ARCHEOLOGICAL ASSISTANCE PROGRAM
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FILTER FABRIC:
A Technique for Short-term Site Stabilization

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Filter fabrics have been available for several years and are used most frequently as an underliner for roadbeds and in other construction related activities. These materials are produced both as woven and nonwoven fabrics and are available in varying weights and porosities. Fabric selection is based on the proposed application and the specifications that the desired material must meet. If filter fabric is selected as the stabilization technology that is to be used, it has the advantage of being available from several manufacturers whose products are competitively priced. These materials, regardless of manufacturer, are relatively inert geosynthetics that are resistant to ultra-violet degeneration.

Advantages

As stabilizing materials, filter fabrics offer a number of advantages for an archeological application. Most have sufficient elasticity to allow them to be molded to the irregular surface contours that characterize archeological sites without massive surface preparation that would require the removal of a portion of the resource. The relatively light weight of the material makes it easy to handle and install on horizontal, sloping and vertical surfaces. Since the fabric is a synthetic, it is resistant to wave, rain and surface water erosion and the permeability of the material can be controlled to some degree by careful fabric selection.

Once in place, the fabric will add surface strength to an archeological deposit and as a result, slope stability is improved. At the same time growth of surface vegetation can be encouraged (or discouraged) by selecting a material of appropriate weave, weight or porosity. Both woven and nonwoven materials can be used as a relatively inexpensive underliner in combination with other stabilizing materials (e.g., riprap). Because of their dark color, these materials generally blend into a natural background and do not call attention to their presence.

Disadvantages

Filter fabrics have disadvantages that must be taken into account when they are being considered for application in an archeological context. Some of the available fabrics are relatively expensive when cost is compared to the useful life of the material. All share the disadvantage (advantage) of being easily cut and can be vandalized or stolen. While they can be made to conform to a variety of surface configurations, improperly installed material may deform and the effectiveness as a protective measure may be reduced. The adequacy of installation and surface conformation is largely regulated by the placement of the steel pins that are used to hold the material in place. The placement of these affect the cultural deposit adversely.

The single greatest disadvantage of filter fabrics is that all have a finite useful life. To insure that the maximum protection is realized, every installation must be inspected regularly and either maintained or replaced. Use of these materials also requires that some additional stabilization measure be identified and put into place before the useful life of the initial installation is reached or exceeded.

Potential applications for archeological stabilization include use of one of the fabrics in combination with a more permanent stabilization technique (e.g., riprap) in a design approach that is intended to maximize the period of site protection. More importantly, these materials may be used as the primary stabilizing material on eroding shorelines of lakes and streams. Their use will provide the resource manager with a relatively easily installed, cost-effective means of stabilizing an important resource until a more permanent stabilization technology can be devised and installed.

The Huffine Island Experiment

The Center for Archaeological Research at the University of Mississippi and the Tennessee Valley Authority (TVA) are cooperating in a program to stabilize archeological sites. The use and the steps in the installation of a nonwoven filter fabric as a stabilizing material as recommended in the paragraphs that follow is based on Center and TVA experience on Huffine Island in Watts Bar Lake in eastern Tennessee. The site, or rather, a portion of the site, that required protection is an eroded cutbank that has exposed approximately a 120 ft profile of a mound. At its apex, the cutbank is about 14 ft high, including about 18 inches of sub-mound alluvial deposit. Protection of the mound is a planned treatment that can be followed in other cases.

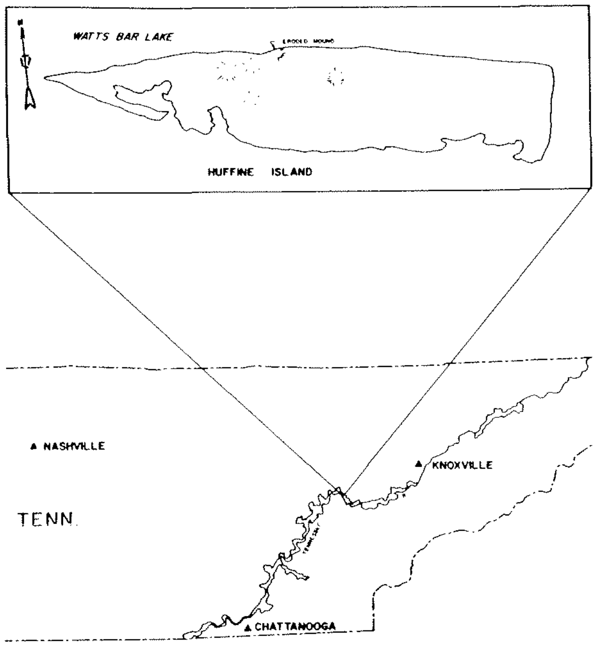

Figure 1. Location of the Huffine Island Site in Eastern Tennessee.

The Huffine Island site is a complex of at least five mounds that have been placed in a lacustrine setting as a result of the closure of Watts Bar Dam. Only one mound in the complex is subject to any adverse impacts from the lake. In reality, the site is afforded some protection from looting and vandalism since the island is a part of a migratory bird refuge whose population includes ducks, geese and eagles.

The initial loss from erosion of a portion of the mound was reported to the TVA by wildlife officers who normally patrol the refuge.

Following the identification of the site's location and the confirmation that erosion was destroying a part of the site, the specific adverse impacts were identified. Since the stated intent of the Center/TVA program is to stabilize sites, the traditional range of archeological data that is normally collected on surveys was not included in this effort. Inspection of the total site indicated that lacustrine erosion and plowing were the primary forces that are working toward the destruction of the resource. The majority of the site, including the mounds, was being disked and planted with winter grasses that would serve as duck, goose and deer forage. Farming of the site has ended as a result of a request to the Tennessee Wildlife Resources Authority from the TVA. Amelioration of the lacustrine erosion was the major problem that remained to be addressed.

Since the site is relatively remote with limited access, a decision regarding the life span of the stabilizing technique to be employed had to be made. As a part of that consideration, we assessed the rate of loss. To make that assessment, several operational assumptions had to be made. This assessment assumed:

(1) the mound was intact at the time Watts Bar Dam was closed;
(2) all mound loss was subsequent to that closure;
(3) wave action and lateral current erosion in the lake were the destructive agents; and
(4) the high point of the present mound remnant approximates the center of the original mound.

Measurements made from the high point of the mound to the toe of the mound to the east, south and west have provided an average working basal diameter of 85 ft. This would have produced an intact basal area of around 22,700 square feet. The portion of the basal area that remains is approximately 13,050 square feet or 57% of the mound. It is then possible to suggest that 43% of the mound has been lost since the closure of Watts Bar Dam in 1942. This represents an average annual rate of loss of about 1%. Observations at the site suggested that the rate of loss from lacustrine and current erosion would remain constant in the future and that no other severe stresses were operating to hasten the rate of loss.

Once these determinations had been made, it was necessary to select the life span of the stabilization technology that would be put into place. Options available for application as a long-term stabilization measure included the use of riprap, containerized stone covering (gabion) or some type of bulkhead. While each of these options would provide the maximum length of protection, the cost of installation was considered to be too great. For these options, materials transport and installation would have to be completed by barge which would add appreciably to the installation cost. A long-term effort at that time was not considered to be practical or cost effective.

Also, in this particular case, the time frame for installation in this remote area with limited access was considered to be critical since the period of winter drawdown would be over in about three months. Any treatment of the resource would have to be completed during that period.

Installation of a short-term, relatively low cost stabilization treatment technology was deemed to be the most appropriate course of action to be followed. Since the material that would be installed would have to be transported to the site by boat, any material to be considered had a preselection weight and bulk requirement built in. Filter fabric appeared to be the material that would not be too heavy or bulky to move in a 16 ft boat. Manufacturer's specification sheets were consulted in an effort to select from some of the materials that were available. Further advice was sought directly from the manufacturer. The erosion control problem was explained, and a recommendation for the "best choice" material was requested. Stabilization conditions that had to be met were detailed, and after several telephone sessions the manufacturer recommended a nonwoven fabric that appeared to best suit the requirements of this particular effort. Because of the permeability of the material selected, it was necessary to determine if an impervious underliner was necessary or desirable. The purpose of the underliner would be to protect the portion of the fabric that would be submerged by the lake water. It was considered possible that the submerged fill material in the mound would be melted during the period of submersion and the silt sized particles would then be trapped in the pores of the fabric. Filling of the pores would not only retard the passage of rainwater during low water periods, but the accumulated soil would add weight to the fabric. This added weight would then in turn put additional stress on the pins that hold the fabric in place. To prevent this situation from developing, an underliner of black polyethylene (6 mils) was installed along the face of the mound to a height of 4 ft, well above the high water line on the face of the mound.

Figure 2. Installation of underliner

As noted earlier, the filter fabrics are pliable and have the capacity to be fitted to a variety of irregular contours. The first step in the actual installation process was to prepare the surface to be protected. Since data recovery was not an issue in this case, surface preparation was limited to removing overhanging vines and those that had rooted to the face of the mound without disturbing the cultural deposit. Vine runners were cut loose along the top of the profile and allowed to drop to the base of the mound where they were raked into a pile. Once the fabric was in place, these vines were piled against the bottom of the mound to serve as a temporary breakwater.

Installation of the filter fabric was accomplished by cutting appropriate lengths of material off the roll and draping each piece down the cutbank like a curtain. The fabric measures 14.5 ft wide and can be cut to appropriate lengths with a sharp knife. Scissors are not recommended because the fabric will compress and pinch between the scissor jaws. In addition, the cloth will quickly dull the cutting edge of any implement, making frequent resharpening necessary.

The first piece of the material was installed on the downstream end of the bank and pinned into place using 18 inch steel pins that have a 1 1/2 inch washer affixed to the top. This washer keeps the pins from pulling through the fabric. Additional pieces of the fabric were added with a 6 to 8 inch overlap at the joints. Once all of the pieces had been properly located and temporarily pinned, additional pins were added at strategic points to insure that the fabric conformed to the undulations of the cutbank. Obviously, the specific installation progression that was employed at Huffine Island will likely have to be adjusted to particular resources being treated in other places.

The final step in the stabilization process was the preparation of a report describing the activity that has been undertaken (Thorne 1987).

Figure 3. Installing filter fabric

Post - Installation Monitoring

Stabilization frequently is an intermediate step towards resource conservation. To ensure long term preservation, the effectiveness of the stabilization treatment must be checked regularly. A monitoring program must be established, and the responsibility for implementing it in a scheduled manner must be assigned to the appropriate personnel.

At Huffine Island, monitoring is completed on a quarterly basis. Responsibility for completion of the inspection process is shared by both the Center and TVA. On the basis of these regular inspections it will be possible to determine if the predicted five year life of the fabric will be reached. If and/or when failure of the material becomes evident, a new effort to further protect the site will be initiated. The material at Huffine Island has been in place for a year at this writing and is functioning in an excellent fashion.

Figure 4. Present appearance of site

Detailed references to the work at Huffine Island include Thorne 1987; 1988. A VHS format video tape that will last between 12 and 15 minutes is currently being prepared and will be available in June, 1988 from the Center address shown below. The tape will be made available on a loan basis.

The variety of options available for land surface stabilization is not widely known within the archeological community. Consequently, neither the use of filter fabrics nor development of other techniques is generally widespread. An experimental program for the development of cost effective archeological site stabilization techniques has been initiated by the Center for Archaeological Research at the University of Mississippi in cooperation with the Cultural Resources Program of the TVA.

Request for Assistance

The *in situ* maintenance of archeological properties is in its developmental stages. Uncertainties regarding the effects of potential techniques on some resources also exist. Sharing of common experiences - both successes and failures - is an urgent need. To this end we have established a clearinghouse for stabilization information at the Center.

Reports on previously implemented archeological site stabilization efforts, when available, are frequently not readily accessible. As a consequence, our efforts in information exchange will be eased considerably if cases of site stabilization are reported to:

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