Marine Pollution Bulletin 86:29-38.

Wright, A.J. 2015. Sound science: Maintaining numerical and statistical standards in the pursuit of noise exposure criteria for marine mammals. Frontiers in Marine Science 2: Article 99.

Yost, W.A. 2007. Fundamentals of Hearing: An Introduction. New York: Academic Press.

Yuen, M.M.L., P.E. Nachtigall, M. Breese, and A.Y. Supin. 2005. Behavioral and auditory evoked potential audiograms of a false killer whale (*Pseudorca crassidens*). Journal of the Acoustical Society of America 118:2688–2695.

Zheng, W. 2012. Auditory map reorganization and pitch discrimination in adult rats chronically exposed to low-level ambient noise. Frontiers in Systems Neuroscience 6:Article 65.

Zhou, X., and M.M. Merzenich. 2012. Environmental noise exposure degrades normal listening processes. Nature Communications 3:843.

Zhu, X., J.H. Kim, W.J. Song, W.J. Murphy, and S. Song 2009. Development of a noise metric for assessment of exposure risk to complex noises. Journal of the Acoustical Society of America 126:703-712.

APPENDIX U

STRANDING PROCEDURES

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UNCLASSIFIED//

DTG: 101705Z APR 08
FM CNO WASHINGTON DC
SUBJECT: REPORTING PROCEDURES FOR MARINE MAMMAL STRANDINGS ON INSTALLATIONS
MSGID/GENADMIN/CNO WASHINGTON DC N45// SUBJ/REPORTING PROCEDURES FOR MARINE MAMMAL STRANDINGS ON /INSTALLATIONS// REF/A/-/OPNAVINST 3100.6H/YMD:20060203// AMPN/REF A DIRECTS THE REPORTING OF ALL INCIDENTS INVOLVING MARINE MAMMAL STRANDINGS OR STRIKES WORLDWIDE VIA THE OPREP-3 REPORTING SYSTEM.// POC/R. E. TICKLE/CIV/CNO N45/WASHINGTON DC/TEL:(703) 602-2787// GENTEXT/REMARKS/1. REF A DIRECTS NAVY COMMANDS TO REPORT ALL INCIDENTS INVOLVING MARINE MAMMAL STRANDINGS OR STRIKES WORLDWIDE.
REF A CURRENTLY REQUIRES ALL COORDINATION INVOLVING STRANDINGS ON INSTALLATIONS TO BE DONE THROUGH OPNAV (N45) PRIOR TO CONTACTING THE NATIONAL MARINE FISHERIES SERVICE (NMFS). HOWEVER, DUE TO THE POTENTIAL FOR DELAY IN RESPONDING TO A MARINE MAMMAL STRANDING, THIS MESSAGE UPDATES THOSE PROCEDURES AND PROVIDES ADDITIONAL INFORMATION.
2. EFFECTIVE IMMEDIATELY, INSTALLATION COMMANDERS ARE TO IMMEDIATELY CONTACT THE APPROPRIATE REGIONAL STRANDING COORDINATORS IN THE EVENT OF A LIVE OR DEAD STRANDING ON A NAVY INSTALLATION.
NOTIFICATION TO N45 WILL OCCUR IMMEDIATELY THEREAFTER.
3. APPROPRIATE PHONE NUMBERS AND POINTS OF CONTACTS ARE:
REGIONAL STRANDING COORDINATORS:
78282 NORTHEAST (CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA)
8478 POC: MENDY GARRON, NMFS, OR SARA MCNULTY, NMFS, 978-281-9351, SOUTHEAST (AL, AR, AZ, FL, GA, LA, MS, NC, PR, SC, TX, VI), 866-755-6622
POC: BLAIR MASE-GUTHRIE, NMFS, 305-361-4586 OR LAURA ENGLEBY, NMFS, 727-824-5312
NORTHWEST (OR, WA), POC: BRENT NORBERG, NMFS, 206-526-6733 SOUTHWEST (CA), POC: JOSEPH CORDARA, NMFS, 562-980-4017 ALASKA (AK), POC: ALERIA JENSEN, NMFS, 907-586-7248 HI AND PACIFIC ISLANDS (HI, GU, AMERICAN SAMOA, CNMI),
POC: DAVID SCHOFIELD, NMFS, 808-944-2269 4. INFORMATION REGARDING NMFS STRANDING EVENT COORDINATORS CAN ALSO BE FOUND AT HTTP://WWW.NMFS.NOAA.GOV/PR/HEALTH/COORDINATORS.HTM.
5. IN ADDITION TO CONTACTING THE APPROPRIATE STRANDING EVENT COORDINATOR IN THE EVENT OF A STRANDING ON A NAVY INSTALLATION OR NEAR SHORE WITHIN A NAVY CONTROLLED AREA SUCH AS A RESTRICTED AREA OR SECURITY ZONE. INSTALLATION PERSONNEL WILL IMMEDIATELY SECURE THE AREA AND NOTIFY THE APPROPRIATE REGIONAL STRANDING COORDINATOR.
INSTALLATION NATURAL RESOURCE SPECIALISTS MAY MONITOR THE ANIMAL, BUT SHALL NOT ATTEMPT TO RESCUE, DISENTANGLE, REHABILITATE, OR MOVE ANY STRANDED ANIMAL FROM ITS STRANDED LOCATION UNLESS THERE IS AN IMMEDIATE RISK TO HUMAN LIFE, OR THEY ARE INSTRUCTED TO DO SO FROM THE NMFS STRANDING COORDINATOR.
6. RELEASED BY REAR ADMIRAL LAWRENCE S. RICE//
==

UNCLASSIFIED//

Marine Mammal Stranding Procedures

Stranding Response Team
757 ~~437 6159~~
385-7575 (dead)
385-7576 (alive)

Quarterdeck → 322-2366
↳ to get in touch w/ CDO

CDO Tidwell · 438 3860
Asst · 438 3861

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APPENDIX V

ADDENDUM: OUTLYING PARCELS

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FINAL

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN ADDENDUM FOR OUTLYING PARCELS: FISHERS ISLAND ANNEX, SENECA LAKE DETACHMENT, AND DODGE POND FIELD STATION

NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND

Prepared by:

Gulf South Research Corporation

For:

Navy Region Mid-Atlantic
Naval Facilities Engineering Command Mid-Atlantic
Public Works Department Newport

September 2021

FINAL

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN ADDENDUM FOR OUTLYING PARCELS:

FISHERS ISLAND ANNEX, SOUTHOLD, NEW YORK

SENECA LAKE DETACHMENT, DRESDEN, NEW YORK

AND

DODGE POND FIELD STATION, NIANTIC, CONNECTICUT

NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND

Prepared by:

Gulf South Research Corporation

For:

Navy Region Mid-Atlantic
Naval Facilities Engineering Command Mid-Atlantic
Public Works Department Newport

September 2021

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EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) Addendum has been prepared and will be implemented in accordance with the Sikes Act (16 United States Code [U.S.C.] 670a *et seq.*) as amended; Department of Defense (DOD) Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual*; DOD Instruction (DODI) 4715.03: *Natural Resources Conservation Program*; and the U.S. Navy (Navy) Environmental Readiness Program (Chief of Naval Operations [OPNAV] Instruction [OPNAVINST] 5090.1E). The Sikes Act (16 U.S.C. 670a *et seq.*) as amended requires the secretary of all military departments to “prepare and implement an INRMP for each military installation in the United States” that contains habitat that is suitable for conservation and management of natural ecosystems. This INRMP for Naval Station Newport’s (NAVSTA Newport) Outlying Parcels—Fishers Island Annex, Seneca Lake Detachment, and Dodge Pond Field Station—is an Addendum to NAVSTA Newport’s Final INRMP (updated in June 2014), which covered the main installation. The 2014 INRMP shall henceforth be referred to as the “primary INRMP.” In conjunction with the primary INRMP, this INRMP Addendum has been prepared in accordance with the following authorities, which were current at the time of preparation. Revisions to the following authorities and guidance documents would replace the older version, and any necessary changes in the INRMP would be documented during the annual review or incorporated into the INRMP at the time it is updated:

- DOD Instruction 4715.03 (*Natural Resources Conservation Program*, 18 March 2011)
- U.S. Department of the Navy (Navy) Instruction OPNAVINST 5090.1E and associated OPNAV Environmental Readiness Program Manual 5090.1 (OPNAV M-5090.1) *Environmental Readiness Program*, 3 September 2019)
- Sikes Act (16 U.S.C. § 670a *et seq.*) as amended
- Naval Facilities Engineering Command (NAVFAC) Natural Resources Management Procedural Manual (P-73, Chapter 2: Integrated Natural Resources Management Plans, 07 December 2005)
- Navy INRMP Guidance dated 10 April 2006
- Endangered Species Act (ESA)

In addition to these authorities, natural resources managers are encouraged to use geographic information systems as the basis for their INRMPs (OPNAV M-5090.1), and to incorporate the guidance and recommendations provided in *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008).

NAVSTA Newport’s INRMP is a long-term planning document designed to guide the installation Natural Resources Manager (NRM) in the management of natural resources to support the installation mission while protecting and enhancing installation resources for multiple use, sustainable yield, and biological integrity. The INRMP Addendum addresses these requirements for NAVSTA Newport's Outlying Parcels, and identifies projects that will be implemented at each of them over the duration of the plan.

In accordance with the Integrated Natural Resources Management Program (32 CFR Appendix to Part 190), the Sikes Act (16 U.S.C. 670a et seq.) as amended; DOD Manual 4715.03; DOD Instruction (DODI) 4715.03 (*Natural Resources Conservation Program,* 18 March 2011, with Incorporating Change 2 21 August 2018); and the United States (U.S.) Department of the Navy (DON) *Environmental Readiness Program Manual* (OPNAV M-5090.1, Chapter 12); installation natural resources managers are required to review their natural resources conservation (NRC) program and INRMP annually. The annual INRMP review must be completed with the cooperation of the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the appropriate state fish and wildlife agency. Concurrent with the review of NAVSTA Newport's primary INRMP by the USFWS and the Rhode Island Department of Environmental Management (RIDEM), the INRMP Addendum will be reviewed annually in coordination with the USFWS, NMFS, the New York State Department of Environmental Conservation (NYSDEC), and the Connecticut Department of Energy and Environmental Protection (CT DEEP). If necessary, the annual review will include an update of the INRMP that includes an updated project list, documentation of significant changes in natural ecosystems, and updates to information contained in the INRMP appendices.

A formal review for operation and effect of the INRMP is required at least once every five years, in coordination with USFWS and the appropriate state partners fish and wildlife agency when possible (OPNAVINST 5090.1E, OPNAV M-5090.1, and Navy 2006). The formal review for operation and effect of the INRMP Addendum will be scheduled to occur in sync with the formal five-year review of the primary INRMP. Forms to document periodic reviews are included at the beginning of this document, immediately following the Approving Officials' signature pages. Tracking forms (as found on page P-3 of the primary INRMP) will be used to compile proposed updates throughout the course of each year and will serve to provide an outline for revisions to be incorporated during the formal five-year review.

The body of the INRMP Addendum is intended to be inserted following the primary INRMP. The structure and organization of the primary INRMP has been duplicated, except insofar as extra sections have been required to cover the three separate installations (Outlying Parcels). Many sections of this INRMP Addendum cross-reference the primary INRMP so-as to avoid unnecessary duplication. The INRMP Addendum is organized into the following chapters:

- **Chapter 1 – Overview**. This chapter describes the INRMP's purpose, scope, goals and objectives, responsibilities, and authorities that are applicable to the plan, and includes a brief discussion of management strategy and other plan integration.
- **Chapter 2 – Current Conditions and Use**. This chapter provides a general description of the installation including land areas, regional land uses, a brief history, and the military mission and operations of NAVSTA Newport's Outlying Parcels. The section also describes the existing physical and natural conditions of NAVSTA Newport's Outlying Parcels. A general site description is included in this section, along with information on, but not limited to, climate; geology; topography; soils; water resources, including surface waters, wetlands, and ground water; and flora and fauna, including vegetative

communities, invasive species, threatened and endangered species, species of concern, and habitats of special concern.

- **Chapter 3 – Natural Resources Management and Mission Sustainability**. This chapter includes discussion of integrating the military mission and natural resources management, consultation requirements, National Environmental Protection Act (NEPA) compliance, beneficial partnerships and collaborative resource planning, public access and outreach, encroachment, and the New York and Connecticut Wildlife Action Plans.
- **Chapter 4 – Natural Resources Program Overview.** This chapter includes a discussion of natural resources management issues that are relevant to NAVSTA Newport's Outlying Parcels, a description of regulatory drivers for natural resources management on DOD installations, and specific recommendations for issues, as appropriate. The management measures and projects planned for implementation under this INRMP also are identified in this section.
- **Chapter 5 – Project Descriptions.** This chapter describes the natural resources management projects introduced in Chapter 4. It includes descriptions of each project, with the corresponding goals and objectives that the project supports.
- **Chapter 6 – Implementation.** This chapter outlines means for implementing this INRMP, including guidelines on supporting the sustainability of the military mission and the natural environment, natural resources consultation requirements, achieving no net loss, project development and classification, funding sources, commitment, and use of cooperative agreements.
- **Chapter 7 – References**. This chapter includes a list of all references used in the development of the INRMP.

The appendices of the INRMP Addendum are intended to be inserted into the corresponding appendices of the primary INRMP, so that like information will be integrated under one common heading. The INRMP Addendum does not contain information that pertains to those appendices of the primary INRMP that are not listed below (i.e., appendices F–H, J, L–T). Information for the NAVSTA Newport Outlying Parcels should be inserted under the following appendices of the primary INRMP:

- **Appendix A – List of Acronyms and Abbreviations**. Appendix A defines all acronyms and abbreviations that are used in the primary INRMP and this INRMP Addendum.
- **Appendix B – Threatened and Endangered Species Fact Sheets.** Appendix B contains printed fact sheets for the federal endangered, threatened, and candidate species and state endangered, threatened, and species of concern that occur on the installation.
- **Appendix C – NAVSTA Newport Natural Resources Project List.** Appendix C contains a table for each installation parcel summarizing all funding-dependent natural resources projects recommended in the INRMP. Each table includes the proposed implementation schedule, prime legal driver/initiative, class, Navy Environmental Readiness Level (ERL), cost estimate, and potential funding sources for each natural resources project.

- **Appendix D – Species Lists**. Appendix D contains tables of all plant and animal species that have been confirmed to occur at NAVSTA Newport and the Outlying Parcels through focused field surveys.
- **Appendix E** – **Threatened and Endangered Species and Species of Special Concern.** Appendix E includes the list of all species documented at NAVSTA Newport's Outlying Parcels that are listed as endangered, threatened, or as a species of special concern by federal or state agencies.
- **Appendix I** – **Federal and State Agency Coordination Letters.** Appendix I contains copies of correspondence between the Navy and RIDEM Division of Fish and Wildlife; NYSDEC Division of Fish and Wildlife; CT DEEP Wildlife Division; National Oceanic and Atmospheric Administration (NOAA); and USFWS to obtain agency concurrence with this INRMP.
- **Appendix K – INRMP Benefits for Endangered Species, Critical Habitat, and Migratory Birds.** Appendix K describes how this INRMP, as implemented, can benefit federal trust species (e.g., migratory birds) and other federally listed, proposed, and candidate species that are confirmed to occur, or may occur, on NAVSTA Newport and its Outlying Parcels.

This INRMP Addendum has been prepared to comply with the Office of the Under Secretary of Defense INRMP format (Office of the Under Secretary of Defense [OSD] 2006). Table ES-1 provides a cross-reference of the recommended format and the corresponding sections of this INRMP update.

Table ES-1. Cross Reference to the Office of the Under Secretary of Defense INRMP Format.

Office of the Under Secretary of Defense Recommended INRMP Format	Cross Reference to Required Information in this Document
Cover Page	**Cover Page**
Signature Page	**Signature Page**
Executive Summary	**Executive Summary**
Table of Contents	**Table of Contents**
Chapter 1 – Overview	**1.0 Overview**
1.a – Purpose	1.1 Purpose and Authority
1.b – Scope	1.2 Scope
1.c – Goals and Objectives Summary	1.3 INRMP Vision, Mission, Goals and Objectives
1.d – Responsibilities of Stakeholders	1.4 Responsible and Interested Parties 1.4.1 NAVSTA Newport Stakeholders
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Source: OSD 2006

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1.0 OVERVIEW

1.1 PURPOSE AND AUTHORITY

This Integrated Natural Resources Management Plan (INRMP) Addendum was prepared to supplement Naval Station Newport's (NAVSTA Newport) Final INRMP (hereinafter referred to as the "primary INRMP")—completed in 2021, and covering the main installation in Newport, Rhode Island—by addressing natural resources management at the three ancillary installations (Outlying Parcels) for which NAVSTA Newport has responsibility. As held true for NAVSTA Newport's primary INRMP, this INRMP Addendum was made to comply with the Sikes Act (16 United States Code [USC] 670a *et seq.*), as amended; 32 Code of Federal Regulations (CFR) Part 190 (Department of Defense [DOD] Natural Resources Management Program) (CFR 2002); DOD Instruction (DODI) 4715.03 (DOD 2018a); Chief of Naval Operations (OPNAV) Instruction (OPNAVINST) 5090.1E: *Environmental Readiness Program* (Navy 2019a), and all other applicable federal and state laws, regulations, and guidance. These regulations require that the Secretary of Defense implement a program to provide for the conservation and rehabilitation of natural resources on military installations. The secretaries of each military department are authorized to carry out the program, consistent with the use of military installations, to ensure the preparedness of the United States (U.S.) Armed Forces. The Secretary of the Navy implements and maintains a balanced and integrated natural resources management program for all Navy and U.S. Marine Corps installations. To facilitate the Natural Resources Program (NRP), the Secretary of the Navy is further directed to prepare and implement an INRMP for each military installation that has significant natural resources. This Addendum to NAVSTA Newport's 2014 INRMP has included a thorough review of the natural resources management programs in place at the Outlying Parcels, incorporated the most up-to-date information and data available, and taken into account the most recent guidance, including DOD Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual* (DOD 2018b); DODI 4715.03 *Natural Resources Conservation Program* (18 March 2011); and the U.S. Department of the Navy (DON) *Environmental Readiness Program Manual* (OPNAV M-5090.1, Chapter 12); in addition to the Navy's *Integrated Natural Resources Management Plan Guidance for Navy Installations: How to Prepare, Implement, and Revise Integrated Natural Resources Management Plans (INRMP)* (Navy 2006); the DOD memorandum, *DOD Integrated Natural Resources Management Plan (INRMP) Template* (OSD 2006); and *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008).

The Sikes Act (16 USC 670a *et seq.*), as amended, requires that the INRMP must be prepared in cooperation with the U.S. Secretary of the Interior, acting through the Director of the U.S. Fish and Wildlife Service (USFWS), and the head(s) of the appropriate fish and wildlife agencies of the state(s) in which the military installation is located. Cooperative preparation with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) is not required by the Sikes Act as amended, but coordination with NMFS is appropriate when the nearshore environment will benefit from INRMP implementation (Navy 2019b). In accordance with the Sikes Act (16 USC 670a *et seq.*), as amended, the INRMP shall, to the extent appropriate and applicable, provide for the following:

- implementation of an ecosystem-based program that provides for conservation and rehabilitation of natural resources consistent with the military mission,

- integration and coordination of all natural resources management activities,
- provision for sustainable multipurpose uses of natural resources,
- provision for public access for use of natural resources within safety and military security considerations, and
- enforcement of applicable natural resources laws (including regulations).

In accordance with OPNAV M-5090.1, the Navy intends to implement this INRMP within the framework of regulatory compliance, mission obligations, anti-terrorism and force protection limitations, and funding constraints. Regulatory drivers that restrict the Navy's operations with respect to natural resources, and that have implications for the management of particular natural resources at NAVSTA Newport, are listed in Chapter 4.0 *Natural Resources Program Overview*.

1.2 SCOPE

An INRMP's scope comprises all lands, ranges, nearshore areas, and leased areas (1) owned by the United States and administered by the Navy; (2) used by the Navy via license, permit, or lease, for which the Navy has been assigned management responsibility; or (3) withdrawn from the public domain for use by the Navy, for which the Navy has been assigned management responsibility (Navy 2006).

In addition to NAVSTA Newport's main installation in Newport County, Rhode Island (RI), NAVSTA Newport manages the following three ancillary parcels, which are occupied and operated by Naval Undersea Warfare Center (NUWC):

- Dodge Pond Field Station (Dodge Pond) in Niantic, Connecticut (0.96 acres)
- Seneca Lake Detachment (Seneca Lake) in Dresden, New York (4.5 acres)
- Fishers Island Annex (Fishers Island), in Block Island Sound, New York (79 acres)

As a group, these installations will be referred to as the "Outlying Parcels." Although these installations originally each had separate INRMPs developed in 1999, their lands are now under the ownership of NAVSTA Newport and therefore fall within the scope of the NAVSTA Newport INRMP.

1.3 INRMP GOALS AND OBJECTIVES

NAVSTA Newport's INRMP is a long-term planning document designed to guide the installation Natural Resources Manager (NRM) in the management of natural resources to support the installation mission while protecting and enhancing installation resources for multiple use, sustainable yield, and biological integrity. Likewise, this INRMP Addendum is a long-term planning document that guides implementation of the NRP to help ensure consistency with the military missions of Fishers Island, Dodge Pond, and Seneca Lake, while protecting and enhancing natural resources at these installations, to the extent practicable. NAVSTA Newport's NRP places emphasis on the application of sound ecological principles to manage and conserve natural resources; refer to Section 1.3 of the primary INRMP for the NRP's full vision statement and mission statement.

In accordance with the Integrated Natural Resources Management Program (CFR 2002, Appendix to Part 190), the Sikes Act (16 USC 670a *et seq.*) as amended, and OPNAV M-5090.1: *Environmental Readiness Program Manual* (Navy 2019b), each INRMP must provide for the following, consistent with military operations at the applicable installation:

- management of fish and wildlife, land, and forest resources
- identification of recreational use activities and areas
- enhancement or modification of fish and wildlife habitat
- protection, enhancement, and restoration of wetlands, where necessary, for support of fish, wildlife, or plants
- integration of, and consistency among, the various activities conducted under the INRMP
- establishment of specific natural resources management goals and objectives, and timeframes for proposed actions
- sustainable use by the government of natural resources, to the extent that such use is consistent with the needs of fish and wildlife management and subject to installation safety and security requirements
- enforcement of natural resources laws and regulations
- no net loss in the capability of military lands to support the military mission of the installation
- regular review of this INRMP and its effects annually, and updated no less often than every five years

The goals and objectives that follow have been defined to address INRMP regulatory requirements and the installation-specific needs of NAVSTA Newport's Outlying Parcels and their operations. These goals and objectives are in sync with the goals and objectives defined for NAVSTA Newport in the primary INRMP. Some goals and objectives have been omitted because they do not apply to the Outlying Parcels; however, the original goal and objective numbers have been maintained for consistency and ease of cross-referencing with the primary INRMP.

Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.

Objective 1.1 *Assess biological conditions, including water quality, of the aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines of NAVSTA Newport's Outlying Parcels, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation.*

Objective 1.2 *Enhance the function(s) and value(s) of NAVSTA Newport's Outlying Parcels' aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible.*

Objective 1.3 *Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable.*

Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.

Objective 3.1 *Identify, monitor, and manage rare, threatened, and endangered (RTE) species in the terrestrial, aquatic, and marine (nearshore) environments.*

Objective 3.2 *Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species, as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport's Outlying Parcels.*

Objective 3.3 *Restore and enhance wildlife habitats at NAVSTA Newport's Outlying Parcels.*

Objective 3.4 *Monitor populations and herd health of select game species to adjust harvest limits, as needed.*

Objective 3.5 *Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species.*

Objective 3.6 *Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.*

Goal 5. Integrate the various activities conducted under this INRMP by ensuring that NAVSTA Newport's natural resources staff receives adequate training and resources, and by promoting environmental awareness, education, and outreach among the internal and external stakeholders for NAVSTA Newport's Outlying Parcels.

Objective 5.1 *Provide adequate staffing, equipment, technology, and training for the NRP at NAVSTA Newport's Outlying Parcels to ensure proper implementation of this INRMP.*

Objective 5.2 *Implement training, education, outreach, and stewardship initiatives for ecosystem management.*

Objective 5.3 *Educate the employees, tenants, and contractors at NAVSTA Newport's Outlying Parcels, as well as academic institutions, about natural resources issues at the Outlying Parcels and best management practices to protect the surrounding watersheds, and engage these parties in NAVSTA Newport's NRP and conservation initiatives.*

Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.

Objective 6.1 *Maintain interagency cooperation with the USFWS, the National Oceanic and Atmospheric Administration (NOAA), related DOD programs, the New York State Department of Environmental Conservation (NYSDEC), and Connecticut Department of Energy and Environmental Protection (CT DEEP).*

Objective 6.2 *Develop partnerships with academic institutions, applicable state and federal agencies, and other local organizations to implement wildlife monitoring and protection programs and habitat restoration projects.*

Objective 6.3 *Coordinate natural resources activities with local community groups, conservation organizations, and private groups.*

Goal 7. Assess the potential impacts of climate change to natural resources of NAVSTA Newport's Outlying Parcels; identify significant natural resources at the installation that are likely to be affected by potential changes in climate and respective sea-level rise; and identify and implement adaptive management strategies to ensure the long-term sustainability of those resources and the military mission.

Objective 7.1 *Participate in, contribute to, or at least monitor the findings of regional partnerships focused on regional or landscape-scale assessment, monitoring, and adaptation of natural resources to climate change.*

Objective 7.3 *Implement natural resource management strategies and best management practices that provide conservation benefits to the ecosystem and are intended to address risks posed by climate change.*

1.4 RESPONSIBLE AND INTERESTED PARTIES

Successfully implementing an INRMP requires the support of natural resources personnel, other installation staff, command personnel, and installation tenants. The following section discusses the responsibilities for INRMP implementation within the U.S. Navy.

1.4.1 Internal Stakeholders

1.4.1.1 Installation Commanding Officer (ICO)

The Installation Commanding Officer (ICO) is responsible for the overall management of the facilities and for successfully carrying out NAVSTA Newport's mission. The ICO is also responsible for implementing and enforcing this INRMP and managing installation operations, including the facilities and security directorates, and contingency operations. To fulfill the environmental stewardship component of NAVSTA Newport's mission, the ICO is responsible for ensuring that NAVSTA Newport has the funding, staffing, and other resources necessary to effectively manage the installation's natural resources.

1.4.1.2 Public Works Department (PWD)
The Public Works Department (PWD) manages real property, natural resources, environmental protection, and pollution abatement programs; and coordinates master planning, engineering, construction, operation, and maintenance of buildings, structures, grounds, and utilities. Its divisions include the Environmental Division, Facilities Maintenance Division, and Facilities Engineering and Acquisition Division.

The PWD Environmental Division is responsible for advising the installation on environmental compliance, planning, and decision-making consistent with Navy regulations and policies. The NAVSTA Newport Environmental Division currently consists of 12 professionals, which include program managers, technicians, and the environmental director within the division. These positions have responsibilities for natural resources management, cultural resources stewardship, pest management, hazardous waste and hazardous materials management, solid waste, wastewater, stormwater, drinking water, air, noise, pollution prevention, contingency planning, environmental management systems, National Environmental Policy Act (NEPA), and environmental permitting.

1.4.1.3 Naval Undersea Warfare Center (NUWC) Division Newport
In addition to the directorates and offices mentioned above, INRMP implementation requires assistance from, or coordination with, a variety of other installation organizations, tenants, and contract personnel. All three of the Outlying Parcels are occupied and operated by the same tenant: NUWC, the principal Navy research, development, test, and evaluation (RDT&E) center for undersea warfare and submarine weapons research. It is necessary for PWD Environmental (and any other participating parties) to coordinate with NUWC Environmental Division and with the NUWC points of contact (POCs) for Fishers Island, Seneca Lake, and Dodge Pond, for the conduct of any surveys (e.g., flora, fauna, or wetlands) and the implementation of all natural resources projects and ongoing management activities at these installations. The NRM has regular contact with the Head of NUWC Environmental Division.

1.4.1.4 Public Affairs Office (PAO)
The Public Affairs Office (PAO) is responsible for formulating, implementing, and disseminating all command information to the public, including information about natural resources management. The PAO, through the Environmental Division, is responsible for providing timely and accurate information about this INRMP and related activities to the public, as the mission will allow.

1.4.1.5 Staff Judge Advocate (SJA)
The Staff Judge Advocate (SJA) provides legal advice to the command in all areas of law, including compliance with applicable environmental and natural resource management laws and regulations. The SJA provides advice about the statutory and policy framework in which this INRMP is implemented. It is the SJA's responsibility to ensure that all violations of federal, state, and local fish and wildlife regulations are investigated and prosecuted, as appropriate. The SJA also is involved in enforcement actions, legal interpretation, development of memorandums of agreement (MOAs) and understanding (MOUs), development of cooperative agreements (CAs), and review and approval authority on actions.

1.4.1.6 U.S. Navy GeoReadiness Program
The U.S. Navy GeoReadiness Program provides, builds, sustains, and advances Commander Naval Installations Command (CNIC)/NAVFAC capabilities to support DOD shore installation management missions. The program develops, maintains, and shares a comprehensive geographic information system (GIS) that includes data relating to installation infrastructure and environmental topics. In addition, the program oversees the development of analytical geospatial applications and the process of spatially enabling existing business applications.

1.4.1.7 Directorate of Contracting (DOC)
The Directorate of Contracting (DOC) performs contracting functions in accordance with the Federal Acquisition Regulation, Defense Federal Acquisition Regulation, Army Federal Acquisition Regulation, and NAVFAC regulations.

1.4.2 External Stakeholders

1.4.2.1 U.S. Fish and Wildlife Service (USFWS)
The USFWS is a signatory agency of installation INRMPs in accordance with the Sikes Act (16 U.S.C. 670a *et seq*.) as amended. In addition, the DOD and Navy consult formally and informally with the USFWS on threatened and endangered species, as well as candidate species and the mitigation of impacts to aquatic habitats and wildlife, pursuant to applicable legislation including the Endangered Species Act (ESA) and the Clean Water Act (CWA). The USFWS office with responsibility for Fishers Island and Seneca Lake is the New York Field Office in Cortland, New York (NY), whereas the office with responsibility for Dodge Pond is the New England Field Office in Concord, New Hampshire (NH). Additional partnership and collaboration opportunities with the USFWS are discussed in Section 3.6 *Partnership and Collaboration*.

1.4.2.2 National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS)
NAVSTA Newport has coordinated with NOAA/NMFS on the development of this INRMP, with respect to the species inhabiting the marine waters around Fishers Island. The DOD and Navy conduct ESA, Section 7 consultation and coordination for federally listed and candidate species (for marine species and anadromous fish). The NMFS Section 7 coordinator is located in the Greater Atlantic Regional Fisheries Office, Protected Resources Division, in Gloucester, Massachusetts. Additional partnership and collaboration opportunities with NOAA/NMFS are discussed in Section 3.6 *Partnership and Collaboration*, and coordination regarding marine mammal stranding events is discussed under Section 4.6.3 *Marine Wildlife Management*.

1.4.2.3 The State of New York
The New York State Department of Environmental Conservation (NYSDEC) is a signatory agency for this INRMP, with responsibility for reviewing sections pertaining to Fishers Island and Seneca Lake. NYSDEC is the single state agency that oversees all New York State programs designed to protect and enhance the environment, and administers and enforces the Environmental Conservation Law. The mission of NYSDEC is, "to conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being" (NYSDEC 2020a). The agency's statewide

responsibilities include regulation of hazardous and toxic wastes; management of the program for oil and chemical spills; pollution abatement; environmental monitoring; management of fish, wildlife, marine, coastal, and forest resources; conservation of wetlands, flood plains, water resources, and rivers; regulation of mining and resource extraction; and public outreach. The NYSDEC Division of Fish and Wildlife, specifically, will ensure that this INRMP adequately protects fish and wildlife resources at Fishers Island and Seneca Lake. In addition, the divisions of Environmental Permits, Water, Lands and Forests, and Environmental Remediation; the Natural Heritage Program; the Coastal Erosion Hazard Area Land-use Management Program; and the Office of Climate Change could all support and guide the activities under this INRMP.

1.4.2.4 The State of Connecticut

The Connecticut Department of Energy and Environmental Protection (CT DEEP) is a signatory agency for this INRMP, with responsibility for reviewing sections pertaining to Dodge Pond. CT DEEP is charged with conserving, improving and protecting the natural resources and the environment of the state of Connecticut as well as making cheaper, cleaner and more reliable energy available for the people and businesses of the state (CT DEEP 2020a). The Bureau of Natural Resources, within the Environmental Conservation Branch, manages the state's fish, wildlife, forests, and natural communities through regulation, management, research, and public education. The CT DEEP Wildlife Division, specifically, will ensure that this INRMP adequately protects fish and wildlife resources at Dodge Pond. In addition, the Fisheries Division, the Wetlands and Water Resources Division, and the Office of Pollution Prevention Programs could all support and guide the activities under this INRMP.

1.5 INRMP AND NATURAL RESOURCES AUTHORITY

The Sikes Act (16 USC 670a *et seq.*), as amended, is the driver behind the NAVSTA Newport NRP and INRMP, including this Addendum covering the Outlying Parcels. According to the Sikes Act and its amendments, the primary purposes of a military conservation program are conservation and rehabilitation of natural resources, sustainable multipurpose use of those resources, and public access to military lands, subject to safety requirements and military security. Moreover, the conservation program must be consistent with the mission-essential use of the installation and its lands. The Sikes Act (16 USC 670a *et seq.*), as amended, requires the preparation of an INRMP to facilitate the conservation program. The INRMP must be cooperatively developed with the USFWS and the state fish and wildlife agencies, which, for this INRMP Addendum, include both the NYSDEC and the CT DEEP due to the fact that Fishers Island and Seneca Lake are located in New York, whereas Dodge Pond is in Connecticut. The resulting plan reflects the mutual agreement of all the parties concerning conservation, protection, and management of natural resources on the installation.

The Sikes Act (16 USC 670a *et seq.*), as amended, states that "the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary, unless the Secretary determines that the absence of significant natural resources on a particular installation makes preparation of such a plan inappropriate." DODI 4715.03 (DOD 2018a) prescribes procedures for integrated management of natural and cultural resources, including preparing an INRMP as required by the Sikes Act, as amended. DODI 4715.03 also states that "INRMPs shall be prepared, maintained, and implemented for all lands and waters under DOD control that have suitable habitat for conserving and managing natural resources." OPNAVINST 5090.1E (Navy 2019a), implements these provisions via the Navy's Environmental Readiness Program. This OPNAV instruction includes the requirements and procedures that shore activities should follow to ensure compliance with state and federal laws, regulations, and executive orders concerning use, management, and protection of natural resources.

1.6 NATURAL RESOURCES STEWARDSHIP AND COMPLIANCE DISCUSSION (REFER TO SECTION 1.6 OF NAVSTA NEWPORT PRIMARY INRMP)

1.7 INRMP REVIEW AND REVISION PROCESS

In accordance with the Integrated Natural Resources Management Program (32 CFR Appendix to Part 190), the Sikes Act (16 U.S.C. 670a *et seq*.) as amended; DOD Manual 4715.03 (INRMP Implementation Manual, 25 November 2013); DODI 4715.03 (Natural Resources Conservation Program, 18 March 2011); and the U.S. Department of the Navy (DON) Environmental Readiness Program Manual (OPNAV M-5090.1, Chapter 12, 10 January 2014); installation natural resources managers are required to review their natural resources conservation (NRC) program and INRMP annually, using the Navy Conservation Web site.

The Installation Commanding Officer must participate in the annual NRC program and INRMP metrics review because INRMPs are prepared to assist the installation commander with his or her natural resources responsibilities, and to ensure adequate and appropriate conservation support for operational requirements (OPNAV M-5090.1). The annual INRMP review must be completed with the cooperation of the USFWS, the NMFS, and the appropriate state fish and wildlife agency. Concurrent with the review of NAVSTA Newport's primary INRMP by the USFWS and the Rhode Island Department of Environmental Management (RIDEM), the INRMP Addendum will be reviewed annually in coordination with the USFWS, NMFS, the New York State Department of Environmental Conservation (NYSDEC), and the Connecticut Department of Energy and Environmental Protection (CT DEEP). Measurement of the success of the INRMP and identification of any issues associated with implementation of the INRMP will result from collaboration with cooperating partners (OPNAVINST 5090.1E and Navy 2006).

The annual review also provides an opportunity to incorporate changes in accepted environmental conservation practices and scientific advances associated with evaluation and implementation of natural resources management. If necessary, the annual review will include an update to the INRMP that includes an updated project list, documentation of significant changes to natural ecosystems, and updates to information contained in the INRMP appendices. Forms to document annual reviews are included in this document, and should be used to document changes to the INRMP that will improve natural resources management. Each entry in the update form should reference the plan section and page number that is being updated to facilitate quick cross-referencing.

Installation natural resources managers are not required to revise their INRMP within a specified time interval; however, a formal review for operation and effect is required at least once every five years, in coordination with USFWS and the appropriate state partners fish and wildlife agency when possible (OPNAVINST 5090.1E, OPNAV M-5090.1, and Navy 2006). With agreement from USFWS and state partners, thorough written documentation of the annual informal reviews may be used to substitute for the five-year formal review, thereby reducing demands on installation commanders. Minor updates to the INRMP should be completed annually to reduce the need for a more costly and time consuming revision following the review for operation and effect. Annual reviews should be fully documented each year to provide each installation the option to utilize the annual review documentation to fulfill the formal review requirement whenever possible. If results of the formal review determine that the existing INRMP is current and operational, the INRMP need not be revised. Any revisions to the authorities and guidance documents driving INRMP update requirements would be implemented as appropriate during the annual or formal review periods.

A review for operation and effect of the primary INRMP will occur every five years with the cooperation of the USFWS, NMFS, and RIDEM. The formal review for operation and effect of the INRMP Addendum will be scheduled to occur in sync with the formal five-year review of the primary INRMP, with the additional cooperation of NYSDEC and CT DEEP. The review for operation and effect shall verify that all environmental compliance projects have been budgeted for and implemented on schedule; that all required natural resource positions are filled with trained staff or are in the process of being filled; that projects and activities identified for the coming year are included in the INRMP; that all required coordination has been conducted; and that all significant changes to the Installation's mission requirements or its natural resources have been identified. It is recommended that the review for operation and effect be conducted during an annual INRMP metrics review. Mutual agreement on operation and effect must be documented in writing from the parties in the form of a new signature page for the INRMP.

INRMP updates are usually covered by the original NEPA documentation (usually an Environmental Assessment [EA]) prepared for the INRMP. A new NEPA analysis may be necessary if a revision of the plan is required, such as if there are significant changes in land ownership, land uses, installation mission, or status of natural resources (OPNAV M-5090.1).

During the review process, the DOD Components, USFWS, and appropriate state fish and wildlife agencies should determine whether an existing INRMP needs formal revision. Circumstances that may suggest that a revision is necessary include: (a) the current INRMP no longer provides adequately for the conservation and rehabilitation of the natural resources on the base; (b) the installation mission or physical features have changed significantly; or (c) there are substantial natural resources effects anticipated from base realignment and closure, such as: a new species listing, new construction, new training, changes to training type or tempo, or other factors that were not addressed in the existing INRMP (DOD Manual 4715.03). Any of these activities should be brought to the attention of the USFWS and the appropriate state fish and wildlife agency during the formal review process. All such revisions require approval by all parties to the INRMP, and will usually call for a new or supplemental NEPA analysis.

1.8 INRMP MANAGEMENT STRATEGY (REFER TO SECTION 1.8 OF NAVSTA NEWPORT PRIMARY INRMP)

1.9 OTHER PLAN INTEGRATION

Internal and external factors place demands on natural resources on NAVSTA Newport which necessitate that natural resources management be integrated and coordinated with other disciplines, plans, and programs on the installation. Typically, these plans include installation master plans, range plans, encroachment action plans, IRP site management plans, Integrated Cultural Resources Management Plans (ICRMPs), Integrated Pest Management Plans (IPMPs), and stormwater management plans, among others. However, such plans generally do not exist for the individual Outlying Parcels, and the plans that are in place for NAVSTA Newport do not cover the Outlying Parcels either. During the process of updating this INRMP Addendum, plans that were identified and reviewed include the Site Plans for grounds maintenance at Fishers Island, Seneca Lake, and Dodge Pond; the Spill Prevention, Control, and Countermeasures Plan for Seneca Lake (NAVUNSEAWARCEN OSO DRESDEN NY 2015); and various reports and plans describing the historical and cultural resources at Fishers Island, Seneca Lake, and Dodge Pond.

In addition, the preparation and development of an INRMP must be coordinated with the development of other installation plans, planning processes, and NEPA documents, as required by the *DOD INRMP Template* (OSD 2006). The Navy plans to cover the Outlying Parcels in NAVSTA Newport's new Installation Development Plan (IDP), which is presently in the early stages of development. The IDP should cross-reference the primary INRMP and this INRMP Addendum to ensure that the natural resources concerns for NAVSTA Newport and the Outlying Parcels are considered, and that plans for future installation development take into consideration the management recommendations of the INRMP. In addition, all EAs and Environmental Impact Statements (EISs) going forward will reference this INRMP.

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2.0 CURRENT CONDITIONS AND USE

2.1 INSTALLATION DESCRIPTION

2.1.1 General Location Description

2.1.1.1 Fishers Island

Fishers Island is located in Block Island Sound, approximately two miles south of the Connecticut shore opposite Stonington, Connecticut, and 12 miles east of Long Island (see Figure 2-1) and approximately six miles northeast of Great and Little Gull Islands (Town of Southold no date [n.d.]). The island is approximately 4,000 acres in size (Town of Southold n.d.), and is a hamlet within the Town of Southold, New York; a town on the north fork of Long Island. Although Fishers Island is geographically close to the Connecticut coast, its political affiliation as a hamlet of the Town of Southold is the result of an unusual arrangement stemming back to the Duke of York's 1664 land patent, a document that trumped Connecticut's prior claims to the seven-mile long island. The bitterly disputed boundary line wasn't finally settled until 1879 (FishersIsland.net n.d.).

Fishers Island is irregularly shaped with most of its shoreline formed by steep bluffs in back of narrow beaches, though a number of low-lying areas are found along the shore. Most of the approximately 300 permanent residents live on the western third of the island; however, since Fishers Island is a seasonal resort, the island's population fluctuates greatly and can increase to several thousand during peak summer periods (FishersIsland.net n.d.). The remainder of the island is developed with large estates. There are approximately 500 houses on the island, with a zoning capacity of 1,000 houses.

Fishers Island is accessible by private boat, ferry, or airplane to Elizabeth Field. Regular passenger and auto ferry service connects the island with New London, Connecticut via an approximately 45-minute boat ride, while smaller commuter boats run back and forth to Fishers Island from Noank, Connecticut, on weekdays only, primarily carrying workers via an approximate 20-minute boat ride (FishersIsland.net n.d.). The airport is unmanned, and is used by single- and twin-engine planes (NUWCDIV 1997a).

The 79-acre Fishers Island Annex is situated on the island's southern shoreline at Wilderness Point, near Mount Prospect, south of Oriental Avenue. West Harbor, located on the northern shoreline of the island, is north of Oriental Avenue. Fishers Island is located on a relatively narrow upland isthmus which separates the more developed western portion of the island from the privately-owned and lower density eastern end.

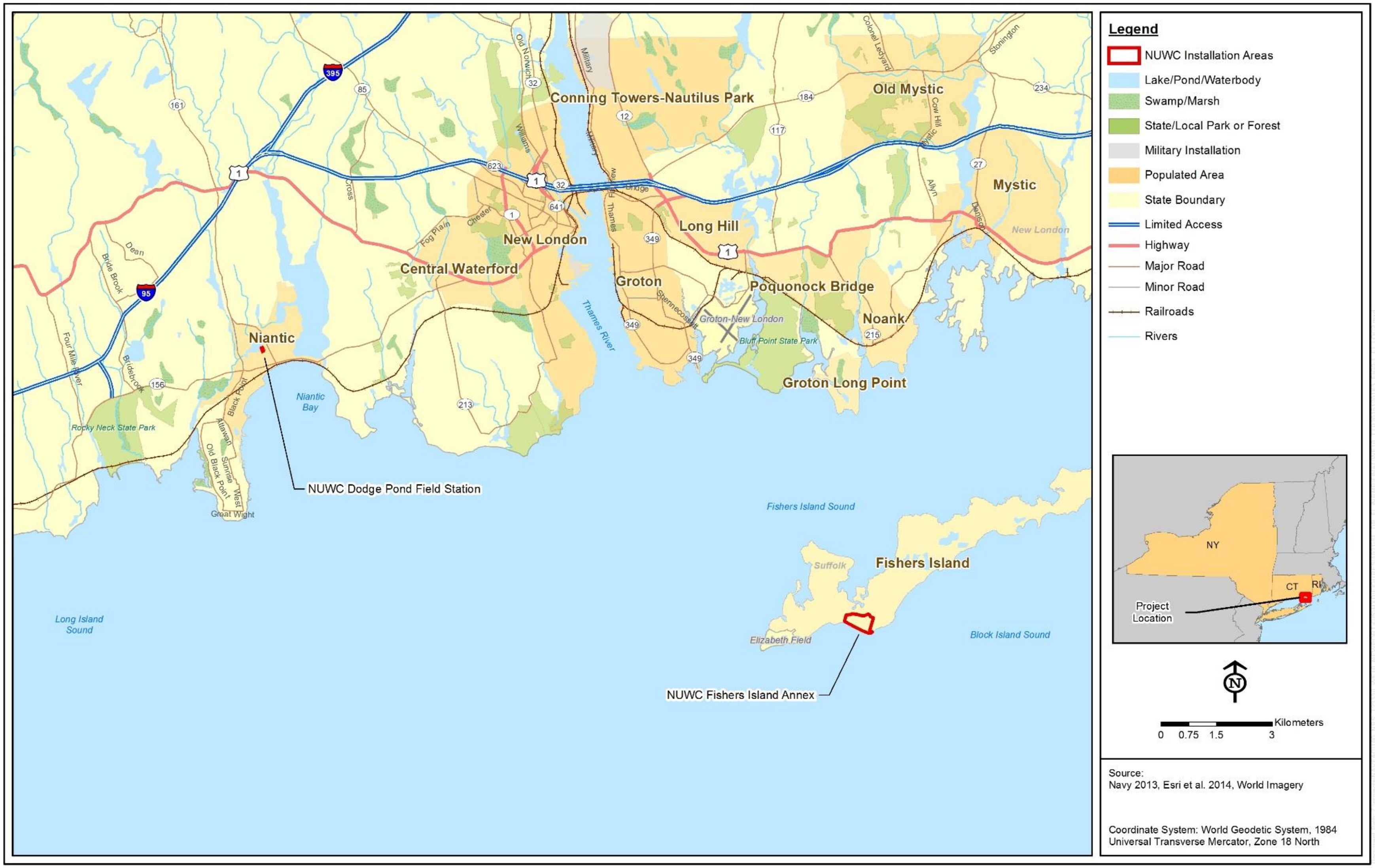

Figure 2-1. General and Relative Locations of Fishers Island Annex, Suffolk County, New York, and Dodge Pond Field Station, New London County, Connecticut.

Paved roads lead to 22 buildings across the site (see Figure 2-2). The site consists of the following areas:

- Wilderness Point area, dominated by estuarine/palustrine wetlands;
- A salt pond adjacent to Building 208, the Submarine Antenna Test Facility (SATF) and the Submarine Antenna Test Platform (SATP) track; and
- Mount Prospect area, including Battery 111, Building 261, and Building 253, the Harbor Entrance and Control Point (HECP).

The Submarine Antenna Test Range, housed in Building 208, consists of a 50 foot diameter ground level salt water pool with an underground 900 square foot electrically and thermally shielded laboratory which affords testing of submarine mast and periscope antennas under simulated at sea operational conditions. Salt water intake for the operation is from an adjacent salt pond. This facility is utilized between 80 and 120 days per year (NUWCDIV 1997a).

The Submarine Sensor Test Platform (SSTP) will enable Code 34 to test submarine antennas under wake conditions similar to those encountered at sea. This facility provides antenna design, development, and evaluation support for a variety of submarine communications, navigation, and electronic warfare programs. The SSTP, when not in use, is housed in Building 263, a recently completed metal building located north of the northeast end of Battery 111 (NUWCDIV 1997a).

The Extremely Low Frequency (ELF) operational receiving site is located in Building 253 (HECP) at Mount Prospect. The receiving site consists of two buried ELF receiving antenna, their associated electronics and telemetry. Antennae are connected via microwave to a laboratory located at the NUWC New London detachment site. This is an unmanned facility in continuous operation.

2.1.1.2 Seneca Lake

Seneca Lake, located within Ontario, Yates, Seneca, and Schuyler counties, lies in the Finger Lakes region of central New York. Small towns and villages are found around the shores of Seneca Lake, with the City of Geneva situated at the northern tip of the lake, while the Village of Watkins Glen, New York is located at the southern tip of the lake (FingerLakes.com 2017; NYSDEC 2019).

Seneca Lake is the largest of the eleven Finger Lakes, with a length of 36 miles and a maximum width of approximately 3 miles (Naval Sea Systems Command 2015a). It has an area of 43,343 acres (67.7 square miles), and a volume of 4.2 trillion gallons (NYSDEC 2014a; NYSDEC 2019). With a maximum depth of 650 feet, Seneca Lake is the deepest lake entirely within the State of New York (Naval Sea Systems Command 2015a, NYSDEC 2019). Seneca Lake, as well as the rivers and streams that feed into it, form the Seneca Lake Watershed. As one of the Finger Lakes, Seneca Lake and its watershed are included in the larger Oswego River Watershed, a 5,122 square mile area drained by the Oswego River (Hobart and William Smith Colleges, et al. 2012; NYSDEC 2014a). NUWC, Newport Detachment Seneca Lake is situated on the central portion of the western shoreline of Seneca Lake, north of Perry Point (see Figure 2-3).

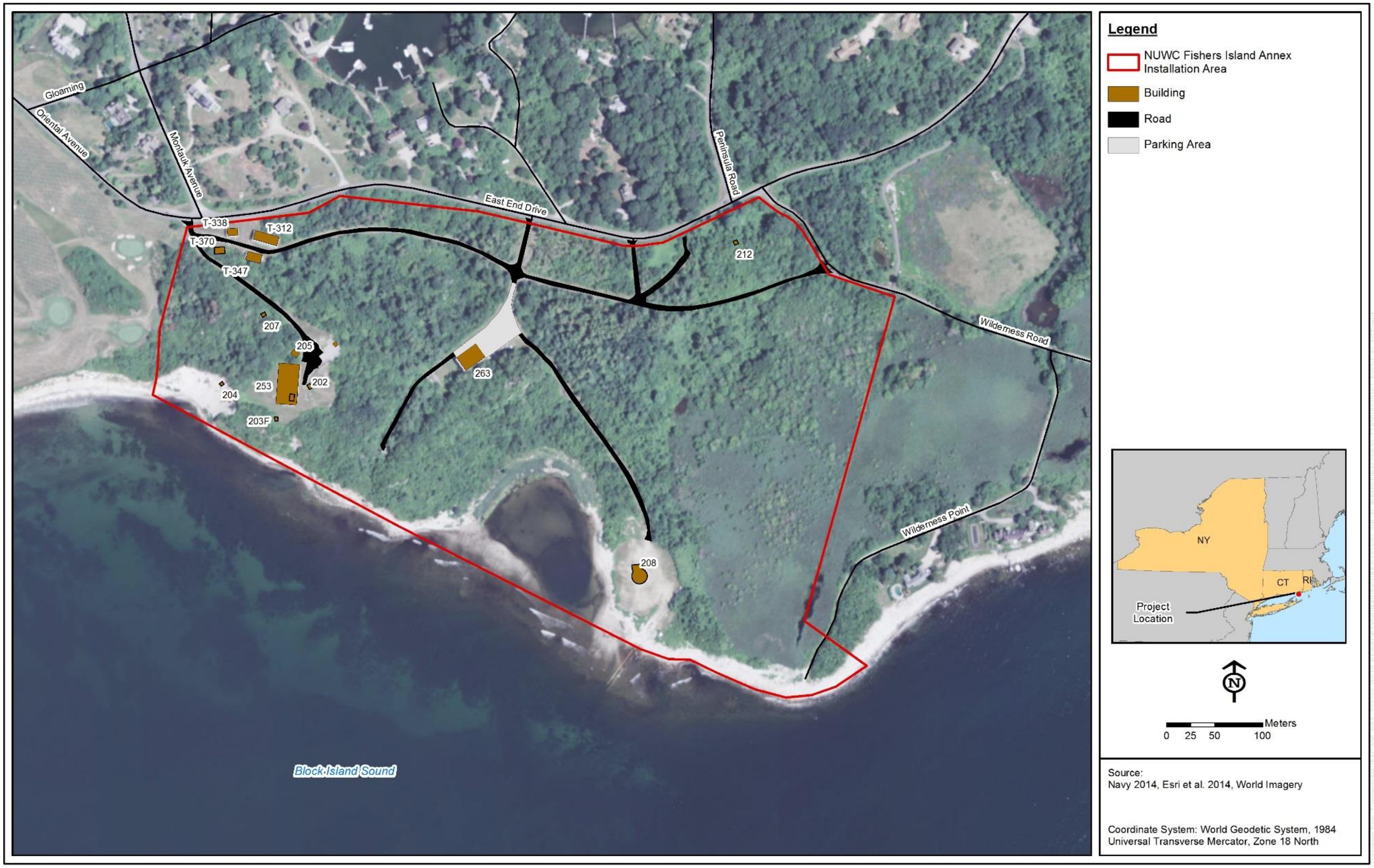

Figure 2-2. Fishers Island Annex Site Map.

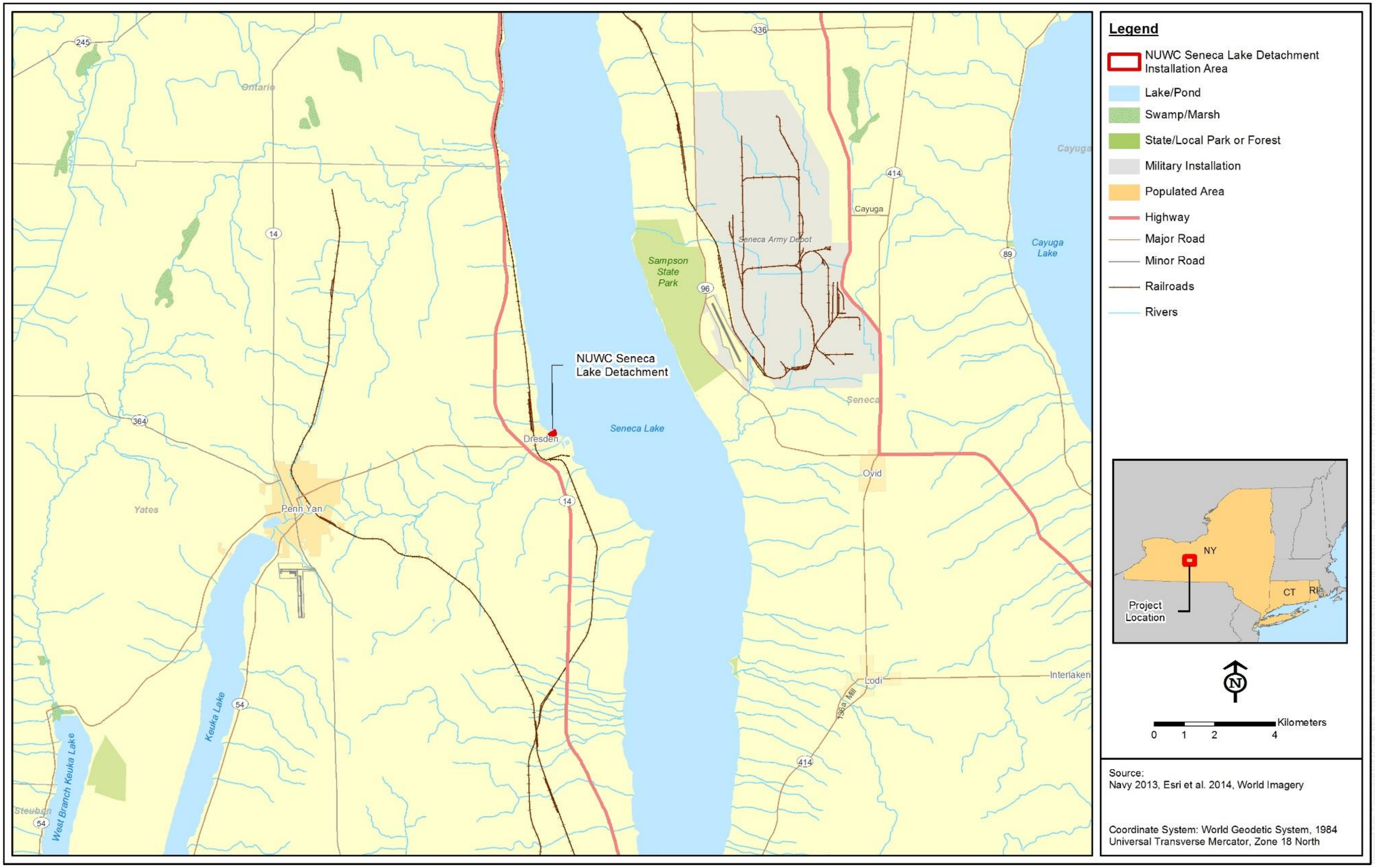

Figure 2-3. General Location of Seneca Lake Detachment, Yates County, New York.

The Navy facility, formally established in 1979, is a 4.7-acre lot within the Town of Dresden, Yates County, New York. The site—which sits at the end of Main Street, where the road comes down to Seneca Lake—was originally used as a gravel borrow pit and later as a private marina. The site consists of the main building (Building 1) with an unpaved parking lot in the western, uphill portion of the site (Figure 2-4). The Naval Undersea Warfare Center On-site Office Dresden, NY (NAVUNSEAWARCEN OSO DRESDEN NY), is housed in this building. A small woodland is present in the southwest corner of the site adjacent to the parking lot. Steep slopes separate these areas from an irregularly shaped lagoon and docking facility in the eastern half of the site. The perimeter of the southern and western edges of the site are steeply sloped to the lagoon. These areas are maintained as mowed turf and old fields, with wooded edges at the top of the slopes. Shore based facilities consist of three buildings (office, storage, and waterfront support), pier, boat house, two 56-foot work boats, one 36-foot personnel boat, three service barges, two Boston Whalers, a 30-ton crane, two fork lifts, and two motor vehicles (Davis 2014a). The shoreline consists of narrow maintained vegetated areas at the base of the slopes to the west and south, and a docking facility to the north. The adjacent properties to the north and south are residential with private docking facilities (NUWCDIV 1997c).

The System Measurement Platform is an H-shaped catamaran floating in two 192-foot by 35-foot pontoons with an overhead center span which ties the two pontoons together and houses laboratory and work spaces. The barge has an installed 220-ton crane which supports full scale testing. A second barge, the Transducer Calibration Platform is a 150-foot by 33-foot conventional barge with an installed deck house and center testing well. An installed 40-ton crane supports testing operations. Both the System Measurement Platform and the Transducer Calibration Platform are moored in the center of the lake in about 500 feet of water (Davis 2014a).

2.1.1.3 Dodge Pond

Dodge Pond is located less than 0.5 mile inland from Niantic Bay, along the coast of eastern Connecticut, on Long Island Sound (see Figure 2-1). The Dodge Pond Field Station occupies 0.96 acres on the southeastern shore of Dodge Pond, in Niantic, Connecticut. Niantic is a village within the town of East Lyme, in the county of New London, Connecticut (NUWCDIV 1997a).

The NUWCDIV, Newport Dodge Pond Field Station consists of five land-side buildings and a fixed-position barge on Dodge Pond (see Figure 2-5). Dodge Pond is a 34.3-acre shallow, inland, freshwater pond owned by the State of Connecticut's Department of Energy and Environmental Protection (CT DEEP 2011) and leased to the Navy for its exclusive use since 1948 (NUWCDIV 1997a). The main pond area encompasses 29.9 acres, which is separated from the southwestern end of the pond by spits of land extending from the north and south shores (the latter of which is where the boat launch is located), which almost connect (Connecticut Agricultural Experiment Station 2013). A narrow outlet connects the main water body to the remaining 4.4 acres of pond, which lie at the head of the Pattagansett Brook (Tetra Tech 2015a).

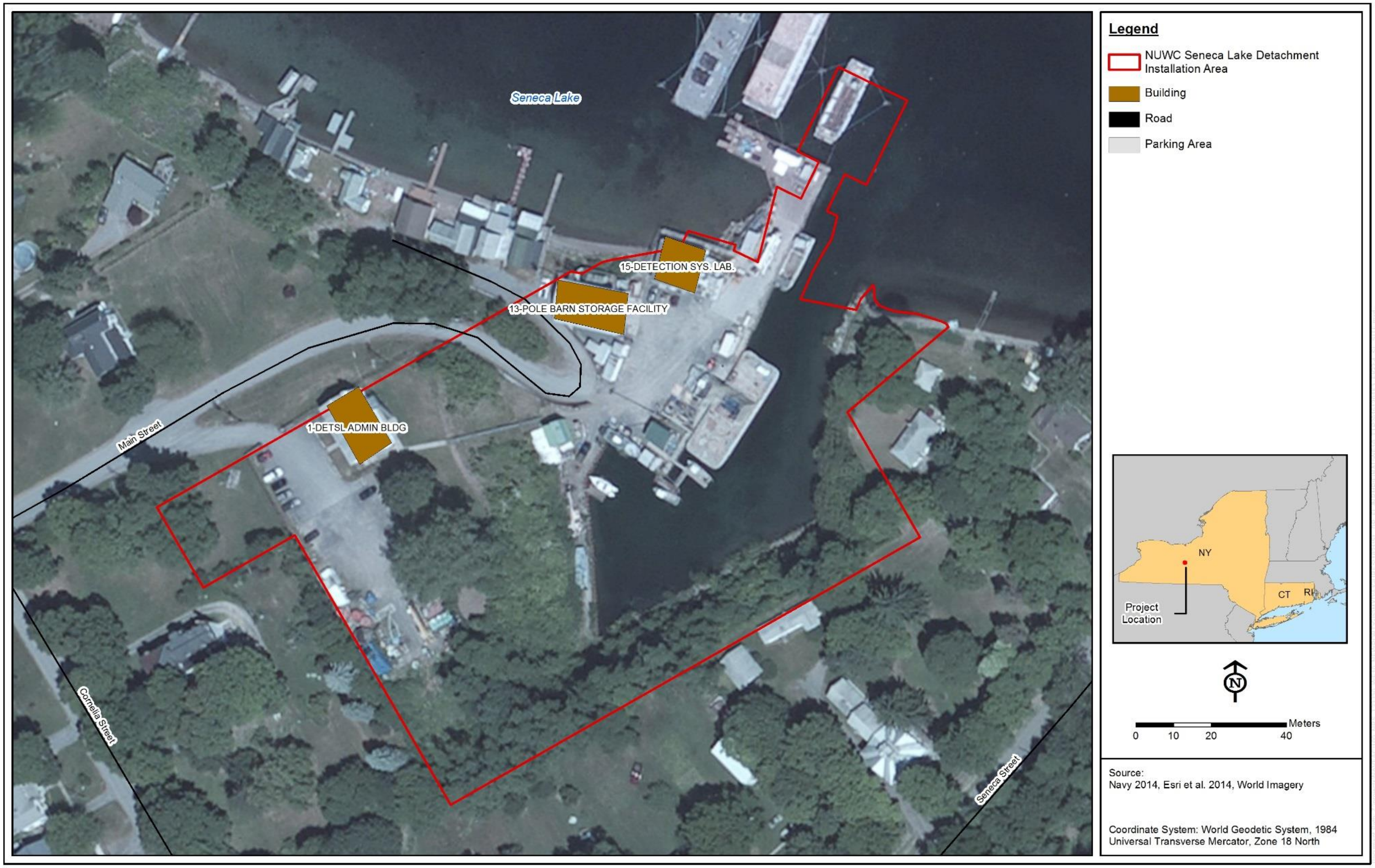

Figure 2-4. Seneca Lake Detachment Site Map.

Figure 2-5. Dodge Pond Field Station Site Map.

The Dodge Pond Field Station is the Navy's principal underwater acoustic RDT&E facility. This facility supports a broad spectrum of the Navy's underwater acoustic research and development programs, and assists in the design, development, application and evaluation of new underwater test equipment and methodology. In 1992, the facility was completely upgraded with a large modern test platform, replacing the older test barges. Today, NUWCDIV's facilities at Dodge Pond consist of a barge complex containing three test wells located in the pond. The test wells can handle transducers up to 25 tons that are 16 feet in diameter and 8 feet high. The barge is connected to land by a causeway capable of supporting loads up to 13 tons. A 6 foot by 12 foot by 6 foot deep tank is also available on-shore for calibration of small transducers (NUWCDIV 1997a).

The site includes the following buildings and structures:

Building 108, the Gatehouse;

Building 109, a residential dwelling converted for use as administrative offices, which house the Naval Undersea Warfare Center On-site Office Niantic (NAVUNSEAWARCEN OSO NIANTIC), is heated by oil stored in an above ground tank in the basement.

Building 110, Underwater Equipment Research & Development Lab—a metal building used to assemble electronic components, and measuring approximately 30 feet by 140 feet, was constructed in 1987 and expanded in 1992.

Two 1,000-gallon above ground storage tanks (ASTs) contain propane used to heat the barge. Propane is piped underground to the barge access road where it is piped alongside.

A walkway from Dodge Court to the shore of the pond is located immediately east of the east fence line. A bench is located on this public right of way (NUWCDIV 1997a).

The barge is anchored in position in the middle, or deepest part of Dodge Pond. The barge and access road are supported by free-floating pontoons. Roof drains discharge below the water level to minimize acoustical interference (NUWCDIV 1997a).

2.1.2 Regional Land Uses

2.1.2.1 Fishers Island

Although Fishers Island was, for most of its history since human settlement, a working cattle and sheep farm with a dairy, the island transitioned to a summer resort community in the 20th century (Henry L. Ferguson Museum 2015). Historically, Fishers Island contained several grand hotels; however, today it is comprised of a small community that supports a wide range of institutions, organizations, businesses, and other privately held lands (FishersIsland.net n.d). Most of the development—including commerce, public services, residential neighborhoods, a marina, and a small airport—is concentrated at the western end of the island, near the ferry terminal. Elizabeth

Field, a former military airfield with two asphalt-paved runways, is situated at the western tip of the island (FishersIsland.net 2013).

The Hay Harbor Golf Club is situated immediately west of Fishers Island Annex. Low density residential development is located north of Oriental Avenue and east of the installation along the shore. Looking further east/northeast of the Installation, the majority of Fishers Island is only lightly developed, with a few roads traversing the island. Large, undeveloped tracts of private land and multiple ponds (salt, brackish, and fresh-water) are interspersed with houses and several country clubs. The island is irregularly shaped, with numerous coves cutting into the northern shore of the island, whereas the southern shoreline is lined with beaches, which are predominantly narrow strips of sand backed by steep bluffs (NUWCDIV 1997a).

2.1.2.2 Seneca Lake

Within the 707 square-mile Seneca Lake Watershed, land use is dominated by the agricultural industry, representing approximately 42.2% of the area within the watershed. However, agricultural land has been noted as being on a steady decline, with forests and developed areas increasing over time. The remaining classifications include: residential (27.5%); vacant land (14.4%); wild, forested, conservation lands and public parks (5.9%); community services (5.1%); unclassified (1.3%); commercial (1.2%); recreation and entertainment (1.1%); public services (0.8%); and industrial (0.5%) (Hobart and William Smith Colleges, et al. 2012).

Seneca Lake is a popular tourist site, with the surrounding area offering a wide array of attractions and activities for visitors, ranging from the Seneca Wine Trail, hiking trails, scenic waterfalls, and fishing (FingerLakes.com 2017). With a climate that supports the growth of native grapes and hybrids, the Finger Lakes have become one of the largest winemaking regions in the eastern United States. The Seneca Wine Trail attracts over 600,000 visitors each year to the area, and is comprised of 35 member wineries which dot the landscape up and down the western lakeshore to the north and south of the installation (FingerLakes.com 2017).

An aerial view of the installation confirms a predominance of agricultural lands to the north, west, and south (Google Imagery 2016). The property immediately surrounding the NUWC Seneca Lake Detachment on all sides is private residential. Just south lies the Keuka Lake Outlet, which is buffered by forested land. South of the outlet, there is an industrialized area with several corporations' manufacturing facilities, past which a railroad line runs north-south.

2.1.2.3 Dodge Pond

The greater East Lyme area provides a wide range of outdoor recreational activities. Two state properties, Nehantic State Forest (in the northwestern corner) and Rocky Neck State Park (along the shore), are located within East Lyme. These sites provide opportunities for hiking, swimming, camping, and picnicking. Numerous public and private beaches are also found in the area (Discover East Lyme 2015a; Discover East Lyme 2015b).

Land use around Dodge Pond is primarily residential, especially along the eastern and southern shorelines (Tetra Tech 2015a). The land surrounding the field station is a mix of medium-density residential, multi-family residential, commercial, and industrial uses. Single family homes are located along Dodge Court, immediately adjacent to the field station on the east and south sides. A lumber yard and hospital supply manufacturing facility are located further south of the site (NUWCDIV 1997a, CT DEEP 2011). Aside from the residential area, there is an industrialized area south of the pond, and a forested area abuts the northwestern shoreline (Tetra Tech 2015a). A Town of East Lyme municipal well is located immediately west of the field station. Dodge Port is located to the north. A public boat launch is located at the west end of the port (NUWCDIV 1997a, CT DEEP 2011). The Niantic Bay lies less than 0.5 mile south of Dodge Pond, and the Niantic River and Smith Cove are at similar distances to the east and northeast, with Military Department Camp Niantic in between these water bodies (Google Imagery 2016).

2.1.3 Historic and Pre-Military Land Use

Fishers Island and Dodge Pond have been operating as military facilities for nearly 70 years, since the World War II era. Prior to Navy acquisition in 1952, Fishers Island was Fort Wright, a U.S. Army shore battery (NUWCDIV 1997a). Seneca Lake was established as a test facility more than 35 years ago. No information is available to describe the historic and pre-military land use of the Navy/NUWC installations at Fishers Island, Seneca Lake, or Dodge Pond.

2.1.4 Military Mission

The mission of NUWCDIV is to operate the Navy's full spectrum research, development, test and evaluation (RDT&E), engineering and fleet support center for submarines, autonomous underwater systems, undersea offensive and defensive weapon systems and countermeasures associated with undersea warfare. The range of NUWCDIV, Newport’s efforts extends from participation in fundamental research to support of evolving operational capacities in the fleet with major thrusts in applied research and system development. The existing resources at NUWCDIV, Newport provide the capability to support an exhaustive variety of research, development, test, and evaluation activities for torpedoes, underwater vehicles, and their launching systems.

NUWCDIV headquarters are located in Rhode Island. Remote test facilities are located on Fisher's Island, at Seneca Lake, and at Dodge Pond. Major facilities of NUWCDIV Newport include an acoustic wind tunnel; an anechoic chamber; a combat systems evaluation and analysis laboratory; a launcher laboratory; the Narragansett Bay Shallow Water Test Facility; an overwater arch facility; a propulsion test facility; a quiet water tunnel; the Submarine Towed and Deployed Systems Research, Development, Test and Evaluation Complex; the Survivability Test Facility; and the Undersea Warfare Analysis facility.

2.1.4.1 Fishers Island

The Fishers Island Annex is unique among the NUWC Detachments in that it is not permanently staffed, and it is only accessible via ferry. The primary mission of the facility is to conduct antenna testing. A majority of the testing conducted at Fishers Island is through the air, via land-based antenna towers and submarine-mounted antennas; no underwater testing is conducted at Fishers Island (Davis 2014b).

In addition, Fishers Island operates an ELF-receiving site, which consists of two buried antennae, their associated electronics, and telemetry. Under a lease agreement, the United

States Coast Guard (USCG) operates the Harbor Entrance and Control Point (HECP), which remotely monitors maritime traffic coming in and out of Long Island Sound by receiving Automated Identification Signals from vessels, out of this building.

2.1.4.2 Seneca Lake

The Detachment Seneca Lake supports the NUWCDIV, Newport mission by providing the only instrumented calibration and testing facility in a deep water lake east of the Rocky Mountains. The facility maintains this role by serving as an underwater acoustic test facility for the evaluation of large sonar systems and low frequency transducers (NUWCDIV 1997c).

In support of NUWCDIV's RDT&E-focused mission, the Seneca Lake facility performs test and evaluation of equipment ranging from single element transducers to complex sonar arrays and systems. Of its many capabilities, this facility is particularly well-known for its massive lift and power capabilities. With access to a deep freshwater lake throughout the entire year, the Seneca Lake facility has become the Navy's primary active instrumented calibration and test facility, with the ability to conduct a wide variety of research and development, including the testing and evaluation of projects requiring deep water with fixed underwater geometry with heavy load-handling and/or electrical power capabilities. The Seneca Lake facility also has machining and fabrication capabilities, allowing for quick repair or manufacture of test gear and fixtures (Naval Sea Systems Command 2015c).

This facility's current primary measurement and calibration resources are the two instrumented test barges: the System Measurement Platform, and the remote Transducer Calibration Platform. The System Measurement Platform, permanently moored near the center of Seneca Lake, is approximately 1.3 miles from the western shore, with a travel time of approximately 5 minutes from the shore (Naval Sea Systems Command 2015c).

2.1.4.3 Dodge Pond

The Dodge Pond facility supports a broad spectrum of the Navy's underwater acoustic research and development programs, and assists in the design, development, application and evaluation of new underwater test equipment and methodology. The facility was established as an acoustic measurement site in 1947 when one small test barge was transported overland and moored in the lake at the end of a 300-foot pontoon access causeway with additional larger test barges being constructed on site in subsequent years (NUWCDIV 1997a).

The Dodge Pond Acoustic Measurement Facility was commissioned in 1955. In 1992–1993, the facility was completely upgraded with a large modern test platform replacing the older test barges (Davis 2014a, Naval Sea Systems Command 2015b). The location is desirable due to the easy access to all parts of central New England, combined with quiet conditions (ambient noise less than sea state zero) for testing of all types of transducers, arrays, domes, baffles, towed line arrays, and other underwater electroacoustic devices (Naval Sea Systems Command 2015b).

2.1.5 Natural Resources Necessary to Support the Mission

The core mission at all three Outlying Parcels is RDT&E. Natural resources within the installations, such as the land areas, soils, hydrology, and vegetation, support the mission in practical ways (i.e., soil stabilization, decreasing stormwater runoff, and providing sites suitable for facilities). The nearshore waters at Seneca Lake are vital for the storage of NUWC's testing barges and other vessels; whereas the deeper waters in the middle of Seneca Lake and Dodge Pond serve the key purpose of providing areas in which to test underwater equipment and devices. Fishers Island's mission relies primarily upon having open space (i.e., air) and salt water in which to immerse its submarines.

2.1.6 Operations and Activities that may Affect Natural Resources

2.1.6.1 Fishers Island

Human use at Fishers Island Annex is minimal and restricted to facility access and regular maintenance of the HECP at Building 261 on Mount Prospect, Battery 111, the Submarine Antenna Test Facility (SATF) at Building 208, the adjacent Submarine Antenna Test Platform (SATP) track, and the SATP storage building. Modifications to the SATP track are fully permitted.

Ongoing activities at Fishers Island do not interfere with wildlife utilization. Disturbances of wildlife caused by humans or equipment, such as the startling of waterfowl, are temporary. While the potential for use of onsite habitats by several species of special concern is high, these species will not be affected by ongoing activities at this facility.

Activities at the site include some fuel oil storage and hydraulic oil on-board the RDT&E system that is deployed off shore. Three areas at the installation store or use oils: Battery 111, HECP/ Building 261, and the Submarine Antennae Platform and Winch. These areas are inherently susceptible to fuel spills, but spill prevention and containment measures are employed to minimize risk potential at these sites.

2.1.6.2 Seneca Lake

The Seneca Lake facility is fully developed with limited natural areas or habitats for terrestrial species. The lagoon provides a valuable fishery habitat as well as a foraging area for waterfowl; utilization by waterfowl is limited to periods of low human activity. Dockside activities and the maintenance and operation of boats and barges in both the lagoon and the lake have the potential to impact water quality via runoff, bilge discharge, sewage overflow, hull paint, cleaning or anti-fouling agents, and leaks or spills. NUWCDIV takes every precaution to minimize these risks so that the ongoing activities at the facility do not appreciably affect fish, wildlife, and aquatic resources in a negative manner. NYSDEC has not noted any measurable negative impacts to aquatic resources from the platforms during the approximately 40 years of the Navy's operations at Seneca Lake (Gibbs 2016).

2.1.6.3 Dodge Pond

The Dodge Pond Field Station has been extensively developed, and there are very limited natural resources on-site at the small parcel. While the RDT&E activities that take place at Dodge Pond do not themselves affect the natural resources on-site or in the pond, maintenance activities such as road sanding and salting, paving operations, and construction/maintenance of waterfront structures and the testing platform are all sources of non-point pollution which may reach the pond via stormwater runoff.

2.2 PHYSICAL ENVIRONMENT

2.2.1 Geology and Topography

2.2.1.1 Fishers Island

The topography at Fishers Island was created through extensive recessional glaciation. As glaciers receded silt, sand, gravel, and boulders were deposited over the existing bedrock. The greater part of Fishers Island consists of dune deposits or manmade features resulting from borrow and fill operations. These consist of sand formed into dunes by wind. The areas of the site closest to Block Island Sound are made up of beach deposits, chiefly well-sorted sand deposited by current and wave action. In places, the deposits may consist of pebble and boulder gravel. Mount Prospect contains less than 5 feet of gravel to sand. The salt marsh is made up of partly decomposed organic material mixed or interbedded with estuarine silt and sand. Abandoned gravel/sand pits have been identified in the northeast and northwest corners of the site. There is no bedrock information available for the site.

Elevation of Fishers Island Annex ranges from sea level to 101 feet at the top of Mount Prospect, one of the highest points on the entire island (Figure 2-6). Mount Prospect sits above a cliff/bluff, and provides panoramic views of the island. The southern flank of Mount Prospect is marked by severe erosion along the shoreline. Although barricades placed in the 1960's have successfully minimized erosion immediately upgradient, erosion is now focused immediately east and west. Building 204, a 9' x 11' observation post, has been severely undermined by erosion of the bluff. Over the past two decades, the vegetated portion of the bluff that lay immediately west of the erosion barricade has yielded over time to erosion and left more bare cliff face exposed. See Section 4.2, Coastal and Marine Management, for further discussion.

2.2.1.2 Seneca Lake

Carved out of bedrock more than 10,000 years ago by glaciers, Seneca Lake is 36 miles long, and is the deepest freshwater lake east of the Mississippi River outside the Great Lakes (Naval Sea Systems Command 2015a). Ice erosion acting on this landscape rounded the existing hills, deepened the valleys, and steepened the valley walls in the southern parts of Yates County. Glacial deposits added drumlins and kame moraines. As the glaciers receded they deposited silt, sand, gravel, and boulders over the existing bedrock. Receding ice conditions formed Seneca Lake where lower land surface offered less resistance to the moving ice sheet (NUWCDIV 1997c). The surface of the edge of the lake to the bottom edge of the lake is a very steep slope, averaging nine percent (Hobart and William Smith Colleges, et al. 2012). The lake reaches a depth of 650 feet at its deepest point; the depth at the System Measurement Platform is 460 feet (Naval Sea Systems Command 2015a).

Elevations at the installation range from approximately 440 feet at lagoon mean water level to 500 feet at the main entrance (Figure 2-7). Steep slopes are present along the western portion of the site between the main building and the docking facility, and between the southern property line and the lagoon edge.

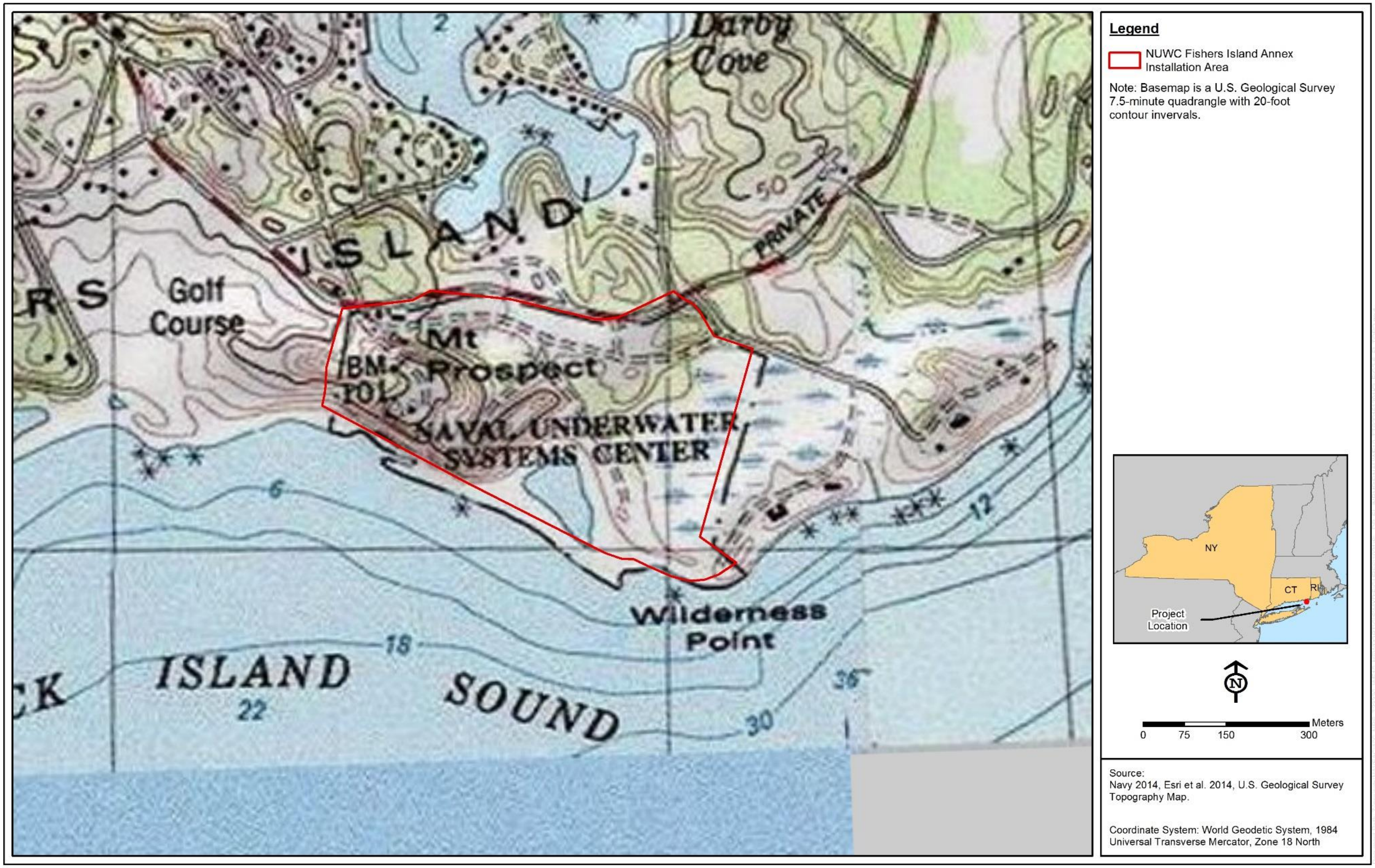

Figure 2-6. Fishers Island Annex, Town of Southold, New York, Area Topography Map.

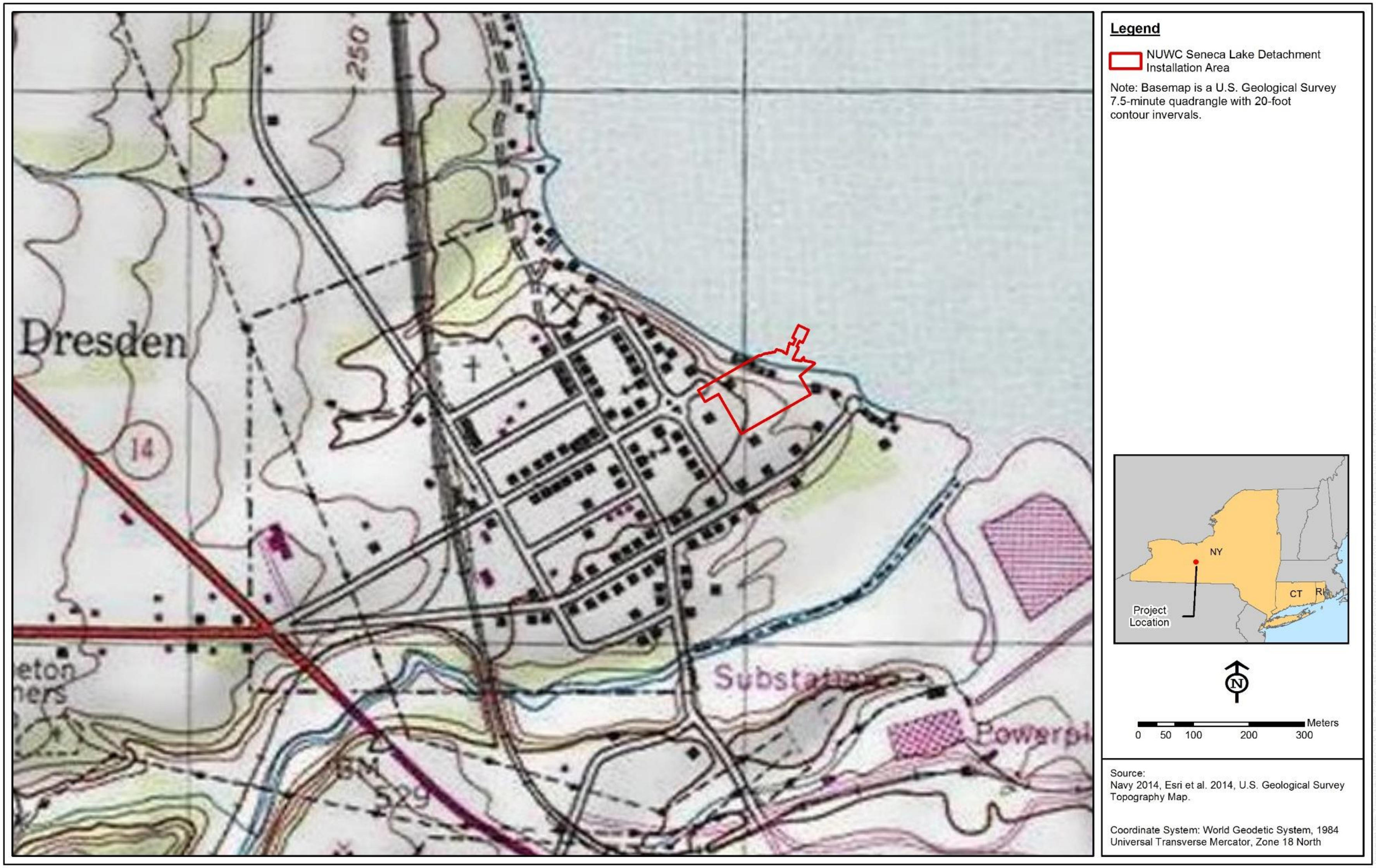

Figure 2-7. Seneca Lake Detachment, Town of Dresden, New York, Area Topography Map.

2.2.1.3 Dodge Pond

The topography at the Dodge Pond Field Station was created through Wisconsin glaciation. As the glaciers receded they deposited silt, sand, gravel, and boulders over the existing bedrock. The greater part of the site is made up of glacial stream deposits. These consist of gravel, sand and silt in valleys. A blanket of late glacial wind-blown silty sand to sandy silt covers the glacial deposits in most places to depths of 1 to 4 feet. It is generally mixed with underlying deposits. A "bridge" of artificial fill bisects the pond roughly two-thirds of the way down along the western shore (NUWCDIV 1997a).

A small part of the western border of Dodge Pond is alluvium, consisting of poorly-to well-sorted silt, sand, and gravel in flood plains of present streams. This may include deposits of the late glacial age. West and north of the pond are areas of loose to compact, silty, sandy, and stony till. It also has an area of weathered bedrock decomposed to sandy-gravelly material to a depth of at least 10 feet. The bedrock is sillimanitic biotite-feldspar-quartz gneiss (NUWCDIV 1997a).

The site lies within the sillimantic-potassium feldspar metamorphic zone. Bedrock under the site is Monson Gneiss, consisting of medium to course-grained, distinctly to indistinctly layered, locally massive biotite- and hornblende-biotite-quartz-plagio-clase gneiss with subordinate layers containing as much as 20 percent microcline. There is also Brimfield Schist under the site, consisting of sillimanitic- and garnet-bearing schist and gneiss, in which layers differ in proportions of biotite, quartz, and feldspar. It consists of thin quartzite near contact with Monson Gneiss (NUWCDIV 1997a).

The Dodge Pond Field Station site slopes down from a high point south of Building 109 to Dodge Pond (Figure 2-8). Elevations above mean sea level range from above 20 feet to 9 feet at the pond (NUWCDIV 1997a).

2.2.2 Soils

2.2.2.1 Fishers Island

Soils on the site belong to the Carver-Plymouth-Riverhead Association. They are moderately textured, and are classified as gravelly loamy sands and sandy loams. Topsoil is thin, but underlying glacial till is deep. Much of the area has been disturbed, thus about two-thirds of the facility's soils are classified as cut and fill and gravel pits (Figure 2-9). Swansea muck soils occur in the wetlands along the site's eastern boundary. Other soil types include Carver and Plymouth sands, Montauk fine sandy loam, and Riverhead very stony loam (NUWCDIV 1997b).

Along the installation's shoreline, the interface between Block Island Sound and upland is marked by beach. At high tide, the shoreline is limited to a narrow sandy beach, flanked by steep bluffs in the Mount Pleasant area and dunes in the Wilderness Point area. An expansive cobble beach and limited areas of tidal marsh are exposed at low tide. As described in Section 2.2.1, the beach and cliff at the western end of the installation property have suffered severe erosion, resulting in loss of buildable land atop the bluff.

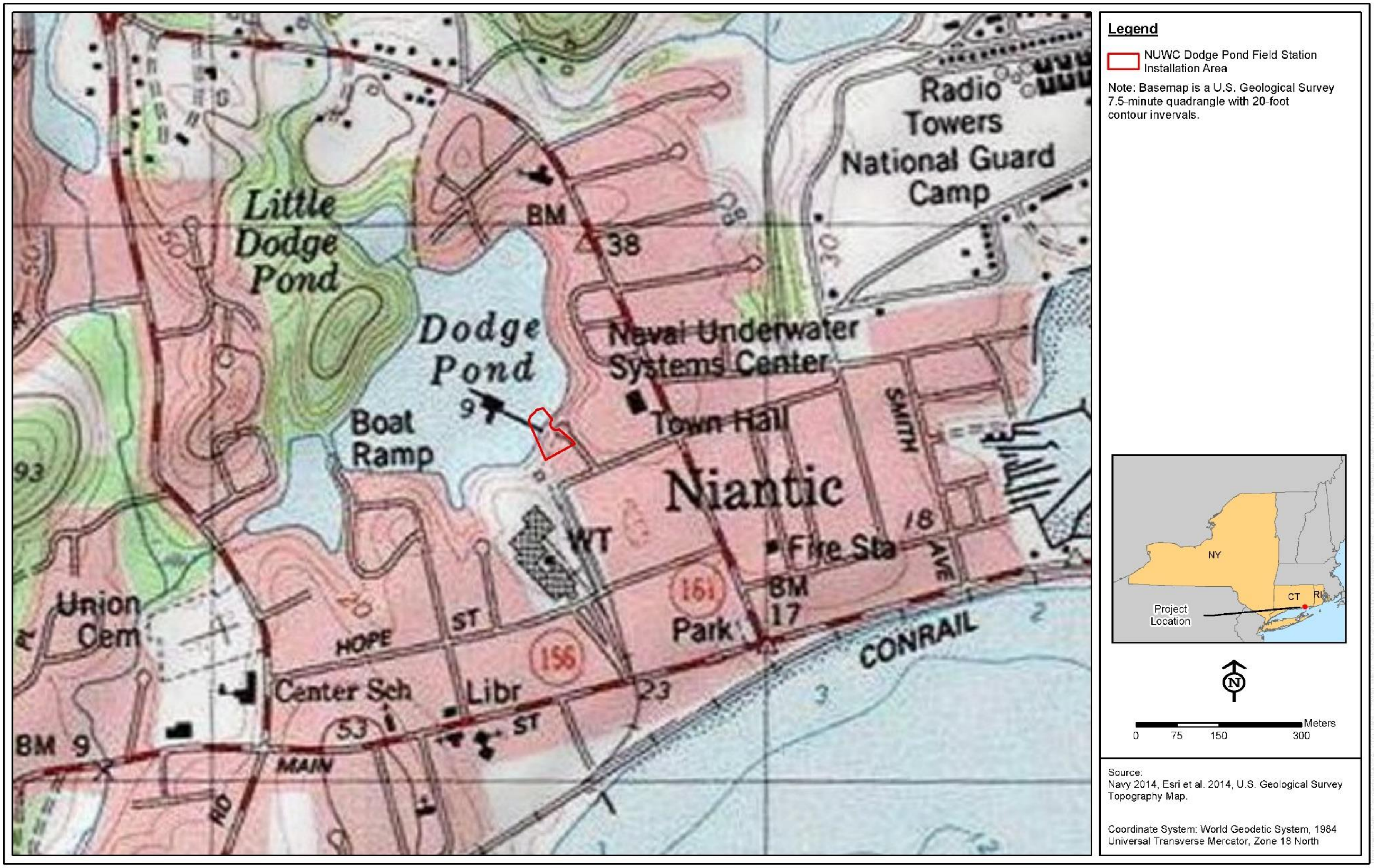

Figure 2-8. Dodge Pond Field Station, Niantic Village, Town of East Lyme, Connecticut, Area Topography Map.

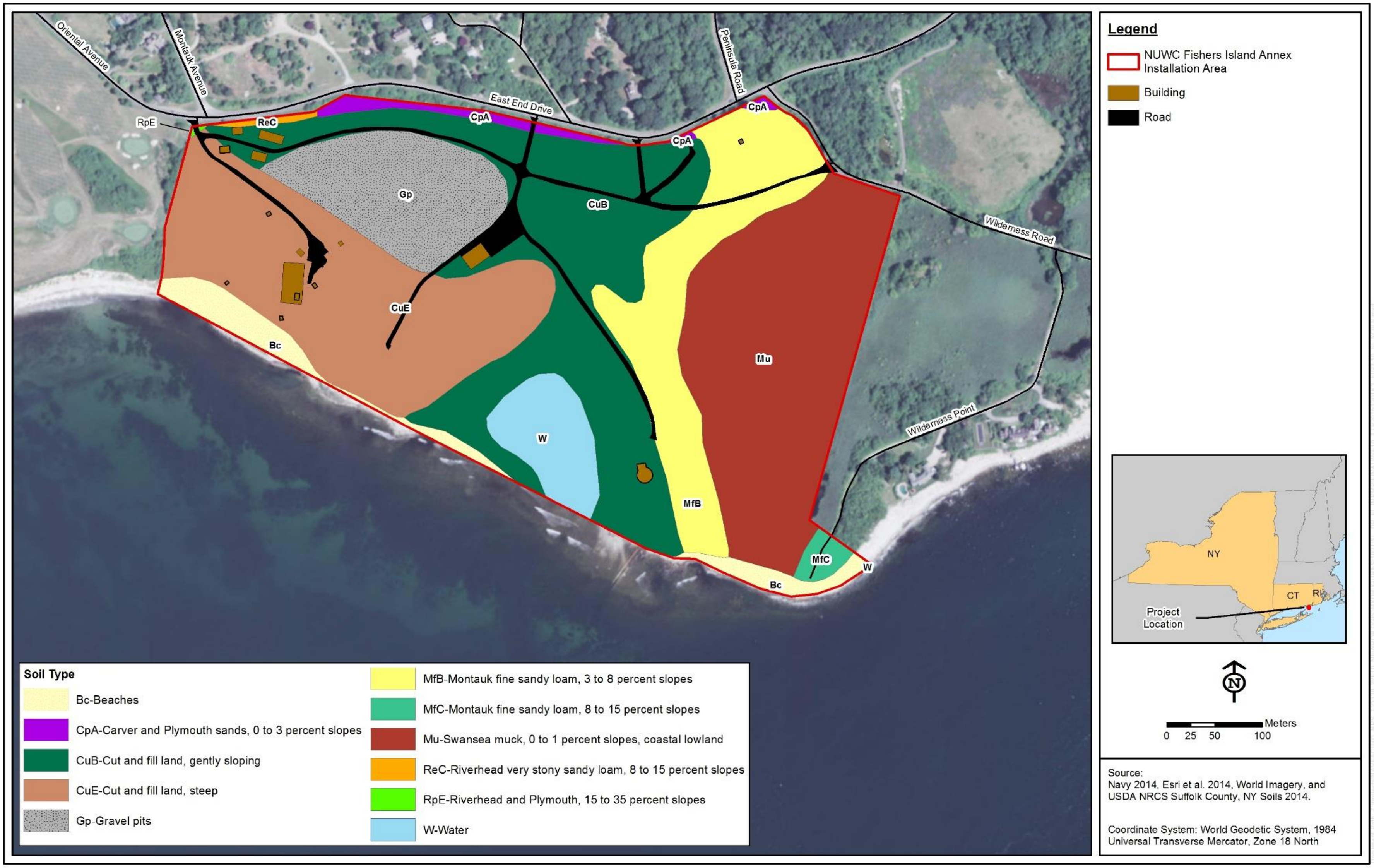

Figure 2-9. Soils at Fishers Island Annex, Suffolk County, New York.

2.2.2.2 Seneca Lake

Soil information presented is from a U.S. Department of Agriculture second order survey and is not field-verified. The soils of the site are mapped as Howard gravelly loam (Hu), 0 to 5 percent slopes (Figure 2-10). The Howard soils are deep, well drained and occur on nearly level terraces and hummocky terraces called kames. The Howard soils are loamy textured in the surface soils with medium textured materials in the subsoil. The depth to bedrock is 60 inches or greater (NUWCDIV 1997c).

The lagoon substratum consists of partly decomposed organic material mixed or interbedded with silt, sand and gravel. Greater than 90 percent of the facility area has been disturbed or altered by construction activities and past sand and gravel mining operations. Natural soil conditions were not observed (NUWCDIV 1997c).

2.2.2.3 Dodge Pond

The soil composition at the Dodge Pond Field Station is predominantly urban land, or land when more than 85 percent of the surface is covered by streets, parking lots, buildings, and other structures. The site also consists of Agawam fine sandy loam, 3–8 percent slope and Hinckley gravelly sandy loam, 15–35 percent slope, around the perimeter of the pond (Figure 2-11). Runoff for Agawam is medium, with moderate erosion hazard. Runoff for Hinckley is very rapid, with severe hazard of erosion. Slopes of excavated areas of both soils are unstable, but excavation activity on the site is infrequent (NUWCDIV 1997a).

2.2.3 Hydrology

2.2.3.1 Fishers Island

Hydrology on the site is determined by topography. No streams were identified on the site with the exception of a man-made ditch running north to south in the wetland on the eastern boundary. Surface water systems include the freshwater wetland and the salt pond. These two systems collect surface runoff from adjacent drainage areas. Surface runoff from upland areas southwest of Building 261 drains to the eroded bluff/cliff face. Runoff east and north of Building 261 is directed toward low-lying areas north of Battery 111 which are connected hydraulically to the salt pond. Runoff to the west flows over land toward the adjacent golf course (NUWCDIV 1997b).

100-Year Floodplain

Lower elevations of the site—predominantly found at the eastern end of the facility and around the salt pond—are subject to inundation during a 100-year flood, which is the base flood that has a 1% chance of being equaled in any given year. Coastal flooding during a 100-year storm may be expected to extend inland throughout the Wilderness Point wetland area, with water surfaces reaching an elevation of 11 feet (computed elevations are rounded to the nearest foot above sea level) immediately along the coast and 8 feet inland (Federal Emergency Management Agency 2009). Given the cobbles on the beach zone at the south end of the wetland, wash-over occurs during some storm events. The saltwater influence is evident in the successful invasion of common reed grass (*Phragmites australis*, commonly referred to as *Phragmites*) into the palustrine wetland (see Section 2.3.2.1).

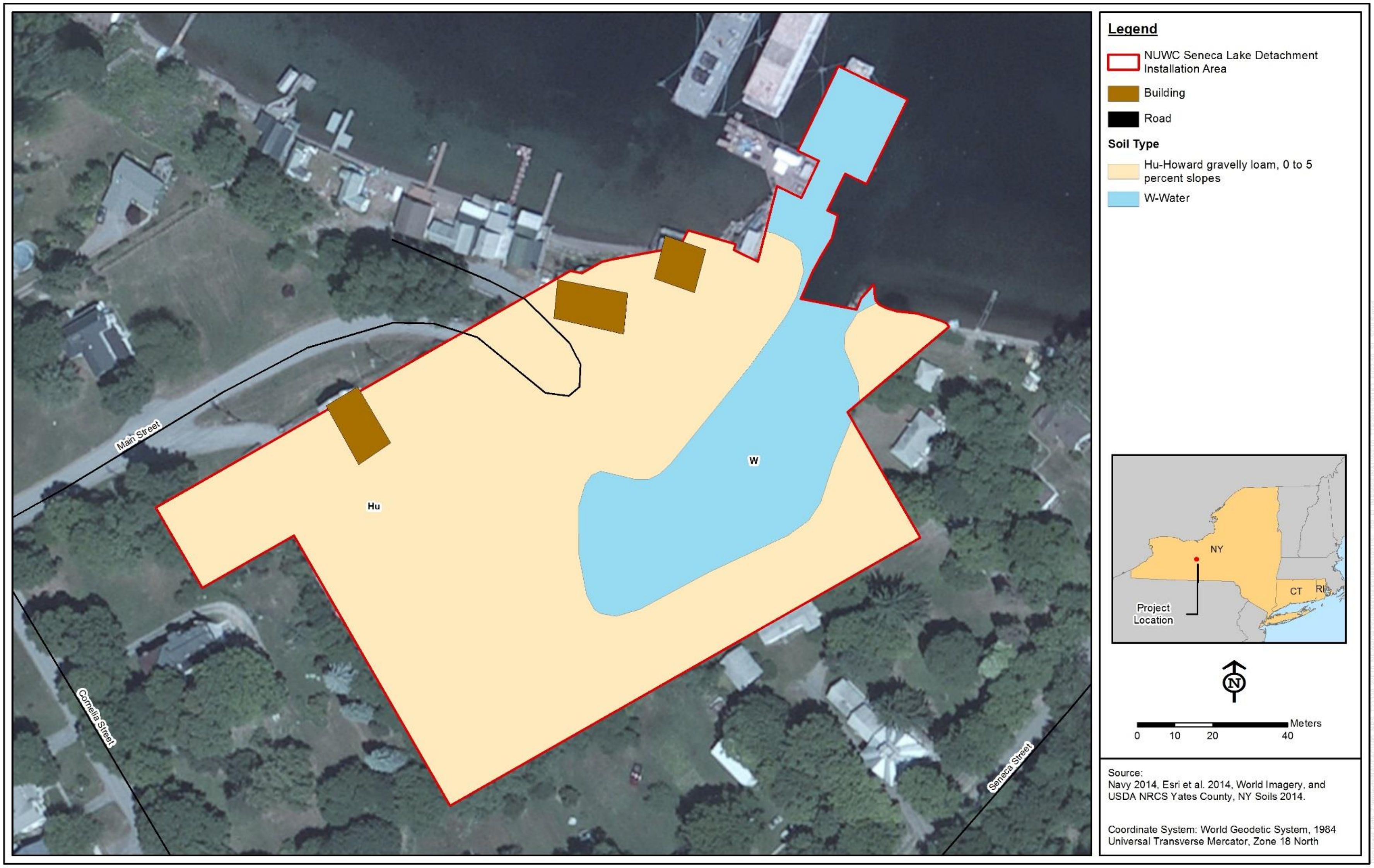

Figure 2-10. Soils at Seneca Lake Detachment, Yates County, New York.

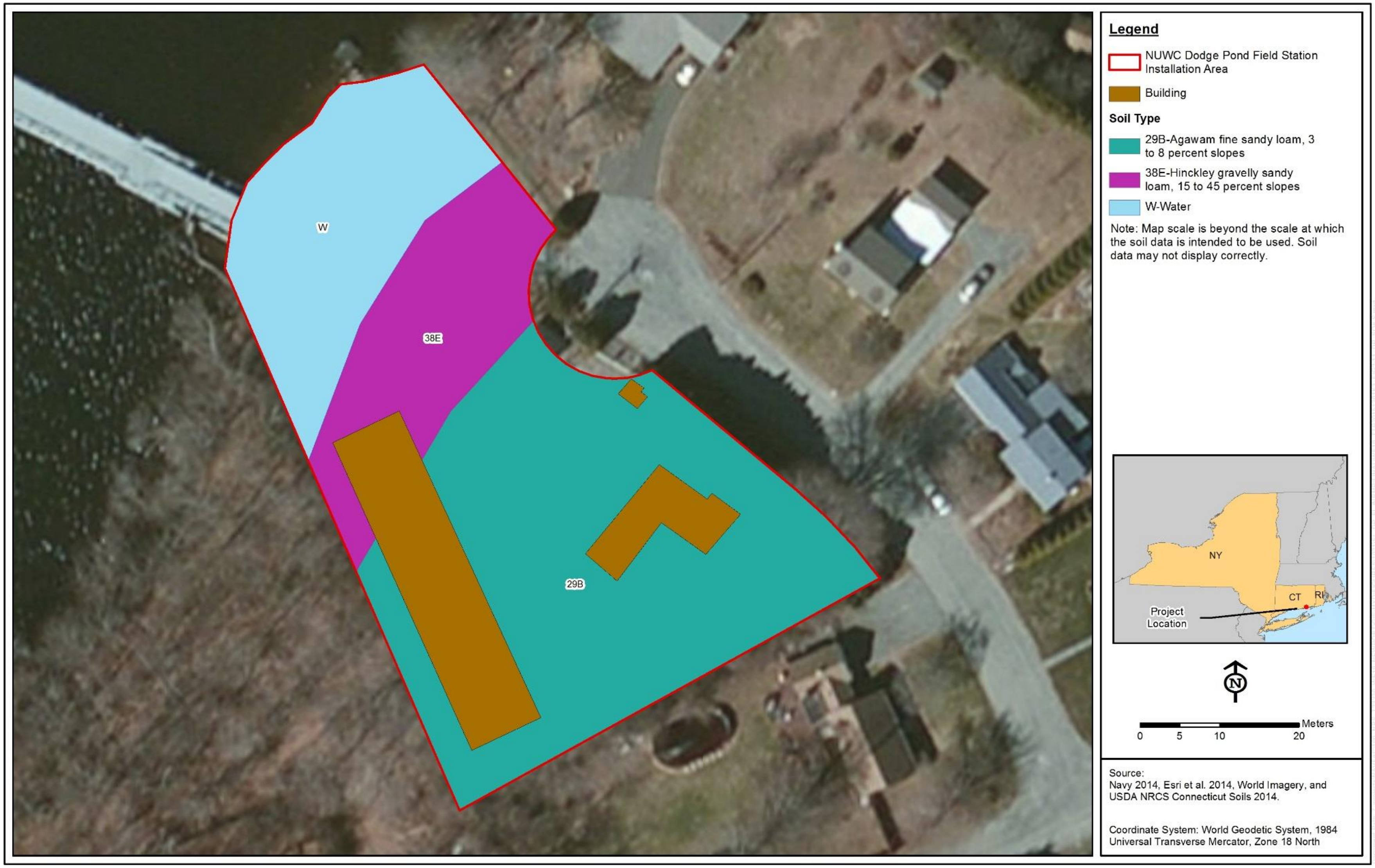

Figure 2-11. Soils at Dodge Pond Field Station, East Lyme, Connecticut.

The shoreline and the area surrounding the salt pond are a designated coastal flood zone with velocity hazard (i.e., susceptible to wave action). Offshore water surface elevations during a 100-year storm may be expected to reach 15 feet elevation above sea level west of the salt pond, or 16 feet in elevation along the shoreline eastward. The water surface with wave action in the salt pond may be expected to reach 15 feet in elevation during such storms, and the zone in the vicinity of the salt marsh, adjacent to the salt pond, may be expected to be inundated to an elevation of 14 feet above sea level (Federal Emergency Management Agency 2009).

2.2.3.2 Seneca Lake

Seneca Lake is located within the Lake Ontario drainage basin and is drained to the north by the Seneca River. The water level of Seneca Lake is controlled by the locks at Waterloo, NY, operated by the New York State Canal Corporation. The Keuka Lake Outlet, a perennial river located just south of the facility, also affects water levels at the facility. The average elevation is approximately 445 feet, while the maximum level attained was approximately 448 feet (NUWCDIV 1997c).

The area surrounding the facility drains overland to the south and east to Seneca Lake by primarily sheet flow into the lagoon. Some surface runoff from the paved access road (Main Street terminus) is collected in a storm sewer and discharged into the northwest portion of the lagoon via a corrugated steel pipe (NUWCDIV 1997c).

100-Year Floodplain
According to the Flood Insurance Rate Map for the Village of Dresden, Yates County, NY, the docking facility and lagoon are at 449 feet above sea level, and classified as Zone A3—Areas of 100-year flood; base flood elevations and flood hazard factors determined. Building No. 1 and the unpaved parking lot are outside of the 100-year floodplain (NUWCDIV 1997c).

2.2.3.3 Dodge Pond
Dodge Pond has a maximum depth of 49 feet and an average depth of 20 feet. There are approximately 30 feet of soft mud/muck at the bottom of the pond that helps reduce echoes. The pond was glacially formed, located within a well-drained coastal plain. Flow from Dodge Pond discharges over a concrete spillway to a wetland west of the pond. This area drains to the Pattagansett River which flows into Long Island Sound between Black Point and Giants Neck. Dodge Pond is primarily a groundwater discharge point; only minor stream flow is observed from Little Dodge Pond and a stream from the southwest slopes of Oswegatchie Hill (NUWCDIV 1997a).

100-Year Floodplain
The Dodge Pond Field Station is located within the 100-year flood zone (NUWCDIV 1997a).

2.2.4 Climate

2.2.4.1 Fishers Island

Fishers Island is characterized by a moderate coastal climate. Continental air masses and weather systems largely dominate prevailing climatic conditions. The island's maritime exposure also produces extended freeze-free temperature periods, reduced ranges in day and annual temperatures, and more precipitation in winter than in summer. The total annual precipitation in 2014 for the closest weather data station (Shirley Brookhaven Airport, located approximately 50 miles to the southwest on Long Island) was 43.57 inches, with the months of November (5.30 inches), December (6.19 inches), and March (6.22 inches) having the highest amounts of rainfall in 2014. Mean temperatures in 2014 ranged from 27.3 degrees Fahrenheit (°F) in January to 73.2°F in July (NOAA National Climate Data Center 2020). Clear sunny weather is typical over 50 percent of the time. Hurricanes occasionally strike the island. Wind is primarily out of the northwest between December and April and is primarily out of the southwest from May through November (Windfinder.com 2020).

2.2.4.2 Seneca Lake

The climate of Dresden, New York is generally continental, but is modified by variations in elevation and proximity to Seneca Lake. Seneca Lake allows for good air drainage and slightly longer growing seasons. Within the Finger Lakes area, the average July air temperature is 70.4°F, while the average January air temperature is 22.4°F. Seneca Lake is isothermal from December through June, with water temperatures at 41°F; during the summer months, a thermocline forms, and surface water temperatures rise, while water below 200 ft. (61 m) remains at 41°F (Naval Sea Systems Command 2015a). The total precipitation averages 32.5 inches per year and is generally spread evenly throughout the year, with the southeastern corner of the watershed receiving a slightly higher amount of precipitation (37.5 inches per year) (Hobart and William Smith Colleges, et al. 2012). Clear sunny weather is typical over 50 percent of the time (NUWCDIV 1997c). Wind speeds average 8 to 10 knots during the spring, summer, and fall; increasing to 16 to 18 knots in the winter (Naval Sea Systems Command 2015a).

2.2.4.3 Dodge Pond

Because of the site's location along the coastline of the Atlantic Ocean, climate is affected by the ocean's thermal qualities. Warm Gulfstream waters provide mild weather in the fall and winter months relative to the weather conditions at inland areas (NUWCDIV 1997a). Within the Town of East Lyme, the average July temperature is 73°F, while the average January temperature is 30°F. The total precipitation averages 49.83 inches per year (Weather Underground 2020).

2.3 BIOTIC ENVIRONMENT

2.3.1 Ecoregion (Northeastern Coastal Zone Ecoregion)

An ecoregion is an area of general likeness in ecosystems and the type, quality, and quantity of environmental resources. This geographic identifier serves as a framework for research, management, and monitoring of ecosystems, and is critical for structuring ecosystem management strategies across federal and state agencies and nongovernmental organizations (U.S. Environmental Protection Agency [EPA] 2010).

2.3.1.1 Fishers Island

Fishers Island falls within the EPA's Northeastern Coastal Zone Ecoregion, specifically the Long Island Sound Coastal Lowland subsection. This subsection comprises the coastal strip occurring in southern Connecticut and Rhode Island that borders Long Island Sound and Block Island Sound, and is characterized by low-elevation rolling coastal plains, tidal marshes, estuaries, sandy dunes and beaches, and rocky headlands. Low gradient streams are also present, with silt, sand, and gravel substrates (EPA 2010).

The geology within this subsection is defined by quaternary sandy till; sandy loamy till; kame moraine gravel, sand, and silt; outwash gravel, sand, and silt; and saline or estuarine marsh deposits. Ordovician schist, granofels, gneiss, and granitic gneiss is also present. Devonian schist, Triassic arkos, and Precambrian gneiss, quartzite, and schist are also found within this area. Some Permian granite is additionally found in Rhode Island. Common soil series found within the Long Island Sound Coastal Lowland subsection include Hinkley, Agawam, Merrimac, Westbrook, Pawcatuck, Ipswich, Charlton, Canton, Gloucester, and Matunuk (EPA 2010).

The Long Island Sound Coastal Lowland subsection has one of the mildest climates within this ecoregion, with an average January temperature of 29°F, and an average July temperature of 72.5°F. Annual precipitation within this subsection ranges from 44 to 48 inches per year. This mild climate allows for the growth of coastal hardwood forests containing black, red, and white oaks, hickories, and black cherry. Additional common plants include vines and shrubs such as catbrier, greenbrier, and poison ivy. Many flora and fauna common in the Southeastern Piedmont and coastal plains reach their northern limit here, including holly, post oak, sweetgum, and persimmon. Pitch pine and post oak may be found along the coastal headlands, while scarlet oak and sassafras stands may be found on stabilized dunes (EPA 2010).

The Long Island Sound Coastal Lowland subsection contains several highly urbanized, suburban, and rural residential areas, including New Haven and areas westward. Some pasture and minor croplands area also found within this area. Coastal areas of this subsection have become popular tourist attractions, with many resorts available for visitors, and various fishing opportunities (EPA 2010).

2.3.1.2 Seneca Lake

Seneca Lake falls within the Great Lakes Ecoregion, specifically the Erie/Ontario Lake Plain subsection of that ecoregion. As part of the central lowlands, this area is characterized by a combination of gently rolling till-plain (glacial ground moraine) and flat lake plain, though several areas with broad, low ridges may be found (generally trending parallel to the lake's shorelines). Along the eastern end of this subsection, within New York State, there are either or both moderately dissected till and drumlin plains or three low "stairstep" escarpments, both parallel to and below the northern margin of the Allegheny Plateau. Elevations within the Erie/Ontario Lake Plain range from 245 feet, the mean elevation of the surface of Lake Ontario, to 1,000 feet along the Appalachian Plateau border; however, much of the land is under 800 feet in elevation. The Erie/Ontario Lake Plain subsection is noted for several lakes and rivers of importance, including Lake Eric, Lake Ontario, the St. Lawrence River, Mohawk River, and Blackhawk River. Other abundant water resources, including perennial streams, inland lakes, canals, reservoirs, and wetlands help to characterize this subsection (U.S. Forest Service 1994).

Soils within the Erie/Ontario Lake Plain are predominantly Udalfs and Aqulafs, though Ochrepts and Aquepts are more commonly found along the shores of Lake Ontario. Medisaprist soils occur in New York, the central part of this subsection. Vegetation within this subsection includes northern hardwood forest, beech-maple forest, and elm-ash forest. Other notable vegetation within this subsection include: beech-maple mesic forest in the east, maple-basswood forest, hemlock-northern hardwood forest, oak openings, and pitch pine-heath barrens. The growing season within the Erie/Ontario Lake Plain lasts 140 to 160 days, but ranges to 180 days in a narrow belt along Lake Ontario (U.S. Forest Service 1994).

The Erie/Ontario Lake Plain subsection has mean annual temperatures ranging from 45°F to 52°F. Annual precipitation within this subsection ranges from 27 to 45 inches per year, increasing from west to east. This precipitation is distributed evenly throughout the year. Areas immediately adjacent to Lake Erie have an average snowfall of 40 to 60 inches, while the remainder of the subsection range from 60 to 80 inches (U.S. Forest Service 1994).

The most prominent land use within this area is agriculture, which accounts for about 50 percent of the total acreage in Erie/Ontario Lake Plain subsection. Further, 30 percent of the land within this subsection is comprised of forest land, mostly in farm woodlots. The remaining land is characterized as residential and urban (U.S. Forest Service 1994).

2.3.1.3 Dodge Pond

Dodge Pond is located in the Northeastern Coastal Zone Ecoregion and the Long Island Sound Coastal Lowland subsection. This is the same subsection as applies to Fishers Island; refer to Section 2.3.1.1 for a description.

2.3.2 Water Resources, Aquatic Habitats, and Wetlands

Water resources comprise of surface and ground water resources. Surface water features include streams, lakes, rivers, reservoirs, wetlands, and estuaries. Ground water includes subsurface hydrogeologic resources such as aquifers. Since surface and ground water are linked, effective land and water management requires clear understanding of both water resource types and how they are linked in any setting. For example, pollution of surface water can cause degradation of ground water quality, and vice versa.

Wetlands are defined under the CWA as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (EPA 2019). For more detail on wetland types, refer to Section 2.3.4.1 of the primary INRMP.

The CWA recognizes special aquatic sites as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values" (EPA n.d.). These sites are also "generally recognized as significantly influencing or positively contributing to the overall environmental health or vitality of the entire ecosystem of a region." The CWA identifies six categories of special aquatic sites: sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes (CWA Part 230, Section 404[b][1] Subpart E). Those special aquatic sites at each of the Outlying Parcels are described below.

2.3.2.1 Fishers Island

Wetlands

The value of wetlands to fish and wildlife resources provides enhanced habitat diversity. Because of this importance to the fish and wildlife food chain, a full review of wetland resources was conducted at the time of development of the 1997 INRMP for Fishers Island Annex (NUWCDIV 1997b).

Surveys performed by the U.S. Fish and Wildlife Service determined that Fishers Island contained a total of 208.8 acres of wetlands, mostly freshwater types (Tiner 2011). Of the 208.8 acres of wetlands on Fishers Island, the USFWS determined approximately 142.3 acres were palustrine wetlands. This amount was further divided into: 4.6 acres aquatic bed; 32.6 acres emergent; 33.4 acres forested; 3.6 acres scrub-shrub; and 68.1 acres of unconsolidated bottoms. The remaining 66.5 acres of wetlands were determined to be estuarine (Tiner 2011).

The National Wetland Inventory (NWI) classification maps for Fishers Island indicate three wetland areas at the Fishers Island Annex (Figure 2-12). This NWI mapping was prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands identified from the system were identified based on vegetation, visible hydrology, and geography in accordance with Classification of Wetlands and Deep-Water Habitats of the United States. This mapping reflects conditions during the specific year and season they were taken, and serves as a general guide but does not accurately depict wetland boundaries. The following wetland complexes were identified on the 2020 NWI mapping:

- Freshwater Emergent Wetland
  - Palustrine emergent persistent seasonally flooded partially drained/ditched (PEM1Ed)
- Estuarine and Marine Wetland
  - Marine intertidal unconsolidated shore irregularly exposed (M2USM)
  - Marine intertidal temporarily flooded seasonally saturated irregularly exposed (M2ABM)
  - Marine intertidal unconsolidated shore regularly flooded (M2USN)
- Freshwater Pond
  - Palustrine aquatic bed permanently flooded (PABH)

Freshwater Emergent Wetland

The 12-acre (approximate) wetland along the eastern boundary is identified under the New York State Regulated Freshwater Wetlands as NL-1, due to its location within the New London [Connecticut] U.S. Geological Survey (USGS) Quadrangle (NYSDEC 2020b). This wetland extends east of the property fence. The lower estuarine section (closest to the marine influence) of the wetland is characterized by a dense stand of *Phragmites*.

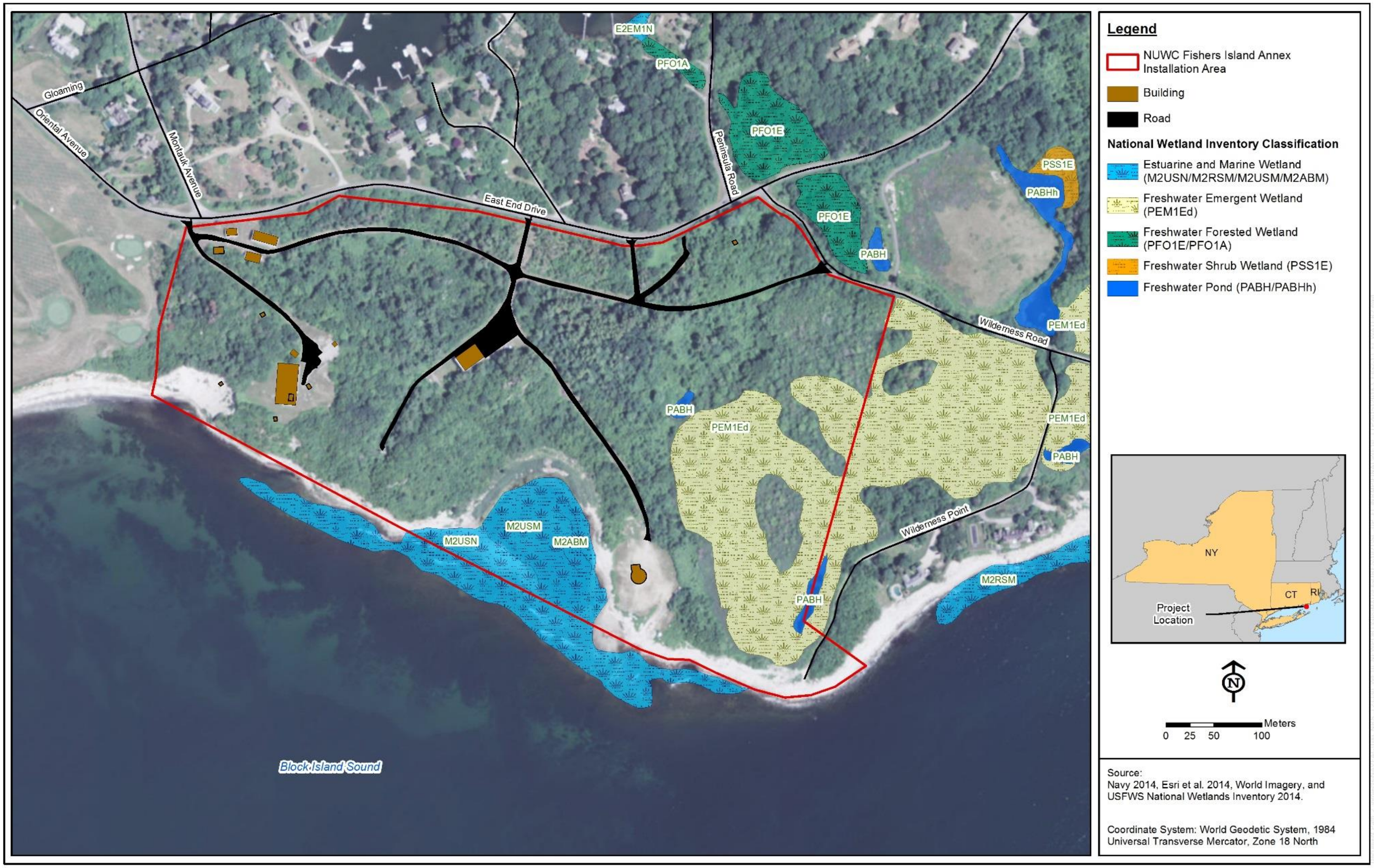

Figure 2-12. National Wetlands Inventory Map for Fishers Island Annex, Suffolk County, New York.

This area is impacted by wash-overs of seawater during major storm events as well as saltwater spray and on-shore winds. At the time of the 1997 INRMP, the upper portion of the wetland was an evolving red maple *(Acer rubrum)* swamp with stands of saplings (dominant) and trees, more indicative of a palustrine or freshwater wetland. The understory included highbush blueberry *(Vaccinium corymbosum)*, sweet pepperbush *(Clethra alnifolia)*, and swamp azalea *(Rhododendron viscosum)*, while the groundcover was dominated by sedge *(Carex stricta)* and moss *(Sphagnum* sp.). Although red maple swamp remains, over the last two decades, *Phragmites* has taken over essentially the entire wetland, and none of the other formerly present vegetation species (listed above) were identified during the site walkover surveys that were conducted (in the fall of 2014 and spring of 2015) for this update. Although some of those species may still be present, there has been a marked decrease in biodiversity.

The *Phragmites* stand extends northward nearly to the northern installation boundary along Wilderness Road, making the entire eastern installation boundary essentially impassible, both inside and outside of the installation. Although the NWI layer shows a gap in the middle of the wetland (Figure 2-12), it appears to be continuous from the edge; it is impossible to determine the true extent of the wetland without a formal delineation.

The wetland is hydrologically fed by groundwater and surface water. The substrate is an organic muck soil (histosol, 16–45 inches thick) (NUWCDIV 1997b). A man-made ditch bisects the wetland and is located near the Navy's property boundary on the east. This ditch is indicated as a freshwater pond on the NWI classification (Figure 2-12). The upland/wetland boundary on the west side of the swamp is delineated by fill material of boulders, earth and debris. The wetland line is abrupt due to the filling activity (NUWCDIV 1997b).

Freshwater Ponds

In addition to the man-made ditch along the eastern boundary of the installation, there is a second, small, freshwater pond shown on the NWI layer. It is located just northwest of the freshwater emergent wetland, and appears to be roughly 35 m long by 10 m wide.

Marine Intertidal Wetlands/Salt Pond

A 2-acre (approximate) coastal salt pond is located behind the cobblestone beach, between Mount Prospect and the Wilderness Point area. This wetland has been identified by NWI as marine subtidal open water subtidal (Figure 2-12). Although there is no tidal flow at low tide, flushing action between the pond and Block Island Sound occurs twice daily at high tide. This pond—the source of 26,262 gallons of sea water used in the Antenna Test Facility housed at Building 208—has previously been dredged to a depth of 10 feet to accommodate the intake. Following testing, all water is drained by gravity back to the rocky shoreline of the tidal pool (NUWCDIV 1997b).

A distinctive pattern of vegetative bands can be found around this salt pond, especially along the west and north shores. From the salt pond to the upland the sequence includes tall saltwater cordgrass (*Spartina alterniflora*) along the intertidal zone, saltmeadow cordgrass (*Spartina patens*) on the high marsh, and common reed grass *(Phragmites australis)* at the marsh-upland interface. Tidal pools were observed beneath boulders, providing cover for finfish and crustaceans. The interface of grass, decaying vegetation, tidal flow bringing oxygenated, nutrient-bearing water, and rock cover, provides habitat protected from gulls and other predators. A complex set of factors including flooding, salinity, substrate, microrelief, oxygen and nutrient availability, ice scouring, and storms interact with the competitive strategies and abilities of the plants to establish themselves (NUWCDIV 1997b). Peaty vegetation along the shoreline has the potential to buffer storm impacts. The eastern shore of the installation's salt pond is dominated by the rocky and sandy beach adjacent to the antenna test facility intake/discharge lines.

Beach and Nearshore Area

The south shore of the salt pond is an unconsolidated, cobble barrier beach, on the far side of which lies Block Island Sound. This barrier beach is frequently overtopped by spring tides or waves generated by coastal storms including hurricanes and northeasters. Seaweeds observed along the barrier beach include *Antithamnion cruciatum,* rockweed *(Fucus vesiculosus),* and kelp *(Laminaria* sp.*)* (NUWCDIV 1997b).

Along the installation's shoreline to the east and west of the salt pond, the interface between Block Island Sound and upland is marked by beach. At high tide, the shoreline is limited to a narrow sandy beach, flanked by steep bluffs in the Mount Pleasant area and dunes in the Wilderness Point area. An expansive cobble beach and limited areas of tidal marsh are exposed at low tide.

The coastline of the Fishers Island Navy property has been designated by NYSDEC as tidal wetlands. The beach area is part of the tidal wetland category SM (coastal shoals, bars, and mudflats). This zone is defined as follows: 1) covered by water at high tide, 2) at low tide is exposed or is covered by water to a maximum depth of approximately one foot, and 3) is not vegetated by low marsh cordgrass (*Spartina alterniflora*) (NUWCDIV 1997b, NYSDEC 2020c). The tidal pond is included in the SM zone. Marine intertidal mudflats such as these serve as important habitat for species such as polychaetes, softshell clams, and blue mussels, and also serve as an important feeding area for shorebirds (including some migratory birds). See Figure 2-13 for a depiction of NOAA's Environmental Sensitivity Index data, showing the range of sensitive biological resources (from bivalves to whales) that use the coastal and marine waters around Fishers Island, as well as the managed areas and different shoreline habitat types.

Seaward of the SM zone is the tidal wetland category LZ (littoral zone). This zone extends to depths of 6 feet at mean low water (NUWCDIV 1997b, NYSDEC 2020c).

The Navy's nearshore areas, by definition, include all submerged lands titled to the Navy and all other submerged lands that are adjacent to the installation that extend from the mean high water level, offshore to the boundary of any secure areas that are controlled by the Navy. There are no titled submerged lands or secure offshore areas at Fishers Island, so the marine nearshore area is not applicable to this INRMP Addendum. All Navy operations that take place in the marine waters of Block Island Sound, Long Island Sound, and Fishers Island Sound, are covered under the Atlantic Fleet Training and Testing Final Environmental Impact Statement/Overseas Environmental Impact Statement (NAVFAC Atlantic 2018).

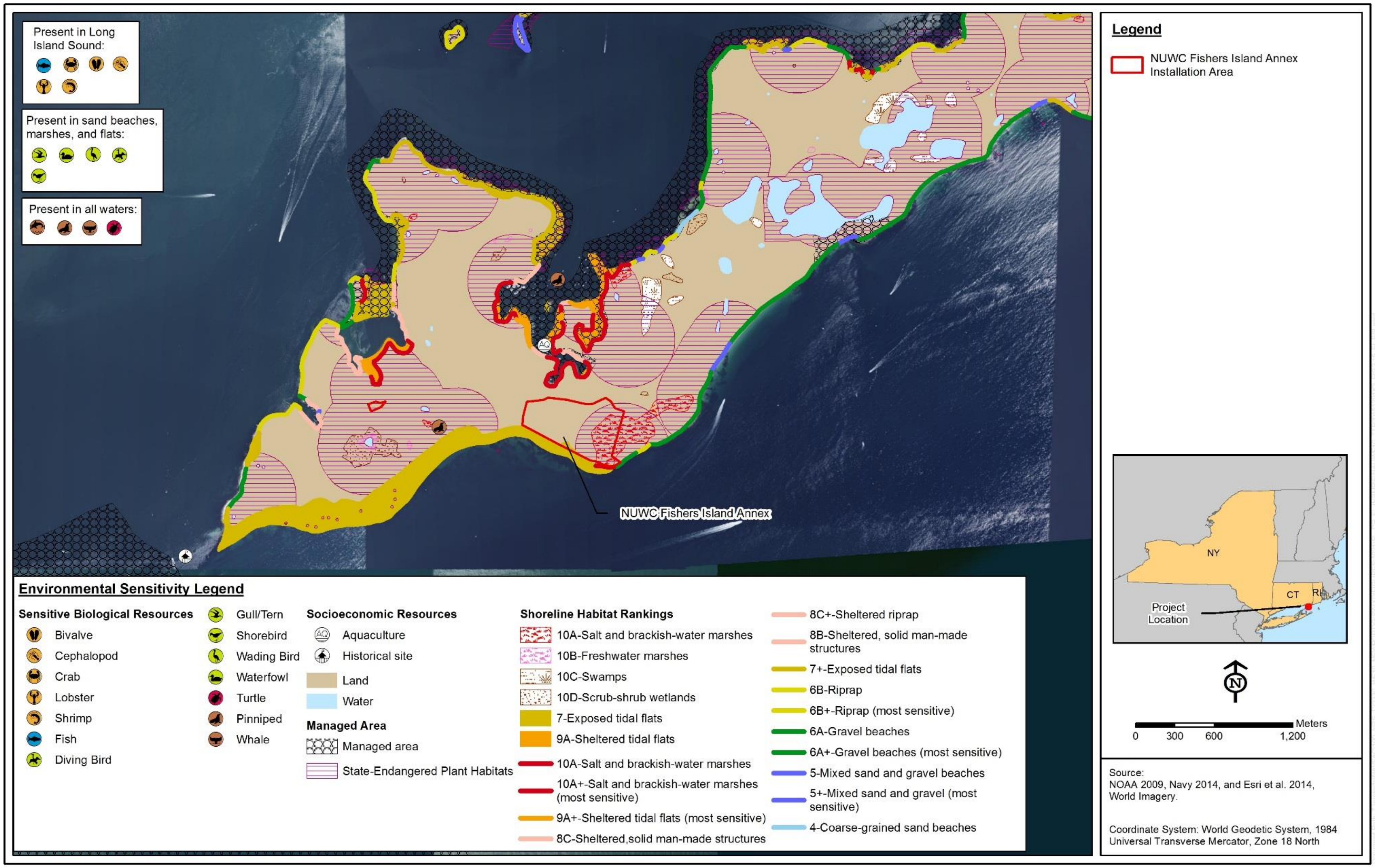

Figure 2-13. Environmental Sensitivity Index Map for Fishers Island, New York.

2.3.2.2 Seneca Lake

Wetlands

Field observations of wetland areas within the Seneca Lake facility for the 1997 INRMP identified the shallow lagoon as a lacustrine limnetic, submerged vascular, excavated aquatic bed, (L1AB2x). The predominant plant species within the aquatic bed included water milfoil, water pennywort and pondweeds (NUWCDIV 1997c). In contrast, there were no submerged aquatic vegetation species observed during the spring 2015 site visit for this INRMP update. This does not mean, however, that they are not present. There were no floating plant fragments in the lagoon. The lake was very turbid that day, and the waves were 2 to 3 feet high. It was near impossible to sample submerged aquatic vegetation, and the extensively armored shorelines in the facility leave no place for plants to "wash up." Rake tosses into the water were all devoid of vegetation. A more extensive aquatic survey would be required to draw conclusions about the presence of aquatic species in the lagoon.

The value of wetlands to fish and wildlife resources provides enhanced habitat diversity and enrichment. Because of this importance to fish and wildlife, a review of available freshwater resources was made. According to the United States Fish and Wildlife Service National Wetlands Inventory, Dresden, NY, Quadrangle Seneca Lake and the lagoon area within the facility are classified as lacustrine limnetic unconsolidated bottom permanently flooded (L1UBH). Wetlands identified from the system were identified based on vegetation, visible hydrology, and geography in accordance with *Classification of Wetlands and Deep-Water Habitats of the United States*. This mapping reflects conditions during the specific year and season they were taken, and serves as a general guide but does not accurately depict wetland boundaries. New York State Freshwater Wetlands Map, Dresden, Yates County, NY, did not identify freshwater wetlands within the vicinity of the facility. It is the Department of Navy's policy to permit "no net loss" of Navy wetlands and to avoid impacting wetlands wherever possible. This policy was endorsed by the President in the spring of 1989, in Executive Order 11990 and is being instituted on Navy property (NUWCDIV 1997c).

Surface Waters

A water classification system has been established in New York State, designating most water bodies within the state based upon the best usage of the water or water body "segment." Seneca Lake has been divided into 4 segments under this water classification system. The New York Department of Environmental Conservation has determined that from the north end of Seneca Lake, down approximately 2.4 miles, was a B classification. Portions of the lake within a 1-mile radius of the mouth of the Keuka Lake Outlet was also given a B classification. Pastime Park, south for 32 miles (and excluding the previous segment) was given the AA (TS) classification. This is the lake section that encompasses the NUWC Seneca Lake Detachment. Finally, Quarter Mile Creek to the southern end of Seneca Lake is listed as a B classification (Callinan 2001). Class AA corresponds to fresh surface waters, which are best used for supply drinking water, culinary or food processing purposes, primary and secondary contact recreation, and fishing. These waters are considered suitable for fish, shellfish, and wildlife propagation and survival. These waters, if subjected to approved disinfection treatments, meet or will meet New York State Department of Health drinking water standards and may be considered for drinking water purposes. The additional classification of TS indicates that this portion of Seneca Lake is classified as trout spawning waters. Class B refers to fresh surface waters that are primarily used for recreation and fishing. Such waters are suitable for fish, shellfish, and wildlife propagation and survival (Thomson Reuters Westlaw 2020).

Portions of Seneca Lake, as with all of the Finger Lakes, are used for a variety of human needs, including supplying public water and wastewater assimilation. Seneca Lake currently has 4 permitted public water supply withdrawals. These 4 sites are permitted to withdrawal approximately 9 million gallons per day (MGD). In total, approximately 180 million gallons per day are permitted to be withdrawn from the Finger Lakes (Callinan 2001).

2.3.2.3 Dodge Pond

Wetlands

The NWI map prepared by the USFWS in 1975 does not identify any wetlands in the upland portion of the site, nor does the present (2020) NWI imagery. This NWI mapping was prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands identified from the system were identified based on vegetation, visible hydrology, and geography in accordance with Classification of Wetlands and Deep Water Habitats of the United States. This mapping reflects conditions during the specific year and season they were taken, and serves as a general guide but does not accurately depict wetland boundaries. NWI mapping identifies Dodge Pond as POW (palustrine open water). This information is not field corrected based on field investigation (NUWCDIV 1997a).

Both the previous and the present (spring 2015) field investigations for the INRMP confirmed that no known freshwater wetlands exist toward the upland beyond the shore at the Dodge Pond Field Station site. A very narrow (< 1 foot) interrupted band of non-persistent emergent wetland plants which border the shoreline along the pond's edge is subject to wetlands regulation. Vegetation includes *Impatiens capensis*, *Carex* sp., *Gallium* sp., *Eupatorium* sp., and *Cuscuta gronovii* (NUWCDIV 1997a). This wetland vegetation is limited due to previous upland construction activities at the site and the continued mowing of the weeds and grasses to the water edge. No wetland shrubs or trees are present. The soil to the water's edge is non-hydric fill material. The wetland plants are also mixed with upland groundcover. The NWI map indicates that no palustrine wetland system exists along the shore at Dodge Pond Field Station.

Surface Waters

Dodge Pond is a 33-acre kettle lake. Kettle holes are depressions formed from melting glaciers. Kettle lakes occur where the kettle hole is filled with water. The eastern shore of Dodge Pond slopes at 8 percent toward the pond, and a similar slope toward the pond is present along most of the remaining shoreline. A bathymetry survey performed at Dodge Pond in December 1998 confirmed the results of Phase I Extended Site Investigation (ESI) soundings, which indicated that the pond is a steep-sided basin with a maximum depth of 50 to 52 feet. The deepest portion of the pond is located beneath the field station barge (Tetra Tech 2015a).

Approximately 30 feet of sediment overlays bedrock on the pond floor. Dodge Pond is approximately 1,750 feet in length along its longest axis, which is southwest-northeast; this axis coincides with the orientation of the prevailing southwesterly winds. Lakes with a small surface area (like Dodge Pond) generally experience less wind-driven turbulence in the water column and tend to stratify, and Dodge Pond undergoes seasonal thermal stratification (Tetra Tech 2015a). The pond is used for recreational fishing, swimming, and boating, but motorized craft are prohibited on the pond without permission from the state (NUWCDIV 1997a, CT DEEP 2011, and Tetra Tech 2015a).

Groundwater in the vicinity of NUWC flows eastward toward the Niantic River. Thus, groundwater west of NUWC flows toward and potentially into Dodge Pond. Surface water runoff from surrounding areas and stormwater outfalls are responsible for most of the water in Dodge Pond. A marshy area known as Little Dodge Pond is located approximately 180 feet northwest of Dodge Pond. An unnamed stream that originates approximately 1.3 miles to the north drains into Little Dodge Pond, then into Dodge Pond (Tetra Tech 2015a).

Several stormwater outfalls that drain into Dodge Pond exist at private residences along the northeastern edge of the pond. In addition, a 12-inch diameter pipe on the southeastern shore was observed during a site visit. An outlet at the southwest end of Dodge Pond drains surface water from Dodge Pond into the Pattagansett Brook, then the Pattagansett River approximately 1,200 feet downstream from the pond; from that point, the Pattagansett River flows for three miles into Long Island Sound (Tetra Tech 2015a). Water also leaves the pond by seepage into the aquifer. Pumping of a backup municipal water supply well for the Town of East Lyme might induce recharge from the pond to the well. The well is located approximately 200 feet south of Dodge Pond (Tetra Tech 2015a).

2.3.3 Flora

2.3.3.1 Fishers Island

The entire island of Fishers Island is part of the marine rocky intertidal natural community (NYSDEC 2020b). Flora found on Fishers Island varies by habitat. Recent surveys throughout the island have determined that all plant species occur in either coastal beaches, tidal marsh or freshwater wetlands. In general, the flora at the Fishers Island facility may be described as invasive, with an early successional, virtually impenetrable tangle of vines, shrubs, and dense trees. Upland woodland species are found in the northwestern quadrant, wetland species cover the eastern Wilderness Point Area, and scrub/shrub vegetation predominates the remainder of the facility outside of the improved/mowed grounds around the buildings and roads.

Site walkover visits of Fishers Island Annex were conducted on 01 October 2014 and 26 May 2015 to verify flora and fauna species lists. These recent field observations have divided the Fishers Island flora into three main categories: trees, shrubs, and forbs. Of the seventeen tree species identified, zero were listed as prohibited on NYSDEC’s list of *Prohibited and Regulated Invasive Species* (NYSDEC 2014b), and two are recognized as NYSDEC regulated invasive species: Norway maple (*Acer platanoides*) and black locust (*Robinia pseudoacacia*). Two black locust stands were identified, located to the east and north of the SATF. Fifteen additional (non-invasive) tree species were identified during field surveys, including: European larch (*Larix decidua)*, Japanese black pine (*Pinus thunbergi*), red maple (*Acer rubrum*), black gum / tupelo (*Nyssa sylvatica*), beach plum (*Prunus maritimia*), bebb willow (*Salix bebbiana*), sweet fern (*Comptonia peregrina*), bay berry (*Myrica pensylvanica*), big toothed aspen (*Populus *grandidentata*), black oak (*Quercus velutina*), European/English oak (*Quercus robur*), black cherry (*Prunus serotina*), pin cherry (*Prunus pensylvanica*), staghorn sumac (*Rhus typnia*), and shining sumac (*Rhus copallina*). The 1997 Fishers Island INRMP (NUWCDIV 1997b) described that the installation's Japanese black pines had been attacked by a black turpentine beetle infestation, making them susceptible to blue stain fungus, and resulting in a wide-spread mortality of mature (then 30- to 40-year-old) trees, and saplings alike. The former management recommendation to remove these infected trees and attempt natural revegetation with native species has not come to fruition: the dead and diseased trees are still standing as snags, and any efforts of native plants to gain a foothold have been overtaken by invasive species.

Eleven species of shrubs and vines have been found throughout Fishers Island, of which the following five are listed as NYSDEC prohibited invasive species: Asiatic/oriental bittersweet (*Celastrus orbiculatus*), Japanese knotweed (*Fallopia japonica*/*Reynoutria japonica*), Japanese honeysuckle (*Lonicera japonica*), and multiflora rose (*Rosa multiflora*). The bittersweet is intermingled with the *Phragmites* stand in the freshwater wetland along the eastern side of the installation, forming a dense, jungle-like tangle. Japanese knotweed was noted in multiple locations, including one spot southwest of the SATF, near the salt-pond's beach; one large and one small stand along the northeastern installation boundary; and another small stand on the south side of the main east–west road, located east/northeast of the Battery. Non-invasive shrubs observed in 2014 include wild raisin (*Viburnum nudum*), greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), Grape (*Vitis* spp.), Poison ivy (*Toxicodendron radicans*), and Virginia rose (*Rosa virginiana*).

Numerous forbs were identified on the Fishers Island installation, including: bracken fern (*Pterdium aquilinum*), Queen Anne's lace (*Daucus carota*), multiple goldenrods (*Solidago* spp.), rose mallow (*Hibiscus palustris*), common reed grass, and multiple asters (*Aster* spp.). Of these, the common reed grass—which dominates the eastern end of the installation (as described in Section 2.3.2.1)—is identified as a NYSDEC prohibited invasive species (NYSDEC 2014b).

In addition, sea-lavender *(Limonium carolinianum)* was identified along the salt pond shoreline during the site investigations for the 1997 Fishers Island INRMP (NUWCDIV 1997b).

2.3.3.2 Seneca Lake

Plant life found along the perimeter of Seneca Lake is primarily dominated by the invasive species, Eurasian milfoil (*Myriophyllum spicatum*). Other aquatic species that may additionally be found include pondweeds, waterweeds, plantain, stoneworts, and muckgrass (NYSDEC 2019).

A site walkover visit of Seneca Lake Detachment was conducted on 13 May 2015 to verify flora and fauna species. Within the boundaries of the facility, flora can be divided into three categories: trees, shrubs and vines, and herbaceous. Invasive species dominate throughout the site: the steep slopes in the southeastern corner of the facility (mid-to-late successional), the areas on both sides of steps descending from Building 1, and the entire vegetated areas on all sides of the lagoon (early successional). There is a shrub/scrub early successional community with a mixture of native and invasive species at the far (southeast) end of the parking lot, along the western facility perimeter.

Eight tree species were identified around the facility during recent field surveys. Of these eight species, two are listed as NYSDEC regulated invasive species: Norway maple and black locust (NYSDEC 2014b). Both species were located within the fencing of the facility, and in multiple locations. A third species, the ash-leaved maple, or box elder (*Acer negundo*), was determined to be co-dominant with the Norway maple and black locust throughout the majority of the naturally vegetated areas of the facility, in both the lower-lying early successional habitat and the mid-to-late successional habitat on the steep slopes. This species is not listed with the NYSDEC as either a prohibited or regulated invasive species. Also notable were the single specimens of several native tree species: yellow birch (*Betula alleghaniensis)*, located on the steep slope; and an Eastern red cedar (*Juniperus virginiana)*, near the storage area.

Thirteen species of shrubs and vines were identified within the vicinity of the Seneca Lake facility, either within the fencing, outside of the fencing, or along the border of the property. Six of these identified species are considered prohibited invasive species by the NYSDEC. These include the Japanese knotweed, common buckthorn (*Rhamnus cathartica*), Japanese honeysuckle, multiflora rose, and Japanese barberry (*Berberis thunbergii*). Both the Japanese knotweed and Japanese barberry were found in multiple locations within the fencing of the facility, concentrated along edges of early successional communities bordering the lagoon. The multiflora rose was identified at multiple locations within the fencing of the facility, and concentrated in the shrub/scrub community. The common buckthorn and Japanese honeysuckle were both confirmed at multiple locations within the fencing of the facility; however, the Japanese honeysuckle is also found outside of the fencing area. Plant species not prohibited or regulated by the NYSDEC were found at multiple locations within the fencing of the facility, concentrated in shrub/scrub communities.

Twelve species of herbaceous plants were confirmed within the fencing of the facility, with many found in multiple locations. Of these twelve species, two are recognized as prohibited invasive species by the NYSDEC (NYSDEC 2014b): mugwort (*Artemisia vulgaris*) and garlic mustard (*Alliaria petiolata*). These two species, together with five other herbaceous plants—catnip (*Nepeta cataria*), greater burdock (*Arctium lappa*), American pokeweed (*Phytolacca americana*), myrtle (*Vinca minor*), and sticky willy/cleavers (*Galium aparine*)—dominated the uphill shrub/scrub community. Violets (*Viola sp.)* were found in an area maintained as lawn outside of the security fence near the flagpole. Four additional herbaceous species were identified at multiple locations in areas maintained as lawn: white clover (*Trifolium repens*), dandelion (*Taraxacum officinale*), broad leaf plantain (*Plantago major*), and narrow leaf plantain (*Plantago lanceolate*).

2.3.3.3 Dodge Pond

The habitat provided at the Dodge Pond Field Station is not dissimilar to that found in the adjacent residential development. A site walkover visit of Dodge Pond Field Station was conducted on 27 May 2015 to verify flora and fauna species.

The upper story tree canopy at the site includes black locust (*Robinia pseudoacacia*), Hertizi junipers (*Juniperus* spp.), and ornamental trees such as black cherry (*Prunus serotine*) and silver/red maple (*Acer saccharinum* and *A. rubrus*) (NUWCDIV 1997a). The 2015 survey effort found that species composition varies along the east, south, and west sides of the fenceline. The Arborvitae (*Thuja* sp.) was noted present along the east fence; the Norway maple was noted along the south fence; and the red maple and black cherry were additionally noted as the primary tree species bordering the facility. A vegetated buffer comprising a speckled alder (*Alnus rugosa*), willow (*Salix* sp.), and red osier dogwood (*Cornus sericea*) was established along the east side of the pier.

Shrubs and vines at Dodge Pond were dominated by invasive species. Surveys performed throughout the facility noted bittersweet and rugosa rose (*Rosa rugose*) as the primary species along the east fence. Bittersweet was also noted as growing up and through the west fence. Honeysuckle was identified along the south fence. Ivy was additionally covering the ground along the west fence. Along the shore on the west side of the pier, there is abundant bittersweet and poison ivy.

No specific herbaceous plant species were identified; however, mowed grass lawns were noted as dominating the overall vegetation of the facility.

A July 2004 survey of Dodge Pond by the Connecticut Agricultural Experiment Station found that water lily (*Nymphaea odorata*) was the most abundant floating-leaved species recorded, and *Potamogeton amplifolius* was the most abundant submerged species. They were among 15 aquatic plants recorded during the survey, all of which are native to the state of Connecticut (Connecticut Agricultural Experiment Station 2004). The survey was repeated in 2015 and found 14 native species and no invasive species. The most dominant plant in 2015 was Robbins' pondweed (*Potamogeton robbinsii*). Other common species were white water lily (*Nymphaea odorata*), western waterweed (*Elodea nuttallii*), and slender naiad (*Najas flexilis*) (Connecticut Agricultural Experiment Station 2015).

Although the aquatic vegetation was not surveyed during the brief site walkover visit conducted in preparation for this INRMP Addendum, a recent report for the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract described it as follows:

> "The aquatic community of Dodge Pond appears to be typical of lakes in the area. Aquatic vegetation such as water lily (*Nymphaea odorata*) and spatterdock (*Nuphar lutea*) are present in shallow areas along the edge of the pond." (Tetra Tech 2015a)

Invasive Plant Species Summary

The species and locations of the non-native invasive flora identified in the surveys are detailed in Table 2-1. Refer to Section 2.3.5.2 of the primary INRMP for detailed descriptions of the individual invasive plant species, such as their appearance, identifying traits, habitat preferences, and means of spreading.

Table 2-1. Invasive Flora at NAVSTA Newport Outlying Parcels.

Common Name	Latin Name	Growth Form	Location Observed
Asiatic bittersweet*	*Celastrus orbiculatus*	Vine	Dodge Pond, Fishers Island
Black locust	*Robinia pseudoacacia*	Woody plant	Fishers Island, Seneca Lake

Common reed*	*Phragmites australis*	Grasslike plant	Fishers Island
Common buckthorn*	*Rhamnus cathartica*	Woody plant	Seneca Lake
Garlic mustard*	*Alliaria petiolata*	Herbaceous plant	Seneca Lake
Japanese barberry*	*Berberis thunbergii*	Woody plant	Seneca Lake
Japanese honeysuckle*	*Lonicera japonica*	Woody plant	Dodge Pond, Fishers Island, Seneca Lake
Japanese knotweed*	*Reynoutria japonica (Polygonum cuspidatum, Fallopia japonica)*	Woody plant	Fishers Island, Seneca Lake
Mugwort*	*Artemisia vulgaris*	Herbaceous plant	Seneca Lake
Multiflora rose*	*Rosa multiflora*	Woody plant	Fishers Island, Seneca Lake
Norway maple	*Acer platanoides*	Woody plant	Dodge Pond, Fishers Island, Seneca Lake
Rugosa rose	*Rosa rugosa*	Woody plant	Dodge Pond

Note: * New York State Department of Environmental Conservation (NYSDEC) prohibited invasive species.
Source: NYSDEC 2014b, Tetra Tech 2015b, Tetra Tech 2015c.

2.3.4 Fauna

2.3.4.1 Fishers Island

The distribution and abundance of fish and wildlife at Fishers Island depends largely upon the nature and availability of the habitat with respect to the species requirements. Important elements include abiotic factors such as climate, topography, geology, soils, moisture regime, areal extent and configuration of habitat, and present land use. Biotic factors to consider include the physiological characteristics of the species (i.e., life history, reproductive strategy, and mobility); nutrient availability (i.e., plant and animal associations); and community structure (i.e., the presence or absence of competitors, predators, or symbionts). If any of these elements are missing, inadequate, or inaccessible, the dependent species will be rare or absent.

Fishers Island habitats available for fish and wildlife species include a tidal pond and adjoining low and high marsh zones, narrow beach/cobble shoreline, freshwater wetlands (red maple swamp and *Phragmites*-dominated wetlands), mowed turf around maintained facilities, and upland woodlands and scrub shrub vegetation. The diversity of habitat types and low human use of the area creates an ideal environment to support numerous birds and mammals. In addition, the vegetative communities associated with these habitats provide a number of plant species with high food and/or cover value, and form a mosaic pattern of habitat types which provide a variety of hunting and feeding locations and a plentiful amount of "edge."

The site walkover visits conducted on 01 October 2014 and 26 May 2015 were primarily intended as focused bird surveys, with incidental observations of other species recorded. The survey would be described as an "area search," although the wildlife biologist stuck to roads, mowed areas, and the shore line. Nearly all unmaintained areas on the facility could be described as impenetrable. Both visual and aural detections were logged. The total number of individuals was tallied by species, taking care to avoid surveying the same areas twice and double counting individuals. A walking transect from the center garage to the high point and then back to the eastern side of the facility comprised the bulk of the survey; species recorded on this transect were included on the "inland" column of the datasheet (144 birds in the spring). The wildlife biologist then walked the southern boundary along the shore, logging species in this area in the "shore" column (90 birds in the spring). A total of 234 individuals of 42 species were detected in the spring, whereas only 12 species were observed in the fall; 45 total avian species were confirmed between the two visits. A pair of common terns (*Sterna hirundo*)—a NYSDEC threatened species (NYSDEC 2015a)—were loafing on the large island-like rock in the salt pond while testing was being conducted on the edge of the pond during the spring survey (apparently, undisturbed by the activity). Two pairs of osprey (*Pandlion haliaetus*)—a NYSDEC species of special concern (NYSDEC 2015a)—were also observed during the spring survey. One pair is nesting on-site, and the other has a nest just north of the installation. Other shorebird detections included American oystercatcher (*Haematopus palliatus*) and black bellied plover (*Pluvialis squatarola*).

During previous, more exhaustive investigations, approximately 97 species of birds were identified as possible, probable or confirmed breeders on Fishers Island. See the species list in Appendix D. An additional 40 bird species are known to utilize the island during migration or other parts of the year for feeding and resting. Most of these species are protected under the Migratory Bird Treaty Act of 1918 and New York State Environmental Conservation Law. Fishers Island provides excellent habitat for both terrestrial and water-dependent bird species. The scrub-shrub habitats and overgrown pine plantations provide dense cover and abundant food sources for nesting and foraging song birds such as the gray cat bird (*Dumetella carolinensis*), common yellow-throat (*Geothlypis trichas*), brown thrasher (*Toxostoma rufum*), and eastern towhee (*Pipilo erythrophthalmus*) (NUWCDIV 1997a, Tetra Tech 2015b). The beaches, salt pond, and tidal pond/marsh complex offers additional foraging and resting sites for migratory shore birds, seabirds, and waterfowl. Coastal ponds and marshes also support a rich diversity of wetland birds including waders such as herons, egrets and osprey. All east coast salt marshes provide food, shelter, and nesting sites for waterfowl on their annual migrations along the Atlantic Flyway (NUWCDIV 1997b). Common terns (*Sterna hirundo*) were observed spending quite a bit of time on the rock in the middle of the salt pond during the spring 2015 survey (Tetra Tech 2015b).

The herpetofauna on the island consists of fourteen confirmed species, including two species of frogs, two species of salamanders, six species of turtles, and four species of snakes (NUWCDIV 1997a). Three herpetofauna species noted in the 1997 INRMP as present on the island, though not confirmed on the installation, are the spotted turtle *(Clemmys guttata),* the wood turtle *(Clemmys insculpta),* the spotted salamander *(Ambystoma maculatum),* and the diamond-back terrapin *(Malaclemmys terrapin).* The former two are Species of Concern. The spotted turtle typically utilizes freshwater ponds and wetlands; the species was observed in the northeast part of the island (Tucker and Horning 1993) but the saltwater influence in the installation's wetlands may make the habitat unsuitable. The wood turtle has not been recently confirmed in Suffolk County (NYSDEC 2015a). The spotted salamander has only been observed within the Brickyard Woods located northeast of the Annex. This species may occur within the forested wetland in the eastern portion of the Annex. The diamond-back terrapin is a saltwater turtle associated with tidal marshes and shallow embayments. This species may utilize the saltwater pond, and tidal marsh habitats within the Annex. While the number of herpetofauna species, particularly frogs, is much lower than on the mainland, this reduced diversity is not uncommon within an island ecosystem, and Fishers Island offers suitable habitat to support a variety of the species known to the island. See the species list in Appendix D.

Mammals common on Fishers Island include 13 known species (NUWCDIV 1997a). See the species list in Appendix D. Several common species are present including white-footed mouse *(Peromyscus leucopus),* meadow vole *(Microtus pennsylvanicus),* eastern cottontail *(Sylvilagus floridanus),* gray squirrel *(Sciurus carolinensis),* muskrat *(Ondatra zibethicus)* and raccoon *(Procyon lotor).* The eastern cottontail and coyote *(Canis latrans)* were incidentally observed during the fall 2014 site visit, which (as described above) was focused primarily on confirming bird and plant species. During the subsequent spring 2015 site visit, several rabbits (ostensibly eastern cottontails, given the known insular population) were found dead on the road. River otters *(Lutra canadensis)* are also known to be present on Fishers Island. They have primarily been observed within the eastern half of the island in association with the numerous ponds on that portion of the island and West Harbor. Notable is the absence of several common mammal species such as eastern chipmunk and the woodchuck. Habitats present are suitable to support all of the mammals known to occur at Fishers Island, with the exception of river otters.

Aquatic habitats are restricted to the tidal pond and shallow shoreline areas of the adjoining Block Island Sound. Past observations have confirmed that these areas support a variety of benthic fauna. Tucker and Horning (1993) reported 24 species of fish sampled from brackish and nearshore waters on the island. See the full species list in Appendix D. The tidal pond and nearshore waters adjacent to Fishers Island most likely supports most of these same fish species. Tidal marshes and salt ponds are recognized as being among the most productive ecosystems in the world. These systems provide nursery ground for finfish and shellfish, and serve to filter heavy metals such as lead and mercury.

Invertebrates are the dominant animals of tidal marshes. Herbivorous grazing insects including leafhoppers and planthoppers, are augmented by detrital-algal feeders such as fiddler crabs, hermit crabs, ribbed mussels, rough periwinkles, and mud snails. Ecologically these invertebrates are primary consumers of the grass production which contributes in part to estuarine and terrestrial food chains (NUWCDIV 1997a). Bivalve resources around Fishers Island include hard-shelled clams/quahog *(Mercenaria mercenaria),* soft-shelled clams *(Mya arenaria),* bay scallop *(Aequipecten irradians),* oyster *(Crassostrea virginica),* blue mussel *(Mytilus edulis),* and ribbed mussel (*Modiolus demissus).* Lobster *(Homarus americana)* are also fished commercially in Fishers Island Sound. During the fall 2014 site visit, the carapace of an Atlantic horseshoe crab (*Limulus polyphemus*) was observed on the shore. Another notable invertebrate observed was the Monarch butterfly (*Danaus plexippus*), whose populations have significantly declined in recent years.

2.3.4.2 Seneca Lake

The habitat available to wildlife at the 4.5-acre facility is limited due to the developed nature of the site and the human activity at the site and adjoining residential areas. The small lagoon, the small woodland area in the southwest portion of the site, and the maintained old fields along the hillslopes provide the only habitat available for terrestrial and aquatic wildlife. In the 1990's, a wide variety of common wildlife were reported to use the habitat, including northern water snake, wild turkey, white-tailed deer, muskrat, cottontail rabbit, raccoon, mink, gray squirrel and grey fox.

A site walkover visit to confirm flora and fauna species lists at Seneca Lake was conducted by a wildlife biologist on 13 May 2015. Personnel stationed at the facility reported observations of a few common mammal species including red fox (*Vulpes vulpes*), eastern grey squirrel (*Sciurus carolinensis*), white-tailed deer (*Odocoileus virginianus*), and woodchuck/groundhog (*Marmota monax*). A fox den was located on the floor of the mid-to-late successional forested community on the steep slope, and at least two groundhog dens were visually confirmed in the shrub/scrub community. The deer was transitory, seen jumping the parking lot fence. No signs or potential locations of bat roosts (cavities or crevices of live or dead trees) were observed during the spring 2015 site visit (Tetra Tech 2015c).

Seneca Lake is located within the North American Flyway for migratory waterfowl and has been designated as a waterfowl concentration area by NYSDEC. Staff interviews during the site visit reported observations of waterfowl in the lagoon, facility docks, or waters of Seneca Lake including double crested cormorant *(Phalacrocorax auritus)*, mallard *(Anas platyrhynchos)* and Canada goose *(Branta canadensis)*. A red-winged blackbird *(Agelaius phoeniceus)* was also confirmed by the lagoon edge. Other piscivorous bird species reported to be seen flying over the facility include bald eagle *(Haliaeetus leucocephalus)* and osprey (a state species of special concern), and the common gull and turkey vulture (*Cathartes aura*) were both visually confirmed during the visit (Tetra Tech 2015c). No nests or signs of nests of osprey or bald eagle were located during the 2015 survey. Current staff members do not recall nesting of these species on-site. Many common backyard bird species were confirmed in the area maintained as lawn outside of the security fence, most notably black-capped chickadee (*Poecile atricapillus*), common starling (*Sturnus vulgaris*), dark-eyed junco (*Junco hyemalis*), American goldfinch (*Spinus tristis*) and tufted titmouse (*Baeolophus bicolor*). A wild turkey (*Meleagris gallopavo*) was also reported by staff to have been observed on that lawn. A snowy owl (*Bubo scandiacus*) was reportedly present within the fencing of the facility at one time, but the last sighting was more than 5 years prior to the May 2015 site visit (Tetra Tech 2015c). See Appendix D for the full species list.

The fish species observed within the lagoon during the spring 2015 site visit included several largemouth bass (*Micropterus salmoides*) and common carp (*Cyprinus carpio*). In addition to these fishes, staff reported seeing the following species in the lagoon and dock area: rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), bluegill (*Lepomis macrochirus*), brown bullhead (*Ameiurus nebulosus*), northern pike (*Esox lucius*), and yellow perch (*Perca flavescens*). The lagoon was observed to be a high quality habitat for freshwater fish due to the combination of extensive shallow water, a submerged aquatic bed and good water quality.

The only herptile observed was an American toad (*Anaxyrus americanus*); no others were reported by onsite staff. The following terrestrial invertebrates were also visually confirmed during the visit: sow bug/woodlouse (Family: Oniscidea), black ant (*Lasius* sp.), stink bug (Family: Pentatomidae), and mosquito (Family: Culicidae).

2.3.4.3 Dodge Pond

The field station property is extensively developed, less than an acre in size, and offers an edge habitat between the woods to the west and the residential area to the east. The "edge" provides cover opportunities for resting and nesting and also offers a diversity of food sources including berries, grass and weed seeds, buds, and herbaceous growth. Buildings, structures, and associated landscape areas present at the site (i.e., lawns, shrubs, and trees) generally support tree squirrels, song birds, and raptors.

The site walkover visit conducted on 27 May 2015 was primarily intended as a focused bird survey, with incidental observations of other species recorded. This rapid survey could be described as an "area search," following the same method as the other surveys, but due to the small property size, the area was covered completely. After walking the installation boundaries, the wildlife biologist stood in the approximate center of the property and conducted a point count covering the whole property. Both visual and aural detections were logged. The total number of individuals was tallied by species, taking care to avoid surveying the same areas twice and double counting individuals. In order to observe early morning bird activity, the wildlife biologist arrived before the installation opened (0700) and began the survey at a public boat launch on the northwest side of the pond, where it was possible to count birds on or boarding the pond. These counts are separate from those made at the facility.

No remarkable species were detected. A total of 52 individuals of 16 species were detected within the property boundary at the facility, including song birds typical of residential areas, such as American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), Baltimore oriole (*Icterus galbula*), blue jay (*Cyanocitta cristata*), cedar waxwing (*Bombycilla cedrorum*), gray catbird, hairy woodpecker (*Picoides villosus*), house finch (*Haemorhous mexicanus*), house sparrow (*Passer domesticus*), house wren (*Troglodytes aedon*), northern cardinal (*Cardinalis cardinalis*), red-winged blackbird (*Agelaius phoeniceus*), and song sparrow (*Melospiza melodia*), among others. Refer to the full species list in Appendix D. In addition, a flock of about 15 barn swallows (*Hirundo rustica*) was congregated all around the shed on the lake. Two piscivorous species were observed on-site, including osprey (fly-over) and ring-billed gull (*Larus delawarensis*). In addition, 65 individuals of 15 species were recorded at the far side of the pond (note that this count was inflated by a flock of 24 red-wing blackbirds using a wetland west of pond). Notable song birds included the chestnut-sided warbler (*Setophaga pensylvanica*) and the warbling vireo (*Vireo gilvus*). A pair of downy woodpeckers (*Picoides pubescens*) was also seen; a black vulture (*Coragyps atratus*) was observed flying over; 14 Canada geese (*Branta canadensis*) were floating on the pond; and other water fowl including pairs of double-crested cormorant, mallard, great blue heron (*Ardea herodias*), and several types of gulls were all using the far side of the pond (Tetra Tech 2015b).

Small mammals and rodents may be expected at the site. A groundhog has taken residence under a storage container on-site. Raccoons (*Procyon lotor*) forage along the shoreline, and piscivorous mammals such as the mink (*Neovison vison/Mustela vison*) and river otter (*Lutra canadensis*) typically forage in aquatic, wooded habitats, and may be present in or around the pond (Tetra Tech 2015a). Chipmunks, squirrels, raccoons, and skunk are typical mammals which might be expected in a suburban area adjacent to woodlands, wetlands and a pond. Larger mammals such as deer and fox could also be expected to occur.

No surveys are known to have been conducted to confirm the full list of fish species present in Dodge Pond. Species that have been reportedly caught by fishermen include the yellow perch (*Perca flavescens*), chain pickerel (*Esox niger*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*) (US Fish Finder 2010). Additional fish species that are typical of other lakes in the area and may be present in Dodge Pond include: bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), white perch (*Morone americana*), and smallmouth bass (*M. dolomieu)*. Due to elevated mercury levels present in Dodge Pond, there is a consumption advisory restricting consumption of largemouth bass, smallmouth bass and pickerel from Dodge Pond by high risk consumers (e.g., pregnant women), and limiting low risk groups to one meal per month of these fishes (CT DEEP 2020b). Nonetheless, the CT DEEP Bureau of Natural Resources, Inland Fisheries Division stocks Dodge Pond annually for recreational fishing; however the pond was not stocked in 2020 (CT DEEP Inland Fisheries Division 2020a). In 2020, trout stocking at Dodge Pond did ot occur, but alewife (*Alosa pseudoharengus*) were stocked (CT DEEP Inland Fisheries Division 2020b). There are no limits on the consumption of trout.

2.3.5 Threatened and Endangered Species and Species of Concern

The Navy completed flora and fauna surveys at each of the Outlying Parcels in preparation of this INRMP Addendum, and did not confirm any rare, threatened, or endangered (RTE) species during the baseline surveys. The following sections will describe the *possible* presence at each installation of RTE species that are listed at the federal or state level.

2.3.5.1 Fishers Island

No federally listed or proposed threatened or endangered flora or fauna species have been documented at Fishers Island Annex, but the installation does contain suitable habitat and there is a potential for protected species to be present. A geographic area search of the USFWS Information for Planning and Conservation (IPaC) database indicates that six federally listed species may occur or could potentially be affected by activities at the installation, including the endangered roseate tern (*Sterna dougallii dougallii*) and sandplain gerardia (*Agalinis acuta*); and the threatened piping plover *(Charadrius melodus)*, red knot (*Calidris canutus rufa*), northern long-eared bat (*Myotis septentrionalis*), and seabeach amaranth (*Amaranthus pumilus*) (USFWS 2020a).

The northern long-eared bat occurs in Suffolk County, New York, where Fishers Island is located (USFWS 2020b), but the species' presence has not been specifically confirmed at the installation. The northern long-eared bat population has suffered sharp declines due to the spread of white-nose syndrome; as a result, the species was listed as a threatened species under the Endangered Species Act on 2 April 2015 (USFWS 2015). A final 4(d) rule enacting conservation measures for the northern long-eared bat was published on 14 January 2016, and is now in effect (USFWS 2016). The population of the monarch butterfly (*Danaus plexippus plexippus*) has also significantly dropped in recent years, making it increasingly rare. NYSDEC has designated the monarch butterfly as a state species of potential conservation need (NYSDEC 2015b). One individual was sighted during the spring 2015 survey at Fishers Island. Although the monarch butterfly is not yet formally protected, the USFWS initiated a status review on 31 December 2014 after finding substantial scientific or commercial information indicating that the petition to list the species as threatened under the ESA may be warranted (USFWS 2014). Presently, the USFWS is developing a status review using the Species Status Assessment framework as the scientific foundation for the listing decision, which is due June 2019 (USFWS 2018).

Only one state-listed species—the state-threatened common tern—was confirmed during the baseline flora and fauna surveys conducted in October 2014 and May 2015 in preparation for this INRMP Addendum. Multiple individuals of the common tern were observed resting on the rock in the middle of the salt pond during the spring survey (Tetra Tech 2015b). In addition, two pairs of osprey—a state species of special concern—were observed during the spring survey. One pair is nesting at the central four-way intersection north of the Battery; the other pair is nesting off-site, just north of the installation. The habitat in this area offers the seclusion that this species requires as well access to foraging areas. No other species of special concern were confirmed during the surveys (Tetra Tech 2015b).

Although the surveys conducted in 2014–2015 did not confirm the presence of any RTE plant species on-site, multiple species of grape, goldenrod, and aster were not able to be definitively identified during the surveys. The State of New York list of protected native plants (NYSDEC 2019) was consulted to determine which species of grape, goldenrod, and aster were state-listed. To narrow down the list of state-listed plants with the potential to be present on Fishers Island, the New York Natural Heritage Program's database http://www.acris.nynhp.org/ was searched and reviewed for records of each pertinent species' range, distribution, and habitat. This exercise resulted in the conclusion that the state-listed winter grape (*Vitis vulpina*), possum haw (*Viburnum nudum* var. *nudum*), and coastal goldenrod (*Solidago latissimifolia*) are not present on Fishers Island, but that two additional state-listed species could possibly be present at the installation: the state-endangered large calyx goosefoot (*Chenopodium berlandieri* var. *macrocalycium*) and the state-threatened saltmarsh aster (*Symphyotrichum subulatum* var. *subulatum*) (NYSDEC 2019; New York Natural Heritage Program 2015a, Natural Heritage Program 2015b). The large calyx goosefoot is most often found on rocky ocean beaches, and occasionally on adjacent pond shores, salt marshes and shrub thickets; on Fishers Island, its occurrence has been noted on rocky/cobble beaches, and at the foot of a bluff (New York Natural Heritage Program 2015a)—descriptions which resemble the beach habitat of the installation. The saltmarsh aster occurs on Fishers Island in coastal areas in salt to brackish marshes, along banks of salt influenced tidal channels and creeks, shrub dominated salt-influenced habitats, salt pond edges, wet brackish swales in maritime dunes, and occasionally in disturbed habitats that are salt influenced (New York Natural Heritage Program 2015b).

The former vegetation surveys conducted in preparation for the original INRMP (NUWCDIV 1997a) identified seven additional plant species of special concern (i.e., state endangered, threatened, rare or vulnerable to exploitation) in the vicinity of the installation that remain protected at the present-day under NYS Environmental Law (6 NYCRR Part 193.3, Protected Native Plants). The vegetative communities within the Fishers Island Annex may be suitable to support several of the rare species confirmed as present on Fishers Island (NUWCDIV 1997a). A total of eleven state-protected plant species with the potentia1 to occur within the vegetative communities present within the Annex are listed, with their protection statuses, in Table 2-2. All of these species occur at sites throughout Fishers Island in either coastal beaches, tidal marsh or freshwater wetlands.

Four species of threatened, endangered and state protected birds are also known to breed on Fishers Island (Table 2-2). Only one of these species, the piping plover, is listed as a federally endangered species and a state endangered species. The most recent observations are of one one pair of piping plovers were on the island in 2019 (Fishers Island Conservancy 2019). The island's Beach Pond area also provides breeding habitat for the state threatened least tern *(Sterna antillarum)* and the state-threatened northern harrier *(Circus cyaneus)*. The installation's tidal habitats are in close proximity, and may be suitable for these species to breed. One additional state protected species, the king rail *(Rallus elegans)*, is also known to breed on Fishers Island, and may make use of suitable habitats within the installation for this purpose. The king rail utilizes scrub shrub wetlands and tidal marshes for breeding and feeding; both types of habitats are present in the eastern portion of the Annex (NUWCDIV 1997a).

Table 2-2. Federal and State-Listed Threatened and Endangered Species and Species of Concern with the Potential to Occur at Fishers Island Annex, Fishers Island, New York.

Common Name	Scientific Name	Status
Mammals		
Northern long-eared bat	*Myotis septentrionalis*	FT, ST
Birds		
American bittern	*Botaurus lentiginosus*	SC
Common loon	*Gavia immer*	SC
Common tern[1]	*Sterna hirundo*	ST
King rail	*Rallus elegans*	ST
Least tern	*Sterna antillarum*	ST
Northern harrier	*Circus cyaneus*	ST
Osprey[1]	*Pandion haliaetus*	SC
Piping plover	*Charadrius melodus*	FT, SE
Red knot	*Calidris canutus* ssp. *rufa*	FT
Roseate tern	*Sterna dougallii dougallii*	FE, SE
Seaside sparrow	*Ammodramus maritimus*	SC
Whip-poor-will	*Caprimulgus vociferus*	SC
Herptiles		
Turtle, Spotted	*Clemmys guttata*	SC
Turtle, Wood (historic)	*Glyptemys insculpta*	SC
Plants		
Field dodder	*Cuscuta campestris*	SE
Golden dock	*Rumex fueginus (Rumex maritimus L.)*	SE
Large-calyx goosefoot	*Chenopodium berlandieri* var. *macrocalycium*	SE
Marsh straw sedge	*Carex hormathodes = C. straminea*	SE

Common Name	Scientific Name	Status
Red-rooted flatsedge	*Cyperus erythrorhizos*	SR
Salt marsh spikerush	*Eleocharis halophila*	ST
Salt meadow grass	*Diplachne maritima = Leptochloa fusca ssp. fascicularis*	SE
Saltmarsh aster	*Symphyotrichum subulatum* var. *subulatum*	ST
Sandplain gerardia	*Agalinis acuta*	FE, ST
Seabeach amaranth	*Amaranthus pumilus*	FT, ST
Seacoast angelica	*Angelica lucida*	ST
Seaside orach	*Atriplex glabriuscula*	SE

[1] Presence at Fishers Island Annex confirmed during 2015 surveys.

Note: Other than the two species confirmed during the 2015 surveys, the species identified above have either been located near the installation, or have been identified by the federal and state agencies as having the potential to occur.

Sources: NUWCDIV 1997a; NYSDEC 2020b, NYSDEC 2020e; USDA NRCS 2020; USFWS 2020a.

FE = Federally Endangered
FT = Federally Threatened
SE = State Endangered
ST = State Threatened
SC = State Species of Concern
SR = State Rare

According to the NOAA National Marine Fisheries Service, Protected Resources Division, as many as nine federally listed endangered or threatened species may be present in the waters of Long Island Sound and Block Island Sound, around Fishers Island. The documented use of the New York Bight by marine mammals and sea turtles indicates a high diversity of these species are present and supports the finding that this region, which includes both Block Island Sound and Long Island Sound, is important to a wide range of marine species. Of the 23 species of cetaceans, 5 species of pinnipeds, and 5 species of sea turtles known to occur in the New York Bight Region, twelve are listed as federally and/or state threatened or endangered species. Of these, three federally listed species of whales and four federally listed species of sea turtles have been documented as occurring seasonally within the waters of Long Island Sound and Block Island Sound (NUWCDIV 1997b, NOAA 2014, Murray-Brown 2016). In addition, two federally listed species of fish (discussed further below), including multiple distinct population segments [DPS], could occur. These marine species and their protection statuses are presented in Table 2-3, and they are included symbolically on the map of sensitive biological resources around Fishers Island in Figure 2-13.

The federally endangered North Atlantic right whale (*Eubalaena glacialis*) and the federally endangered humpback whale (*Megaptera novaeangliae*) are found off the coast of New York seasonally, as indicated in Table 2-3. The federally endangered fin whale (*Balaenoptera physalus*) is also seasonally present in the waters off New York, but is typically found in deeper offshore waters. NMFS has noted that, while listed whale species can be found in offshore waters of New York, the onshore locations of the proposed INRMP projects and the minimal water depths adjacent to the Navy property make it extremely unlikely for listed whales to be present or to be affected by the INRMP activities (Murray-Brown 2016).

Sea turtles including the threatened Northwest Atlantic DPS of loggerhead *(Caretta caretta)*, the threatened North Atlantic DPS of green *(Chelonia mydas)*, and the endangered Kemp's ridley *(Lepidochelys kempii)* occur off the north shore of Long Island (Murray-Brown 2016). These turtles feed primarily on mollusks, crustaceans, sponges, and a variety of marine seagrasses and seaweeds. In addition, the endangered leatherback *(Dermochelys coriacea)* forages for jellyfish in the nearshore waters of Long Island from June to November. The Kemp's ridley sea turtle inhabits inshore bay and estuarine habitats; the green sea turtle is occasionally seen in nearshore waters from Massachusetts to Virginia; and the loggerhead sea turtle is found along the continental shelf and in large bays (NUWCDIV 1997a). Sea turtles typically occur along the New York coast from May to mid-November, with the highest concentration of sea turtles present from June through October (Murray-Brown 2016).

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) are present in the waters of Long Island Sound and its surrounding bays and tributaries. Adults and subadults originating from four federally endangered DPS and one federally threatened DPS of Atlantic sturgeon could occur off Fishers Island (Murray-Brown 2016). The federally endangered shortnose sturgeon (*Acipenser brevirostrum*) is present in Block Island Sound to the south and east, and Long Island Sound to the west and north of Fishers Island (NOAA 2014), and could occur in the bays and nearshore waters (Murray-Brown 2016). However, no early life stages (i.e., eggs, larvae, or juveniles) of either species occur in the ocean sounds or adjacent bays because they are intolerant of saline waters and remain in their natal river/estuary until approximately age 2 (Murray-Brown 2016).

Table 2-3. State and Federally Listed Threatened and Endangered Species Occurring in Block Island Sound and Long Island Sound.

Common Name	Scientific Name	Status	Occurrence
Marine Mammals			
Porpoise, Harbor	*Phocoena phocoena*	SC	
Whale, Fin	*Balaenoptera physalus*	FE, SE	offshore
Whale, Humpback	*Megaptera novaeangliae*	FE, SE	Feb–Apr, Sep–Nov
Whale, North Atlantic right	*Eubalaena glacialis*	FE, SE	1 Sep – 31 Mar
Seabirds			
Loon, Common	*Gavia immer*	SC	
Reptiles			
Sea turtle, Green (North Atlantic DPS)	*Chelonia mydas*	FT	May – mid-Nov
Sea turtle, Kemp's ridley	*Lepidochelys kempii*	FE	May – mid-Nov
Sea turtle, Leatherback	*Dermochelys coriacea*	FE	May – mid-Nov
Sea turtle, Loggerhead (Northwest Atlantic Ocean DPS)	*Caretta caretta*	FT	May – mid-Nov
Fish			
Sturgeon, Atlantic (New York Bight, Chesapeake Bay, South	*Acipenser oxyrinchus oxyrinchus*	FE	

Common Name	Scientific Name	Status	Occurrence
Atlantic, and Carolina DPS)			
Sturgeon, Atlantic (Gulf of Maine DPS)	*Acipenser oxyrinchus oxyrinchus*	FT	
Sturgeon, Shortnose	*Acipenser brevirostrum*	FE, SE	

Sources: Murray-Brown 2016, NOAA 2014, NUWCDIV 1997a, NYSDEC 2015a, USFWS 2015.

Notes: DPS = distinct population segment, FE = Federally Endangered, FT = Federally Threatened, SC = State Species of Concern, SE = State Endangered, ST = State Threatened.

All potential interactions that may occur with these species during Navy operations in marine waters off of Fishers Island are covered under the Atlantic Fleet Training and Testing Final Environmental Impact Statement/Overseas Environmental Impact Statement (NAVFAC Atlantic 2018). This INRMP Addendum addresses potential interaction between the Navy and marine species in the intertidal area or on shore.

2.3.5.2 Seneca Lake

No federally or state-listed threatened, endangered, or candidate species, or New York species of special concern, have been found at Seneca Lake Detachment. No listed flora or fauna species were found during the spring 2015 site visit or the surveys conducted in preparation for the original INRMP (NUWCDIV 1997c), nor have any been known to occur at the installation in the interim. A geographic area search of the USFWS IPaC database indicates that one federally listed species may occur or could potentially be affected by activities at the installation: the threatened northern long-eared bat (USFWS 2020c). Because Seneca Lake is a freshwater environment, it not come under NMFS' jurisdiction (Murray-Brown 2016).

Although the federally threatened and (New York) state-threatened northern long-eared bat occurs in Yates County, no signs of bats or potential bat roosts (e.g., cavities or crevices of live or dead trees) were found during the spring 2015 survey for confirmation of flora and fauna species at Seneca Lake Detachment (Tetra Tech 2015c). There is one federally listed plant species—the Leedy's roseroot (*Rhodiola integrifolia ssp. leedyi*)—that occurs in Yates County; it is, in fact, found on cliffsides along the shores of Seneca Lake just south of the NUWC Seneca Lake Detachment, but the species does not occur within the installation. Suitable habitat for Leedy's roseroot is only present on the north side of the lagoon beyond the security fence (Tetra Tech 2015c).

Based on field observations of the habitats present at the facility, a review of available reports and correspondence with regulatory agencies, federal and state-listed threatened and endangered species do not appear to use the natural resources of the site. Offshore areas of the lake are utilized by the osprey—a New York species of special concern—on a transient basis.

2.3.5.3 Dodge Pond

No federally or state-listed threatened, endangered, or candidate species, or Connecticut species of special concern, have been found at Dodge Pond. A geographic area search of the USFWS IPaC database indicates that three federally listed species may occur or could potentially be affected by activities at the installation, including the threatened red knot, northern long-eared bat, and small-whorled pogonia (*Isotria medeoloides*) (USFWS 2020d). Because Dodge Pond is a freshwater environment, it does not come under NMFS' jurisdiction (Murray-Brown 2016).

The federally threatened and (Connecticut) state-endangered northern long-eared bat occurs in New London County, Connecticut, where Dodge Pond is located, but the species' presence has not been specifically confirmed at the pond (USFWS 2020b). Formerly, the bald eagle and the peregrine falcon (*Falco peregrinus*) were the only two federally-listed species with occasional, transient occurrence at Dodge Pond. Both of these species have since been de-listed under the ESA, although they both remain listed as threatened by the State of Connecticut (CT DEEP, Bureau of Natural Resources 2015b).

According to a State of Connecticut, Department of Environmental Protection letter dated 01 July 1996, there is a historic site for resupinate (or reversed) bladderwort *(Utricularia resupinata),* at Dodge Pond. Over the course of the last two decades, the species' state protection status has escalated from a Species of Special Concern to a Connecticut state-endangered species (CT DEEP 2020b). *Utricularia resupinata* grows in lakes, ponds and rivers on the shores or in shallow water. This species was not observed during the previous INRMP field investigation on 16 July 1996, nor during the aquatic vegetation survey of Dodge Pond in 2004 (NUWCDIV 1997b). It is presumed to be absent from the Navy installation and extirpated from Dodge Pond.

Of the bird species confirmed at Dodge Pond, three are identified as Species of Greatest Conservation Need (SGCN) in the 2015 Connecticut Wildlife Action Plan. The Baltimore oriole's breeding population is critically imperiled, and the non-breeding population is vulnerable to extirpation. The breeding population of the osprey is also vulnerable to extirpation. The chestnut-sided warbler is among the most secure of the SGCN, with a demonstrably widespread, abundant, and secure breeding population (CT DEEP, Bureau of Natural Resources 2015a).

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3.0 NATURAL RESOURCES MANAGEMENT AND MISSION SUSTAINABILITY

3.1 SUSTAINING MILITARY MISSION AND NATURAL ENVIRONMENT

3.1.1 Integrating Military Mission and Sustainable Use (Refer to Section 3.1.1 of NAVSTA Newport Primary INRMP)

3.1.2 Define Impact on Military Mission (Refer to Section 3.1.2 of NAVSTA Newport Primary INRMP)

3.1.3 Encroachment Partnering

The NAVSTA Newport Encroachment Action Plan (EAP) does not include the Outlying Parcels, and there are no EAPs in place for the individual installations. However, encroachment is not an issue of great concern at these facilities due to the fact that no training is conducted on-site. Nonetheless, encroachment could pose minor issues at each facility, in the manners described as follows. At Fishers Island Annex, the Town of Southold wants to use Navy property for a bike path; there has been recent request to place solar arrays on the property; and a neighboring landfill is looking at a process for renewables that could be electrically loud, which could impact the military mission. At Seneca Lake Detachment, residential neighbors pass through Navy property to access their private, waterfront property, but an easement is not identified; the Town of Dresden has asked for the Navy to help pay to pave this road. At Dodge Pond, members of the public recreationally swim, kayak, and fish in close proximity to the testing barge; however, they have done so for years without incurring a problem (Monaco 2015). Although none of these factors have compromised the military mission at the Outlying Parcels yet, the Navy may have to collaborate with the local municipalities and neighbors to ensure that community relationships and interactions with the public remain positive. Furthermore, the Navy must take proactive steps to avert any developments that would impact the military mission.

3.2 ECOSYSTEM SERVICES (REFER TO SECTION 3.2 OF NAVSTA NEWPORT PRIMARY INRMP)

3.3 CLIMATE CHANGE

DODI 4715.03 (DOD 2018a) requires climate change to be addressed in INRMPs to help mitigate potential impacts of climate change to the natural resources on installations. Impacts that must be considered include shifts in species' ranges and distributions, changes in phenology, rising sea levels, and variations in ecological processes such as drought, fire, and flood (DOD 2016). All DOD components shall, in a regionally consistent manner to the extent practicable, and using the best science available:

- utilize existing tools to assess the potential impacts of climate change to natural resources on DoD installations;
- identify significant natural resources that are likely to remain on DoD lands or that may in the future occur on DoD lands; and

- take steps to implement adaptive management to ensure the long-term sustainability of those resources, when not in conflict with mission objectives.

Climate change information is summarized below for the areas of New York and Connecticut surrounding NAVSTA Newport's Outlying Parcels.

3.3.1 Regional Climate Trends

New York

Annual average temperature in New York have been increasing steadily over the past 100 years, largely due to the increased amount of greenhouse gases (GHGs) present in the atmosphere (NYSDEC 2020d). The fastest increase over this period has occurred since 1970, with the average temperature in the state rising approximately 2.4°F and winter warming exceeding 4°F. Average nighttime temperatures have risen faster in comparison to daytime temperature increases since 1970. This trend is parallel to the overall trend of global temperature increases since 1850.

Winter snow cover in New York has been decreasing and on average spring temperatures have been observed a week or so earlier in comparison to a few decades ago, with average blooming dates across the state increasing by eight days (NYSDEC 2020d). Ranges for bird species have increased northward in the state on an average of 40 miles in the past two decades. Sea level along New York's coastline has increased by approximately one foot since 1900.

Connecticut

The Northeast U.S. (including Connecticut), where Dodge Pond is located, has been warming at a rate of nearly 0.5 degrees F per decade since 1970, with winter temperatures rising faster, at a rate of 1.3°F per decade since 1970 (Adaptation Subcommittee 2010). This translates to a total average annual temperature change of 2.3°F, coupled with winter warming of nearly 6°F. The increase in regional temperatures has been coupled with many other climate-driven changes to the ecosystem, such as more frequent days with temperatures above 90°F; a longer growing season; less winter precipitation falling as snow and more as rain; reduced snowpack and increased snow density; earlier breakup of winter ice on lakes and rivers; earlier spring snow melt resulting in earlier peak river flows; and rising sea-surface temperatures and sea levels (Adaptation Subcommittee 2010).

3.3.2 Future Climate Change Projections

Scientists are projecting average annual temperatures to continue to increase across the globe since carbon dioxide and other important greenhouse gases can remain in the atmosphere for decades or centuries, even if emissions begin to decline (NYSDEC 2020d). It is expected that the effects of increased amounts of heat and other climate change factors will continue to persist and intensify.

The Intergovernmental Panel on Climate Change (IPCC) is a United Nations-sponsored, scientific body that provides for the assessment of climate change. The IPCC projects global sea levels to rise faster during the 21st century than it has in the decades since 1970 (NYSDEC 2015c). During the past century, the rate of global mean sea level rise was about 0.7 inches per decade, with observations supporting acceleration of the rate of global sea level rise. Using an assumption of a moderate rate in land ice melting, the IPCC projects global sea levels to rise 20–38 inches by 2100.

New York

By 2050, it is expected that New York's winter temperatures will rise by another 2.5ºF to 4.0ºF, with summer temperatures expected to increase by 1.5ºF to 3.5ºF. Sea level rise along the New York coastline could rise by 31 inches due to expansion associated with warmer seawater and melting of ice (NYSDEC 2020d), with an increase of up to 75 inches in sea level possible by 2100 (NYSDEC 2015c). These factors could contribute to more frequent and intense flooding events resulting from extreme rains and storm surges. Additionally, short-term droughts may become more frequent, contributing to increased soil erosion and reduced water levels.

A 2011 study titled, *Responding to Climate Change in New York State*, prepared by New York State Energy Research and Development Authority, provides state-scale projections of sea level rise along New York's coastlines and estuaries (New York State Energy Research and Development Authority 2014). This report was last updated in 2014 to reflect the most recent climate change research and climate modeling, which substantiate the findings of the original report, and includes observations of the most recent extreme events that have been intensified by sea level rise. Sea level rise in New York is expected to exceed global sea level rise projections due to regional conditions such as subsidence of coastal lands.

The coastline and adjacent tidally-influenced areas of New York—such as Fishers Island—are most at risk from storm surges and flooding, with can cause substantial damage to local communities and their infrastructure, and habitats and ecosystems that provide a buffer against floods, protect drinking water and provide habitat for important species (NYSDEC 2015c). As sea levels rise the frequency and intensity of severe flooding, storm surges, and beach erosion also rise. Low lying areas are inundated, which may allow for seawater infiltration into freshwater systems and aquifers. Infrastructure associated with sewage, wastewater, transportation, communication, and energy are also at risk of being affected.

Connecticut

It is projected that by the end of the century, regional temperatures may increase by 4°F to 7.5°F, and precipitation may increase by 5 to 10 percent, with less snow and more rain (Adaptation Subcommittee 2010). Meanwhile, droughts may increase in frequency, duration, and intensity, causing a reduction in soil retention and a drop in groundwater levels, thereby jeopardizing the viability of agriculture. Extreme storm events may rise in frequency and severity, leading to more flooding of coastal areas as well as upland areas around rivers.

Climate change risk studies for Connecticut, New York, and the Northeast estimate that sea level has the potential to rise by 12 to 23 inches by the year 2100, or in the case of a "rapid ice-melt sea level rise" scenario, to rise by 41 to 55 inches by 2100 (Adaptation Subcommittee 2010, Genova et al. 2010). Like New York, Connecticut faces the likelihood of experiencing sea level rise faster than the global rate due to the state's geological subsidence.

3.3.3 Implications for Natural Resource Management

Given the exposed shorelines along the southern coast of Fishers Island, sea-level rise and increased storm surges may be significant issues for sustaining the beach and tidal wetland habitats, and thus habitat for migratory birds (e.g., least terns) and marine mammals (e.g., harbor seals). Meanwhile, all three Outlying Parcels may face continuing challenges with invasive species as warming temperatures enable more southern invasive species to prevail over native species.

Adaptation strategies can focus on promoting climate change resiliency to enable natural resources sustainability. Adaptation strategies can include the following types, as examples:

Decrease Stressors – Decrease other stressors that negatively affect at-risk species, priority habitats, and water bodies, such as the stressors of invasive species, disease vectors, polluted runoff, and future development of remaining natural areas and open space.

Sustain Coastal Habitats – To minimize loss of coastal beaches and marshes, conserve adjacent upland areas to allow coastal lands to naturally migrate inland as the sea rises. Dune and beach stabilization with vegetation will reduce coastal erosion and increase storm resilience.

Restore Habitat – Continue to restore priority habitats and ecosystems including habitat for at-risk species. Maintain stabilized slopes and banks around water bodies with shrubs and trees to decrease sediment and nutrient loads into them. Eradicate invasive species and restore native communities.

Education and Outreach – Educate personnel and surrounding communities on the threat climate change poses to natural resources and resulting impacts on property, structures, and infrastructure.

3.4 NATURAL RESOURCES CONSULTATION REQUIREMENTS (REFER TO SECTION 3.4 OF NAVSTA NEWPORT PRIMARY INRMP)

3.5 NEPA COMPLIANCE (REFER TO SECTION 3.5 OF NAVSTA NEWPORT PRIMARY INRMP)

3.6 PARTNERSHIPS AND COLLABORATION

Section 3.6 of the primary INRMP describes NAVSTA Newport's existing partnerships with DOD, Navy, and other federal agencies and programs. The military mission of the Outlying Parcels has limited the Navy's ability to involve outside agencies in the NRP for these installations, and to-date there are no formal partnerships in place. To the extent that it is possible to develop partnerships with regional and state resources agencies, local colleges and universities, and local conservation groups in support of the management of the Outlying Parcels' natural resources, such partnerships would increase the local knowledge and expertise available to natural resources personnel, and would foster positive community relationships.

Partnering opportunities associated with the implementation of this INRMP Addendum have been identified for the following organizations:

- New York State Department of Environmental Conservation (NYSDEC)
- CT DEEP
- Connecticut Agricultural Experiment Station
- Local colleges and universities (e.g., Hobart and William Smith Colleges' Finger Lakes Institute, Ithaca College, Cornell University, Connecticut College)
- Fishers Island Conservancy
- Seneca Lake Area Partners in 5 Counties (SLAP-5)
- NYS Federation of Lake Associations (FOLA)

Due to the Outlying Parcels' access restrictions, partnerships might be most feasible in the form of information sharing and collaboration for the protection and management of regional resources.

3.7 PUBLIC ACCESS AND OUTREACH

3.7.1 Public Access and Outdoor Recreation

Although provision of public access is addressed in the Sikes Act (16 U.S.C. 670a *et seq*.) as amended, security concerns in the aftermath of 11 September 2001 ("September 11th") have greatly restricted public access on DOD facilities. Because the Outlying Parcels are all used for research, development, and testing, they do not support outdoor recreation or other forms of public access. In the 1990's, Boy Scouts and Girl Scouts were allowed to camp at Fishers Island, but this use of the installation is no longer authorized. Due to the location of the Dodge Pond and Seneca Lake facilities on state-owned water bodies, the general public is allowed to swim, boat, and fish in these waters. There is also a public access right-of-way at Seneca Lake for private citizens who reside in the homes just north of the installation, which are accessible only via the road that descends through the facility down to the shore. However, access to NUWC testing platforms, piers, and barges is restricted to Navy personnel.

Access requests for natural resources-related events (e.g., surveys, delineations) taking place at a NAVSTA Newport facility should be submitted directly to the NAVSTA Newport NRM. The NRM will then forward the access request to the Security Office.

3.7.2 Public Outreach and Environmental Education

Given the lack of public access and the small number of personnel at the Outlying Parcels, opportunities for public outreach and environmental education are very limited. Ensuring that NUWC personnel are trained in the relevant SOP's and are informed about ongoing natural resources management actions and projects is of the utmost important for the success of the INRMP.

In addition, the NRM and the Outlying Parcel POC's can support regional environmental education programs. For example, they can help ensure that Dodge Pond remains clean and clear of invasive vegetation, such as milfoil, by supporting CT DEEP efforts to educate boaters about responsible boating practices to prevent the spread of invasive aquatic species. Refer to Section 4.13 for an Environmental Awareness project around this issue.

3.8 STATE WILDLIFE ACTION PLANS

In the August 2006 memorandum that provided DOD's official INRMP template, DOD identified the incorporation of State Wildlife Action Plans (SWAPs) into INRMPs, and vice versa, as a critical element of the environmental management strategy and mission sustainability. In order to achieve the goals established by the Sikes Act (16 U.S.C. 670a *et seq*.) as amended via mutually agreed-upon fish and wildlife conservation objectives, NAVSTA Newport has consulted with both the New York SWAP (NYSDEC 2015b) and the Connecticut SWAP (CT DEEP Bureau of Natural Resources 2015a), and coordinated with the both the NYSDEC Division of Fish and Wildlife and the CT DEEP Wildlife Division to develop an INRMP Addendum that is complementary with the natural resources management strategies and priorities of the states.

3.8.1 New York

New York State completed its first SWAP in 2005, and published the first revision in September 2015 (NYSDEC 2015b). The 2015 New York SWAP identifies the species of greatest conservation need (SGCN), the location and condition of their different habitat types, and threats to SGCN in New York; and presents conservation actions, monitoring programs, and priority actions for implementation. The most frequently cited threats included, in descending order: pollution (including urban runoff, erosion, and sedimentation); invasive and problematic native species; climate change; and natural system modifications—especially habitat fragmentation by dams (NYSDEC 2015b).

The following actions and strategies from the New York SWAP are directly relevant to Fishers Island:

- Continue periodic monitoring of SGCN and their habitats, including population surveys at bat hibernacula.
- Control of invasive and problematic native plant and animal species.
- Foster conservation of pollinator habitats.
- Continue developing strategies to adapt to sea level rise.
- Prevent installation of improperly designed shoreline hardening structures, while minimizing shoreline erosion.
- Document and evaluate avian use of intertidal habitats.
- Restore habitat in non-barrier island tidal wetlands.

The following actions and strategies from the New York SWAP are directly relevant to Seneca Lake:

- Continue periodic monitoring of SGCN and their habitats, including population surveys at bat hibernacula.

- Control of invasive and problematic native terrestrial and aquatic species.
- Foster conservation of pollinator habitats.
- Prevent installation of improperly designed shoreline hardening structures, while minimizing shoreline erosion.
- Continue programs to reduce non-point source pollution.

These actions have been incorporated in the development of this INRMP Addendum and are supported by the natural resources management programs presented in Chapter 4.

3.8.2 Connecticut

Connecticut revised its SWAP in October 2015 (CT DEEP Bureau of Natural Resources 2015a), providing a current assessment of the state's natural resource management concerns and conservation strategies to inform this INRMP Addendum. This was the first revision of the Connecticut SWAP (formerly known as the Comprehensive Wildlife Conservation Strategy) since 2005, and it builds on the knowledge gained over the last 10 years. The 2015 SWAP presents the species of greatest conservation need (GCN species), their habitats, problems, research needs, and conservation actions; and also addresses how CT DEEP will monitor effectiveness, coordinate with conservation partners, and foster public participation in wildlife conservation efforts. Coastal Plain Ponds (which would include Dodge Pond), are identified as one of the six sub-habitats determined to be most important to wildlife, but their condition is generally poor (CT DEEP Bureau of Natural Resources 2015a), indicating a need for remediation.

The most significant threats to Connecticut's land and waterscapes include: habitat loss, degradation, and fragmentation; changes in land use; and competition from non-native or invasive species. Other threats include insufficient scientific knowledge regarding wildlife and their habitats, the lack of landscape-level conservation, insufficient resources to maintain or enhance wildlife habitat, and public indifference toward conservation (CT DEEP Bureau of Natural Resources 2015a).

The following actions and strategies from the Connecticut SWAP are directly relevant to Dodge Pond:

- Conduct surveys of declining GCN species, including bats and migratory birds, and implement Best Management Practices developed by CT DEEP for GCN species.
- Monitor wetland birds in coordination with DOD Partners in Flight and other avian conservation initiatives.
- Manage and restore habitats for native pollinators.
- Increase invasive plant species control on public and private lands.
- Reduce pollutant runoff through land use management.
- Promote shoreline vegetative buffers.

- Protect water quality by minimizing habitat degradation from sediment pollution, water contamination, nutrient concentrations, and pesticides through coordinated efforts with the CT DEEP Branch of Environmental Quality.

These actions have been incorporated in the development of this INRMP Addendum and are supported by the natural resources management programs presented in Chapter 4, Natural Resources Program Overview.

4.0 NATURAL RESOURCES PROGRAM OVERVIEW

This section provides detailed information on the primary natural resources management program elements identified for NAVSTA Newport. Specific projects and actions have been developed that will assist the installation in meeting the established goals and objectives. Actions are bulleted differently in the following sections depending on whether the project is dependent on funding, or if it is an action that will not require a specific funding mechanism to complete. All projects requiring funding are summarized in Chapter 5 and Appendix C.

- ☞ Specific project that requires a funding mechanism to complete. Funding-dependent projects may be associated with more than one management unit.
- ❖ Management action that can be carried out passively, without the need to seek out specific funding to complete.

No impacts on the mission are expected to occur from implementation of the natural resources management projects and actions described in this section; however, if special considerations are necessary, these are described where applicable.

4.1 WATER RESOURCES MANAGEMENT

The importance of water resources for providing both ecological and hydrologic functions in the ecosystem is outlined in Section 4.1 of the primary INRMP. The applicable federal and state laws and local ordinances for the protection of water resources are also listed. In addition to those laws and programs listed in the primary INRMP, the following apply to the Outlying Parcels:

- 2008 Amendments to New York State Water Quality Standards Regulations (6 NYCRR Parts 700 - 704)
- New York Freshwater Wetlands Act, Article 24 of the Environmental Conservation Law
- Connecticut Clean Water Act of 1967
- 2013 Connecticut Water Quality Standards Regulations (Sections 22a-426-1 to 22a-426-9)
- Connecticut Inland Wetlands and Watercourses Act of 1972
- *Inland Wetlands and Water Courses Regulations of the Town of East Lyme,* Connecticut (revised 11 April 2011)

The following sections describe water resources management in regard to surface waters, wetlands, and floodplains, and provide management actions that address the specific set of issues that occurs at NAVSTA Newport's Outlying Parcels.

4.1.1 Fishers Island

Water Quality Standards are the basis for programs to protect the state waters. Standards set forth the maximum allowable levels of chemical pollutants and are used as the regulatory targets for permitting, compliance, enforcement, and monitoring and assessing the quality of the state's waters. Waters are classified for their best uses (e.g., fishing, source of drinking water, etc.) and standards (and guidance values) are set to protect those uses.

The water quality standards program is a state program with federal (i.e., EPA) oversight. New York's longstanding water quality standards program predates the federal Clean Water Act and protects both surface waters and groundwater. New York State Water Quality Standards Regulations were most recently amended in 2008. The most recent Water Quality Monitoring Report for New York State identifies the the marine waters surrounding Fishers Island as having minor impacts (NYSDEC 2016).

4.1.1.1 Surface Waters

NYSDEC regulates soil erosion resulting from construction activities through State Pollutant Discharge Elimination System (SPDES) permits. NYSDEC guidance on erosion and sediment control standards are found in the *NY Standards and Specifications for Erosion and Sediment Control* (August 2005). This document provides standards and specifications for selection, design and implementation of erosion and sediment control practices.

At the local level, the Suffolk County Soil Conservation District was established in accordance with the New York Soil and Water Conservation Districts Law to assist in the prevention of soil erosion and flood control; as amended in 1989, the law charged local soil conservation districts with the additional tasks to improve water quality and to control and abate nonpoint source pollution. In addition, the New York Nonpoint Source Management Program catalogues and the EPA guidance document on nonpoint source pollution in coastal waters contain recommended management practices to control soil erosion.

With any on-site construction activities, an erosion and sediment control plan should be prepared. The plan should include operation and maintenance requirements for both temporary and permanent control measures and identify responsibility for the measures. The erosion and sediment control plan should contain sufficient information to satisfy regulatory requirements and ensure that problems of erosion and sedimentation for a given project are adequately addressed. The length and complexity of the plan should be commensurate with the size of the project, the severity of site conditions, and the potential for off-site damage, especially to sensitive resource areas such as the bluff and in the vicinity of freshwater and tidal wetlands.

During construction, it is recommended that weekly inspections be conducted by the NRM to determine compliance with construction specifications relating to sediment control. Inspections should be conducted immediately following rain or more frequently during prolonged storm events. A write-off should be required at each inspection to assure compliance. Soil erosion is a nonpoint source of pollution. Two areas of concern for soil erosion at Fishers Island are upland soils near Building 208 and the coastal bluff seaward of the Building 261 complex. The following is a description of erosion potential and recommended remedial measures in these areas.

SATF, Building 208

The elevated ground surface atop Building 208 at the terminus of the paved road can be characterized as vehicle packed dirt. Vegetation is sparse. Following the installation of the Submarine Antenna Test platform, this area has been revegetated (May 1997) with appropriate plantings to prevent erosion and sedimentation from reaching the tidal pond or Block Island Sound.

- ❖ Coordinate with NYSDEC, CZM, U.S. Army Corps of Engineers, Long Island Sound CCMP, and the Town of Southold for any construction projects in the vicinity of the SATF, Building 208.
- ❖ Inspect erosion control measures atop Building 208 to ensure the establishment of the new plantings which will prevent the flow of sediment to the salt pond or shoreline.

Cliff/Bluff

The coastline of the Annex property is currently experiencing different degrees of coastal bluff erosion between the tidal pond and the western property line. The exposed bluff is sand (very fine sand to very coarse sand). A bulkhead of 46 concrete cylinders secured with wooden planks on either side and fronted by boulders was previously placed beneath Building 261 to halt bluff erosion. The eroding slope face behind the bulkhead had been reseeded and today it is covered with vegetation. The upper bluff edge is heavily vegetated.

On either side of this bulkhead, however, the bluff is eroding. Between the tidal pond and the bulkhead, the sand bluff is partly exposed with the remainder of the slope face vegetated. In contrast, a nearly 100 foot high bluff immediately west of the bulkhead is fully exposed and actively eroding. Slump features are visible on the eroding slope face.

Instability of the bluff is accelerated by ground water seepage from above which weakens the sand. Most slope failures on high bluffs occur during or after heavy rainfall events or elevated ground water levels. The lawn south of Building 261 demonstrates evidence of erosion as indicated by sandy patches in the grass. If the Navy chooses to institute erosion control measures at this bluff, it is recommended to institute infiltration controls (to prevent infiltration) and drainage controls to remove subsurface water, in combination with a toe of slope bulkhead and slope seeding.

Options to divert surface flow away from the bluff require installation of infiltration controls at the top of the bluff. These include construction of ditches or swales or sealing surface cracks with compacted relatively impermeable clay soil. Drainage of the subsurface may require installation of vertical or horizontal drains. A bulkhead at the toe of the bluff would protect it from wave erosion and undercutting. Vegetation similar to species present along adjacent bluffs would protect the slope face from slumping and from wind erosion.

- ❖ A coastal engineer should be consulted to evaluate the bluff erosion and recommend corrective action to protect the government assets and property. Actions chosen to control the erosion should follow management guidelines found in U.S. Army Corps of Engineers (USACE) manuals or other approved engineering practices.

4.1.1.2 Wetlands

To comply with the federal policy of no net loss of wetlands, OPNAV M-5090.1, instructs that impacts on wetlands, other surface waters, and riparian areas by planned future projects are to be avoided to the extent practicable (Navy 2019b). If wetland impacts are unavoidable, a permit is required to authorize the activity; appropriate impact minimization and mitigation will be required, and will be determined through consultation with the appropriate federal and state agencies. However, because the entire island of Fishers Island is within the coastal zone, wetlands permits will not be required from NYSDEC for proposed projects at Fishers Island; instead, any actions potentially affecting these wetlands need to be addressed through a federal consistency review with the New York State Coastal Management Program (see Section 4.2 *Coastal and Marine Management* for more information).

As directed by the Clean Water Act (CWA), the military is responsible for identifying and locating jurisdictional waters of the United States, including wetlands that have the potential to be affected by activities associated with the military mission. To minimize further wetland impacts, wetland inventory/planning maps prepared for the installation are used during the site selection process for new construction, and a wetland delineation is conducted prior to finalizing the site selection to ensure that wetlands and buffer areas are avoided to the maximum extent possible and practicable.

The wetland boundary on the Navy Fishers Island property was delineated, flagged and surveyed in 1996 to locate for future plans on the site. As of the publication of the 1997 INRMP, a contract had been signed for completion of Legacy-funded GPS survey to geodetically record the boundary. It is recommended that a jurisdictional wetlands delineation be conducted for the entire installation to update the GIS data and mapping of wetlands, and thereby gain efficiencies for evaluating impacts from future proposed projects.

- ☞ Conduct an installation-wide wetlands delineation.

In addition, Section 404 of the CWA requires restoration of wetlands damaged by any project activities, with in-kind replacement of wetlands as the preferred mitigation strategy. The Navy also encourages wetlands creation or enhancement projects and use of wetland mitigation banks, where compatible with the installation's mission (Navy 2019a). The wetlands on the east side of the Fishers Island installation have been impaired by the spread of invasive species. *Phragmites* has taken over essentially the entire wetland, so that many native species have been replaced, and biodiversity extremely reduced. Enhancement of these wetlands to restore native species and improve their ecosystem function would be consistent with Navy policy.

- ☞ Apply invasive species controls to restore palustrine wetlands at the east side of the installation.

Consistent with EPA guidance on siting hazardous waste management facilities in and adjacent to wetlands, and with NAVSTA Newport's management of wetlands at the main installation, the following management action from the primary INRMP will apply at Fishers Island:

❖ Wetland and riparian areas will be avoided in future construction of structures and other facilities, including roads, to the maximum extent possible and practicable.

New York's Tidal Wetlands Act regulates activities in tidal wetlands and adjacent areas. Adjacent areas are any lands immediately adjacent to a tidal wetland within whichever of the limits described in 6 NYCRR Part 661 *Tidal Wetlands Land Use Regulations* is closest to the most landward tidal wetland boundary. The adjacent area boundary is site-specific and is not greater than 300 feet landward of the most landward boundary of the tidal wetland. In addition, activities in these wetlands and within 75 feet of mean high water are regulated by the Town of Southold under Chapters 37 and 97 of the Town Code. Generally, activities conducted at Fishers Island within 300 feet of a tidal wetland require a NYSDEC Tidal Wetlands Permit, and actions within 100 feet of a tidal or freshwater wetland require permits from both NYSDEC and the Town of Southold. However, as described in Section 4.2.1, any DOD actions potentially affecting these wetlands on Fishers Island are addressed through a federal consistency review with the New York State Coastal Management Program rather than being required to obtain a Tidal Wetlands Permit through NYSDEC. Tidal wetlands and adjacent areas should be protected from the impacts of erosion and sedimentation by the implementation of the management practices discussed above.

4.1.1.3 Floodplain Management

Section 4.1.3 of the primary INRMP describes the ecological function of floodplains, the potential for sea level rise to cause changes in flood plains, and the federal laws and guidelines that protect flood plains by prohibiting new construction and regulating existing construction in the 100-year flood zone.

The only building at Fishers Island Annex that lies within the 100-year flood zone (described in Section 2.2.3.1, *Hydrology – Fishers Island*) is Building 208, the SATF. This building would be subject to the EPA's Section 264.18, Location Standards, of the Resource Conservation and Recovery Act (RCRA) (40 CFR 26418), requiring that the facility be designed, constructed, operated, and maintained to prevent washout of any hazardous waste. However, the SATF does not house any hazardous substances.

The salt pond, which is the source of 26,262 gallons of sea water used in the SATF, was dredged to a depth of ten feet to accommodate the intake. Maintenance dredging at the salt pond, as well as construction of new piers or bulkheads, would be subject to the jurisdiction of the U.S. Army Corps of Engineers (USACE). Regulatory authorities and responsibilities of the U.S. Army Corps of Engineers are defined by the following laws:

- Section 10 of the Rivers and Harbors Act of 1899 (331 U.S.C. 403) authorizes the USACE to regulate certain structures or work in or affecting navigable waters of the United States.
- Section 404 of the Clean Water Act (33 U.S.C. 1344). Section 301 of this act authorizes the USACE to regulate the discharge of dredged or fill material into waters of the United States.

- Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 U.S.C. 1413) authorizes the Corps of Engineers to regulate the transportation of dredged material for the purposes of disposal in the ocean.
- Section 401 of the Clean Water Act requires applicants to obtain a certification or waiver from the state water pollution control agency, (NYSDEC) to discharge dredged or fill materials.

The following management action applies to flood plains at Fishers Island:

❖ Any dredge or fill activities planned for areas located within the floodplain zone will require coordination with USACE and NYSDEC to obtain the appropriate permits, and may be subject to NEPA review and documentation before any ground-disturbing activities are undertaken in floodplains.

4.1.2 Seneca Lake

4.1.2.1 Surface Waters

According to the Seneca Lake Pure Waters Association, the main threats to the lake's water quality include: (1) stormwater runoff from construction and development; (2) agricultural runoff; (3) onsite wastewater (septic) systems; (4) runoff from urban areas; (5) industrial and commercial activities; and (6) fertilizers and pesticides (Seneca Lake Pure Waters Association 2019).

Erosion and Sediment Control

For any future on-site construction activity, a soil erosion and sedimentation control plan should be prepared and implemented. The plan should include operation and maintenance requirements for both temporary and permanent control measures and identify responsibility for the measures.

Past erosion of the slopes leading to the lagoon has been controlled through the establishment of a regularly maintained mowed turf and old field on the slopes, and a forested and scrub-shrub property edge. Evidence of erosion was still observed on the southern banks of the lagoon and within a portion of the gravel staging area.

Stormwater Management (Point Sources and Non-Point Sources)

Non-point source runoff concerns are associated primarily with stormwater flow from nearby asphalt and gravel roadways and the improved land areas. Field observations noted several minor areas for non-point source pollution. A stormwater outlet was observed at the northwestern edge of the lagoon. A septic system under the existing dock area adjacent to the northern edge of the lagoon is likely to discharge to the lagoon during periods when the water levels of the lake rise to the height of the dock (NUWCDIV 1997c).

The potential for non-point pollution sources are minimal from off-site areas. On site, the septic system located near the docks and the fuel storage area pose as potential non-point sources of pollutants that could enter the lagoon during periods of high water or as a result of accidental spills. The infrequent use of the lavatory within the warehouse building and the infrequent flooding of the docks by high water that could result in the uncontrolled release of septic leachate does not pose as a significant source of pollutants. Due to its infrequent use of the lavatory, a replacement with a chemical toilet using a mixture of several different chemicals in the holding tank may further prevent source pollutants. The SPCC Plan being implemented at the facility (NAVUNSEAWARCEN OSO DRESDEN NY 2015) will provide for the proper containment and control of any accidental spills of fuels or other substances at the facility.

Landscape contractors' use of herbicides and fertilizer is regulated in accordance with DODI 4715.03 (DOD 2020), the 1995 President's Executive Memorandum on *Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds* (60 Federal Register 40837), EO 13148, and *Greening the Government through Leadership in Environmental Management* (21 April 2000). By NUWCDIV, Newport policy, fertilizers and the general use of pesticides is not allowed on grounds. This ensures the minimal use of these substances and decreases the likelihood of these substances entering the lagoon as non-point pollutants within surface runoff.

Other potential sources of non-point pollutants include the storage drums and underground storage tanks present at the facility. The SPCC Plan has identified these areas and has addressed control measures (NAVUNSEAWARCEN OSO DRESDEN NY 2015). Refer to Section 4.10.2 (Seneca Lake Land Management) for more details on the SPCC Plan.

4.1.2.2 Wetlands

State and federal regulations pertaining to the management of wetlands on federal lands in New York are described in Section 4.1.1.2 (Fishers Island Wetlands). The same regulations and Navy policies are also applicable to the lagoon at Seneca Lake, which is a lacustrine limnetic unconsolidated bottom permanently flooded wetland (L1UBH). In summary, functions and values of wetlands and the zone within 50 feet of the edge of the wetland (perimeter wetland) and 100 feet from the edge of a watercourse less than 10 feet wide are protected; dredging and filling in this zone is heavily regulated; activities within the adjacent area that drains into the wetland are regulated if they alter the functions and values of the wetland (e.g., reduce water quality, decrease flood storage capacity by sedimentation, or alter wildlife habitat characteristics by sedimentation or nutrient enrichment from runoff). Conflicts are most likely from activities in areas abutting wetlands (NUWCDIV 1997c).

Consistent with Navy policy and with EPA guidance on siting hazardous waste management facilities in and adjacent to wetlands, and with NAVSTA Newport's management of wetlands at the main installation, the following management action from the primary INRMP will apply at Seneca Lake:

- ❖ Wetland and riparian areas will be avoided in future construction of structures and other facilities, including roads, to the maximum extent possible and practicable.

Dredging of the Seneca Lake Sonar Test Facility lagoon was completed throughout much of the last decade. The permitted action allowed for the dredging of three areas, encompassing the entire turning lagoon. Area 1 (along the docks on northern side of the lagoon) was dredged to a depth of 5 feet below mean low; and Areas 2 and 3 (western and southern banks) were dredged to a depth of 4 feet below mean low water. Dredging all three areas involved the removal and disposal of approximately 3,060 cubic yards of dredge material, and the installation of approximately 510 linear feet of sheet-pile around the perimeter of the lagoon. In sum, the permitted action involved sheet piling, installation of a turbidity curtain, dredging, and disposal of contaminated soil and resulting water from dewatering operations (NAVUNSEAWARCEN OSO DRESDEN NY 2006).

Dredging the lagoon has provided boat access to the pier, access to the inner protected area of the lagoon, and access to the southeastern side of the lagoon and has permitted the temporary barges, formerly located at the end of the wooden pier, to be brought into the protected lagoon (NAVUNSEAWARCEN OSO DRESDEN NY 2006). This improved the aesthetics of the residential lake front area adjacent to the Detachment and improved the safety conditions of facility personnel who work on these barges. It achieved the mission objective of restoring the facility to full operational capacity. Sheet-piling also provided stabilization of the lagoon shoreline, eliminating former erosion areas.

The USACE, USFWS, and New York State Historic Preservation Office were consulted on the permit application. The original permit was issued for August 2005 – August 2008. The permit was later extended through August 2010.

- ❖ Any dredge or fill activities planned for areas located within the lagoon or elsewhere in the floodplain zone will require coordination with USACE and NYSDEC to obtain the appropriate permits, and may be subject to NEPA review and documentation before any ground-disturbing activities are undertaken in floodplains.

4.1.3 Dodge Pond

4.1.3.1 Surface Waters

Dodge Pond has been given a surface water quality class of A (CT DEEP 2018)—improved from the former rating of class D at the time of the 1997 INRMP. Designated uses for class A waters are habitat for fish and other aquatic life and wildlife, and the potential for drinking water supplies, recreation, navigation, and water supply for industry and agriculture. Discharges to class A inland surface waters are restricted to: discharges from public or private drinking water treatment systems, dredging and dewatering, emergency, and clean water discharges (CT DEEP 2015).

Dodge Pond is classified by CT DEEP as a mesotrophic lake. Mesotrophic lakes are moderately enriched with plant nutrients. Moderate biological productivity is characterized by occasional nuisance blooms of algae and/or small areas of nuisance macrophyte beds. These water bodies offer good opportunities for water contact recreation. Mesotrophic waterbodies must adhere to the following criteria (CT DEEP 2013):

1. Total Phosphorus: 10–30 ug/1 spring and summer
2. Total Nitrogen: 200–600 ugh/1 spring and summer
3. Chlorophyll-a: 2–15 ug/1 mid-summer

4. Secchi Disk Transparency: 2–6 meters mid-summer

Groundwater

Groundwater surrounding Dodge Pond is classified by CT DEEP as groundwater class GAA, but may not currently be meeting the standards (CT DEEP 2018). By definition, designated uses of GAA waters include existing or potential public supply of water suitable for drinking without treatment and baseflow for hydraulically-connected surface water bodies. This classification is a subclass of GAA for ground water that is a tributary to a public water supply reservoir, and is given a 500-foot radius as the area of contribution to a public well. The area of contribution to a public water supply well is along the southeastern portion of Dodge Pond (CT DEEP 2018). Discharges to GAA-rated groundwater are limited to treated domestic sewage, certain agricultural wastes, and certain water treatment wastewaters (CT DEEP 2015).

The area surrounding Dodge Pond has been labeled as a Final Aquifer Protection Area (Level A). This program helps to protect Connecticut's public drinking water resources by delineating aquifer protection areas for public supply wells and establishing land use regulations within these areas. Areas under this designation represent the land areas that contribute to ground water to active public water supply wells or well fields that serve more than 1,000 people and are set in sand and gravel aquifers (stratified drift deposits) (CT DEEP 2018).

Erosion and Sediment Control

Stabilization of groundcover on lawns and grass slopes along the bank of Dodge Pond is key to protecting the quality of pond water. Erosion caused by sheet flow, surface runoff, and construction runoff was the primary concern addressed in the 1997 Dodge Pond INRMP. Recommended actions/projects to address the problem included: (1) establishment of grass and wildflower vegetation on lawns, especially those with slopes along Dodge Pond; and (2) construction of two drainage sumps to divert stormwater sheetflow from the parking lot and from drainage which flows from Dodge Court. Construction of the two sumps was intended to reduce surface runoff across the lawn east of the barge access drive, making it easier to successfully establish grass and wildflowers. Although the second of these actions was not implemented, the facility has been successful at establishing good vegetative cover and curbing the erosion problem. As of the 2015 site walkover visit, the sloped areas on the Navy property are all vegetated with grass. There are no current erosion issues at this facility (Geremia 2015).

To prevent erosion from recurring in the future, an erosion and sediment control plan should be prepared with any on-site construction activities. The plan should include operation and maintenance requirements for both temporary and permanent control measures and identify responsibility for the measures. The erosion and sediment control plan should contain sufficient information to satisfy regulatory requirements and ensure that problems of erosion and sedimentation for a given project are adequately addressed. The length and complexity of the plan should be commensurate with the size of the project, the severity of site conditions, and the potential for off-site damage.

During construction, it is recommended that weekly inspections be conducted by the NRM to determine compliance with construction specifications relating to sediment control. Inspections should be conducted immediately following rain or more frequently during prolonged storm events. A write-off should be required at each inspection to assure compliance.

Point Sources and Nonpoint Sources

Non-point source runoff concerns are associated primarily with stormwater flow from the improved shore areas and from the barges and causeway. With the gradient on the site, all surface runoff is directed northward toward Dodge Pond. Any incidental pollutants from the entrance road or parking area over which water flows could be transported down the barge road and end up in the pond water. Sheet erosion is caused by a shallow sheet of water (called “sheet flow”) running off the land. These very shallow moving sheets of water are seldom the detaching agent, but the flow transports solid particles which are detached by raindrop impact and splashing. The shallow surface flow rarely moves as a uniform sheet for more than a few feet on land surfaces before concentrating in the surface irregularities.

The potential for off-site stormwater runoff to enter the property from Dodge Court via Gate E appears probable. Since road salting takes place on roadways off-site, measures should be taken to limit the amount of stormwater entering the property.

- ❖ When it is time to repave the asphalt surfaces at Dodge Pond, the Navy should consider paving with permeable surface materials that will allow water to be absorbed into the ground through the surface, rather than transporting nonpoint source pollutants across the pavement and downhill into the pond.

Historical pollutants of uncertain origin have caused Dodge Pond to be contaminated. Lead, mercury, and arsenic were found in samples of Dodge Pond’s surface water and sediments in 1991. The Connecticut Department of Environmental Protection (the former name of CT DEEP) determined that investigations should focus on mercury.

Several investigations have been conducted in Dodge Pond to evaluate chemical concentrations in surface water, sediment, and fish tissue. In 2009, the Navy had a Watershed Contaminated Source Document (WCSD) (Tetra Tech 2009) prepared for the NUWC site at Dodge Pond to assess the potential for both Navy and non-Navy sources to have contaminated sediment in the waterbody adjacent to the Navy property. The WCSD did not identify a significant historic or continuing Navy or non-Navy source of mercury to Dodge Pond. The most recent environmental sampling investigation (prior to the 2015 Tetra Tech investigation) was conducted in 2011, and included sampling of sediment, fish tissue, and bird guano.

All mercury concentrations in the samples were greater than 0.2 mg/kg used as the basis for the less stringent fish consumption advisory. The overall average mercury concentration in all eleven fish (0.66 mg/kg) was less than 1.0 mg/kg. Also, mercury concentrations in the fillet portion of fish tissue samples were approximately 25 percent lower in 2015 than they were in 2011 (Tetra Tech 2015a). Mercury concentrations in fish appear to be decreasing over time and the average mercury concentrations indicate that the least stringent fish advisory is protective of human health.

❖ As mercury concentrations in fish have decreased since the previous fish sampling event, additional fish sampling every five years (next, in 2020) may indicate if concentrations are continuing to decrease over time.

4.1.3.2 Wetlands

There are no wetland areas within the property boundaries at Dodge Pond beyond the shoreline. However, the pond itself is a palustrine open water wetland, and a buffer zone extending 100 feet from the watercourse (i.e., pond) edge is protected by state and local regulations. Pursuant to Section 22a-42 of the Connecticut General Statutes, the public policy of the state is to require municipal regulation of wetlands and watercourses (Town of East Lyme 2016). The state wetland regulations set forth by the State of Connecticut's Inland Wetlands and Watercourse Act regulates state activities in affecting wetlands and water courses, but federal agencies are not subject to this regulation (NUWCDIV 1997a). Federal agencies typically comply with the intent of the local bylaw. In accordance with the *Inland Wetlands and Water Courses Regulations of the Town of East Lyme, Connecticut* (revised 11 April 2011), all proposed work activity within the buffer zone (including cutting of trees, stumping, grubbing, grading, etc.) must be submitted by application to the East Lyme Inland Wetland Agency to obtain a permit. Regulated activities include those activities which remove material from, deposit material in, construct, obstruct, alter, or pollute or otherwise negatively impact inland wetlands and watercourses (Town of East Lyme 2016).

❖ All proposed Navy alterations or treatment of the test platform or causeway over Dodge Pond, or work activity within the 100-foot buffer zone (including cutting of trees, stumping, grubbing, grading, etc.) must be submitted by application to the East Lyme Inland Wetland Agency to obtain a permit.

4.2 COASTAL AND MARINE MANAGEMENT

4.2.1 Fishers Island

As explained in Section 4.2 of the primary INRMP, states are responsible for designating their state coastal zones. The landward boundary of New York State's Coastal Area (coastal zone) has been delineated in close coordination with local authorities and varies from region to region. In the Long Island region, the Coastal Area includes all islands—thus, all of Fishers Island is within the New York State Coastal Area. The seaward boundary follows the New York/Connecticut and New York/Rhode Island boundaries to the three-mile limit of the territorial sea in the Atlantic Ocean.

The Coastal Zone Management Act of 1972 (CZMA) expressly excludes federal lands from the state coastal zone. Federal actions with impacts that are confined entirely within federal property are not subject to state or local regulations. Federal entities are not required to obtain permits from state coastal zone management (CZM) agencies. (The exception to this is the need for Coastal Erosion Management Permits under the Coastal Erosion Hazard Area Act, from which federal property is not exempted.) Although federal lands are excluded from the coastal zone, Section 307(c)(1)(A) of the CZMA states that:

> "Each Federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs."

The federal agency is required to perform its own determination as to the proposed action's consistency with the state CZM regulations to the "maximum extent practicable" and submit the *consistency determination* to the state CZM agency for "concurrence." In the state's coastal consistency review, the CZM program must evaluate work activity plans for the protection of resources directly in the coastal zone that are high quality, sensitive, or protected under state policies.

The New York State Coastal Management Program was established pursuant to the CZMA and the State Waterfront Revitalization and Coastal Resources Act of 1981. New York State law and the CZMA each require that all federally mandated, authorized, or funded actions taking place within the jurisdictional boundary of a local waterfront revitalization program (LWRP) must be consistent with the State coastal management policies as expressed by the State- and Federal-approved LWRP. The Town of Southold LWRP refines and supplements the State's Coastal Management Program and provides a comprehensive framework within which critical waterfront issues can be addressed, and planned waterfront improvement projects can be pursued and implemented. The Town of Southold LWRP was originally approved in 2005; the amended Southold LWRP was adopted by the Southold Town Board on 21 June 2011, and approved by the New York State Secretary of State on 25 February 2014 for incorporation into the New York State Coastal Management Program (New York State Department of State 2014).

The waterfront revitalization policies of the Town of Southold are a local refinement of the Long Island Sound Regional Coastal Management Program Policies that apply throughout the Long Island Sound region. These 13 policy statements implement the State's 44 coastal policies as far as they are applicable within the Town of Southold. The policies are organized under four headings: developed coast; natural coast; public coast; and working coast. Upon adoption of the Town of Southold LWRP, the policies became the basis for consistency determinations made by local, state and federal agencies for actions affecting Southold's coastal area. The Town of Southold requires that that *all federally conducted and funded activities, and those activities requiring federal agency authorizations, whether inside or outside the coastal area, be consistent with the LWRP* (New York State Department of State 2014).

Likewise, the federal requirement for a coastal consistency determination also applies to any proposed federal work activity within the state wetland buffer zone (i.e., 100 feet) at Fishers Island, because the entire island is within the State Coastal Area (coastal zone). Thus, any DOD actions potentially affecting these wetlands are addressed through a federal consistency review with the New York State Coastal Management Program rather than being required to obtain a Freshwater Wetlands Permit through NYSDEC.

- ❖ All federally conducted and funded activities in the New York Coastal Area (i.e., any part of Fishers Island, or the surrounding waters) require a federal coastal consistency review and notification of the responsible municipal government with an approved LWRP (i.e., Town of Southold) to ensure consistency with the CZMA.

Comprehensive Conservation and Management Plan for Long Island Sound

The EPA, the states of Connecticut and New York, and other concerned parties formed a bi-state partnership in 1985 called the Long Island Sound Study with the common goal to protect and restore the sound. The Long Island Sound Study developed the Long Island Sound Comprehensive Conservation and Management Plan (CCMP), which was approved in September 1994 by the EPA and the States of Connecticut and New York (Long Island Sound Study 2016). Navy activities conducted at Fishers Island should be consistent with the CCMP objectives to restore and protect Long Island Sound.

The marine waters of Fishers Island Sound and eastern Long Island Sound are designated by NYSDEC as surface water Class SA, which indicates saline surface waters with best usages of shellfishing for market purposes, primary and secondary contact recreation, and fishing (Thomson Reuters Westlaw 2020). Class SA waters should be suitable for fish, shellfish, and wildlife propagation and survival. NYSDEC has found that the primary use that is adversely impacted in these waters is shellfishing, which is affected by pathogens in runoff.

The Long Island Sound CCMP identifies water quality degradation and habitat loss as key issues that need to be addressed with regard to improving and protecting the sound. Water quality in Long Island Sound is being increasingly degraded by hypoxic conditions, toxic substances, pathogen contamination, and floating debris; these factors result from various types of water pollution, and should be addressed by the Navy's pollution prevention and stormwater management programs, rather than the INRMP. With regard to habitat loss, specific problems include loss of tidal wetlands from dredging and filling, degradation of wetlands due to spread of common reed, and competition between non-native and native animal species for food and breeding grounds. Consistent with the management and conservation recommendations of the CCMP (Long Island Sound Study 2016), the Navy can help conserve coastal habitats with the following management priorities:

- Protection of tidal wetlands and other productive habitats, such as intertidal sand and mud flats and submerged aquatic vegetation;
- Habitat restoration and enhancement activities; and
- Wildlife management, including population monitoring and programs to protect and restore populations of endangered and threatened coastal plants and animals.

Coastal Erosion Hazard Area

The coastline of the Navy's Fishers Island property has been designated by NYSDEC as a Coastal Erosion Hazard Area pursuant to the New York Coastal Erosion Hazard Areas Act. Specifically, the installation coastline is a natural protective feature area. Natural protective feature areas are defined as land and/or water areas that contain natural protective features (i.e., nearshore area, beach, bluff, primary dune, secondary dune or wetland, and the vegetation thereon), the alteration of which might reduce or destroy the protection afforded other lands against erosion or high water, or lower the reserves of sand or other natural materials available to replenish storm losses through natural processes.

Regulated activities within a Coastal Erosion Hazard Area require a Coastal Erosion Management permit issued by the Town of Southold, which has its own coastal erosion hazard law. The new construction, modification, or restoration of coastal erosion control measures are regulated activities. A permit would therefore be required for construction of a new bulkhead along the beach. The landward limit of the bluff is 25 feet landward of the bluffs' receding edge or the point along the top of the bluff where the slope changes. Any grading of the bluff associated with seeding or infiltration and drainage controls requires a permit. Seeding of the bluff face may be considered by the Town of Southold to be maintenance and not require a permit.

An application for a Coastal Erosion Management Permit is not complete until: an Environmental Assessment form has been submitted, a lead agency established, and a negative declaration or a conditional negative declaration has been filed; and a determination has been made concerning the impact of the project on properties listed on the State or National Register of Historic Places. A cultural resources survey may be required.

During site visits in preparation for this INRMP Addendum, extensive bank erosion was observed along the shoreline, which is mostly unvegetated. Plantings of shrubs and grasses could be a cost effective alternative to large scale efforts to buttress banks.

- ☞ Bank stabilization: Plant small areas of eroded shoreline with coastal shrubs and grasses, and monitor success of revegetation to determine effectiveness before undertaking a large-scale effort. (In addition to reducing erosion, this would also benefit birds of conservation concern.)

- ❖ Any future construction or modifications to the Navy SSTP facility, SATF, or Fishers Island coastal zone will be coordinated with (and permitted, as necessary) by the required regulatory agencies: New York State Coastal Management Program, Town of Southold, NYSDEC, and/or USACE. Efforts will be made to ensure that disturbances to the shoreline will be minimal and temporary, and that no long-term impacts to fish or wildlife or their habitats will occur.

New York State Coastal Nonpoint Pollution Control Program

Section 6217 of the 1990 amendments to the CZMA (Coastal Zone Act Reauthorization Amendments of 1990) requires that states with federally approved CZM programs develop Coastal Nonpoint Pollution Control Programs. The most significant change which Section 6217 represents is that the program must be "enforceable," moving beyond the traditional voluntary approach to addressing nonpoint pollution. New York submitted a proposed program to NOAA and EPA in July 1995. The State of New York undertook a number of actions to address NOAA and EPA's conditions of approval, and in October 1998, the agencies approved the *Final Administrative Changes to the Coastal Nonpoint Pollution Control Program Guidance for Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990.*

Navy activities conducted at the Annex should follow the applicable management practices recommended in the guidance document. These recommendations support the remedial management actions identified for soil conservation in Section 4.1.1 (repeated below):

- Inspect erosion control measures atop Building 208 to ensure the establishment of the new plantings which will prevent the flow of sediment to the salt pond or shoreline.

- Consult a coastal engineer to evaluate the bluff erosion and recommend corrective action to protect government assets and property.

4.3 VEGETATION MANAGEMENT

Guidance for grounds maintenance practices on Navy properties is provided in DODI 4715.03 (DOD 2018a), the 1995 President's Executive Memorandum on *Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds* (60 Federal Register 40837), EO 13148, and *Greening the Government through Leadership in Environmental Management* (21 April 2000). DODI 4715.03 states that each installation shall, to the extent practicable, use regionally native plants for landscaping and other beneficial techniques (DOD 2018a). Section 4.3 of the primary INRMP describes the above Navy policies for landscaping and grounds maintenance, and provides management actions to support beneficial landscaping practices, management of natural areas to promote wildlife habitat and encourage native species; and promotion of pollinator habitats.

In accordance with these guidance documents, Navy policies restrict the use and application of fertilizers and herbicides by landscape contractors to minimal levels necessary for maintaining the grounds and controlling vegetative growth along the fenced perimeter. Landscape contractors' use of herbicides and fertilizer should be reviewed periodically and regulated in accordance with the 1995 President's Executive Memorandum on *Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds* (60 Federal Register 40837). Because these policies apply to all three of the Outlying Parcels, the corresponding management actions are summarized here, rather than repeating them under each subsection below.

The concept of beneficial landscaping emphasizes using regionally native plants to reduce water and nutrient demands; using construction practices that minimize adverse effects on the natural habitat; preventing pollution by reducing fertilizers and pesticides, using integrated pest management (IPM) techniques, recycling green waste, and minimizing runoff; and practicing soil and water conservation. The following management actions for beneficial landscaping apply to all three of the Outlying Parcels:

- Avoid use of fertilization in lawns and other grounds maintenance areas in the *spring season* (to prevent nutrient pollution into the Bay), except for new plantings, to help them become established.
- Use regionally native plant species and beneficial landscaping practices. Supplemental plantings of native trees and shrubs in maintained open areas and around buildings and

recreational areas should be conducted, where consistent with current and planned land uses, to help enhance habitat diversity and meet wildlife management objectives.

Management actions to support the establishment of pollinator habitat include:

- identifying areas in landscaped grounds, grounds maintenance areas, and no-mow areas that can be enhanced with native plants to establish pollinator gardens (in landscaped and grounds maintenance areas) and habitats (in no-mow areas);
- identifying how natural areas can be managed to support pollinator populations; and
- developing best management practices for landscaped grounds, grounds maintenance areas, no-mow areas, and natural areas in regard to maintenance and management (e.g., restricted use of pesticides).

4.3.1 Fishers Island

Pollutants contained in these applied chemicals have the potential to reach ground water by infiltration or wash off with surface runoff to surface waters. Given the natural state of the grounds, the application of herbicides, pesticides and fertilizer is not recommended for this facility. Vegetation along the fenced perimeter can be controlled by periodic mowing.

The old fields along Oriental Avenue used to be maintained with a mowing regime of once every two to five years in mid to late summer (after July 30). Considering the nesting activity of the state threatened osprey, this regime was timed to occur after all of the young osprey have fledged and left the nest site to avoid disturbing this species. If the mowing of each field can be staggered, a variety of successional stages can be maintained. However, the AntiTerrorism Force Protection (ATFP) Directorate, which was enacted by DOD since 9/11, calls for regular mowing along installation roads and boundaries. ATFP is mission-driven, so it trumps natural resources habitat management. In accordance with ATFP, the Fishers Island Grounds Maintenance contract includes mowing maintained areas 8x/year, and mowing the fenceline 2–3x per year. It is not clear to Natural Resources when the mowing is timed to occur.

- Determine if it is possible to schedule the mowing of the fenceline beginning in mid- to late summer (after July 30).

The natural areas can be proactively managed to restore native habitats for regional protected species, migratory birds, other wildlife, and pollinators. As part of the Installation Conservation Design Plan, incorporate management actions for how to restore and manage these natural areas to encourage native biodiversity and to control invasive species. Refer to Section 4.9 Invasive Species Management.

Given that monarch butterflies were identified at Fishers Island, and considering the fact that this migrating pollinator species is undergoing a Status Review by the USFWS for possible listing under the ESA, it would be pro-active for the Navy to establish pollinator habitat including native milkweed plants to specifically attract and encourage reproduction of monarch butterflies. Milkweed can be planted in flower beds in developed areas close to buildings, or scattered with other wildflower seeds in well-drained, grassy fields.

- Establish wildflower habitat including native milkweed varieties to support the monarch butterfly.

4.3.2 Seneca Lake

The Grounds Support/Grounds Keeping Plan for Seneca Lake Detachment calls for the mowed areas to the west of the parking lot, and north and east of Building 1 to be continuously maintained as mowed grass. The steep slopes around the edge of the lagoon (referred to as "old fields") are only mowed 1–2x/year, not before August. Delaying mowing until late summer benefits any birds and wildlife species that nest in or inhabit these areas by allowing time for young to mature and/or fledge.

- Restrict mowing activities within the old field areas to after July 30 to benefit small mammals (as well as the nesting activity of birds) which may utilize these areas.

A fair number of flowering shrubs, vines, and herbaceous plants occur at the installation, within the fencing in the shrub/scrub community, and outside of fencing in the area maintained as lawn, including: Japanese honeysuckle, Multiflora rose, Japanese barberry, American pokeweed, blackberry, forsythia, golden rods, violets, myrtle, white clover, and dandelion. These natural and landscaped areas help support pollinator populations and encourage biodiversity. As discussed in Section 2.3.3.2 and Section 4.9.2, several of these species are invasive—namely, Japanese honeysuckle, Multiflora rose, and Japanese barberry. Their benefit to pollinators does not outweigh their competition with native species, and the habitat would be healthier and more diverse if they were eradicated and replaced by native pollinator plants.

4.3.3 Dodge Pond

The site grounds maintenance plan at Dodge Pond consists simply of mowing roughly 0.5 acre of grass.

- For any future planting on the site, it is recommended to refer to the *Connecticut Native Tree and Shrub Availability List* (Connecticut Department of Environmental Protection 2005).

4.4 FOREST MANAGEMENT – N/A

4.5 WILDLAND FIRE MANAGEMENT – N/A

4.6 FISH AND WILDLIFE MANAGEMENT

The purpose of fish and wildlife management on NAVSTA Newport is to protect, conserve, and manage fish and wildlife resources at a level that is compatible with the military mission and federal and state laws. Management guidelines should not necessarily optimize the installation for any one species but should instead provide a diversity of habitats for a variety of species. The applicable federal and state laws and local ordinances for the protection of fish and wildlife resources are listed in Section 4.6 of the primary INRMP. In addition to those laws and programs, the following apply to managing fish and wildlife at the Outlying Parcels:

- New York Environmental Conservation Law
- NYSDEC Fish and Wildlife Regulations (6 NYCRR Parts 1 through 189)
- New York Marine Fisheries Regulations (6 NYCRR Parts 40 through 49)
- Connecticut Fishing Regulations (Sections 26-112-21 through 48, and 26-40d-1 of the Regulations of Connecticut State Agencies)
- Connecticut Wildlife Regulations (Sections 26-55-1 through 6, and 26-306-1 through 7 of the Regulations of Connecticut State Agencies)

The state wildlife action plans (SWAPs) provide the foremost guidance on priorities for the conservation of fish and wildlife resources in New York and Connecticut. The major threats to wildlife and habitats, and the applicable conservation actions and strategies identified in the SWAPs are described in Section 3.8.1 for New York and Section 3.8.2 for Connecticut. Many of these strategies apply to other aspects of this INRMP, such as water resources management, coastal and marine management, and vegetation management. There are many common themes for conserving wildlife and promoting habitat between the New York and Connecticut SWAPs, which can be broadly applied across all of the Outlying Parcels, including the following:

- Continue periodic monitoring of species of greatest conservation need (SGCN or GCN) and their habitats, including bats and migratory birds.
- Control of invasive and problematic native plant and animal species.
- Document and evaluate avian use of intertidal habitats.
- Restore habitat in non-barrier island tidal wetlands.
- Monitor wetland birds in coordination with DOD Partners in Flight and other avian conservation initiatives.
- Manage and restore habitats for native pollinators.

4.6.1 Wildlife Management

Invasive species have degraded the quality of habitat on NAVSTA Newport's Outlying Parcels. For example, the shrubs and grasses present at Fishers Island and Seneca Lake are used for nesting and foraging by birds, amphibians, and small mammals. However, the value of this habitat is greatly degraded by overgrowth of invasive, non-native plant species. Thinning invasive plants, though also proactively restoring native plants, can help enhance the quality of the natural areas for wildlife, and utilizing best management practices as described in Section 4.9, *Invasive Species Management*.

Conservation, or beneficial, landscaping can attract pollinators, increase food resources for wildlife, and provide habitat for migratory birds and other fauna species. Conservation landscaping at NAVSTA Newport's Outlying Parcels could include planting native plant species, reducing the use of chemical fertilizers and pesticides, establishing or promoting pollinator habitat, building bird and bat boxes in appropriate places, and minimizing bare soil, among other things (http://www.envirolandscaping.org/conservation.htm). For more information, see Section 4.3, *Vegetation Management*, of this INRMP.

4.6.1.1 Fishers Island

The human use at the Annex facilities is minimal and restricted to facility access and regular maintenance of the active facilities. On-going activities at Buildings 208 and 235 do not interfere with wildlife utilization of existing habitats nor do they appreciably alter these habitats in any way. While the potential for use of on-site habitats by several species of special concern is high, these species will not be affected by the on-going activities at this facility.

The wildlife that utilize the habitats present within the Fishers Island Annex would be best served by maintaining and restoring the existing habitats to native species, as these areas provide a diverse source of food and plentiful cover for a variety of wildlife.

It was noted during the fauna surveys conducted in 2015 that bats could possibly use the abandoned barracks on the northwest corner of the installation and the three bunkers in the center of the installation as hibernacula. Bat species are federally and state-protected in New York, so the management actions to address their possible presences and conservation at Fishers Island are covered under Section 4.7, *Threatened and Endangered Species Management, Critical Habitat, and Species of Concern*.

4.6.1.2 Seneca Lake

The NUWCDIV, Detachment Seneca Lake facility is fully developed with limited natural areas or habitats for terrestrial species. Ongoing activities at the facility do not appreciably affect wildlife resources in a negative manner. No federal or state-listed threatened or endangered species utilize the area within or immediately adjacent to the facility on a regular basis. No impacts to these species or wildlife in general are anticipated. The wildlife that utilize the habitats present within the Detachment Seneca Lake facility would be best served by maintaining the existing habitats. To this end, the only wildlife management activity recommended is the restriction of mowing activities within the old field areas to after July 30 to benefit small mammals (as well as the nesting activity of birds) which may utilize these areas. The adoption of other specific management strategies for fish and wildlife resources at this facility are not warranted.

- ❖ Restrict mowing activities within the old field areas to after July 30 to benefit small mammals (as well as the nesting activity of birds) which may utilize these areas.

4.6.1.3 Dodge Pond

Aside from birds, the only wildlife species documented as using the site at Dodge Pond during the 2015 survey was a groundhog. Human use of the installation does not interfere with its use by common rodents. Being a small and fenced-in parcel with no natural areas, there is no opportunity for wildlife to use the site other than transient avian species. No management actions are recommended.

During the fauna surveys conducted in 2015, it was noted that, although they do not reside at the Dodge Pond Field Station, bats could occur at Dodge Pond as transient species. As a pro-active step to benefit bat and avian species that pass through the area, the Navy could install bat boxes and bird houses.

☞ Enhance wildlife habitats by installing bat and blue bird boxes.

4.6.2 Migratory Bird Management

The Migratory Bird Treaty Act of 1918 (MBTA) is the primary legislation in the United States established to conserve migratory birds. It implements the United States' commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. The species of birds protected by the MBTA appears in Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13). On 02 December 2003 the President signed the 2003 National Defense Authorization Act. The Act provides that the Secretary of the Interior shall exercise his/her authority under the MBTA to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense. For a full discussion of migratory bird conservation with respect to military activities, refer to Section 4.6.2 of the primary INRMP.

All three Outlying Parcels are within the Atlantic flyway, which is a major bird migration route. The Atlantic flyway stretches over some of the most densely populated and developed areas of the United States, which makes it critically important that natural areas and undeveloped lands be conserved and managed to support these species. Numerous bird species protected under the MBTA utilize the installation (see Section 2.3.6 *Fauna*); as a result, protection of existing habitat for many species of migrating land birds and shorebirds is an important component of this INRMP. Habitats important to migratory birds for nesting, foraging, and providing migratory stopover include beaches, salt marshes, and maritime shrublands along the coast; wetlands such as emergent marshes and shrub swamps; and successional fields and forests growing on disturbed lands.

Nesting disturbance and disruption of migratory birds and shorebirds by routine operations, special projects, and other work-related activities is prohibited without a permit. During annual INRMP reviews, the Navy must report any migratory bird conservation measures that have been implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds. NAVSTA Newport also coordinates with the USFWS for all impacts on migratory birds.

❖ Report migratory bird conservation measures and impacts to the USFWS and pertinent state wildlife agency during annual INRMP reviews.

The DOD and U.S. Geological Survey (USGS) jointly developed a "Coordinated Bird Monitoring Plan," which outlines procedures for bird monitoring, including study design, data collection methods, and data analysis. The plan also calls for data to be stored in a long-term repository, such as the Coordinated Bird Monitoring Database (CBMD). NAVSTA Newport staff should share their data with the CBMD; ideally, data should be checked for quality and then uploaded immediately following each field season.

4.6.2.1 Fishers Island

Fishers Island and its associated inland and coastal waters are located within the Atlantic Flyway and are therefore used by migratory birds during winter months and summer. Species expected in the summer typically breed on the Island and winter further south. These species may include the following: osprey, Canada geese, fish crow, black duck, mallard, great blue heron, great egret, snowy egret, glossy ibis, little blue heron, black-crowned night heron, and the American oystercatcher. Species common to the Island in the winter are species which typically breed further north during the summer including sea ducks, greater scaup *(Aythya marila)*, black duck *(Anas rubripes)*, mallard, cormorant *(Phalacrocorax* sp.*)*, common merganser *(Mergus merganser)*, and bufflehead *(Bucephala albeola)* (NUWCDIV 1997a, Tetra Tech 2015b). For a full list of species, see Appendix D.

Compliance with the MBTA may be problematic regarding mission activities at the Fishers Island Annex. The presence of regulated species may be highly variable, with nests located throughout the site in landscaped areas, overgrown scrub/shrub habitat, wetlands, the bluff and shoreline area, and on and around buildings and Battery III. Any clearing or grubbing activities have the potential to displace nests of migratory bird species.

In accordance with the MBTA, trees should be inspected prior to felling in order to determine if active nests are present. Nests should be reported to the NRM, for determination of applicability of the MBTA. Backhoe operators should be alert for potential presence of nesting migratory birds and other species of concern prior to any future demolition activities. Landscaping crews should also report nests observed to the NRM prior to hedge trimming and pruning activities.

Stabilization of beaches and bluffs along the southern shoreline (described under Section 4.2.1 *Coastal Management, Fishers Island*) would benefit several shorebirds that are species of special concern by maintaining and possibly restoring beach habitat utilized by these species. However, a large colony of bank swallows (*Riparia riparia*) was observed just west of the installation boundary along the shore, so any action taken to improve the shoreline must take precautions not to disturb or damage the habitat, breeding activity, or nesting, of the swallow colony.

Thus, the following projects and management action for managing migratory birds at Fishers Island are planned:

- ☞ Bank stabilization: Plant small areas of eroded shoreline with coastal shrubs and grasses, and monitor success of revegetation to determine effectiveness before undertaking a large-scale effort.
- ☞ Add avian data to DOD Coordinated Bird Monitoring Database.
- ❖ Inspect plantings, trees, or overgrown areas for nests prior to trimming, clearing or grubbing activities.

4.6.2.2 Seneca Lake

The lagoon was observed to provide a valuable fishery habitat as well as a foraging area for waterfowl. Utilization by waterfowl is limited to periods of low human activity. Ongoing activities at the facility do not appreciably affect migratory birds in a negative manner. No impacts to these species or wildlife in general are anticipated. The fish and wildlife that utilize the habitats present within the Detachment Seneca Lake facility would be best served by maintaining the existing habitats. To this end, the only wildlife management activity recommended is the restriction of mowing activities within the old field areas to after July 30 to benefit the nesting activity of birds and small mammals which may utilize these areas. The adoption of other specific management strategies for migratory birds at this facility are not warranted.

- ❖ Restrict mowing activities within the old field areas to after July 30 to benefit small mammals (as well as the nesting activity of birds) which may utilize these areas.
- ❖ Inspect plantings, trees, or overgrown areas for nests prior to trimming, clearing or grubbing activities, including the cutting or removal of invasive species. Nests should be reported to the NRM, (401) 841-6377 for determination of applicability of the MBTA.
- ❖ Add avian data to DOD Coordinated Bird Monitoring Database.

Sea gulls present a persistent problem for the maintenance of the barges and testing platform, in that they are so prevalent that their guano must be cleaned off of the barge decks almost daily during the warm months of the year (Dobbertin 2016). Guano removal is necessary because bird feces can damage the surfaces of equipment, rigging, and decks. NYSDEC has noted the potential for this practice to have localized impacts to water quality, and suggested that the Navy might consider monitoring water quality after washing occurs to determine the effect (Gibbs 2016). To minimize the amount of guano washed into Seneca Lake, the NRM and POC also could work with the Navy commands to determine whether scraping and disposal of guano, or some other cleaning method, could be a viable alternative.

Gulls are protected under the MBTA; however, when migratory birds become nuisance species and/or pose a threat to the military mission, depredation permits may be issued to allow the installation to take a set number of individuals in order to control the population. If NAVSEAWARCEN OSO DRESDEN NY finds that the sea gull and guano problem are severe enough to warrant population controls, NAVSTA Newport would have to obtain annual approval to conduct depredation activities by applying for the necessary depredation permit through the USFWS Division of Migratory Bird Management.

- ❖ Grid wires suspended on rooftops and barges, audio and visual frightening, or any other technique that will not result in injury or harm may be used to harass (i.e., deter) gulls. Harassing gulls does not require a permit under the MBTA.
- ❖ Determine whether the guano problem has a severe enough impact on the military mission at Seneca Lake to warrant applying for a depredation permit annually.

The discussion of this issue and the recommended management actions are essentially repeated under Section 4.8.2, *Pest Management, Seneca Lake*.

4.6.2.3 Dodge Pond

Compliance with the Migratory Bird Treaty Act may be problematic regarding mission activities at the Dodge Pond Field Station. Although the site is highly developed, the presence of regulated species may be highly variable, with nests located in landscaped (trees, hedges) and overgrown areas. Any clearing or grubbing activities have the potential to displace nests of migratory bird species. Migratory birds utilizing Dodge Pond on a seasonal basis include song birds, woodpeckers, barn swallows, and crows, as identified during the field visit. Waterfowl such as mallards, Canada geese, cormorants, and various gulls were observed on the pond.

Thus, the following management action and projects for managing migratory birds at NAVSTA Newport are planned:

- ❖ Vegetation clearing should occur from November to March to the extent practicable.
- ❖ Inspect plantings, trees, or overgrown areas for nests prior to trimming, felling, clearing or grubbing activities. Nests should be reported to the NRM, (401) 841-6377, for determination of applicability of the MBTA.
- ❖ Add avian data to DOD Coordinated Bird Monitoring Database.

4.6.3 Marine Wildlife Management

All marine mammals and sea turtles are protected species; both groups have declined in population over the past century. Some of the main threats include accidental capture in fishing gear, habitat destruction or degradation, illegal hunting, pollution, underwater noise, and ship strikes. Under the Marine Mammal Protection Act (Marine Mammal Protection Act 1972), it is unlawful to “take” a marine mammal without authorization; depending on the species, authorization can come from the National Marine Fisheries Service or the USFWS. Under the MMPA, to “take” is to “harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect” marine mammals. Any action that produces sound underwater in areas occupied by marine mammals could constitute harassment and, therefore, must be evaluated by the appropriate agency. According to OPNAVINST 5090.1E, *Environmental Readiness Program*, all Navy requests for take authorizations must be coordinated with the Chief of Naval Operations Environmental Readiness Division (Navy 2019a). Detailed information on the MMPA take authorization process can be found on NMFS’ Office of Protected Resources website at http://www.nmfs.noaa.gov/pr/permits/incidental.htm.

Any Navy training or testing operations taking place in the waters around Fishers Island, seaward from the mean high water mark, are covered under the Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement (AFTT EIS/OEIS). Therefore, any marine mammal takes or interactions with federal threatened or endangered species in the nearshore area are outside the scope of this INRMP; instead, the associated MMPA Letter of Authorization and the ESA Incidental Take Statement would apply

(Tompsett 2015). Accordingly, the following section only addresses possible strandings of marine mammals or sea turtles on the shore of the installation.

4.6.3.1 Fishers Island

As listed in Table 2-3, marine mammals that may be present in the marine waters around Fishers Island include the harbor porpoise, finback whale, humpback whale, and North Atlantic right whale. Sea turtles that occur in the vicinity include the Kemp's ridley, leatherback, loggerhead, and green sea turtles. Protected fish species that may occur include the Atlantic sturgeon and the shortnose sturgeon. See Figure 2-13 for a depiction of NOAA's Environmental Sensitivity Index data, showing the range of sensitive biological resources (from bivalves to whales) that use the coastal and marine waters around Fishers Island, as well as the managed areas and different shoreline habitat types. Measures taken under this INRMP to protect water quality, and under the stormwater pollution prevention program to reduce runoff and pollution entering marine waters are vital to the protection of the habitat of these sensitive species. In addition to the conservation benefits described above, the Navy can ensure the continued protection of these threatened and endangered marine species by considering the potential effects of ongoing and planned actions with regard to effects of increased suspended sediment, suspension of contaminated sediments, discharge of any other pollutant, loss of prey, increased vessel traffic, the effects of underwater sound pressure waves, and any impacts to habitat or conditions that could make the affected water bodies unsuitable for these species (Murray-Brown 2016).

- ❖ Protect marine wildlife habitat by taking steps to reduce risk of spills and environmental pollution, and continue best management practices relating to stormwater management.

Stranding occurs when an animal is found alive or dead on a beach, or else found floating dead in open water. Given its location on Block Island Sound, it is possible that some marine mammals may become stranded on coastal areas of Fishers Island. NMFS has established several marine mammal stranding centers to assist stranded or beached animals. In the event that stranding occurs, personnel should adhere to the protocol established by the Chief of Naval Operations (CNO) (Navy 2006) Environmental Readiness Division. These management actions apply to any stranded marine mammal or sea turtle that appears to be injured, disoriented, or dead.

- ❖ The installation commander will immediately contact the NMFS regional stranding coordinator in the event of a live or dead marine mammal stranding at the installation, with notification to the CNO Environmental Readiness Division occurring immediately thereafter. The NMFS regional stranding coordinator for the Northeast region is Mendy Garron, who can be reached at (978) 282-8478.
- ❖ In addition to contacting the NMFS regional stranding coordinator and notifying the CNO Environmental Readiness Division, the Northeast Region Stranding Network Marine Mammal and Sea Turtle Stranding and Entanglement Hotline will be contacted at 866-755-6622. The members of this network are authorized by federal law to respond to marine mammal and sea turtle strandings. Mystic Aquarium in Mystic, Connecticut, is the NOAA Fisheries' authorized responder to rescue stranded marine mammals and sea

turtles in the vicinity of Fishers Island. Mystic Aquarium can be reached at (860) 572-5955, extension 107.

- ❖ Monitor the animal from a safe distance. Remain a minimum of 100 yards from the stranded animal. Crowding the animal is unsafe for the observer as well as the animal. Do not touch the animal, alive or dead, because wild animals can carry many diseases, parasites, and bacteria, some of which can be transmitted to humans. Do not attempt to push the animal back into the water, and if it goes back into the water on its own, do not attempt to follow after or swim with it.
- ❖ Carefully observe the animal. Observe the position of the alive or dead animal and monitor its breathing. Wait for responders from the NMFS and or the Northeast Stranding Network to arrive and direct them to the animal. Relay all observations to the responders so that they can provide the best possible care for the stranded mammal or sea turtle.

4.6.4 Fisheries Management

The Fish and Wildlife Conservation Act (Non-game or Forsythe-Chafee Act) of 1980 sets forth general management guidelines for fish and wildlife resources by encouraging all federal departments and agencies to utilize their statutory and administrative authority to conserve and promote conservation of non-game fish and wildlife, and their habitats. In addition, two other federal laws apply to the management of fish and wildlife resources: the Lacey Act of 1900, as amended by the Lacey Act of 1981, and the Magnuson-Stevens Fishery Conservation and Management Act, as amended in 1996, and as reauthorized under the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSA). It is DOD policy to allow fishing on military installations, provided that such activities are in accordance with DODI 4715.03 (DOD 2018a), OPNAVINST 5090.1E (Navy 2019a), OPNAV M-5090.1 (Navy 2019b), and relevant state and federal regulations.

4.6.4.1 Fishers Island

Due to security concerns, the Navy has no interest in permitting any fishing or hunting on the site at Fishers Island.

Discretionary activities which could impact fisheries resources and habitats include marine construction and repair of offshore testing facilities, and maintenance dredging in the salt pond. Mitigation is possible to minimize impacts from these activities. Construction may be limited to seasons of the year when fish are not spawning in the area. Construction methods may be selected to minimize impacts (i.e., pile driving, not auguring). Placement of silt curtains around dredging sites and placement of hay bales (on land) downgradient of upland areas on which activities involving soil disturbance are taking place should be used to confine sedimentation to the immediate project site.

4.6.4.2 Seneca Lake

Seneca Lake, and the lagoon onsite at Seneca Lake Detachment, contain freshwater fish populations that serve as an important food source for migratory birds and as an important recreational fishing resource. No federal or state threatened or endangered fish species are presently known to occur within Seneca Lake.

Due to security concerns, fishing is not permitted within the limits of the facility. Existing fish populations (and secondarily, the migratory birds that feed on them) will benefit from the management actions identified under Section 4.1.2, *Water Resources Management, Seneca Lake*, and by following the Spill Prevention, Control, and Countermeasures Plan (SPCC Plan), as discussed under Section 4.10.2, *Land Management, Seneca Lake.*

4.6.4.3 Dodge Pond

Fisheries management at Dodge Pond is the charge of CT DEEP, since the pond is owned by the State of Connecticut. The Navy does not authorize fishing or have any responsibility for its occurrence or management at Dodge Pond. CT DEEP oversees the recreational fishing at Dodge Pond, and stocks Dodge Pond annually with trout. CT DEEP Bureau of Natural Resources, Inland Fisheries Division stocks Dodge Pond annually for recreational fishing.

Sampling by the University of Connecticut in 1995 found that fish from Dodge Pond contained elevated concentrations of mercury. Dodge Pond was one of five sites sampled statewide where mercury concentrations in all largemouth bass samples exceeded 0.5 mg/kg wet weight—the threshold level generally used by state governments to warn fish consumers (Tetra Tech 2009).

Because of potential methyl mercury contamination, Connecticut has a state-wide advisory on consumption of freshwater fish (excluding the stocked trout), and recommends that consumption be limited to one meal per week for the general population and one meal per month for high-risk populations (defined as pregnant women, women planning to become pregnant within one year, nursing mothers, and children under six). There is a separate and more stringent advisory resulting from methyl mercury contamination on the consumption of largemouth bass, smallmouth bass, and pickerel in Dodge Pond and a few other water bodies in Connecticut: consumption of these fish should be limited to one meal a month for the general population, and high-risk populations should avoid consumption. The State of Connecticut stocks Dodge Pond annually with trout; presumably the trout are not in the pond long enough to accumulate sufficient amounts of mercury to impact the general population. There are no limits on the consumption of trout. However, the CT DEEP fish consumption advisory recommends that the high risk group eat no more than one large trout (over 15 inches in length) from lakes and ponds per month (Connecticut Department of Public Health 2020).

4.7 THREATENED AND ENDANGERED SPECIES MANAGEMENT, CRITICAL HABITAT, AND SPECIES OF CONCERN

Section 4.7 of the primary INRMP describes the Endangered Species Act of 1973 (ESA), and the federal framework for protecting species that have been federally listed as threatened or endangered under the ESA, and the consideration of candidate species for listing under the ESA. DOD is obligated to comply with federal protections to avoid "taking" any listed species. However, in accordance with the Defense Authorization Act for fiscal year 2004, DOD installations are exempt from the designation of critical habitat, provided that a comprehensive and approved INRMP is in effect, the INRMP specifically addressed the conservation of species under consideration, and the INRMP was implemented. For more details, refer to the primary INRMP.

4.7.1 Fishers Island

As described in Section 2.3.5.1, no federally listed or proposed threatened or endangered flora or fauna species are known to be present at Fishers Island Annex, but the installation contains suitable habitat to support such species. Given the lack of personnel at the installation and the fact that no dedicated surveys for threatened and endangered have been conducted during the past 20 years, combined with the fact that multiple federal listed species have the potential to occur in the area, the presence of listed species cannot be discounted. Installation-wide surveys to detect threatened and endangered species are warranted.

The federally threatened and state-threatened northern long-eared bat is one of the bat species that has been most impacted by the spread of white-nose syndrome; as a result, the species was listed as a threatened species under the Endangered Species Act on 2 April 2015 (USFWS 2015). Precipitous declines of northern long-eared bats have not been observed on some coastal areas, however, and one hypothesis is that groups are roosting in old buildings and therefore are not exposed to white nosed syndrome common in many caves now across the region. Annual bat monitoring, along with regular acoustic surveys, could help natural resource managers better understand which species occur on the installation, when and where they occur, and how their population numbers are changing through time. Acoustic monitoring could potentially be preceded by roost searches and seasonal emergence counts to document the locations of active hibernacula and seasonal variation.

Federally threatened piping plovers are present on the island, and the roseate tern and the red knot may be transiently present during migration. Only one state-listed species was identified during the flora and fauna surveys conducted in preparation for this INRMP Addendum: the common tern. However, it should be noted that these were rapid site walkover surveys for confirmation of species lists; intensive threatened and endangered species surveys have not been conducted. Multiple other state-listed bird species have the potential to occur, including the king rail, least tern, and northern harrier. In addition, two nesting pairs of osprey—a state species of special concern—were observed during the spring survey. The measures described under Section 4.6.2, *Migratory Bird Management*, in accordance with the MBTA, will benefit and protect all bird species that are present at the installation. In addition, stabilization of beaches and bluffs along the southern shoreline would benefit several bird species of special concern by maintaining and possibly restoring beach habitat utilized by these species. Of particular interest is the federally-endangered piping plover and the state-threatened least tern; both are known to utilize similar sites for breeding on the Island. Since the existing beach could be utilized by these and other rare plant and animal species, the design of any restoration/stabilization efforts should accommodate their presence.

Multiple federal and state listed species have the potential to be present in the installation's beach and wetland habitats, including the federally endangered sandplain gerardia and the federally threatened seabeach amaranth. The spotted turtle, a state species of concern which was documented on the island in preparation for the 1997 INRMP (NUWCDIV 1997a), may be present in wetland areas. Desktop investigation determined that the state-endangered large calyx goosefoot (*Chenopodium berlandieri* var. *macrocalycium*) and the state-threatened saltmarsh aster (*Symphyotrichum subulatum* var. *subulatum*) also could possibly be present at Fishers Island Annex in the rocky cobble beach and the salt pond edge habitats (NYSDEC 2019, 2020b; New York Natural Heritage Program 2015a, New York Natural Heritage Program 2015b). The Navy's planned management measures for the avoidance of wetlands and beaches in future development, and for the restoration of coastal populations of protected species, as described in Section 4.1.1 and Section 4.2.1, will benefit any protected species that might be present in these habitats. The applicable management measures include:

- Protection of tidal wetlands and other productive habitats, such as intertidal sand and mud flats and submerged aquatic vegetation.
- Wildlife management, including population monitoring and programs to protect and restore populations of endangered and threatened coastal plants and animals.
- Avoidance of wetland and riparian areas in future construction of structures and other facilities, including roads, to the maximum extent possible and practicable.

Multiple other state-listed wildlife species or species of concern have the potential to occur at the installation (see Section 2.3.5.1, Table 2-2). The Navy plans to conduct surveys to confirm the occurrence of these species through the implementation of this INRMP. Any future construction projects should be sensitive to the potential presence of federal and/or state threatened or endangered wildlife species and rare plants. A field reconnaissance of any proposed site should be performed to determine if a protected species is currently nesting within the project area or would be adversely affected in some other way by the proposed project. If potential impacts are unavoidable, mitigation measures would be taken in accordance with NEPA.

The defined projects for threatened, endangered, and candidate species include:

- Conduct a survey for rare, threatened, and endangered species.
- Periodically monitor known and potential RTE species habitats (every five years).
  - Special emphasis on determining whether the piping plover or other listed shorebird species use the beach habitat, and whether the spotted turtle is found in the installation's wetland habitats.
- Conduct baseline bat surveys, including acoustic monitoring using full-spectrum bat detectors for identification of bat species, followed by mist-netting for *Myotis* bat species (i.e., Northern long-eared bat and little brown bat) in natural habitat areas, and a bat roost search during the summer. Repeat acoustic monitoring every 3 to 5 years.
- Conduct an emergence count at least three times per year (bi-annually) to document use of bat roosts.

Specific management actions for threatened, endangered, and candidate species include the following:

- Conduct field reconnaissance of proposed sites for future construction to determine if a protected species is currently nesting within the project area or would be adversely affected by the proposed project.
- Ensure that the decontamination protocol recommended by White-Nose Syndrome.org is followed (White-Nose Syndrome.org n.d.) while conducting mist netting surveys.
- Implement the following proactive measures for piping plover and other listed shorebirds:
    - prohibit off-road vehicles during the breeding season
    - require that dogs be leashed along beaches, in wetlands, and other coastal habitats
    - manage beach areas to promote growth of native vegetation
    - remove trash and other debris from beaches

No critical habitat currently has been designated on Fishers Island Annex or in its surrounding waters. The ESA directs both the NMFS and USFWS to designate critical habitat for listed species. Critical habitat is defined as a specific geographic area that is essential for the conservation of a threatened or endangered species. The ESA requires that federal agencies consult with either the NMFS or USFWS if an agency action may adversely modify critical habitat. In 2004, Congress amended the ESA to specify that critical habitat should not be designated on land controlled by the DOD if it is determined that the INRMP provides sufficient benefit to the species in question.

Atlantic sturgeon range from Labrador, Canada, all the way to Cape Canaveral, Florida. They are a wide ranging fish and could potentially be found in any river or estuary on the East Coast. Thus, NAVSTA Newport can work with the NMFS to ensure that the installation is supporting adequate habitat for the species. NAVSTA Newport has consulted with NMFS and confirmed that areas on or in the immediate vicinity of NAVSTA Newport are not being considered for designation of critical habitat for Atlantic sturgeon.

Additionally, even if the installation or its surrounding waters are designated as critical habitat in the future, the Navy could qualify for exemption due to the fact that the management measures included in this INRMP will benefit protected species if implemented.

4.7.2 Seneca Lake

Based on field observations of the habitats present at the facility, a review of available reports, and correspondence with regulatory agencies, no federal or state-listed threatened and endangered species occupy or use the natural resources of the Seneca Lake Detachment.

The federally endangered plant species known as Leedy's roseroot (*Rhodiola integrifolia ssp. leedyi*) does not occur within the installation, but is found on cliffsides along the shores of

Seneca Lake just south of the NUWC Seneca Lake Detachment. The proximity of this species warrants periodic monitoring for its presence at the installation. Habitat for Leedy's roseroot is only present on the north side of the lagoon beyond the security fence (Tetra Tech 2015c).

A New York species of special concern, the osprey, may use onsite perches, and is known to forage in offshore areas of the lake on a transient basis.

The following project will be conducted at Seneca Lake:

- ❖ Monitor periodically for the presence of *Rhodiola integrifolia ssp. Leedyi,* a federally endangered species for which there is potential habitat on the north side of the lagoon.

4.7.3 Dodge Pond

Based on field observations of the habitats present at the facility, a review of available reports, and correspondence with regulatory agencies, no federal or state-listed threatened and endangered species, or species of special concern, occupy or use the natural resources of the Dodge Pond Field Station.

The federally threatened and (Connecticut) state-endangered northern long-eared bat occurs in New London County, Connecticut, where Dodge Pond is located, but the species' presence has not been specifically confirmed at the pond.

Of the bird species confirmed at Dodge Pond, three are identified as Species of Greatest Conservation Need (SGCN) in the 2015 Connecticut Wildlife Action Plan: the Baltimore oriole, the osprey, and the chestnut-sided warbler (CT DEEP, Bureau of Natural Resources 2015a).

Although no action is required by the Navy for the protection of these species, the following pro-active and low-cost project has been identified:

- ❖ Enhance wildlife habitat by erecting bat boxes and bird houses.

4.8 PEST MANAGEMENT

Refer to Section 4.8 of the primary INRMP for the definition of "pest" in accordance with the DOD's Pest Management Program; for a summary of integrated pest management (IPM) methods; and for a description of NAVSTA Newport's 2009 Integrated Pest Management Plan.

4.8.1 Fishers Island

As is described in Section 2.3.3.1, by the early 1990's, Japanese black pines at the Fishers Island Annex had become infested with the black turpentine beetle *(Dendroctonus terebrans),* a beetle which bores into the bark where it feeds and reproduces, creating extensive galleries between the cambium and the bark. These galleries tended to girdle the tree, reducing the flow of sugar and other nutrients to and from the roots and leaves. Typically these beetles bored into the tree two to three feet from the ground. Indications of infestation included pitch tubes which develop on the bark, indicating that a hole has been made in the bark. Although these beetles caused stress on the trees, they were not frequently the cause of mortality. Rather, the beetles were inclined to pick up and carry a blue stain fungus on their bodies, which caused mortality of a tree by plugging the vascular system. Trees infected with the Blue Stain Fungus exhibited relatively rapid mortality; needles turned off-color quickly and the tree frequently died within one year, although beetles would continue to inhabit and feed on the bark until the tree dried out (NUWCDIV 1997a).

Management procedures recommended by the Cornell Cooperative Extension Service focused on sanitation and pesticide application:

> *Sanitation:* rogue or remove dead or dying trees, removing infected trees at the earliest sign of infestation. There is no cure for infestation; once attacked by the Blue Stain Fungus a tree will not recover. Trees removed should either be burned (in accordance with local solid waste disposal regulations) or buried. Any dead timber left on the ground will continue to support the fungus until the specimen dries out.
>
> *Pesticide Application:* pesticide application is a preventative measure, directed toward preventing the Black Turpentine Beetle from boring into the bark. Once the beetle has bored into the bark and begun feeding and reproducing, it will not be susceptible to pesticide application. It is known that the beetle has one generation per year, although broods appear to hatch at different times and therefore have different feeding times, presumably in late spring and early summer. Pesticide application would therefore be most successful during this time period.

During the July 1997 survey, it was noted that reforestation by hardwoods such as red oak and black cherry in addition to Japanese black pine saplings was occurring. Since oak and cherry are indigenous to the area, sanitation and pesticide application were not recommended. Given the magnitude of the problem and the vulnerability of the timber stands to infestation, aggressive sanitation and pesticide application were determined not to be cost-effective or advisable. In any case, the standing dead trees made excellent perches for raptorial birds which migrate through the area, so they were left standing, and a stand of many black pine snags remains in the present-day. No live Japanese black pines were noted. The notion that the dying pine forest would be reforested with hardwoods has not come to fruition, unfortunately, due to the dominance of invasive vegetation species (see Section 4.9.1).

No current pest management concerns have been identified for Fishers Island. If pesticides are necessary to control a persistent pest, use of integrated pest management techniques will significantly reduce the need for pesticides.

- ❖ In conjunction with ongoing installation activities or other scheduled natural resource surveys, passively monitor trees and shrubs for signs of pest infestation, such as bore holes in bark, fungus growth, or other forms of disease.
- ❖ If the need for pest control arises, take action as early as possible, and employ targeted, sustainable IPM methods, such as: education; habitat modification; biological, genetic, mechanical, and physical control; and where necessary, the judicious use of least-hazardous pesticides.

4.8.2 Seneca Lake

Staff at Seneca Lake cite nuisance wildlife as a big problem. There is so much guano accumulation from seagulls on the Seneca Lake barges that NUWC washes the deck several times per week during the warmer months (Dobbertin 2016). Decks are washed using water drawn from the lake. These measures are necessary because bird feces can damage the surfaces of equipment, rigging, and decks. NYSDEC has noted the potential for this practice to have localized impacts to water quality, and suggested that the Navy might consider monitoring water quality after washing occurs to determine the effect (Gibbs 2016). To minimize the amount of guano washed into Seneca Lake, the NRM and POC also could work with the Navy commands to determine whether scraping and disposal of guano, or some other cleaning method, could be a viable alternative.

There is no nuisance wildlife control plan in place, and the installation does not hold any take/depredation permits. According to the MBTA, it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird, unless authorized under a permit. Since gulls are migratory birds, and are therefore protected under the MBTA, NAVSTA Newport would have to obtain annual approval in order to conduct depredation activities by applying for the necessary depredation permit through the USFWS Division of Migratory Bird Management.

- ❖ Grid wires suspended on rooftops and barges, audio and visual frightening, or any other technique that will not result in injury or harm may be used to harass gulls. Harassing gulls does not require a permit under the MBTA.
- ❖ Consider whether the guano problem has a severe enough impact on the military mission at Seneca Lake to warrant applying for a depredation permit.

4.8.3 Dodge Pond

No pest management concerns have been identified for Dodge Pond.

4.9 INVASIVE SPECIES MANAGEMENT

Refer to Section 4.9 of the primary INRMP for a general discussion of invasive species management and control methods, regulatory drivers, the integrated pest management (IPM) approach, and best management practices for slowing the spread of invasive species. Refer to Table 2-1 (following Section 2.3.3.3) for the list of invasive species that have been identified at the Outlying Parcels.

4.9.1 Fishers Island

Widespread presence of invasive plant species is the greatest conspicuous ecological concern for the installation. Actions could be taken on source stands on the installation to prevent further spread. As described in Section 2.3.3.1, stands of Japanese knotweed, *Phragmites*, and black locust were delineated during the site walkover surveys in preparation for this INRMP Addendum, so the locations of invasive species stands are generally known. A combination of herbicide application and mowing could be effective measures to combat the most prevalent stands of knotweed and *Phragmites* on the installation. However, a more comprehensive survey would ensure that all invasive plant species and all problem areas at the installation are identified so that an effective invasive species management plan can be developed and implemented. Due to the risk of compromising water quality through groundwater seepage and runoff, it is important that any herbicide application at Fishers Island be targeted rather than broadly applied.

Invasive species management projects to be implemented at Fishers Island include the following:

- ☞ Conduct an installation-wide invasive species inventory and develop an invasive species management plan.
- ☞ Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts.
- ❖ Consult the NYSDEC list of Prohibited and Regulated Invasive Species at 6 NYCRR Part 575 (NYSDEC 2014b) prior to future planting of trees, shrubs, vines, or ornamentals on the installation to ensure that invasive species are avoided.

4.9.2 Seneca Lake

Terrestrial invasive plants/vegetation

As described in Section 2.3.3.2, invasive species dominate the Seneca Lake site in all community classifications. The flora surveys conducted in 2015 provided a good overview of which invasive species dominate which natural communities, and where they are located within the installation. However, a formal baseline survey would ensure that all invasive plant species at the installation are identified so that an effective invasive species management plan can be developed and implemented, with comprehensive controls. Due to the risk of compromising water quality through groundwater seepage and runoff, it is important that any herbicide application at Seneca Lake be targeted rather than broadly applied. To further avoid potential direct and indirect impacts to the lake from the control of invasive species, the Navy will preferably use herbicides that are marketed as safe for use over/near waterbodies.

Invasive species management projects to be implemented at Seneca Lake include the following:

- ☞ Conduct an installation-wide invasive species inventory and develop an invasive species management plan.
- ☞ Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts.
- ❖ Consult the NYSDEC list of Prohibited and Regulated Invasive Species at 6 NYCRR Part 575 (NYSDEC 2014b) prior to future planting of trees, shrubs, vines, or ornamentals on the installation to ensure that invasive species are avoided.

Aquatic invasive species

No aquatic invasive vegetation species were observed at the facility during the survey in preparation for this INRMP Addendum, but presence or absence of such species would need to be verified in a survey that targets aquatic species. Eurasian milfoil, in particular, is widely prevalent around the perimeter of Seneca Lake. Zebra mussels have existed in Seneca Lake for over 20 years; however, staff have observed that their population seems to vary from year to year. Quagga mussel (*Dreissena bugensis*) is also a present invasive species of mussel at Seneca Lake. The greatest impacts to the facility, are the occasional restriction of the water systems on the System Measurement Platform due to mussel buildup. When this occurs, on-site staff remove the intake piping and clean with scrapers and high pressure water. The bottom of the barges and boats also accumulate a buildup which is cleaned via contract divers during inspection every 5 years. Only the M-boats are coated with anti-fouling paint, and this has not been done for many years; however, NUWC is currently putting together a contract to refurbish one of the boats (Dobbertin 2016).

☞ Survey/monitor/control zebra mussels, Eurasian milfoil, and other aquatic invasive species in the lagoon and nearshore area of Seneca Lake.

❖ Support the efforts of local finger lake organizations to reduce the spread of invasive species such as milfoil and zebra mussels by educating staff and public boaters on how to properly clean equipment and avoid contamination.

4.9.3 Dodge Pond

As described in Section 2.3.3.3, bittersweet and poison ivy are abundant on the west fence and on the west side of the pier. Invasive species control measures could be applied to this area, so that a vegetated buffer of native species (e.g., speckled alder, willow, and red osier dogwood) can be established similar to that found on the east side of the pier.

☞ Clean up invasive species on west side of the pier and replant with native species.

Zebra mussels were previously thought to be a problem at Dodge Pond, but CT DEEP does not list the pond among water bodies that are infested. In fact, all areas assessed as being at medium to high risk of colonization by zebra mussels are located in western Connecticut (CT DEEP 2020b). Furthermore, no invasive aquatic species were identified in a survey of the pond’s aquatic vegetation species (Connecticut Agricultural Experiment Station 2013). It beneficial to the military mission to maintain the pond free of invasive species.

☞ Support the efforts of CT DEEP to prevent the spread of aquatic invasive species such as milfoil and zebra mussels by producing signage and educational materials for public boaters on how to properly clean equipment and avoid contamination.

4.10 LAND MANAGEMENT

For a general description of the Navy’s Installation Restoration Program (IRP), refer to Section 4.10.1 of the primary INRMP. The Outlying Parcels do not have individual installation restoration plans, and are not included in the NAVSTA Newport Installation Restoration Plan.

4.10.1 Fishers Island

The *Spill Prevention Control and Countermeasures Plan* (SPCC Plan) prepared for NUWCDIV, Newport in May of 1996 covered Fishers Island Annex. However, this plan is no longer valid due to lack of revisions and changes in oil storage capacity. The current NAVSTA Newport SPCC Plan does not cover any of the Outlying Parcels (NAVFAC 2012). Instead, a simple Spill Response Guide provides instructions for reporting, safety, and avoidance of spill hazards.

Three areas at the Annex store or use oils: Battery 111, HECP / Building 261, and the Submarine Antennae Platform and Winch.

Battery 111

Battery 111, located west of the salt pond, is partially located below the ground surface. One 1,000-gallon single-walled steel AST, located within the battery, was historically used to fuel the heating system. The most likely spill scenario was a fueling hose rupture during filling from a tanker truck, with a maximum expected spill of less than 100 gallons, as fueling operations are constantly manned (NUWCDIV, 1997b). This tank has since been removed, reducing the total oil storage on the installation to below the SPCC-threshold of 1,320 gallons (Geremia 2015).

HEPC Building 261

A 275-gallon, cylindrical, steel AST on the east side of Building 261 is confined within a concrete berm and has a fiberglass roof for protection from the elements. The tank is used to store diesel fuel for the building's heating system. The most likely spill scenario would be an accident occurring while refueling the tank such as a ruptured tanker truck fill line or overfill of the storage tank. Overfill spillage would be contained in the tank's containment area (NUWCDIV, 1997b).

In accordance with SPCC recommendations (NUWCDIV, 1997b), a spill containment kit is available at the tank to help with rapid response in the event of a spill situation. Additionally, single-wall copper supply lines have been replaced with double-walled containment piping, and the roofing system has been made more water-tight upon its replacement, minimizing the accumulation of precipitation within the secondary confinement structure.

Submarine Antennae Platform and Winch

The antennae platform and winch each contain approximately 50 gallons of hydraulic fluid. The majority of the fluid is stored in the reservoir of each unit. Site observations indicated evidence of a small area of soil stained on the eastern side of the winch. The SPCC predicted two potential spill scenarios in this area. The first would be if the antennae platform ruptured a line while being operated underwater; releasing hydraulic fluid into the water and creating a potential threat to the nearby shoreline. In the second scenario, a ruptured hydraulic line on the winch or an accident while changing the hydraulic fluid in one of the units could result in soil contamination. A spill at either unit would be limited to 50 gallons, the maximum storage capacity of the reservoir (NUWCDIV, 1997b).

In accordance with SPCC recommendations (NUWCDIV, 1997b), spill equipment consisting of sorbent socks (100') and oil absorbent pads are kept near the SSTP to contain and cleanup potential spills from the equipment. The hydraulic fluid has been replaced with an FDA-approved, biodegradable hydraulic fluid. In addition, when the Submarine Antenna Platform is being deployed, personnel have a utility boat available, with a Class two or Class three boom (100 feet), to contain potential spills and to protect the shore.

4.10.2 Seneca Lake

NAVUNSEAWARCEN OSO DRESDEN NY recently finalized a new *Spill Prevention, Control, and Countermeasures Plan* (SPCC Plan) for the Seneca Lake Sonar Testing Facility (NAVUNSEAWARCEN OSO DRESDEN NY 2015). The purpose of the SPCC Plan is to prevent oil discharges from occurring, and to prepare the Seneca Lake Sonar Test Facility to respond in a safe, effective, and timely manner to mitigate the impacts of a discharge.

This SPCC Plan has been prepared to meet the requirements of Title 40, Code of Federal Regulations, Part 112 (40 CFR Part 112) as well as the New York Department of Environmental Conservation (NYDEC) Petroleum Bulk Storage Regulations as referenced in 6 NYCRR Part 612.1(c) and the New York State Navigation Law, Article 12, Part 1, chapter 172. In addition to fulfilling requirements of 40 CFR Part 112, this SPCC Plan is used as a reference for oil storage information and testing records, as a tool to communicate practices on preventing and responding to discharges with employees, as a guide to facility inspections, and as a resource during emergency response (NAVUNSEAWARCEN OSO DRESDEN NY 2015).

The Seneca Lake Sonar Test Facility employs a 500-gallon diesel tank, a 500-gallon gasoline tank, two 200-gallon diesel generator tanks, and minimal small quantity storage in containers less than 55 gallons in volume. The total aggregate above ground storage is approximately 2,300 gallons and may vary based on delivery and usage of virgin petroleum products as well as disposal of waste or spent petroleum products. The two 500-gallon tanks are Convault tanks that were installed in 1996. In addition to the typical Convault tank construction, specifically, a steel tank inside of a bag, encased in concrete, there is also containment below each of the tanks. Both Convault tanks are sheltered from the weather (NAVUNSEAWARCEN OSO DRESDEN NY 2015). Seneca Lake Sonar Test Facility follows the federal protocol laid out in the installation’s 2015 SPCC Plan for the handling, use, and transfer of oil products.

Facilities that could reasonably be expected to cause Substantial Harm to the environment by discharging oil into or on navigable waters are required to prepare and submit Facility Response Plans. Utilizing a self-selection process, the facility is not expected to cause Substantial Harm to the environment by discharging oil into or on navigable waters or adjoining shorelines. The Seneca Lake Sonar Test Facility does transfer small quantities of oil over water, but does not have a total storage capacity greater than 42,000 gallons (NAVUNSEAWARCEN OSO DRESDEN NY 2015). Consequently, the facility does not meet the requirement for a Facility Response Plan as specified in 40 CFR 112.120.

The SPCC Plan describes three spills that occurred during the five-year period from 2010 to 2015. They included two small oil leaks (less than half a gallon each) and the release of gray water. In all cases, spill containment and cleanup measures were applied in accordance with regulatory requirements. Now that the SPCC Plan is in place, in the event of an oil spill, employees are directed to follow discharge response procedures, and then order the Spill Contingency Plan into effect. Spill kits are stored at the two 500-gallon underground storage tank (UST) locations: one, between Building 4 and the concrete loading area, and the other, on the southeastern corner of the marina alongside the lagoon. For information on potential discharge volumes and flow directions, containment measures, training, and discharge prevention, refer to the Seneca Lake Sonar Test Facility SPCC Plan (NAVUNSEAWARCEN OSO DRESDEN NY 2015).

- ❖ Seneca Lake Sonar Test Facility will follow the protocol laid out in the installation's 2015 SPCC Plan for the handling, use, and transfer of oil products. In the case of a leak or spill, the SPCC Plan's discharge response procedures will be followed, and Seneca Lake Sonar Test Facility's Oil Spill Contingency Plan will be put into effect.

4.10.3 Dodge Pond

The *Spill Prevention Control and Countermeasures Plan* (SPCC Plan) prepared for NUWCDIV, Newport in May of 1996 covered Dodge Pond Field Station. However, this plan is no longer valid due to lack of revisions and changes in oil storage capacity. The current NAVSTA Newport SPCC Plan does not cover any of the Outlying Parcels (NAVFAC 2012). Instead, a simple Spill Response Guide provides instructions for reporting, safety, and avoidance of spill hazards at Dodge Pond.

Potential spill risks at Dodge Pond were identified at Building 110, the test barge, and Building 109, as described below.

Building 110

Small spills of hazardous materials could occur at Building 110 during transportation and would be confined to the building. No floor drains are located in the building. A spill of less than one gallon occurring in a locker would be contained within the locker.

Test Barge

Small spills of hazardous materials could occur during transportation and would be confined to the second floor of the barge. A large spill on the barge could result from a ruptured drum; such a spill would be contained in the spill pallet. An open area to the pond exists in the center of the barge. Any spill occurring on the barge would be containerized, using the spill kit located next to the hazardous materials locker. A spill of less than one gallon occurring in a locker would be contained within the locker.

Building 109

A spill could occur during the filling of the 275-gallon tank in the basement of Building 109. Approximately five gallons maximum would leak during filling. A bag of absorbent rags is located next to the tank. The floor drain located in the basement is capped.

The SPCC Plan of 1996 recommended that spill kits be placed in Building 109 and on the barge, and that the 275-gallon heating oil storage tank in Building 109 be clearly marked with capacity and an identification number. These management actions have been implemented, and spill prevention countermeasures are ongoingly employed.

4.11 OUTDOOR RECREATION

As is described in the primary INRMP, NAVSTA Newport offers military personnel and their families a variety of recreational opportunities at the main installation, under the guise of the Morale, Welfare and Recreation (MWR) department. The Navy is committed to increase opportunities for outdoor recreation such as these, with the exception of parcels where security is a concern that prohibits such activity. Due to the fact that the missions of the Outlying Parcels are focused on research, development, and testing, it is not possible for the Navy to make these properties available for outdoor recreation.

4.12 CONSERVATION LAW ENFORCEMENT

Conservation law enforcement staff is not present on any of NAVSTA Newport's Outlying Parcels. Due to the highly restricted access to these installations, and lack of outdoor recreation such as hunting or fishing programs, conservation law enforcement is not a pertinent issue.

4.13 ENVIRONMENTAL AWARENESS, EDUCATION, AND OUTREACH

Due to the limited staff and restricted access to the Outlying Parcels, there are very limited opportunities to engage and educate personnel or community members in environmental awareness.

The following management actions are ideas that, if able to be implemented, would increase environmental awareness both on and off the installation:

- Hold a Fishers Island Clean-Up Day. Involve available staff from the Environmental Divisions of NAVSTA and NUWC in the effort, along with personnel who are regularly onsite at Fishers Island, and grounds maintenance contractors in activities such as:
    - trash clean-ups along the shore of the installation
    - invasive plant removal
    - native species plantings
    - installing bluebird and bat boxes
- Collaborate with CT DEEP to develop educational signage to be posted at the Dodge Pond Boat Ramp for fishermen and boaters on how to, "Keep Dodge Pond Clean," by preventing the spread of invasive aquatic species such as milfoil and zebra mussels. Responsible practices could be described and pictured, such as proper cleansing of personal footwear, waders, boats, and fishing equipment, and other steps to avoid contamination. Training of Natural Resources Personnel (Refer to Section 4.14 of the NAVSTA Newport Primary INRMP)

4.14 GIS MANAGEMENT, DATA INTEGRATION, ACCESS, AND REPORTING

In accordance with guidance pertaining to the use of GIS for natural resource management, all GIS data layers associated with the NAVSTA Newport INRMP are provided to NAVFAC MIDLANT and NAVSTA Newport's Environmental Division. All GIS data created or modified for use in this INRMP follows the spatial data standards for facilities, infrastructure, and environment (SDSFIE). Likewise, all GIS deliverables associated with implementation of applicable INRMP projects should adhere to SDSFIE.

The map figures presented in this INRMP were developed using:

- existing digital data files provided by the Navy Geo-Readiness Center in spring 2014;
- photo interpretation and field reconnaissance of aerial photography;
- other GIS databases available to the public.

The base imagery used is a color-balanced image mosaic, one-meter ground sample distance (GSD), high-resolution digital orthophotographs produced from aerial photos collected over New York and Connecticut. The imagery is projected to Universal Transverse Mercator, Zone 18 North, World Geodetic System 1984. The data produced from this effort are provided in Universal Transverse Mercator, World Geographic System 1984, Zone 18N.

Additional data from publically available sources such as the U.S. Geological Survey, USFWS National Wetlands Inventory, and NOAA were used to identify the state of natural resources within and beyond the installation boundaries, enabling the management planning process to take into account the greater ecosystem in which the installations exist, and providing insight into the natural resource-related interests of other stakeholders.

4.15 LEASES

Pursuant to the Sikes Act (16 U.S.C. 670a *et seq*.) as amended and DOD Policy, INRMPs address natural resource management on all lands for which the installation has real property accountability, including lands used via license, permit, or lease, and lands occupied by tenants or lessees.

At Fisher's Island, NAVSTA Newport leases Building 253, which sits atop Mount Prospect, to the U.S. Coast Guard (USCG) for the remote operation of the Harbor Entrance Control Point (HECP), which comprises an automated identification system for monitoring maritime traffic entering and exiting Long Island Sound. The license provides the USCG non-exclusive use of the space. NUWCDIV's ELF operational receiving site is also located on the premises of Building 253. This Real Estate Agreement (Navy File No. LIC-O-11021) was most recently renewed on 07 November 2014 (DON 2014), covering the period from 01 November 2014 to 31 October 2019.

Since 1952, the Navy has continuously leased 23.5 acres at Dodge Pond (which totals 33 acres in area) from the State of Connecticut for a nominal fee of $1 per year, with ingress and egress rights thereto.

4.15.1 Installation Service Support Agreements (ISSAs)

This section is not applicable; there are no ISSAs at NAVSTA Newport's Outlying Parcels.

4.15.2 Enhanced Use Leasing (EULs)

This section is not applicable; there are no EULs at NAVSTA Newport's Outlying Parcels.

4.15.3 Agricultural Outleases (N/A)

This section is not applicable; there are no Agricultural Outleases at NAVSTA Newport's Outlying Parcels.

5.0 PROJECT DESCRIPTIONS

This chapter provides the descriptions for projects introduced in Chapter 4 (and a couple of projects that are discussed in Chapter 3). The INRMP Project Summary Table, located in Appendix C, contains a listing of all the projects with their applicable project codes, implementation schedule, the legal driver, the Navy assessment level, funding priorities, cost estimates, funding sources, and the targeted dates for completion. The projects are intended to develop, enhance, and maintain natural resources management practices at NAVSTA Newport's Outlying Parcels, and they have been prioritized for implementation. The DOD funding priority classifications are explained in Section 6.1.1 *Programming Hierarchy*.

The following sections details the projects identified for each of the Outlying Parcels. The INRMP project descriptions below address relevant INRMP goals and objectives that each project supports, in addition to details such as anticipated location, potential collaborators, timeframe for implementation, and recurrence.

5.1 FISHERS ISLAND

Project 1. Stabilize beaches and bluffs to benefit birds of conservation concern.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 1.2. Enhance the function(s) and value(s) of NAVSTA Newport's Outlying Parcels' aquatic freshwater, brackish, and coastal ecosystems through the protection and restoration of wetlands and shorelines, using living shoreline stabilization techniques, where feasible. Objective 3.3 Restore and enhance wildlife habitats at NAVSTA Newport's Outlying Parcels.
Location	Steep, eroding bluffs at western end of installation shoreline on Long Island Sound
Potential Collaborators	USACE, NYSDEC, New York State Coastal Management Program, and/or Town of Southold
Project Description	During site visits in preparation for this INRMP Addendum, extensive bank erosion was observed along the shoreline, which is mostly unvegetated. The Navy will attempt to stabilize the bank and restore the eroding habitat by planting small areas of eroded shoreline with coastal shrubs and grasses, and monitoring the success of revegetation to determine its effectiveness before undertaking a large-scale effort. In addition to reducing erosion, this would also benefit birds of conservation concern by restoring beach and bluff habitats. The coastline of the Navy's Fishers Island property has been designated

	by NYSDEC as a Coastal Erosion Hazard Area pursuant to the New York Coastal Erosion Hazard Areas Act. Specifically, the installation coastline is a natural protective feature area. The new construction, modification, or restoration of coastal erosion control measures are regulated activities which would require a Coastal Erosion Management Permit issued by the Town of Southold. Therefore, construction of a new bulkhead along the beach or grading of the bluff (e.g., to facilitate seeding or infiltration and drainage controls) would require a permit. Refer to Section 4.2.1 for the required components of a Coastal Erosion Management Permit. Planting or seeding of the bluff face may be considered to be maintenance and not require a permit; this approach stands out as the most cost-effective option, and is recommended as the initial management strategy. Ideally, soft or "living shoreline" techniques are one of the preferred methods for abating coastal erosion since hardened/structural shoreline methods can have detrimental impacts on natural resources. Living shorelines are the term used for restoring a natural shoreline (often of fringe salt marsh vegetation) to provide the benefit of storm-surge buffering and reduction of coastal erosion. Typically, a living shoreline project involves restoring an eroding coastal area by first grading the bank back to a gradual slope and then re-vegetating with natural wetland or beach vegetation. It also can include "soft engineering" (or bioengineering) techniques to abating coastal erosion such as installing coir logs, which are made from woven coconut fiber and can be used at the base of an eroding bank or salt marsh. Additional coastal restoration techniques may need to be considered (e.g., vegetation enhancement, bioengineering, and bank grading) based on the characteristics of coastal erosion areas and the success of the attempt to establish shrubs and grasses by planting and seeding. This project is expected to require multiple years to complete.

Project 2. Conduct an installation-wide invasive species inventory and develop an invasive species management plan.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species. Objective 3.6. Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.
Location	Installation-wide

Potential Collaborators	N/A
Project Description	Widespread presence of invasive plant species is the greatest conspicuous ecological concern for the installation. Stands of Japanese knotweed, *Phragmites*, and black locust were delineated during the site walkover surveys in preparation for this INRMP Addendum. The Oriental/Asiatic bittersweet is intermingled with the *Phragmites* stand in the freshwater wetland along the eastern side of the installation, forming a dense, jungle-like tangle. Japanese knotweed was noted in multiple locations, including one spot southwest of the SATF, near the salt-pond's beach; one large and one small stand along the northeastern installation boundary; and another small stand on the south side of the main east–west road, located east/northeast of the Battery. Two black locust stands were identified, located to the east and north of the SATF. Although the major locations of invasive species stands are generally known, a more comprehensive survey would ensure that all invasive plant species and all problem areas at the installation are identified so that an effective invasive species management plan can be developed and implemented. Following completion of an installation-wide invasive species survey, an invasive species management plan will be developed. The plan will identify priority species and habitats for invasive species control, and will lay out recommended methods, timing, and recurrence of treatments for controlling each target species. This is a high-priority project anticipated to be implemented and completed over the course of two fiscal years.

Project 3. Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.3. Restore and enhance wildlife habitats at NAVSTA Newport's Outlying Parcels. Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species. Objective 3.6. Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.
Location	Installation-wide
Potential Collaborators	N/A
Project Description	This project will implement the invasive species management plan that

	will be developed under Project 2. The plan will identify priority species and habitats for invasive species control, and will lay out recommended methods, timing, and recurrence of treatments for controlling each target species. In areas where the objective is to restore native habitats, planting of native shrubs and vegetation may need to occur along with the control of invasive species. This project will require an initial intensive effort to control and eradicate large, dense stands of invasive species, which may occur in multiple stages, followed by a recurring effort (e.g., annual maintenance) in accordance with the management actions and timeframe(s) identified in the Invasive Species Management Plan.

Project 4. Enter migratory bird species occurrences in the DOD Partners in Flight program's Coordinated Bird Monitoring Database.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, NGOs, universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport's Outlying Parcels. Objective 6.1. Maintain interagency cooperation with USFWS, NOAA, related DOD programs, NYSDEC, and CT DEEP.
Location	N/A
Potential Collaborators	USFWS, NYSDEC, DOD Partners in Flight
Project Description	The DOD and USGS Coordinated Bird Monitoring Plan calls for data to be stored in the Coordinated Bird Monitoring Database and periodically updated. Data documenting the observations of avian species during baseline surveys in preparation for this INRMP Addendum will be logged promptly upon completion of the updated document. In ongoing support of the DOD Partners in Flight program, as additional and more comprehensive fauna surveys are conducted, migratory bird species will be noted and entered in the DOD database. Ideally, data should be checked for quality and then uploaded immediately following each field season.

Project 5. Conduct an emergence count at least three times per year (bi-annually) to document use of bat roosts.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species, as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport's Outlying Parcels.
Location	TBD based on the installation-wide roost search results
Potential Collaborators	USFWS, NYSDEC
Project Description	Bi-annually conduct an emergence count at least three times per year (spring, summer, and fall) at a variety of sites (i.e., abandoned buildings, large trees with cavities, underground storage, etc.) to document the presence of any bat roosts. Surveys should begin 45 minutes before sunset and continue for approximately two hours, with the approximate number of bats counted. Survey locations should be based on findings from the annual installation-wide roost search (Project 6). This project is programmed to recur on every even-numbered fiscal year.

Project 6. Conduct baseline bat surveys, including acoustic monitoring, mist-netting, and summer bat roost searches. Repeat acoustic monitoring every 3–5 years.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species, as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport's Outlying Parcels.
Location	Natural habitats and potential roosts across the installation
Potential Collaborators	USFWS, NYSDEC

Project Description	Baseline surveys will be conducted to determine which bat species are present at the installation, and particularly, whether the federally threatened and state-threatened northern long-eared bat occurs and/or roosts there. Surveys should span from roughly April/May to September/October; due to the remoteness of the installation, three separate targeted surveys of 2 nights each in the spring, summer, and fall are likely to be more effective than continuous passive acoustic monitoring. Multiple locations may be surveyed at once by setting up passive acoustic survey stations in combination with active acoustic monitoring. Data should be analyzed using the same techniques used during previous surveys at NAVSTA Newport. Acoustic monitoring should be repeated every 3 to 5 years. If the northern long-eared bat or other protected species of concern are acoustically identified, a mist-net survey for *Myotis* bat species should be conducted in natural habitat areas at Fishers Island Annex. Mist-netting should follow established USFWS protocols for trapping *Myotis* species. The netting protocols should adhere to established WNS decontamination guidelines. Mist-netting capture surveys should consist of two net sets per night at different locations, and could be combined with telemetry to identify hibernacula as an additional option. Any *Myotis* species captured should be banded per USFWS guidelines. In conjunction with mist netting, a passive bat detector should be deployed at each net to acoustically document bat species calls. In conjunction with other summer survey efforts, potential roosts and hibernacula across the installation shall be searched for the presence of bats (by detection of guano) to learn where bats are roosting. Abandoned barracks on the northwest corner of the installation and the three bunkers in the center of the installation have the potential to be used as hibernacula, and should be checked.

Project 7. Conduct a survey for rare, threatened, and endangered species.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.

Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 6.1. Maintain interagency cooperation with the USFWS, the National Oceanic and Atmospheric Administration (NOAA), related DOD programs, the New York State Department of Environmental Conservation (NYSDEC), and Connecticut Department of Energy and Environmental Protection (CT DEEP).
Location	Natural habitats and potential roosts across the installation
Potential Collaborators	USFWS, USDA NRCS, and NYSDEC
Project Description (continued next pg.)	Installation-wide surveys are warranted to detect and confirm the presence of any rare, threatened, and endangered (RTE) species at Fishers Island Annex. The installation contains suitable habitat to support federally and state-protected flora and fauna species, but their presence is generally uncertain. Based on the most recent data available from the USFWS, USDA NRCS, and NYSDEC, the following species have the potential to occur and should be included in this project: Northern long-eared bat; American bittern; Common loon; Common tern; King rail; Least tern; Northern harrier; Osprey; Piping plover; Red knot; Roseate tern; Seaside sparrow; Whip-poor-will; Spotted Turtle; Wood Turtle; Field dodder; Golden dock; Large-calyx goosefoot; Marsh straw sedge; Red-rooted flatsedge; Salt marsh spikerush; Salt meadow grass; Sandplain gerardia; Seabeach amaranth; Seacoast angelica; Seaside orach

	Comprehensive RTE surveys may determine that some of these species are not, in fact, present within the installation property. For protected species whose occurrence is confirmed, the identification of the locations and/or habitats where they are found will inform both the future management of the installation and the assessment of potential environmental impacts of actions which the Navy intends to take. Implementation of this project should include the following: • Coordination with the NYSDEC Division of Fish and Wildlife and Natural Heritage Program personnel to identify survey protocols for protected species that have the potential to occur at the installation; • Conducting a detailed survey that provides species counts and population trends for protected species in their respective habitats using detailed survey protocols as determined through coordination with NYSDEC and other interested agencies; • Developing recommendations to maintain and/or enhance the respective species habitat, based on survey results. This project is a high priority and funding will be sought for the next cycle, in FY17.

Project 8. Periodically monitor known and potential RTE species habitats (every 5 years).

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 6.1. Maintain interagency cooperation with the USFWS, the National Oceanic and Atmospheric Administration (NOAA), related DOD programs, the New York State Department of Environmental Conservation (NYSDEC), and Connecticut Department of Energy and Environmental Protection (CT DEEP).
Location	Natural habitats and potential roosts across the installation
Potential Collaborators	USFWS, USDA NRCS, and NYSDEC

Project Description	To follow up on the results of the RTE survey to be conducted under Project 7, periodic monitoring of known and potential RTE species habitats should be conducted. If federal threatened or endangered species are confirmed to be present within the installation, it would be prudent to escalate the timeframe to monitor those protected species populations to recur annually. Detailed, installation-wide RTE species surveys should be repeated every 5 years. The same type of agency coordination described under Project 7 is warranted for the ongoing monitoring of protected species.

Project 9. Conduct an installation-wide wetlands delineation.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of the aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines of NAVSTA Newport's Outlying Parcels, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation. Objective 1.3. Avoid and protect perimeter, streambank, and floodplain wetlands in accordance with state regulations (at a minimum), and enhance these riparian areas consistent with other management objectives (e.g., water quality, habitat requirements) to the extent practicable.
Location	Installation-wide
Potential Collaborators	USACE, NYSDEC
Project Description	A jurisdictional wetlands delineation across the installation is needed to comply with the requirement of military installations under the CWA to identify and locate jurisdictional waters of the United States, including wetlands that have the potential to be affected by activities associated with the military mission. By ensuring that wetland boundaries are properly defined, impacts on wetlands can be avoided or minimized, and when not possible, mitigation measures can be determined. This project is currently scheduled to occur after the completion of the RTE species survey, the invasive species inventory, invasive species controls and habitat restoration, but it should be given higher priority and completed sooner if the Navy anticipates any future construction projects or development of the Fishers Island Annex that would require the evaluation of environmental impacts.

Project 10. Establish wildflower habitat including native milkweed varieties to support the monarch butterfly.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.3. Restore and enhance wildlife habitats at NAVSTA Newport's Outlying Parcels. Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species.
Location	TBD
Potential Collaborators	USACE, NYSDEC
Project Description	As a pro-active, stewardship measure to support the monarch butterfly, which has been identified at Fishers Island, and undergoing a Status Review by the USFWS for possible listing under the ESA, the Navy will establish pollinator habitat including native milkweed plants. Milkweed is a vital food source for the survival of monarch caterpillars, so it attracts the adult monarch butterflies, which can only successfully reproduce where milkweed is present to lay their eggs upon. Milkweed can be planted in flower beds in developed areas close to buildings, or scattered with other wildflower seeds in well-drained, grassy fields. Non-native varieties are often sold as ornamental plants, but native varieties that will thrive in the temperate New England climate should be selected. To provide habitat for a variety of native pollinators, diverse floral sources that provide a succession of flowers throughout the spring, summer and fall are needed so nectar and pollen are available to insects for the entire growing season. Flowers of different shapes also are needed to attract pollinators with different body sizes and mouthparts. A variety of other native wildflower species, which are adapted to coastal New York's growing conditions and native pollinators, may be planted and interspersed among the milkweed beds. Established improved landscaping beds and/or no-mow areas should be selected in order to allow the flowering plants to flourish and complete their natural cycles of seed dispersal.

5.2 SENECA LAKE

Project 1. Conduct an installation-wide invasive species inventory and develop an invasive species management plan.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species. Objective 3.6. Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.
Location	Installation-wide
Potential Collaborators	USDA and NYSDEC
Project Description	Invasive species dominate the Seneca Lake site in all natural areas and community classifications. To expand upon the data gathered in the 2015 baseline flora surveys, a formal installation-wide, invasive species inventory will be completed to ensure that all invasive plant species at the installation are identified and their corresponding locations documented. Following completion of an installation-wide invasive species survey, an invasive species management plan will be developed. The plan will identify priority species and habitats for invasive species control, and will lay out recommended methods, timing, and recurrence of treatments for controlling each target species. This is a high-priority project anticipated to be implemented and completed over the course of two fiscal years.

Project 2. Implement the invasive species management plan, once completed, with invasive species control and habitat restoration efforts.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.3. Restore and enhance wildlife habitats at NAVSTA Newport's Outlying Parcels. Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species. Objective 3.6. Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.

Location	Installation-wide
Potential Collaborators	N/A
Project Description	This project will implement the invasive species management plan that will be developed under Project 1. The plan will identify priority species and habitats for invasive species control, and will lay out recommended methods, timing, and recurrence of treatments for controlling each target species. In areas where the objective is to restore native habitats, planting of native shrubs and vegetation may need to occur along with the control of invasive species. This project will require an initial intensive effort to control and eradicate large, dense stands of invasive species, which may occur in multiple stages, followed by a recurring effort (e.g., annual maintenance) in accordance with the management actions and timeframe(s) identified in the Invasive Species Management Plan.

Project 3. Monitor periodically (every 5 years) for presence of the federally endangered plant, *Rhodiola integrifolia ssp. Leedyi*.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 6.1. Maintain interagency cooperation with the USFWS, the National Oceanic and Atmospheric Administration (NOAA), related DOD programs, the New York State Department of Environmental Conservation (NYSDEC), and Connecticut Department of Energy and Environmental Protection (CT DEEP).
Location	North side of lagoon
Potential Collaborators	USDA NRCS and NYSDEC Natural Heritage Program
Project Description	Due to occurrence of the federally endangered Leedy's roseroot in proximity of the Seneca Lake Detachment, and the identification of suitable habitat for the species on the north side of the facility lagoon (beyond the security fence), periodic monitoring should be conducted every 5 years. If the species is confirmed to be present within the installation, it would be prudent to escalate the timeframe for monitoring

	to recur annually. Implementation of this project should include Coordination with the NYSDEC Natural Heritage Program personnel to identify potential habitat and survey protocols for the Leedy's roseroot.

Project 4. Survey/monitor/control zebra mussels and other aquatic invasive species in the lagoon and nearshore area of Seneca Lake.

Applicable INRMP Goal(s)	Goal 1. Manage water resources to sustain and enhance water quality of surface waters, wetlands, the nearshore environment, and other aquatic ecosystems, using a watershed approach. Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, non-governmental organizations (NGOs), universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 1.1. Assess biological conditions, including water quality, of the aquatic ecosystems, special aquatic sites (e.g., mudflats and submerged aquatic vegetation beds) and shorelines of NAVSTA Newport's Outlying Parcels, focusing on areas that have the potential to be affected by stormwater runoff, point and non-point source pollution, and/or erosion and sedimentation. Objective 3.6. Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health. Objective 6.2. Develop partnerships with academic institutions, applicable state and federal agencies, and other local organizations to implement wildlife monitoring and protection programs and habitat restoration projects. Objective 6.3. Coordinate natural resources activities with local community groups, conservation organizations, and private groups.
Location	Aquatic areas around facility structures and vessels
Potential Collaborators	NYSDEC, Finger Lakes Institute at Hobart and William Smith Colleges, and Seneca Lake Area Partners in 5 Counties (SLAP-5)
Project Description	To better manage the zebra mussel population, the lagoon and nearshore area will be surveyed to determine the extent of mussel buildup around facility structures and vessels. Water intake pipes, including at the System Measurement Platform, and the bottoms of barges and boats will be inspected. Based on the survey's determinations, control measures will be

	taken to remove and limit future accumulation of the invasive aquatic organisms. The problem will be monitored annually, and both preventive and control measures will be taken continuously as deemed appropriate. The initial survey and the ongoing effort to monitor and control the zebra mussels should be conducted in accordance with NYSDEC's recommended guidelines and protocols (as well as the DOD's). In addition, assistance, data, and expertise may be available and should be sought from other associations that are dedicated to maintaining the water quality of Seneca Lake. This project is anticipated to be a recurring and ongoing effort.

Project 5. Enter migratory bird species occurrences in the DOD Partners in Flight program's Coordinated Bird Monitoring Database.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, NGOs, universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport's Outlying Parcels. Objective 6.1. Maintain interagency cooperation with USFWS, NOAA, related DOD programs, NYSDEC, and CT DEEP.
Location	N/A
Potential Collaborators	USFWS, NYSDEC, DOD Partners in Flight
Project Description	The DOD and USGS Coordinated Bird Monitoring Plan calls for data to be stored in the Coordinated Bird Monitoring Database and periodically updated. Data documenting the observations of avian species during baseline surveys in preparation for this INRMP Addendum will be logged promptly upon completion of the updated document. In ongoing support of the DOD Partners in Flight program, as additional and more comprehensive fauna surveys are conducted, migratory bird species will be noted and entered in the DOD database. Ideally, data should be checked for quality and then uploaded immediately following each field season.

5.3 DODGE POND

Project 1. Clean up invasive species on west side of pier and replant with natives.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport's Outlying Parcels.
Applicable INRMP Objective(s)	Objective 3.5. Maintain and enhance native vegetation to promote community diversity, and to eradicate or control and monitor noxious, invasive, and exotic plant species. Objective 3.6. Implement integrated pest management controls to reduce or eliminate invasive or nuisance species, and species that pose a potential threat to human health.
Location	West side of facility
Potential Collaborators	N/A
Project Description	Invasive species control measures will be applied to clean up the abundant bittersweet and poison ivy on the west side of the pier and along the west fence. Once the dense, invasive vines are cut back and removed, a vegetated buffer of native species (e.g., speckled alder, willow, and red osier dogwood) will be established similar to that found on the east side of the pier.

Project 2. Enhance wildlife habitats by installing bat boxes and bird houses.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage rare, threatened, and endangered (RTE) species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.3. Restore and enhance wildlife habitats at NAVSTA Newport's Outlying Parcels.
Location	Tank farms
Potential Collaborators	USFWS, CT DEEP
Project Description	As a stewardship action to enhance wildlife habitat, construct and erect two bat boxes and two bird houses of different styles. These structures could potentially benefit the federally threatened and (Connecticut) state-endangered northern long-eared bat (if present) or numerous other state-protected bat species, as well as migratory bird species including the Baltimore oriole and the chestnut-sided warbler, which are Connecticut Species of Greatest Conservation Need (SGCN). After the first season, evaluate whether the boxes have been used.

Project 3. Enter migratory bird species occurrences in the DOD Partners in Flight program's Coordinated Bird Monitoring Database.

Applicable INRMP Goal(s)	Goal 3. Assess, sustain, and enhance the health of natural vegetation communities, wildlife species populations, and suitable habitats of NAVSTA Newport. Goal 6. Protect, conserve, and enhance the ecological value and diversity of natural resources by building productive relationships with resource and regulatory agencies, regional partnerships, NGOs, universities, and the public, to sustain the military mission.
Applicable INRMP Objective(s)	Objective 3.1. Identify, monitor, and manage RTE species in the terrestrial, aquatic, and marine (nearshore) environments. Objective 3.2. Identify, monitor, and manage shorebird and migratory bird populations, including waterfowl and neotropical species as well as bats, to minimize "takes" of these species resulting from military readiness activities at NAVSTA Newport's Outlying Parcels. Objective 6.1. Maintain interagency cooperation with USFWS, NOAA, related DOD programs, NYSDEC, and CT DEEP.
Location	N/A
Potential Collaborators	USFWS, CT DEEP, DOD Partners in Flight
Project Description	The DOD and USGS Coordinated Bird Monitoring Plan calls for data to be stored in the Coordinated Bird Monitoring Database and periodically updated. Data documenting the observations of avian species during baseline surveys in preparation for this INRMP Addendum will be logged promptly upon completion of the updated document. In ongoing support of the DOD Partners in Flight program, as additional and more comprehensive fauna surveys are conducted, migratory bird species will be noted and entered in the DOD database. Ideally, data should be checked for quality and then uploaded immediately following each field season.

6.0 IMPLEMENTATION

Implementation of this INRMP will follow an annual strategy that addresses legal requirements, DOD and Navy directive or policy requirements, funding, implementation responsibilities, technical assistance, labor resources, and technological enhancements. This INRMP will be considered implemented once the following actions are completed:

1) Funding is secured for completion of all Environmental Readiness Level (ERL) 4 projects, as described in Section 6.3 of the NAVSTA Newport Primary INRMP.
2) Installation is staffed with a sufficient number of professionally trained environmental staff needed to perform the tasks required by the INRMP.
3) Annual coordination with all cooperating offices is performed.
4) Specific INRMP action accomplishments that are undertaken are documented each year.

The following sections provide an overview of the role that implementation of this INRMP would play in understanding project development and classification, achieving no net loss, identifying funding sources, establishing commitment, and endorsing the use of cooperative agreements. The project table presented in Appendix C provides information for the implementation schedule, prime legal driver and initiative, class, Navy assessment level, cost estimate, and funding source for each of the projects proposed in this INRMP.

6.1 PROJECT DEVELOPMENT AND CLASSIFICATION (REFER TO SECTION 6.1 OF NAVSTA NEWPORT PRIMARY INRMP)

6.2 ACHIEVING NO NET LOSS OF MILITARY MISSION (REFER TO SECTION 6.2 OF NAVSTA NEWPORT PRIMARY INRMP)

6.3 FUNDING SOURCES

The primary sources for funding Navy NRPs include the following:

1) Operation and Maintenance, Navy (O&MN) Environmental Funds
2) DOD Legacy Resource Management Program (Legacy Program) Funds
3) Forestry Revenues
4) Agricultural Outleasing
5) Fish and Wildlife Fees
6) Recycling Funds
7) Strategic Environmental Research and Development Program (SERDP) Funds
8) Other Non-DOD Funds

The first seven funding sources listed above are covered in Section 6.3 of the NAVSTA Newport Primary INRMP. The following section will describe additional grant programs and funding opportunities outside of the DOD that pertain to natural resources projects in the areas where the three Outlying Parcels are located.

6.3.1 Other Non-DOD Funds

Non-DOD funds, such as those received from grant programs, are available to fund natural resources management projects, such as watershed management and restoration, habitat restoration, and wetland and riparian area restoration. Federally funded grant programs typically require non-federal matching funds; however, installations can partner with other groups for preparing proposals for eligible projects.

Other sources of funding may be available for natural resources that the installation may not be able to apply for directly, but could obtain funding for projects by partnering with the state or nonprofit organizations. Section 3.6 discusses potential partnerships and collaboration available to NAVSTA Newport. NAVSTA Newport should consider grant funding and partnerships as a potential funding source for INRMP projects.

Some potential opportunities for funding and grants in collaboration with partners include the following:

- **New York State Department of Environmental Conservation**
  - Competitive grants for environmental protection and improvement are available for municipalities, community organizations, not-for-profit organizations and others; it may be possible for NAVSTA Newport, in conjunction with one or more of its Outlying Parcels, to partner with these entities on a joint project.
  - Funding for projects is available in the following categories:
    - Water Protection Grants
    - Environmental Cleanup Grants
    - Wildlife Protection Grant Programs
    - Land and Forest Protection Grants
  - All vendors (governmental organizations, not-for-profit organizations, Commissions, Authorities, Tribal organizations, etc.) should visit the NYS Grants Reform website, http://www.grantsreform.ny.gov/ and become familiar with the new statewide Grants Gateway, web-based grants management system. The Grants Gateway is an online system that will allow vendors to browse all NYS Agency anticipated and available grant opportunities, providing a one-stop location that will improve the way grants are administered by the State of New York.
  - Beginning January 1, 2014, all grant applicants/vendors must be registered in the NYS Grants Gateway to be eligible to apply for a NYS grant opportunity, to enter into a future contract, and to receive future grant payments.

- **National Invasive Species Control Grant Programs**
  - *U.S. Department of Agriculture (USDA) Grant and Partnership Programs that Can Address Invasive Species Research, Technical Assistance, Prevention and Control - Federal Fiscal Year 2016.* This workbook contains basic information on programs in USDA that could be used to fund and support invasive species related projects. This

list should be a helpful place to start a search for sources of technical and financial resources for invasive species activities but may not include all potential invasive species funding opportunities. Available at: http://www.invasivespeciesinfo.gov/toolkit/grantsusda.shtml.

- Each year the National Fish and Wildlife Foundation (NFWF) coordinates the *Pulling Together Initiative,* in partnership with the Service, the Bureau of Land Management (BLM), the USDA Forest Service (FS), the USDA Animal and Plant Health Inspection Service (APHIS), and the Natural Resource Conservation Service (NRCS). Through this program grants are provided to non-profit organizations and government agencies interested in managing invasive and noxious plant species. For more information, visit http://www.nfwf.org/pti.
- The *Wildlife Restoration Act* provides funding to states for the selection, restoration, rehabilitation, and improvement of wildlife habitat and other projects including those for controlling invasive plants. For more information, visit https://wsfrprograms.fws.gov/Subpages/GrantPrograms/MultiState/MS.htm.
- The *North American Wetlands Conservation Act of 1989* provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands conservation projects in the United States, Canada, and Mexico for the benefit of wetlands-associated migratory birds and other wildlife. Conservation projects can include habitat restoration projects which could include an invasive species component. For more information, visit https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php.

6.4 COMMITMENT (REFER TO SECTION 6.4 OF NAVSTA NEWPORT PRIMARY INRMP)

6.5 COOPERATIVE AGREEMENTS

Section 6.5 of the primary INRMP describes the types of cooperative agreements into which DOD installations may enter in support of their natural resources program. It also highlights the Memoranda of Understanding into which Naval Station Newport has entered. Due to the highly classified nature and restricted accessibility of the Outlying Parcels, the Navy does not have any cooperative agreements in-place relating to the natural resources management of the Outlying Parcels.

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7.0 REFERENCES

Adaptation Subcommittee. 2010. The Impacts of Climate Change on Connecticut Agriculture, Infrastructure, Natural Resources and Public Health. A Report to the Governor's Steering Committee on Climate Change. April. 195 pp. Available at: https://resilientrural.com/wp-content/uploads/2018/10/CT-impactsofclimatechange.pdf. Accessed on 4 August 2020.

Benton, N., J.D. Ripley, and F. Powledge, Eds. 2008. Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers. ISBN 0-9711053-8-3. Arlington, VA: NatureServe. Available at: http://www.DODbiodiversity.org. Accessed on 4 August 2020.

Callinan, C. W. 2001. Chapter 2: Introduction. Water Quality Study of the Finger Lakes. Albany, NY: New York State Department of Environmental Conservation. 24 pp. Available at: https://digitalcommons.brockport.edu/cgi/viewcontent.cgi?article=1076&context=tech_rep. Accessed on 23 February 2020.

CFR (Code of Federal Regulations). 2002. Title 32, Part 190. Natural Resources Management Program. Available at: http://www.gpo.gov/fdsys/granule/CFR-2002-title32-vol1/CFR-2002-title32-vol1-part190/content-detail.html. Accessed 19 October 2020.

Connecticut Agricultural Experiment Station. 2004. Dodge Pond, East Lyme. [Web site]. Last updated 11 July 2013. http://www.ct.gov/caes/cwp/view.asp?a=2799&q=345466. Accessed 20 February 2020.

Connecticut Agricultural Experiment Station. 2015. Dodge Pond, East Lyme. [Web site]. Last updated 2015. https://portal.ct.gov/CAES/Invasive-Aquatic-Plant-Program/D/Dodge-Pond/Dodge-Pond-2015. Accessed 20 February 2020.

Connecticut Department of Environmental Protection. 2005. Connecticut Native Tree and Shrub Availability List. Bureau of Natural Resources: Hartford, Connecticut. 10 pp.

Connecticut Department of Public Health. 2020. If I Catch It, Can I Eat It? A Guide to Eating Fish Safely, 2020 Connecticut Fish Consumption Advisory. Available at: https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/environmental_health/eoha/Fish_/IfICatchIt-2020-final-English.pdf. Accessed 21 October 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection). 2011. Dodge Pond Boat Launch, East Lyme. [Web site]. Last updated 02 November 2011. http://ct.gov/deep/cwp/view.asp?a=2686&q=383852&deepNav_GID=1620. Accessed 20 February 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection). 2013. State of Connecticut Regulation for Connecticut Water Quality Standards. Connecticut Law Journal. State of Connecticut Judicial Branch. Effective October 10. 69 pp.

CT DEEP (Connecticut Department of Energy and Environmental Protection). 2015. Water Quality Standards and Classifications Fact Sheet. [Web site].

http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325620&deepNav_GID=1654. Accessed 16 October 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection). 2018. Water Quality Classifications, East Lyme, CT. Available at: http://cteco.uconn.edu/maps/town/wtrqualcl/WtrQualCl_EastLyme.pdf. Accessed on 19 October 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection). 2020a. About Us. [Web site]. https://portal.ct.gov/DEEP. Accessed 14 February 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection). 2020b. 2020 Connecticut Fishing Guide. Available at: https://portal.ct.gov/DEEP/Fishing/General-Information/Fishing-Guide. Accessed on 25 February 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection), Bureau of Natural Resources. 2015a. Connecticut Wildlife Action Plan, 2015 Revision. Prepared by Terwilliger Consulting Inc. October 28. Available at: http://www.ct.gov/deep/cwp/view.asp?a=2723&q=329520&deepNav_GID=1719#Review. Accessed 27 February 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection), Bureau of Natural Resources. 2015b. Connecticut's Endangered, Threatened and Special Concern Species. [Brochure]. CT DEEP Wildlife Division: Hartford, Connecticut. 20 pp.

CT DEEP (Connecticut Department of Energy and Environmental Protection), Inland Fisheries Division. 2020a. 2020 Spring/Fall Trout Stocking Report. Available at: https://portal.ct.gov/-/media/DEEP/fishing/weekly_reports/CurrentStockingReport.pdf. Accessed 25 February 2020.

CT DEEP (Connecticut Department of Energy and Environmental Protection), Inland Fisheries Division. 2020b. Fish Stocking Report. Available at: https://portal.ct.gov/-/media/DEEP/fishing/general_information/2020-Fish-stocking-report-final-01202021.pdf. Accessed 25 February 2020.

Davis, Robert. 2014a. Personal communication (e-mail) to Shannon Kam Re: NUWC Property Parcels. 19 June.

Davis, Stephen. 2014b. Personal communication recorded by Tetra Tech in Fishers Island Site Visit Planning Meeting Summary (revision). Meeting date 29 July. Meeting summary revised 04 August. 3 pp.

Discover East Lyme. 2015a. About East Lyme, CT. [Web site]. http://discovereastlyme.com/about-east-lyme/. Accessed 20 February 2020.

Discover East Lyme. 2015b. Things to Do. [Web site]. http://discovereastlyme.com/things-to-do/. Accessed 20 February 2020.

Dobbertin, Bud. 2016. Personal communication (e-mail) to M. Geremia Re: NAVSTA Newport projects (INRMP development). Message relayed by M. Geremia to C. Tompsett to S. Kam. 29 January.

DOD (Department of Defense). 2013. Department of Defense Manual (DODM) 4715.03: Integrated Natural Resources Management Plan (INRMP) Implementation Manual. Dated 25 November 2013, Incorporated Change 2 August 31 2018. Available online at: https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodm/471503m.pdf?ver=2018-11-13-125658-050. Accessed 14 February 2020. 31 pp.

DOD (U.S. Department of Defense). 2016. Adaptation Planning for Climate Change in Integrated Natural Resources Management Plans. Available at: https://denix.osd.mil/nr/focus-areas/adaptive-resilience/fact-sheets1/adaptation-planning-for-climate-change-in-integrated-natural-resources-management/. Accessed 18 February 2020.

DOD (U.S. Department of Defense). 2018a. Department of Defense Instruction (DODI) 4715.03: Natural Resources Conservation Program. Dated 18 March 2011, Incorporated Change 2 August 31 2018. Available at: https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/471503p.pdf?ver=2019-02-28-120916-070. Accessed 14 February 2020. 40 pp.

DOD (U.S. Department of Defense). 2018b. Department of Defense (DOD) Manual 4715.03: Natural Resources Conservation Program. Dated 18 March 2011, Incorporated Change 2 August 31 2018. Available at: https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodm/471503m.pdf?ver=2018-11-13-125658-050. Accessed 14 February 2020. 40 pp.

DON (Department of Navy). 2014. Executed Real Estate Agreement, Contract No. N40085-15-RP-00022 (Navy File No. LIC-O-11021). 07 November.

EPA (U.S. Environmental Protection Agency). n.d. Clean Water Act §230.3(q-1) Definitions.

EPA (U.S. Environmental Protection Agency). 2010. Ecoregions of New England. [Website]. Available at: https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=209857&Lab=NHEERL. Last Accessed 22 February 2020.

EPA (U.S. Environmental Protection Agency). 2019. Wetlands Definitions. [Website]. Available at: https://www.epa.gov/cwa-404/how-wetlands-are-defined-and-identified-under-cwa-section-404#:~:text=%22Wetlands%20are%20areas%20that%20are,life%20in%20saturated%20soil%20conditions. Last accessed 22 February 2020.

Federal Emergency Management Agency. 2009. Flood Insurance Rate Map, map number 36103C0019H. [Search results for "Southold, Town of, NY" from the FEMA Flood Map Service Center]. Available at https://msc.fema.gov/portal. Last Accessed 22 February 2020.

FingerLakes.com. 2017. Seneca Lake. [Web site]. https://www.fingerlakes.com/about/. Accessed 18 February 2020.

Fishers Island Conservancy. 2019. Piping Plovers Return to Fishers Island. [Blog]. Available at: https://ficonservancy.org/2019/04/piping-plovers-return-to-fishers-island/. Accessed 27 February 2020.

FisherIsland.net. n.d. About Fishers Island. [Web site]. http://fishersisland.net/about-fishers-island/. Accessed 18 February 2020.

Genova, L. K., A. Hickok, D. E. Hudgens and C. Roberts 2010. "Connecticut." In James G. Titus, Daniel L. Trescott, and Daniel E. Hudgens (Editors). *The Likelihood of Shore Protection along the Atlantic Coast of the United States. Volume 2: New England and the Southeast.* Report to the U.S. Environmental Protection Agency. Washington, DC. 74 pp. Available online at: http://risingsea.net/ERL/CT.html. Accessed 14 October 2020.

Geremia, Michael L. 2015. Personal communication (e-mail) to Shannon Kam Re: INRMP Questions for NUWC Outlying Parcels. 09 December.

Gibbs, John A. 2016. Personal communication (e-mail) to Shannon Kam. Re: Integrated Natural Resources Management Plan. [Agency comments re: Integrated Natural Resource Management Plan (INRMP) Addendum Review for Seneca Lake Detachment]. New York State Department of Environmental Conservation, Region 8. 11 July. 2 pp.

Google Imagery. 2016. Cnew/Spot Image, DigitalGlobe, New York GIS, USDA Farm Service Agency. Available on Google Earth software.

Henry L. Ferguson Museum. 2015. 2015 Annual Exhibition: The History of Farming on Fishers Island. Available at: http://fergusonmuseum.org/2015/05/2015-annual-exhibition-the-history-of-farming-on-fishers-island/. Accessed 27 February 2020.

Hobart and William Smith Colleges, Finger Lakes Institute at Hobart and William Smith Colleges, Genesee/Finger Lakes Regional Planning Council, and Southern Tier Central Regional Planning and Development Board. 2012. Seneca Lake Watershed Management Plan: Characterization and Subwatershed Evaluation. Prepared for New York State Department of State. Geneva, NY: Hobart and William Smith Colleges. Available at: http://people.hws.edu/halfman/Data/SenecaCharacterizationSubwatershedEval.pdf. Accessed 20 February 2020.

Long Island Sound Study. 2016. The Comprehensive Conservation and Management Plan. Management and Conservation. [Web site]. http://longislandsoundstudy.net/about/our-mission/management-plan/management-and-conservation/. Accessed 19 October 2020.

Monaco, William. 2015. Personal communication (e-mail) to Shannon Kam Re: INRMP Questions for NUWC Outlying Parcels. Details of Encroachment Action Plans. 04 November.

Murray-Brown, Mark. 2016. Agency response letter re: Natural Resource Management Plan (INRMP) Addendum Review. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, Protected Resources Division. 25 August. 3 pp.

Naval Sea Systems Command (NAVSEA). 2015a. The Lake. [Web site]. http://www.navsea.navy.mil/Home/Warfare-Centers/NUWC-Newport/What-We-Do/Detachments/Seneca-Lake/Lake-Statistics/. Accessed 20 February 2020.

Naval Sea Systems Command (NAVSEA). 2015b. Welcome to Dodge Pond. [Web site]. http://www.navsea.navy.mil/Home/WarfareCenters/NUWCNewport/WhatWeDo/Detachments/DodgePond.aspx. Accessed 20 February 2020.

Naval Sea Systems Command (NAVSEA). 2015c. Welcome to Seneca Lake. [Web site]. http://www.navsea.navy.mil/Home/WarfareCenters/NUWCNewport/WhatWeDo/Detachments/SenecaLake.aspx. Accessed 20 February 2020.

NAVFAC (Naval Facilities Engineering Command). 2012. Spill Prevention Control and Countermeasure Plan (SPCC). Last accessed 16 August 2013. 47 pp. + Appendices.

NAVFAC Atlantic (Naval Facilities Engineering Command Atlantic). 2018. Atlantic Fleet Training and Testing Final Environmental Impact Statement/Overseas Environmental Impact Statement. Available at: http://navfac.navy.mil/products_and_services/ev/products_and_services/environmental-planning/at_sea_compliance.html. Accessed 23 February 2020.

NAVUNSEAWARCEN OSO DRESDEN NY (Naval Undersea Warfare Center On-site Office Dresden, NY). 2006. Environmental Assessment for Dredging and Shoreline Stabilization at the Naval Undersea Warfare Center Division, Newport On Site Office Dresden, New York. February.

NAVUNSEAWARCEN OSO DRESDEN NY (Naval Undersea Warfare Center On-site Office Dresden, NY). 2015. Seneca Lake Sonar Test Facility Spill Prevention, Control, and Countermeasures Plan. Version 3. Dresden, NY. December. 92 pp.

Navy (U.S. Department of the Navy). 2006. Integrated Natural Resources Management Plan Guidance for Navy Installations: How to Prepare, Implement, and Revise Integrated Natural Resources Management Plans (INRMP). April. 119 pp

Navy (U.S. Department of the Navy). 2019a. OPNAV Instruction 5090.1E (OPNAVINST 5090.1). *Environmental Readiness Program*. Dated September 3, 2019. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington DC. Available at: https://www.secnav.navy.mil/doni/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-00%20General%20Admin%20and%20Management%20Support/5090.1E.pdf. Last accessed 13 February 2020. 4 pp.

Navy (U.S. Department of the Navy). 2019b. OPNAV Manual 5090.1 (OPNAV M-5090.1). Environmental Readiness Program Manual. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington, District of Columbia. January 10. Available at: http://doni.daps.dla.mil/SECNAV%20Manuals1/5090.1.pdf. Accessed 18 November 2013. 996 pp.

New York Natural Heritage Program. 2015a. Online Conservation Guide for *Chenopodium berlandieri* var. *macrocalycium*. [Searchable Website]. Available at: http://www.acris.nynhp.org/guide.php?id=8934. Accessed 26 February 2020.

New York Natural Heritage Program. 2015b. Online Conservation Guide for *Symphyotrichum subulatum* var. *subulatum*. Available at: http://www.acris.nynhp.org/guide.php?id=8749. Accessed 26 February 2020.

New York State Department of State. 2014. Town of Southold LWRP. Approved by New York State Secretary of State 25 February 2014. Available at: https://docs.dos.ny.gov/opd-lwrp/LWRP/Southold_T/Index.html. Office of Planning & Development. Accessed 30 October 2020.

New York State Energy Research and Development Authority. 2014. Responding to Climate Change in New York State (ClimAID). Available at: https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Environmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York. Accessed 14 October 2020.

NOAA (National Oceanic and Atmospheric Administration). 2014. Environmental Sensitivity Index Map. ESI-31 (New London, Conn – N.Y.) and ESI-32 (Mystic, Conn – N.Y. – R.I.). Available at: https://response.restoration.noaa.gov/esi. Accessed 27 February 2020.

NOAA (National Oceanic and Atmospheric Administration) National Climate Data Center. 2020. Monthly Climatological Summary for Shirley Brookhaven Airport, NY, US. Available at: http://www.ncdc.noaa.gov/cdo-web/. Accessed 22 February 2020.

NUWCDIV Newport (Naval Undersea Warfare Center). 1997a. Integrated Natural Resources Management Plan for Dodge Pond Field Station, Niantic, Connecticut. Prepared for NUWCDIV Newport by Louis Berger & Associates, Inc. Providence, RI. April. 72 pp.

NUWCDIV Newport (Naval Undersea Warfare Center). 1997b. Integrated Natural Resources Management Plan for Fishers Island Annex, Fishers Island, New York. Prepared for NUWCDIV Newport by Louis Berger & Associates, Inc. Providence, RI. April. 116 pp.

NUWCDIV Newport (Naval Undersea Warfare Center). 1997c. Integrated Natural Resources Management Plan for Seneca Lake Detachment, Dresden, New York. Prepared for NUWCDIV Newport by Louis Berger & Associates, Inc. Providence, RI. April. 63 pp.

NYSDEC (New York State Department of Environmental Conservation). 2014a. Vessel Waste No Discharge Zone Designation Petition for Lake Seneca and Lake Cayuga, New York. Prepared by the New England Interstate Water Pollution Control Commission. Available at: https://www.dec.ny.gov/docs/water_pdf/ndzfgrlks2014.pdf. Accessed 09 October 2020.

NYSDEC (New York State Department of Environmental Conservation). 2014b. 6 NYCRR Part 575, Prohibited and Regulated Invasive Species. September 10. 4 pp. Available at: http://www.dec.ny.gov/docs/lands_forests_pdf/islist.pdf. Accessed 20 February 2020.

NYSDEC (New York State Department of Environmental Conservation). 2015a. List of Endangered, Threatened and Special Concern Fish & Wildlife Species of New York State. [Web site]. https://www.dec.ny.gov/animals/7494.html. Accessed 23 February 2020.

NYSDEC (New York State Department of Environmental Conservation). 2015b. State Wildlife Action Plan. Draft Final. September. NYSDEC: Albany, NY. 105 pp. Available at: http://www.dec.ny.gov/animals/7179.html. Accessed 26 February 2020.

NYSDEC. 2015c. Sea Level Rise. Projections and Impacts for New York. [Web site] https://www.dec.ny.gov/regulations/103889.html. Accessed 28 February 2020.

NYSDEC (New York State Department of Environmental Conservation). 2016. Water Quality Assessment of New York State 2012. [Online Map]. Available at: https://www.dec.ny.gov/docs/water_pdf/section305b2016.pdf. Accessed 18 October 2020.

NYSDEC (New York State Department of Environmental Conservation). 2019. Seneca Lake. [Web site]. https://www.dec.ny.gov/outdoor/25574.html. Accessed February 20 2020.

NYSDEC (New York State Department of Environmental Conservation). 2020a. About DEC. [Web site]. NYSDEC: Albany, New York. http://www.dec.ny.gov/24.html. Accessed 16 February 2020.

NYSDEC (New York State Department of Environmental Conservation). 2020b. Environmental Resource Mapper. [Online interactive map, with results identified for point W 72.003 N 41.254]. NYSDEC: Albany, New York. Available at: https://www.dec.ny.gov/animals/38801.html. Accessed 22 February 2020.

NYSDEC (New York State Department of Environmental Conservation). 2020c. Tidal Wetlands Categories. [Web site]. NYSDEC: Albany, New York. Available at: https://www.dec.ny.gov/lands/5120.html. Accessed 22 February 2020.

NYSDEC. 2020d. Climate Change in New York. [Web site]. https://www.dec.ny.gov/energy/44992.html. Accessed 23 February 2020.

NYSDEC (New York State Department of Environmental Conservation). 2020e. New York Nature Explorer. [Online interactive search results]. NYSDEC: Albany, New York. Available at: http://www.dec.ny.gov/natureexplorer/app/species/results.16. Accessed 28 February 2020.

OSD (Office of the Undersecretary of Defense). 2006. Memorandum: Integrated Natural Resource Management Plan (INRMP) Template. Available at: https://www.denix.osd.mil/nr/focus-areas/integrated-natural-resource-management-plans-inrmps/guidance/dod-inrmp-template/10_INRMP-TEMPLATE.PDF. Accessed 05 November 2020.

Seneca Lake Pure Waters Association. 2019. Supporting the Seneca Watershed Intermunicipal Organization. [Online brochure]. Available at: https://www.senecalake.org/resources/Documents/August%20Newsletter.pdf. Accessed 27 February 2020.

Tetra Tech, Inc. 2009. Site 1 Dodge Pond Watershed Contaminated Source Document. Naval Undersea Warfare Center – East Lyme. East Lyme, Connecticut. Prepared for Naval Facilities Engineering Command Mid-Atlantic. December. 607 pp.

Tetra Tech, Inc. 2015a. Draft 2015 Data Package for Additional Sediment and Fish Sampling. Site 1 – Dodge Pond. Naval Undersea Warfare Center – East Lyme. East Lyme, Connecticut. Comprehensive Long-term Environmental Action Navy (CLEAN) Contract. Prepared for Naval Facilities Engineering Command Mid-Atlantic. July. 351 pp.

Tetra Tech, Inc. 2015b. Fishers Island and Dodge Pond Spring Avian Memo. Summary of methods, results, and combined species list from 06 October 2014, 26 May 2015, and 27 May 2015 visits. Prepared by C. Parrish.

Tetra Tech, Inc. 2015c. Seneca Lake Post-Field Summary. Memo, species list, annotated maps, and photo log from 13 May 2015 visit. Prepared by A. Hemenway.

Thomson Reuters Westlaw. 2020. Part 701: Classifications-Surface Waters and Groundwaters. Available at: https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=I0682f230b5a111dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default). Accessed 23 February 2020.

Tiner, R. W. 2011. Wetlands and Deepwater Habitats of Long Island, New York: Status 2004—Results of the National Wetlands Inventory. Hadley, MA: U.S. Fish and Wildlife Service, Northeast Region. 28 pp. Available at http://www.fws.gov/northeast/ecologicalservices/pdf/WetlandsDeepwaterHabitatsLI_FINAL.pdf. Accessed 22 February 2020.

Tompsett, Christopher G. 2015. Personal communication [e-mail] to Shannon Kam Re: Take Permits. 09 December.

Town of East Lyme. 2016. Inland Wetlands and Watercourses. [Web site]. http://eltownhall.com/government/departments/land-use/inland-wetlands-watercourses/. Accessed 19 October 2020.

Town of Southold. n.d. Fishers Island. [Web site]. http://www.southoldtownny.gov/index.aspx?NID=242. Accessed 30 October 2020.

Tucker, Gordon C., and Edwin H. Horning. 1993. Fishers Island Water Supply and Watershed Study: Ecological Component. New York State Biological Survey Research Report# 93-3. New York State Museum: Albany, NY.

U.S. Fish Finder. 2010. CT Fish Finder. [Web site]. http://www.cteco.uconn.edu/guides/resource/CT_ECO_Resource_Guide_Water_Quality_Classifications.pdf. Accessed 23 February 2020.

U.S. Forest Service. 1994. Chapter 17: Ecological subregions of the United States. Erie and Ontario Lake Plain. http://www.fs.fed.us/land/pubs/ecoregions/ch17.html#222I. Accessed on 22 February 2020.

USDA NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service). 2020. About PLANTS [Database]. Threatened and Endangered. Available at http://plants.usda.gov/java/threat. Accessed 27 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2014. Endangered and Threatened Wildlife and Plants; 90-day Findings on Two Petitions. Notice of petition findings and initiation of status reviews. Federal Register, 79(250): 78775–78778. 31 December. Available at http://regulations.justia.com/regulations/fedreg/2014/12/31/2014-30574.html. Accessed 26 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule. Final rule, and interim rule with request for comments. Federal Register, 8(*63*): 17974–18033. 02 April. Available at http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinalListing02April2015.pdf. Accessed 26 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2016. Endangered and Threatened Wildlife and Plants; 4(d) Rule for the Northern Long-eared Bat. Final rule. Federal Register, 9(*81*): 1900–1922. 14 January. Available at http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf. Accessed 26 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2018. Species Status Assessment: Monarch Butterfly. [Online factsheet]. 15 September. 2 pp. Available at https://www.fws.gov/savethemonarch/pdfs/MonarchSSAFactSheet.pdf. Accessed 26 February 2020.

USFWS (U.S. Fish and Wildlife Service). 2020a. IPaC Trust Resources Report for NAVSTA Newport Integrated Natural Resources Management Plan Addendum, Fishers Island Annex, Southold, New York. Geographic search results from the Information for Planning and Conservation (IPaC) tool. Available at https://ecos.fws.gov/ipac/. Accessed 10 January 2020.

USFWS (U.S. Fish and Wildlife Service). 2020b. Counties in Northern Long-eared Bat Range. [Excel spreadsheet]. 30 April. Available at http://www.fws.gov/midwest/endangered/mammals/nleb/. Accessed 22 October 2020.

USFWS (U.S. Fish and Wildlife Service). 2020c. IPaC Trust Resources Report for NAVSTA Newport Integrated Natural Resources Management Plan Addendum, Seneca Lake Detachment, Dresden, New York. Geographic search results from the Information for Planning and Conservation (IPaC) tool. Available at https://ecos.fws.gov/ipac. Accessed 10 January 2020.

USFWS (U.S. Fish and Wildlife Service). 2020d. IPaC Trust Resources Report for NAVSTA Newport Integrated Natural Resources Management Plan Addendum, Dodge Pond Station, East Lyme, Connecticut. Geographic search results from the Information for Planning and Conservation (IPaC) tool. Available at https://ecos.fws.gov/ipac. Accessed 10 January 2020.

Weather Underground. 2020. East Lyme, Connecticut. [Web site]. https://www.wunderground.com/intellicast. Accessed 22 February 2020.

Windfinder.com. 2020. Wind & Weather Statistics for Long Island MacArthur Airport. [Web site]. http://www.windfinder.com/windstatistics/long_island_mac_arthur_airport. Accessed 22 February 2020.

APPENDIX W

ANNUAL REVIEW TRACKING FORM

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ANNUAL REVIEW TRACKING FORM

DATE	SECTION/PAGE	COMMENT	REVIEWER

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