

***PROTECTING THE PAST  
TO SECURE THE FUTURE:  
BEST MANAGEMENT  
PRACTICES FOR HARDENING  
ARCHEOLOGICAL SITES  
ON DoD LANDS***

Legacy Project # 06-303

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# Best Management Practices for Hardening Nineteenth Century Foundations and Villages for Training

Legacy Resource Management Program  
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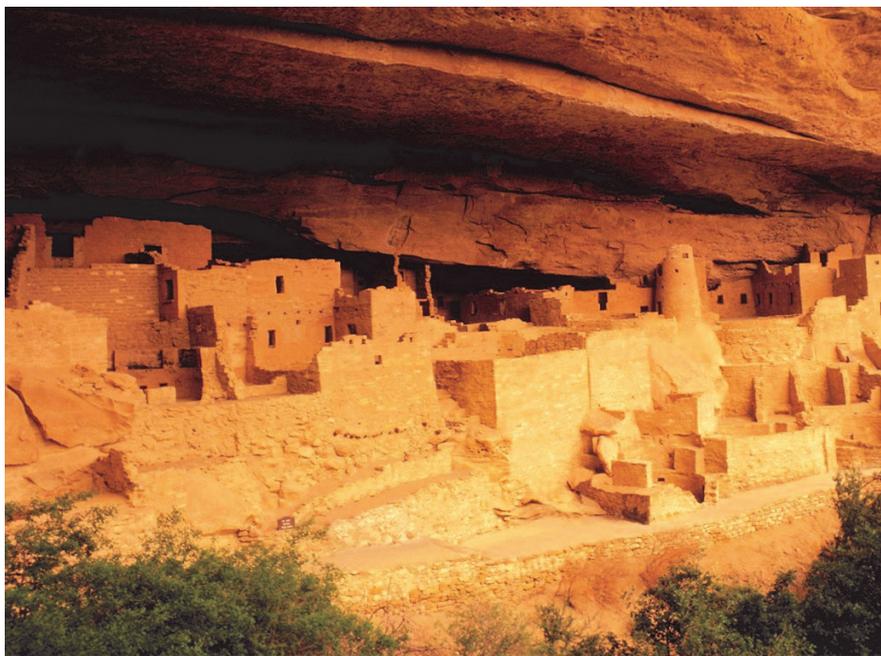
# INTRODUCTION

## Reducing Cultural Resources Encroachment Through Partnership with Integrated Training Area Management (ITAM)

For approximately 5 years, the Cultural Resources Program and ITAM Program have formed a proactive partnership in providing protection for cultural resources and access to the land necessary for military training.

Protection of the land and access for military training can be viewed as being at cross purposes. However, since ITAM and Cultural Resources began a new proactive land use strategy the ideas of protection and military training on the land have evolved into a shared goal.

This effective partnership includes several well established as well as new and innovative techniques for providing both protection and access, without compromising one for the other. Eroded site re-vegetation, GIS cooperation, site hardening, buried posting, public outreach, and development of training assets are just some of the ways in which the partnership has advantageously accomplished its goals.



Mesa Verde National Park, Colorado

## ***Site Selection Considerations***

Archeological sites are an irreplaceable resource. It is a complicated decision to determine whether a site is best left alone or if burying the site will improve preservation efforts. Intentional site burial or covering, also known as *in situ* burial, is a preservation and mitigation technique that has been used for years.

The first consideration in site selection has to be site evaluation. This evaluation will determine National Register eligibility and the nature of the site. This pamphlet will not go into depth about the process and regulations to determine National Register eligibility (evaluation will depend upon National Register Criteria for Evaluation (36 CFR Part 60) and other pertinent state and federal regulations).

When determining the nature of the site there are important questions you will need to answer. Will burial/hardening treatment have any adverse effect on the property? What type of treatment is appropriate for the site?

Why bury and/or harden a site? A review of the landscape and the property in question is needed at this stage. Is the area heavily used? Is the area being repeatedly requested by military trainers? Is the area easily accessible? Has the area been used regardless of signage or fencing? Does the area have cultural resource training potential?

Burying or hardening a site can be a complex process. The most effective way to plan for this type of project is to have a multi-disciplinary team and to work effectively within the regulatory structure. Developing a multifaceted approach will produce a more effective and comprehensive outcome.

## ***Working Productively in a Regulatory Environment***

### **National Environmental Policy Act**

The National Environmental Policy Act (NEPA) is environmental law enacted in 1969 and applied only to federal projects and to programs funded by federal monies. This was one of the many legislative responses to surging public concern about the environment. This law necessitates that prior to undertaking any “significant” action, that the federal agency or federally funded agency must consider the

environmental impacts of their actions and incorporate public input. This consideration has effectively mandated that federal agencies integrate environmental values and laws into their decision-making process by considering the impact of their actions and devising viable alternatives.

To adhere to NEPA regulations, federal agencies need to prepare a Record of Environmental Consideration (REC), an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) which is a detailed statement of proposed actions. Any undertaking should coordinate, but remain independent of, NEPA compliance with responsibilities of the National Historic Preservation Act in preparing an environmental assessment (EA) or an environmental impact statement (EIS).

*The regulations implementing these Historic Preservation requirements are found in Titles 36 and 43 of the CFR.*

## **State Historic Preservation Office**

State Historic Preservation Offices (SHPO) exist in every state in the union as provided for by the National Historic Preservation Act of 1966. SHPO's spearhead all state preservation initiatives by assisting local governments, state and federal agencies and private citizens by helping identify, evaluate, preserve and revitalize the state's historic, archeological and cultural resources.

## Tribal Historic Preservation Office

*“Sacred sites protection is a momentous responsibility requiring tremendous dedication on the part of those who serve this purpose. The duty of cultural preservation must be approached with knowledge, diligence and especially, reverence. This is what our Tribal Historic Preservation Officers impart.”*

- Keller George,  
President, United South  
& Eastern Tribes Inc.

Provisions to the National Historic Preservation Act federally designated recognized Indian tribes to elect Tribal Historic Preservation Officers (THPO) to take formal responsibility for the preservation of significant historic and cultural properties on tribal lands. This amendment, Section 101 (d)(2), allows tribes to assume any and all functions of a State Historic Preservation Office (SHPO) in regard to tribal land. Individual tribes decide on their participation in the program.

Federal agencies are required to consult with Tribes throughout the planning process of any undertaking which may affect a property of religious or cultural significance. THPO representatives often are a valuable consultation and planning partner in the hardening process for archeological sites if the site has a Native American component. Comprising a team in the planning stages that includes consulting Tribes and

associated THPOs ensures that plans are comprehensive in scope.

## Public Stakeholders

An important and regulatory requirement in cultural resource management activities is involving and incorporating general public involvement. Public

### Interesting Example:



Sometimes stakeholder consultation yields unexpected results. As the Fort Drum CRM, Dr. Laurie Rush had very hard choices to make regarding the historic village of Sterlingville, taken over in 1941 by eminent domain. Sterlingville was a small rural crossroads community built around an iron works industry with some dozen homes and small businesses. Past residents of the village are still attached to the memories of this landscape where only basements and foundations remain. This area is very important for military training. Active military training and historic preservation would seem to be opposing agendas in most instances.

The CR team consulted with former Sterlingville citizens and their descendents. A number of these people commented that their sacrifice of home and land would be meaningless if those areas were not used by Soldiers. This was the opposite of the response the CR team was expecting.

Dr. Rush and the ITAM team decided on a two-fold solution. The foundations and landscape would be preserved by hardening the landscaping and supporting the foundations in order to allow for military training to occur on the landscape. By making the area available for training and by stabilizing and preserving the landscape, Dr. Rush and ITAM created a win-win situation.



acceptance is crucial in today's military environment with increased needs for training space, problems with urbanization, noise, and the pressure of base closures.

The public is invited to comment during the Environmental Assessment (EA) process of NEPA. Public meetings, surveys, and public announcements in the popular media (i.e., newspaper, TV) are other ways to involve the public.

## **Partnerships**

Establishing partnerships with other institutions, organizations, agencies and individuals is an excellent way to create a multidisciplinary team. Partnerships are cost-effective means to share expertise, information and combine resources. Many natural and cultural conservation efforts nationwide depend on partnerships and volunteers to be a success.

## **Compliance Checklist: Federal Law & Regulations**

- National Environmental Policy Act (NEPA)
  - Record of Environmental Consideration
  - Environmental Assessment
  - Environmental Impact Statement
- Archeological and Historic Preservation Act of 1974 (AHPA)
- Archeological Resources Protection Act of 1979 (ARPA)

- National Historic Preservation Act (NHPA)
- Native American Graves Protection and Repatriation Act (NAGPRA)

### **Site Checklist: Concern/Extent**

- Flora—Will this project affect threatened or endangered species, loss of plant diversity, deforestation, loss or destruction of habitat?
- Wetlands—Will this project affect water quality, loss of wetlands, loss of adjacent habitat, sedimentation basins, and significant hydrological modification?
- Fauna—Will the project affect threatened or endangered species, loss of habitat, population imbalance, health?
- Cultural resource site condition.
- Past management practices for the resource.
- Factors endangering the resource.



### **Preparing Documentation**

The following list is meant to be a general guide of the types of documentation that may be needed prior to any archeological site hardening. This list is not meant to be all inclusive. Regulations and laws change from state to state.

All necessary documentation for potential consultation with the State, federally recognized Tribes, and interested parties should be developed.

At Fort Drum, we feel that sound documentation should include the following:

- Accurate map(s). These should include a map of the site surface before modification, accurate GPS location of site datum, and any excavation-related maps for the site.
- Record of Environmental Consideration (REC) through NEPA.
- Environmental Assessment (if the documentation in the REC is not appropriate).
- Full project description to include goal and possible timeline for completion that incorporates any available comment.
- Project material specifications (i.e. fill, fabric materials, etc.).
- Complete set of before and after site photographs. The photographs should exhibit the state of the site prior to vegetation clearance, after vegetation clearance and after site hardening is complete.

## **Documentation of Consultation with Stakeholders**

Consultation on any project with principal stakeholders is an integral factor to a successful end product.

Stakeholders, in this context, are groups or individuals who have a legitimate interest in a project or organization. Consultation with stakeholders is required during project review under NHPA and is increasingly important under NEPA regulations. Responsible consultation can improve public

### **Important Note:**

**DO NOT** consult with stakeholders just to say you did! If you include them, you must be willing to include their point of view and intend that consultation will result in change or a new direction for the project.

perception of an organization. Consultation and partnership programs are one way that military installations and Cultural Resources Programs can promote mutually satisfying and productive relationships with the surrounding community.

### Benefits of Reaching Out to Stakeholders

- Challenges traditional thinking and sparks creative problem solving.
- Final product geared toward success when stakeholders are involved in the planning and outcome of the project.
- Opens lines of communication and allows for feedback.

### Options for Consultation

- *Surveys*: Cost effective way to gain input from a large number of people in a relatively short time frame. Make sure to ask the right questions and

follow up on survey results.

- *One-on-One Consultation*: Excellent way to foster productive relationships with stakeholders. Set expectations with participants about how the information will be used.
- *Neutral Forum with Multiple Stakeholders*: Generally this involves a workshop or convention setting, but it might also be an “open house” day for a program where stakeholders can visit facilities and archeological sites, followed by discussion time. **Warning:** Opposing groups may show up to such an event that might best be worked with on an individual basis.

## Safety

Abandoned human habitations, the places Cultural Resource Managers define as archeological sites, often create safety hazards. Open foundations, wells, barbed wire, broken glass, farm implements, industrial machinery and industrial waste are often associated with historic archaeological sites. Prehistoric sites with above ground structures and artifacts may also be a hazard. Abandoned structures and features can be unstable. Crumbling masonry can surprise personnel on foot, especially when features are masked by vegetation. Many by-products of nineteenth century industrial activity are toxic and/or hazardous. Slag piles and dumps containing heavy metals and other toxic materials have now become part of the historic



(Above) An overturned tank caught unaware by an open hole, not unlike historic foundations.

(Below) Laurie Rush receiving thanks from the PA Army N.G. on top of a hardened hotel foundation that one of their tanks fell into the previous year.



landscape, and again may take personnel by surprise.

Open historic foundations can be hazardous for cross-country vehicle maneuvers, military personnel, and civilian visitors.

Fort Drum is not alone in experiencing accidents with military vehicles driving unexpectedly into open foundations now found in training areas where

occupants were evicted during the Second World War.

Abandoned historic wells and deep cisterns are potential traps and pose a risk to human life. Most historic wells were hand-dug with shovels and picks. Most hand-dug wells are three to six feet in diameter and range in depth from 10 to 30 feet. Hand-dug wells were generally lined with fieldstone, concrete or other

hard material that held earth in place while allowing water to fill the well.

Covering a historic well provides some immediate protection. However, wood and even concrete well covers are subject to deterioration by the elements. If the mitigation

strategy is to simply cover the well, the cover should be made of reinforced concrete or thick metal plate heavy enough that it would take two or more adults to move it.

Prior to covering a well, answers to the following questions should aid decision making.

- Will filling the well, or how you fill the well, affect the quality of groundwater?
- Are there any animal or plant species that have taken up residence in the well that need to be considered?
- Is there ready access to the well?
- Can heavy equipment reach the well without damaging associated cultural features?
- Can heavy equipment reach the well without impacting wetlands or other natural features?



*Wells are often well-disguised hazards!*

## **Methods for Filling Wells and Cisterns**

The standard way to fill a well is first to level any protruding ground feature to ground level. Next, fill the



*A historic cistern that went from endangered resource to fighting position.*

well to within two feet of the surface with a mixture of clean coarse gravel, sand or agricultural lime. The remainder of the well should be filled with clay or clay-rich soil, mounded slightly at the top and compacted by machine to offset settling. Needless to say, heavy equipment access to an abandoned well makes the filling process much easier.

Bored wells (auger or scoop-dug wells) are also large, averaging two to four feet in diameter and generally twenty to eighty feet in depth. Commonly these types of wells were lined with clay or concrete composite pipe. When abandoned, these types of wells are as dangerous as dug wells and cisterns and should be plugged.

Cisterns vary in size from region to region in the US. Cisterns in the northeast tend to be a much smaller variety than those found in other areas of the country. Cisterns were designed for holding and filtering ground water, not drawing water.

Cisterns are often as dangerous as wells since many are deep with steep sides that still hold water. Abandoned cisterns should be filled.

As with all treatment procedures, filling wells on military installations should follow the NEPA guidelines. There may be wildlife habitat issues or compliance issues that the REC will address.

*“I do believe in certain instances, the only way to avoid mitigating a site and ensure its integrity is to bury it.”*

-Randy Korgel,  
Yakima Training Center CRM

## **Why Hardening?**

Archeological sites, by nature, are in a constant state of deterioration. Shallow, exposed sites are especially vulnerable to destruction and degradation from natural and human disturbances. Foot traffic, ATVs, vehicular traffic, severe weather, vegetation growth, and erosion are among the many factors that can act to further endanger the resource. Off-limits signs, Seibert stakes and other signage are often not effective deterrents to human disturbance in heavily used military training areas. In less used areas, the growth of heavy, dense vegetation creates a situation in which the archeological site cannot be preserved and is further endangered.

Prior to making a decision to cap or bury a site, it is

important to take the following factors into consideration.

- Will the capping methods chosen be reversible?
- Will archeologists or other stakeholders want or need access to the site in the near future?
- Will important site data be lost through compaction?
- Will the capping method result in accelerating, rather than slowing the deterioration of the site?
- Will the capping method result in horizontal displacement?
- Will the capping method result in any changes in soil chemistry?
- Will the capping method alter the hydrology of the site?
- Would the site be better off untreated?
- Does the site contain personnel or environmental hazards that trump preservation concerns?

Some archeological sites need to be managed because of exposed artifacts that can be a safety hazard. Historic Period industrial sites can have safety hazards like iron ore, remnants of machinery, broken glass, fencing, and open foundations.

Data recovery, as a form of mitigation for a deteriorating archeological site, is often extremely cost

prohibitive and is often not the best solution for a site. Data recovery is, to an extent, a destructive form of mitigation.

The option of doing nothing should be kept in mind as well. Is the site important enough to expend valuable resources in protecting it? Does it still have sufficient integrity to warrant protection? Are the aspects of the site that contribute to its eligibility at risk? One compelling question about properties like Historic Sterlingville is, *If all the foundation features were to deteriorate*

*completely, would it affect the elements of the village that make it National Register Eligible?* Other considerations could be cultural, religious or sentimental. In the case of historic Sterlingville, we elected not to treat

the Catholic Church when we found smashed stained glass in situ around the foundation. It has remained off limits.

***Is Off Limits Good CR Management?***

- Vegetation was destroying above ground foundations.
- Off limits areas were requiring constant monitoring, active enforcement, and labor intensive clean-up.
- Displaced families felt that they had given up their homes for nothing.
- Training area encroachment.

***Cultural Resources Objectives***

Department of Defense Cultural Resources Programs provide for the protection and interpretation of archeological sites, traditional cultural places, sites associated with a significant event or person, important traditional places like buildings, objects, structures and

monuments for public benefit and knowledge while complying with all federal and state statutes, regulations, guidelines and standards.

Cultural Resources Programs on military installations across the nation share the responsibility of protecting significant archeological resources in compliance with the National Historic Preservation Act (NHPA).

Planning objectives often center on scientific and historic study of pertinent sites. The Cultural Resource Manager (CRM) often needs to provide an appropriate solution to the amount and type of military training and recreational use that the area can sustain without causing damage to significant sites.

A successful cultural resource plan will always include ways to provide an educational opportunity with the outcome. Educating soldiers about the significance of cultural resources before they go in-theatre is especially important. In an ideal setting, soldiers should have the opportunity to occupy a heritage site without damage at their home installation prior to occupation of world heritage sites overseas.

Site preservation should be evaluated on a case-by-case basis to allow for site-specific management recommendations. Site-specific recommendations can include continued monitoring, site testing (including sub-surface testing), restoration activities, site hardening to control training use of the landscape, seeding and re-seeding with natural plants, weed control measures, additional site control closures including posting interpretive signage.

Sub-surface evaluations are destructive to a site and can result in the site becoming more vulnerable. Initial evaluations of a site, including documentary research, exploration of soil chemistry in nearby, non-sensitive areas, and recording surface indicators to determine site significance without resorting to sub-surface evaluations, may be critical in developing a site preservation plan.

For the majority of buried archeological resources, preservation *in situ* is the preferred method for protecting the site. Any burying or site hardening plan should ensure that the site matrix is protected during the placement process.

## **Getting Materials and Supplies**

### **Geotextiles**

Many times the study of materials provides inspiration when creative solutions are needed.



*From top to bottom: Laying geotextile fabric across a site, beginning to place clean sand fill on the fabric, continuing to put clean fill atop the fabric.*

### Interesting Note:

Geotextiles have been used for thousands of years. Natural material geotextiles were used in roadway construction in the days of the Egyptian Pharaohs to stabilize roadways and their edges. These early geotextiles were made of natural fibers, fabrics or vegetation mixed with soil to improve road quality.



Get to know the closest local source of geotextiles and construction materials. Look at the options first hand. Visit the vendors at erosion control, land management and/or construction conferences. Sometimes the nature of the material will suggest an innovative application. Don't be afraid to stop by the side of

the road if you think you see an example of stabilization or erosion control that you haven't seen before. Visit construction sites on your installation, and don't be afraid to use materials that contractors are truly done with and have left behind.

Geotextiles are any permeable textile that is used with rock, soil, or other foundation material in order to increase stability and separate, filter, reinforce, drain and decrease environmental erosion. Geotextiles are made from either synthetic or natural fibers that are permeable and allow fluids to flow through.

Choosing which type of geotextile is best to protect an archeological site is often not easy. Talking directly to a local geotextile manufacturer or dealer will help you establish your choices for your area based on climate suitability. On most archeological sites you will want to choose a woven polypropylene textile which has carbon black incorporated into the fabric to make the fabric sun resistant. If the geotextile is susceptible to UV rays and ever exposed, there could be serious

concerns over the contamination of the archeological site in terms of millions of tiny pieces of geotextile material across the site. Woven geotextiles tend to be very strong and permeable so that water flow will continue as it was before the hardening process. However, woven material does allow small particles of sand to filter through so that the separation between the archeological site or structure and the fill material will include an intermixed lens.

Your other option would be a non-woven, polypropylene or polyester textile which does not have any UV resistance. Non-woven geotextiles will have more stretch than their woven counterparts. Non-woven textiles will allow water to pass through; however, they are much more susceptible to being clogged with fine soil particles which will restrict the flow of water. Non-woven textiles also tend to be much more expensive.

Sun-resistant textiles (or carbon black textiles) should almost always be preferred to white textiles. Even if the product is buried, it is likely that it will sit on site for at least some time in the sun. This can cause the white textiles to become brittle



Laying geotextile fabric and clean sand over the geotextile.



and stiff resulting in incorrect and labor intensive installation.

Geogrids are another type of material used to help stabilize poor soil sites or eroding sites. Geogrids are net-shaped synthetic polymer-coated fibers that are used to reinforce slopes, wall and base layer construction. Geogrids can be particularly useful in hardening archeological sites because they do a great job at stabilizing and preventing erosion at a low cost. They also make it possible to reinforce and stabilize soils so that they are safe for high weight-bearing capabilities. This is particularly useful if one of the end products desired when hardening an archeological site is to open up the area for military training.

Fort Drum will be testing geogrids for reinforcing WWII trench walls for adaptive re-use.

### ***Sources of Fill***

Some installations have their own sources of borrow. On western installations, silt ponds offer quantities of silty material, and using this material to harden sites offers a productive disposal method. Silt can work as the cushioning layer on the geotextile and perhaps could work as a surface layer for seeding as well.





*These recycled tank treads allow for protection of the site while making the site a useful vehicle fighting position for training.*

It is important to identify and exhaust free sources of fill prior to making the commitment to purchase. Transportation costs are critical to the cost of fill material so it is important to keep in mind the

proximity of the nearest quarries and gravel pits. It is also important to identify a secure place if it is necessary to stockpile fill. Ideally, fill will be delivered directly to the project location so that the logistics of the actual site hardening process are greatly simplified.

## ***Recycled Materials***

Recycling is an effective way to divert some solid waste from landfills. Recycling is not a 100% solution to reducing landfills, but it is an essential component of any installation's solid waste management program.

Best management practices (BMP) should be employed as often as possible. BMP are common-sense actions, often required by law, that require environmental and CRM programs to be innovative in their preservation and management plans.

There are many BMP strategies in relation to hardening, capping or burying an archeological site.

Military installations and surrounding communities offer a great on-site source of materials. BMP that encourage new purchases that favor reasonably priced local and renewable products will save money and the environment in the long term. CRM should use all reasonable efforts to purchase or acquire reusable and recycled products when they are available.

An example of a BMP in use is the repurposing of used and discarded tank treads. Military installations often create considerable amounts of solid waste from regular maintenance of military vehicles. Some of these materials can be sold as scrap metal through the Defense Reutilization and Marketing Office (DRMO). What cannot be sold ends up in landfills. An innovative use for some of these items, like tank treads, saves not only the DoD but project dollars in the long-term. Fort Carson, Colorado, was the study site of a cross-functional pollution prevention team which resulted in the Department of the Army *PW Technical Bulletin 200-1-16, The Innovative Uses of Recycled Tank Tracks for Erosion Control*.

When considering reusing or recycling materials for a job, always first determine the permit process needed for using said materials. Preparing and laying tank tracks is very, very labor intensive. The pins are hard, sometimes impossible, to remove. Removal of the rubber substance on the tracks is difficult. Also the tracks can be quite heavy and require heavy machinery to move them onto a site. Laying just the tracks will not be sufficient to halt erosion or to stabilize a site and can actually increase erosion problems. The planning

determination will need to assess whether soil, riprap, or another medium will be needed before the tracks are installed to evenly disperse the weight of the tracks across the base of the project site. It has been recommended through



trial use that the tracks be cabled together or interlocked to form one single unit that does not easily move. Also, tracks should be laid against the contour of the site and not with the slope.

## ***Concrete Revetment Systems***

Articulated concrete revetment systems (ACB) are an alternative to using riprap, stone fill, gabions, structural concrete, and other heavy erosion protection systems. These ACB units (sometimes known by the manufacturer names A-Jacks™ or Shoretec™) are so named because of the capability of individual blocks in a system to accommodate to the changes in slope while remaining interlocked.

These ACB systems are highly stabilized concrete units that range in size from 70 lbs to 11 tons. These systems would be placed on top of a site to prevent erosion and digging-in problems. They would also curtail looting of the site because of their sheer size and weight.

There are downsides to the ACB systems for archeological sites. The weight of the block and their uneven weight distribution on the surface must be accounted for so that they do not destroy the integrity of the site. Most ACB systems include a multi-stabilization plan which includes geotextile underlay and a clean fill layer prior to laying the concrete block into place which will help with the weight distribution problem. Another problem is that the ACB blocks could prove to be an attractive nuisance for military training exercises, since the large size of the blocks could be used as cover by soldiers.



*Beach Grass  
re-vegetation on sand  
plains.*

However, if the underlayment is properly installed, foot traffic across the site should not be a problem and the soldier presence would further deter looters.

An advantage of a concrete revetment systems like A-Jacks is that they offer maneuver obstacles that can serve as valuable training

assets. They could also work well in desert type environments to protect surface sites from vehicular damage.

## ***Re-vegetation***

If a site is suffering from erosion, there are several methods with which to stabilize a site. Re-vegetation is building up a site or plant community to strengthen its natural defenses, promote native vegetation, improve

and restore natural habitat, and re-establish vegetation to prevent erosion. The re-vegetation process should use only native and non-persistent exotic plant species.

State and local agricultural cooperatives can greatly assist in the planning process of any re-vegetation efforts.

### ***Training Asset Potential***

The use of porous pavement systems in a hardening plan could prove to be beneficial. These systems could be used to restore historic roads and trails which often cut across military installations, to improve training access to the land. By restoring these roads, a well thought out landscape preservation plan could channel military traffic onto historic right-of-ways, thereby decreasing cross-country travel. This would further decrease the potential of damaging historic sites and features along roadways by providing an easiest route scenario. Particularly sensitive archeological sites could also be placed into this plan and roads re-routed to further avoid access to the site.

In any effective long-term plan for an archeological site, the CRM team should inspect the site to see if it has any features that can be transformed into training assets. Also take into consideration the possibility that a site may inadvertently offer assets that military personnel might already be using to the detriment of the site's integrity.

### ***Logistical Considerations***

- Identify sources of materials.



This natural and archeological site at the Yakima Training Center is an important spiritual site but also a huge safety hazard for military personnel. This open lava tube is also a spiritual portal site for the Wanapum people. To alleviate the safety hazard and keep the site protected and accessible, Randy Korgel, the Yakima CRM , devised an innovative solution. A supported metal grate was constructed to fit over the opening which was then covered in rock. This successfully eliminated the safety hazard and protects the site for spiritual purposes, while disguising it in the landscape.

- Arrange for delivery and storage.
- Arrange for materials and machinery delivery to the site.
- Determine access to the actual features being treated.
- Determine the order in which things will be done.
- Buy, rent, or borrow tools and equipment.
- Arrange for any training or certifications that need to be acquired.

## ***Treatment Options***

Hardening is just one of many possibilities when

considering treatment options for sensitive vulnerable archeological sites.

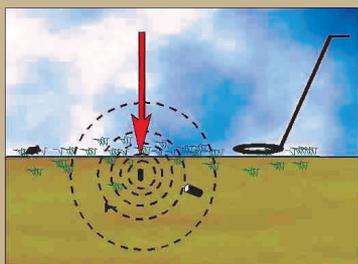
Sites may be protected with just signage. You will need to consider what activities will be permitted at the site; who can access the site; and how the site will be used. Will training be permitted? Vehicles? Digging? Will signage include warnings about disturbing features? Will historic archeological features be disturbed or demolished in an attempt by soldiers to improve their training positions?

Spiritually sensitive sites require special consideration. Usually these types of sites require access by select individuals and groups, but not by the general population. In these cases, you may want to consider camouflaging a site to match the landscape.

Discussing options for treatment with the military training community and Range Division establishes a basis for constructive dialog with the Cultural Resources team. Likewise, it may also be advantageous to evaluate and discuss opportunities for public outreach with little cost to the overall project.

On many military installations, culturally sensitive areas or environmental areas are marked “OFF-LIMITS” to training, maneuver, or other activities by Seibert stakes. Seibert stakes consist of a 16-inch piece of PVC with alternating grey, red and yellow reflective tape rings mounted on a metal post





*Electronic Marking System*

approximately 4-5 feet above the ground marking the boundaries of an area that is off-limits. A black strip runs down the backside of the Seibert stake. If this black strip is visible it is an indicator that the person is on the site and must leave immediately.

Cultural Resources Managers often encounter the problem of ensuring accurate relocation of archeological sites and features for monitoring purposes. Sites are also continually monitored for changes in vegetation, soil, surface erosion, vandalism, and looting.

One alternative source to standard surface datum spikes and posted signage is to use a new technology called electronic marking systems (EMS). These systems have been used for years in construction and by the DoD as the way to document underground infrastructure such as lines for electric, gas, water, sewer, information technologies, and other systems. In these arenas, EMS has proven to reduce inadvertent damage to critical systems and improve efficiency for future upgrades or repairs. EMS markers are extremely durable markers that can be buried in augured holes, test units, shovel test pits or other excavated features. They have no visible surface presence that can be vandalized or used by looters to locate sites.

Electronic marking systems on archeological sites

should be used in conjunction with standard documenting procedures. The sites should still be mapped, recorded with GPS coordinates, and other dimensional measurements. In the past, archeologists have relied, for the most part, on above-ground markers or landscape features. Any above-ground markers are susceptible to vandalism, looting, removal, or other destructive behavior.

The two most useful cyberstakes for archeologists are the near-surface markers (these are approximately the size of an index finger) and the ball marker (the size of a softball). These markers are easy to install and light and small enough to carry in a field vest or pack. The ball marker is a permanent non-visible datum that can

## *Lessons Learned*

In beginning the Sterlingville project, the CRM and the LRAM Coordinator at Fort Drum spent hours developing a vegetation removal and treatment plan



for each foundation without removing any vegetation at all. The vegetation removal plan began with removal of small stems. With a better look at the first foundation, it immediately became clear that the lack of visibility had resulted in meaningless planning efforts. At that point, the LRAM crews removed all small stems from historic features and treatment prescriptions began again. A related lesson was that in some cases, advanced root development was preserving stone masonry so decisions to remove vegetation have to be made with care.

be easily established in a small auger hole. These ball markers are stable, invisible datums that can be easily relocated without causing ground disturbance and without leaving any above-ground trace. The near-surface markers can be used to mark shovel tests, test units, boundaries, or small isolated finds for relocation and re-excavation in the future. These markers can be made into site lines or grids to monitor the long-term effects and impacts of erosion. Cyberstakes are easy to relocate without disturbing vegetation or excavation of soils.

The real importance of posting, signage, and cyberstakes is that they are permanent indicators by the archeologist and the military of their continued commitment to monitor and preserve the site.

Off-limits areas do not necessarily need to be a deterrent for military training activities. With group effort and coordination from the CRM, Range Control, and ITAM, these off-limits areas can be included in a larger training scenario where the off-limits areas would be considered minefields, chemically contaminated



**“Keep out by order of the Commander”** is a military order. If a site is to be buried but not signed, a layer of fabric bearing posting information can be placed on top of the geotextile.

areas, or other tactical avoidance areas for planning and executing training activities.

## ***Deciding Treatment***

### **Important Note:**



Treat any unknown plants with respect. **DO NOT** eat any wild plants, mushrooms, etc. in the field. Ordinary ornamental plants commonly found around historic structures, like lily of the valley, jack in the pulpit, buttercup, and bleeding heart, are just some of the plants that can cause serious health issues, even death, if eaten.

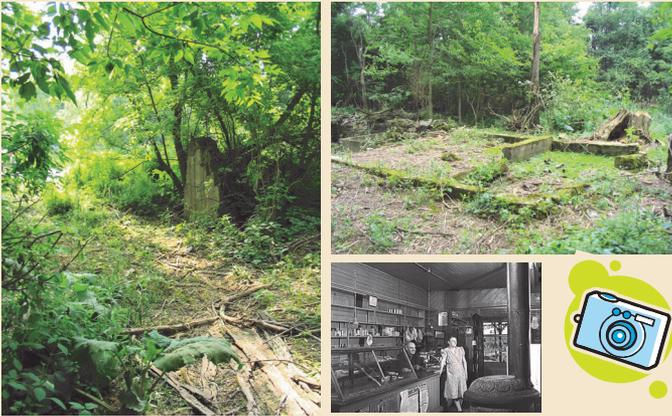
### **Step One: Vegetation Clearance**

If vegetation obscures the archeological site, then the vegetation must be removed to increase visibility of the site for analytical purposes. Vegetation clearance is often the first step completed with full cooperation between the Cultural Resources Program and the ITAM Program. Full documentation of the site, including scale drawings of the landscape, scale drawings of the foundations, and then removing and cataloging any surface artifacts, can be done by the archeologist once excessive vegetation is removed. Remember to document the site before and after vegetation clearance with high quality photographic images.

In the beginning stages of implementing a hardening plan, make sure to plan for vegetation-specific issues. Issues such as whether vegetation will be hand or mechanically removed need to be addressed.

Consulting professionals familiar with local plant life is essential. The last thing you want is to have your entire crew on sick leave for days because they removed poison ivy from a building foundation. Poison ivy, poison oak, poison sumac, and stinging nettles are just some of the plants you will need to take special precautions with when removing vegetation.

Another function of vegetation clearance can be to open historic roads and pathways. Historic maps and aerial photos can be used in conjunction with field reconnaissance to determine historic pathways. Opening the historic road can serve to concentrate modern training traffic onto an old roadway, preventing inadvertent damage to historic cultural features like farmsteads and foundations that could result from unguided cross-country travel. At Fort Stewart, Georgia, the Cultural Resources Manager worked with



Foundations, like this historic store, were disguised in a mass of overgrown vegetation. Clearing the vegetation makes the site more accessible for determining its preservation needs while allowing for great photographic opportunities that can be used for public outreach.

the ITAM Program to identify and open the historic trolley paths across the installation as tank trails. In addition to channeling the traffic, the historic paths already offered prepared roadbeds resulting in tremendous trail construction cost savings and minimizing environmental impacts of new roadways.

In a similar manner, the Fort Hood ITAM Program has used gully plugs very effectively to channel low water crossing traffic away from prehistoric sites.

Just as offering historic pathways can channel pedestrian and vehicle traffic, construction of an alternative training asset can serve as a magnet that can draw personnel away from an historic property that needs protection. At Fort Drum, construction of ambush points resulted in preservation of a blacksmith shop foundation.

**Step Two:  
Develop a  
feature-  
specific  
treatment  
plan and  
document the  
site**

These methods can be used for individual sites or features or, as in the case of Historic Sterlingville and



One case study using the Geoblock systems at the Edith Wharton house, was described in *Landscape Architecture*, September 2003. The archeology team and the landscape preservationist used a Geoblock system in their landscape restoration plan with great success. The porous pavement system provided great protection for the heavy pedestrian traffic encountered while appearing as nothing more than turf in the image.

Lewisburg on Fort Drum, entire historic village properties composed of multiple features.

### ***Lessons Learned-***

Begin with the best documentation possible and be prepared for surprises. Since hardened sites will not be accessible, a moderate level of data collection, i.e., photography, mapping, and ample documentation, should be done before hardening.

Treatment plans

can range from “do nothing” to complete lining, filling, and hardening of a site or feature. Each plan needs to specifically address the needs and considerations of the resource to be protected.

On military installations, the treatment plan needs to take military training needs into consideration. On some occasions, minor adjustments to the treatment plan can make the difference between a simple hardened site and a valuable military training asset.

Once a preliminary plan is developed, it may be appropriate to submit the plan for review to the SHPO or for consultation with stakeholders.

Complete photo-documentation should be conducted before implementing treatment plans. At Fort Drum, we have discovered that vegetation clearance offers excellent opportunities for photography that can be used for public outreach, including virtual internet site tours.

## **Step Three: Implement the Plans**

**Site Type:** Sprawling Surface Sites Suffering from Erosion

**Treatment Plan:** Simple Re-vegetation

In some cases, simple re-vegetation may be the most appropriate treatment for site stabilization. In very successful cases, a stabilized re-vegetated site can be re-opened for “no dig” or surface-use-only training.

There are outstanding vegetation experts who can support re-vegetation efforts in most environments. The Army Corps of Engineers Cold Weather Research

Laboratory (CRREL) is one example of an outstanding resource. Their agronomists have guided much of the successful re-vegetation at Fort Drum. Partnering with

**Lessons Learned-**

Not every installation has free fill, and available fill varies regionally. Verify soil type before it is delivered.



Covering the Horton Store site at USMC Quantico, Virginia, involved covering a majority of the site with geotextile fabric and clean fill. These photographs exhibit the correct way to apply and spread topsoil over fabric.

your local agricultural cooperative extension or soil conservation office in the planning stages can also be extremely beneficial. They can often provide you with soil specifications for your site, recommendations for erosion control and re-vegetation species options.

Often they can also provide low-cost options and alternatives including local farmers who can fertilize and plant a site.

If the site is too unstable for just seeds and fertilizer to be effective, some of the newest products on the market can help. New porous pavement systems (under the manufacturer name Geoblock<sup>®</sup> or Geoweb<sup>®</sup>) are interconnected polyethylene paving units that simultaneously provide load support and vegetation protection.

**Site Type:** Sprawling Surficial Sites with Middens and Scattered Features

**Example:** Horton Store, USMC Quantico, Virginia

Excellent Phase II site documentation was available for Horton Store – a crossroads occupation with multiple structures and wells. Vegetation clearance at Horton Store revealed features that had been missed due to dense poison ivy and brambles. The site was too large to be cost effectively covered in its entirety. Better exposure of the site yielded a chimney fall that was previously unrecorded. In addition, a depression that was thought to be evidence of an excavated foundation or crawl space began to look much more like a field



### **Lessons Learned–**

When renting heavy equipment, sometimes the rental company insists on fueling the equipment themselves. Arrangements have to be made if they need access to the remote places where military archeologists often work.

Tactical Operations Center (TOC) feature resulting from military training.

***Treatment Plan:***

The CRM for USMC Quantico selected the portions of the site with the best integrity for coverage with filter fabric. The decision was made to add layers of topsoil above the filter fabric and seed it so that the protected area will be indiscernible from the untreated landscape. The area was signed for “no dig” training.



Custom printed sign to be buried with the geotextile.

***Steps:*** Vegetation Clearance/Documentation of Newly Discovered Features/Remapping of the Site/Ordering and Acquisition of Materials – Fabric, Topsoil, and Seed.

Some installations may choose to have their geotextiles custom printed with postings. As a result, if the fabric is disturbed and the site compromised, the CRM has the option of prosecuting the offenders. If there is concern about the potential of looters or others intentionally disturbing a buried site, a layer of material like chain link fence, can also be added to this treatment method.

***Application and Spreading of the Topsoil over the Fabric***



*The Stafford Store at USMC Quantico. From top to bottom: before vegetation removal, cleared foundation during treatment, supported and treated foundation.*

When spreading fill over geo-textiles using heavy equipment, the equipment should never come in direct contact with the textile that is laying over an archeological resource. The careful equipment operator dumps the fill ahead of the equipment and uses the resulting layer of fill as the cushion between the equipment and the site or feature. The equipment operator carefully fills ahead of where the next layer of fill needs to be so that the site is always protected.

**Site Type:** Open laid stone foundation

If the foundation is completely deteriorated and slumped and does not pose a personnel hazard, the best choice might be to leave it alone. Some foundations at Fort Drum were seriously damaged

or destroyed when the military occupied the properties during World War II.

If the foundation has intact walls and is still deep, fabric and fill may be a good solution.

**Example:** L. Cunningham House, Historic Sterlingville

**Steps:**

- Cover with filter fabric
- Use honeycomb fabric to hold sand in place

Because of the depth of the foundation, there was concern about the sand slumping into the center. As a result, honeycomb geo-textile was applied. The honeycombs fill with sand and stay in place.

- Apply sand

In this case, because the fill was going to be relatively deep, a layer of sand was placed on the fabric. The same considerations that were described above for laying fill ahead of the equipment should be followed.

- Apply gravel or clean fill material.

**Site Type:** Open foundation with laid stone walls but not all walls intact.

**Example:** The J. Sterling Store, Historic Sterlingville

**Treatment Plan:**

Portions of this foundation had intact walls. However, the back wall was completely destroyed. As a result, it was decided to treat the base of the foundation with

geotextile, a layer of sand, and a layer of gravel.

This particular foundation allowed the CRM and ITAM team to create a win-win situation by stabilizing the historic site and simultaneously creating a military training position. The cross-roads location of the feature and the new vehicle fighting position created a valuable military training asset. To create a fighting position over the existing cultural resource, the side walls of the foundation were protected with sand bags and the destroyed back wall with recycled tank treads so that a vehicle could safely drive over it.

**Steps:**

- Lay geotextile
- Apply sand
- Apply gravel
- Sand bag the sides of the foundation
- Acquire and prepare tank treads
- Install the tank treads



***Lessons Learned-  
Recycled Tank  
Treads***

Using recycled tank treads is a labor-intensive task. The treads may be rusted, corroded, bent, or welded together. The ITAM crew at Fort Drum found that lubricating oil and torches would loosen the tread connectors enough to pry them apart.

You will need to reconfigure and put the treads back together on site with new connectors.

**Site Type:** Foundation or feature that should be visibly preserved for greater appreciation

**Example:** RC Willard House Historic Sterlingville Fort Drum; Stafford Store, USMC Quantico

**Treatment Plan:** Pressure Treated Lumber Structure

One way to preserve an example of masonry is to build a reinforcing structure made of pressure treated lumber. We have found that the design of these reinforcing structures is most effective when done hand-in-hand with the construction team. For success with this approach, team members with excellent carpentry skills are a must. The CRM or one of the CR team should be on site at all times in this process.

**Steps for Constructing Support Frame:**



**Design and Materials**

- Brainstorm for ideas on design. Best if done on location. No two structures will be the same. Solicit ideas from anyone on the team.
- More supports are better!
- Always over-estimate the materials needed. Unused portions can be used on other projects or returned.
- When material arrives, check to make sure everything is there and usable.
- Secure material to make sure it does not walk away. Take smaller items with you. It is more time consuming, but you should try to keep tools and materials locked or with you at all times.

## Construction

- Have at least two people on site for safety reasons and to make the work easier.
- Bring any tools you might need. You never know ahead of time what that will be.
- Bring extra tools with dual purpose (e.g., two drills—one with drill bit, one with screwdriver bit).
- Make sure all tools work before taking them to the field!
- Have patience and be prepared for unexpected changes!
- Consult with CRM before moving features to layout base pieces.
- “Measure twice, cut once.”  
When possible, keep pieces long and cut to length once the piece has been fitted.
- Utilize open mortise and lap joints to add strength.
- Utilize nuts and bolts when possible and lags everywhere else.



## Finishing project

- Replace feature around base structure to add support.
- Utilize sandbags to stabilize loose features, around or on top of wooden structure.
- Police area.

Carpentry projects in remote places pose logistical challenges and require careful planning.

## List of Tools



- Generator – gas and oil, extra spark plugs
- Drills – cordless extra batteries
- Regular drill for backup
- Circular saws – one for regular cutting, one for mortise cutting
- Speed square
- Framing square
- Pencils – many
- Hammer
- Chisels – different sizes
- Extension cords – many
- Drill bits – many
- Air compressor
- Hoses – many
- Impact wrench and sockets
- Utility knife – blades
- Shovels
- Sawhorse – 2 pairs
- Boards to make bench on sawhorses
- Sawzall – blades
- Tools – to fix problems with above mentioned tools
- Measuring tapes (at least 2)

**Site Type:** Foundations with Cisterns or Standing Interior Walls

**Example:** J. Murray Hotel, Historic Sterlingville

**Treatment Plan:**



*J. Murray Hotel in Sterlingville before it burned in the early 1900s.*

When treating foundations with cisterns and/or standing interior walls, a key consideration is to make sure that the treatment never puts too much weight on one side of the wall without providing counter weight on the other side. Treatment methods are the same as for an open foundation as long as the fill application remains balanced. In the case of a smaller feature like a cistern, sand bagging could serve as an effective counter weight on the inside. The sandbagged cistern at the J. Murray Hotel can also double as a fighting

position.



**Site Type:** Historic Earthworks

**Example:** World War I Trenches, Fort Lee, Virginia

Fort Lee, Virginia has over six miles of National Register

Eligible World War I training trenches. The trainers are requesting use of these trenches for training for the War on Terror and are frustrated by the possibility that the Military could be denied the use of its own training assets due to historic considerations.

### ***Treatment Plan:***

We have recommended installation of a wide pane geo-grid to reinforce sections of the trenches that will be receiving the greatest impacts. Turf can grow through the geo-textile, so there should be no visible effects from the application of these materials. The combination of the textile with vegetation growing through it should work well even on relatively steep slopes. Temporary orange fencing can be used to protect newly treated areas prior to vegetation becoming established and locking into the reinforcing fabric.

## ***Conclusion***

The decision to alter an archeological site in any way is never taken lightly. Traditional archeology is an inherently destructive activity, so responsible archeologists are trained from the beginning to weigh the costs and benefits of their actions. Compliance archeology multiplies the pressure and the stakes in decision making of this type. From the Fort Drum perspective, there are critical factors that every cultural resource manager should take into consideration.

First, archeological sites on federal land are held in trust for the American people. That being said, the primary goal of a federal work force on a US military installation is to support the military mission. The challenge for the Cultural Resources Manager is to find the common ground where good stewardship and enabling military training work in concert. A second consideration is stakeholders who have an interest in

an archeological site that goes above and beyond the concerns of ordinary stewardship. Consultation with Native American tribes is critical, and the Cultural Resources Manager is a key advocate for sound management of ancestral places on any military property. In the case of Historic Sterlingville on Fort Drum, the feelings of displaced residents played an important role in our considerations. It became very clear very quickly that they measured the value of the sacrifice of their homes and community in terms of military training and not as an historic preservation exercise. Our archeology colleagues may also be stakeholders. After all, many of these sites are designated for protection based on the information they may contain. Third, we need to think about our legacy as Cultural Resource Managers. How will the decisions we make be viewed over the long term? Was our documentation of the site prior to treatment sufficient? What are the long term implications of these methods as preservation strategies? Are the materials we selected durable enough? How will our treatments alter the site over the long term? Will the methods we select protect sites even in times of cultural resource budget cutting and increased intensity in military land use? Have we done everything within our power to make the treatments reversible? With those questions in mind, we are the first to recognize that more research is needed. Our methods need more testing including meeting the challenge of recovering a treated site while evaluating durability, reversibility, and long term impacts.

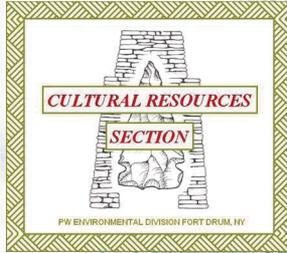
The military setting brings assets along with challenges. Fort Drum encouraged development of an

an interdisciplinary team composed of individuals who were well equipped and who excel in their areas of expertise. The installation was also willing to consider new approaches to addressing ongoing management issues. DoD Legacy funding offered an opportunity to test ideas across the services, on different installations, and in different environments. In summary, we feel that successful management solutions are found by thinking as stewards, not as owners, by a willingness to work as a team, and by remembering that the opportunity to manage historic properties is a privilege.

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