YAZOO BASIN - STREAMBANK EROSION CONTROL EVALUATION AND DEMONSTRATION PROJECT

by

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The Streambank Erosion Control Evaluation and Demonstration Project was authorized by Section 32 of the Water Resources Development Act of 1975, Public Law 93-251. This act authorized the Corps of Engineers to:

1. Evaluate the extent of streambank erosion nationwide.
2. Develop new methods and techniques for bank protection and identify causes of erosion.
3. Report to Congress on study results and recommend a means for prevention and correction.
4. Construct demonstration projects including bank protection works.

The above items represent only a portion of the information presented in PL 93-251, but do reflect the charge placed on the Corps of Engineers by Congress. The Section 32 Program is a nationwide program, but this paper will be limited to the activities underway in the Yazoo River Basin. (Fig. 1). In 1969, a report was presented to the Secretary of the Army concerning streambank erosion. This report stated that over one-half million miles of streambank was undergoing some degree of erosion and that 148,000 miles merited further examination to determine if treatment is justified. This same report revealed that over ninety million dollars' damages were contributed to streambank erosion annually. These damages include land losses, undermined structures, threatened homes, sedimentation and reduction in aesthetic appeal of the streams. Almost one-half of the damages were attributed to sedimentation. In my opinion, these damage figures are not at all inflated but are probably low, based on the experience the Vicksburg District is having with sedimentation in the Yazoo River Basin. These figures are not currently accurate but are used to serve one purpose. That is to illustrate the magnitude of the streambed and bank erosion problem.

The specific streambank problems addressed in this paper occur on the hill tributaries to the Yazoo River above Greenwood and below Arkabutla Lake within the Yazoo Basin Watershed. Figure 1 is a schematic illustration of the demonstration area.

Most of the small tributary streams in the Yazoo Basin probably looked like the stream in Figure 2 prior to settlement of the area. There were defined channels, vegetated to the top bank with a tree canopy overlapping the stream. Now, many of the streams have eroded badly, entrenched themselves deep into the highly erodible soils, and are choked with debris and sand (Fig. 3). Many factors have contributed to the deterioration, most all of them imposed by development of the area for agricultural and other land uses, such as urbanization and mining.

The immediately identifiable factors that contribute to streambank instability are:

1. Straightening of the stream, thereby increasing the hydraulic gradient.
2. Lowering of the base level of the stream the tributary empties into, which also increases the gradient of the tributary.
3. Poor land use practices which include excessive land clearing, clearing and plowing to top bank, and disposal of debris in the stream.

There are many other factors having varying degrees of influence on stream stability. The above are considered the most influential.

You may have noted earlier that I referred to the problem as a streambed and bank erosion problem. We believe that a majority of the serious bank caving problems within the hill area of the Yazoo River Basin are attributable to bed instabilities. For instance, if the degradation trend begins on a stream because of one of the factors mentioned earlier, the bed will degrade and the banks will then fail. (See Figs. 4 & 5). Because of this, we have divided the program into three major areas of activity:

1. Bank protection works in areas where active bank caving is occurring.
2. Grade control to prevent bed degradation from moving upstream, thereby creating additional bank stability problems.
3. Data collection and analysis within the watershed to identify watershed problems and possible cures.

The third area of activity is being performed by the U. S. Department of Agriculture, Science and Education Administration, in Oxford for the Corps; and I expect this will be the topic of numerous technical reports in the future.

We have used many different techniques to protect caving banks, including board fence revetments, used tire revetments, transverse stone dikes, wire post retards, board fence retards, longitudinal stone dikes, and longitudinal toe protection using old tires and hay as fillers (Figs 6-13). Vegetative treatment in combination with all the structural techniques has been done. Vegetative treatment has so far been seeding with grasses and planting willows. Further experimentation with various vegetative techniques is being done by SEA in Oxford. In order to illustrate the effects of the stabilization methods used thus far, a series of before and after photographs is presented

(Figs. 14-21). The captions explain the treatment at each location.

Our second approach to the problem involves grade control. The idea here is to install a "hard point" in the streambed to prevent degradation from progressing upstream. Figure 22 illustrates a typical head cut in Perry Creek. Figure 23 is a typical grade control structure used to control head cuts. By controlling the head cut, bed degradation is controlled, preventing future bank caving upstream of the degradation. Figures 4 & 5 show the difference in character of the stream above and below a head cut.

Grade control offers much more hope for curing stream instabilities than does bank protection. Bank protection is only a "bank-aid" that solves this problem locally but does nothing to eliminate or reduce further caving at other locations. Bank protection should not be minimized in importance, however, because it is quite essential in actively caving areas to protect property, structures, and stream alignment. Grade control can prevent caving upstream of the structure and will serve to prevent increases in sediment load in the stream that contributes to instability of the stream and jeopardizes the stream system's ability to pass flood flows.

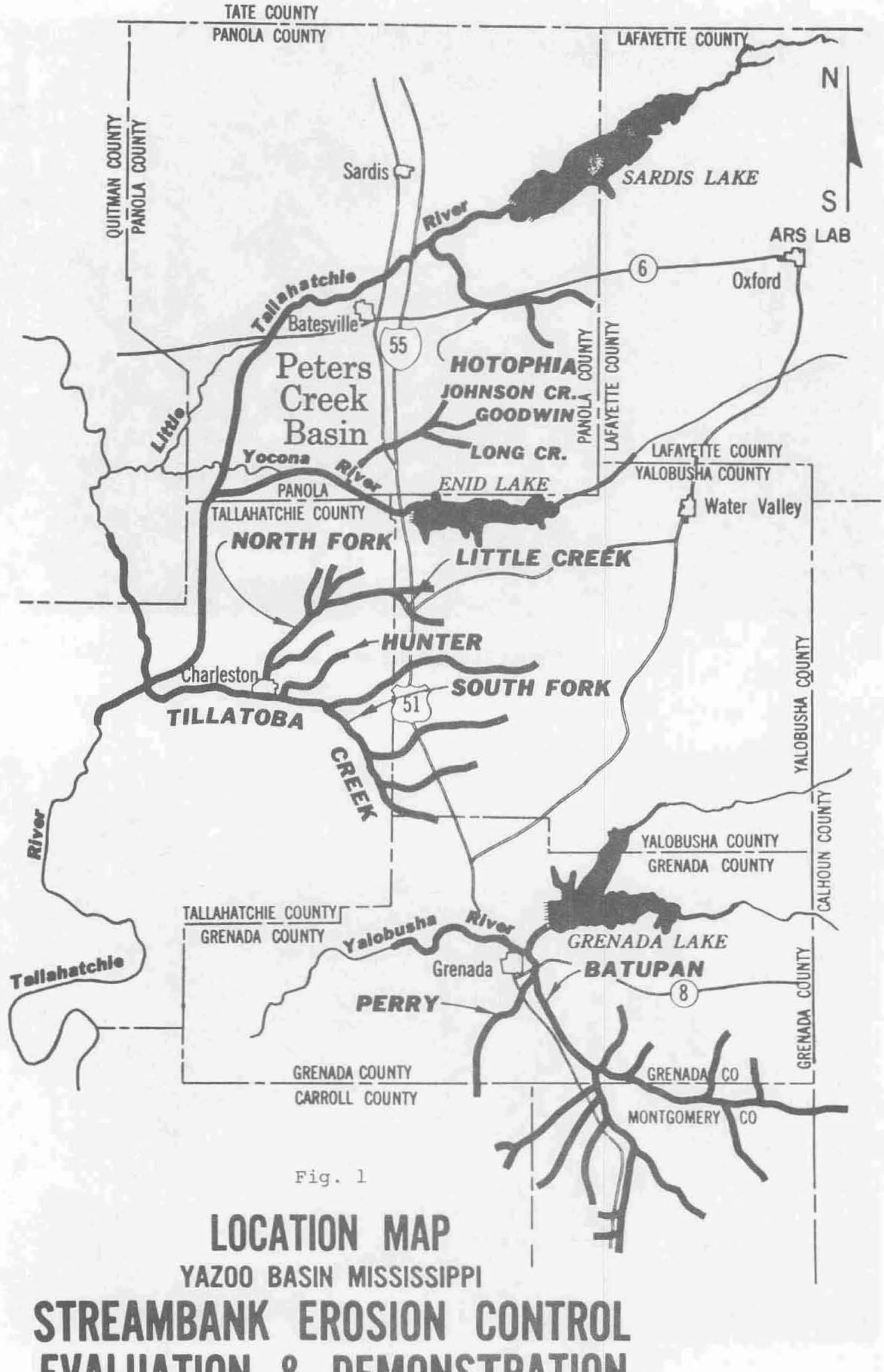

Fig. 1

LOCATION MAP
YAZOO BASIN MISSISSIPPI
STREAMBANK EROSION CONTROL EVALUATION & DEMONSTRATION

Figure 2. Natural Stable Stream

Figure 3. Heavily Eroded Stream

Figure 4. Headcut Viewed Upstream

Figure 5. Looking Downstream of Headcut

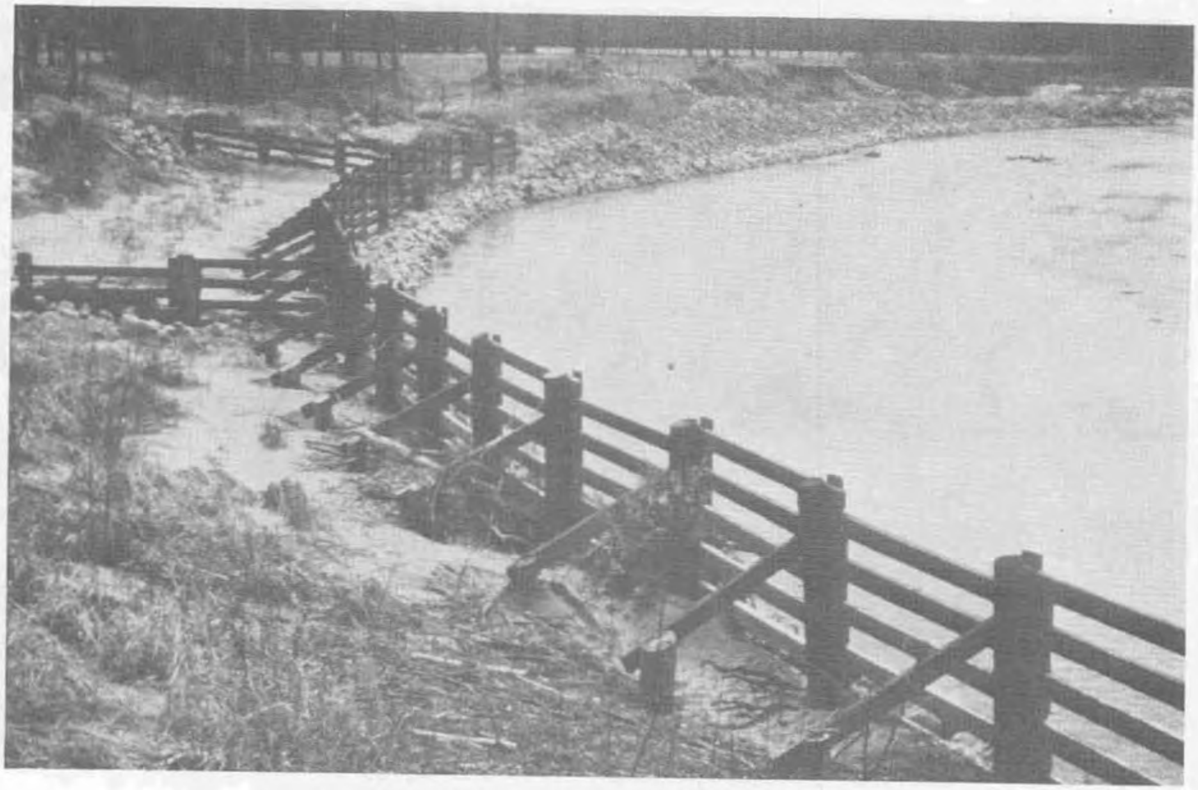

Figure 6. Board Fence Revetment

Figure 7. Used Tire Revetment with Willow Stob

Figure 8. Transverse Stone Dike

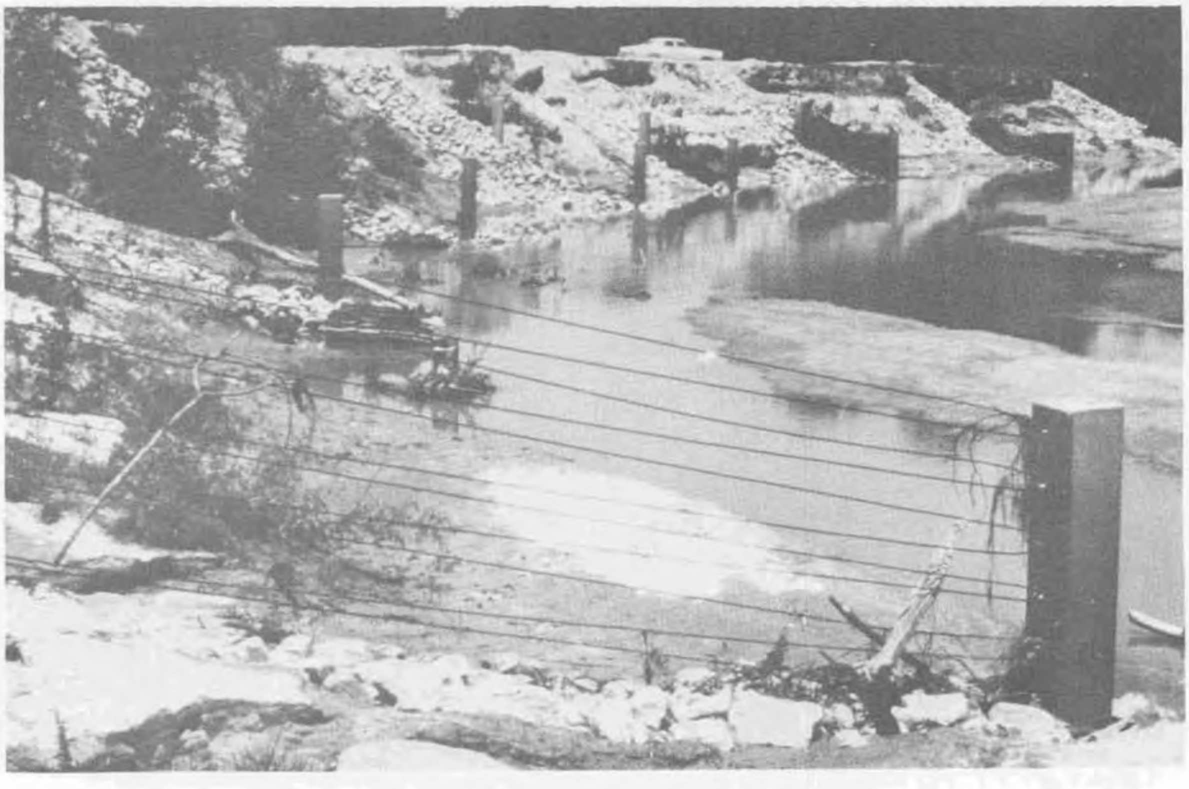

Figure 9. Wire Post Retards

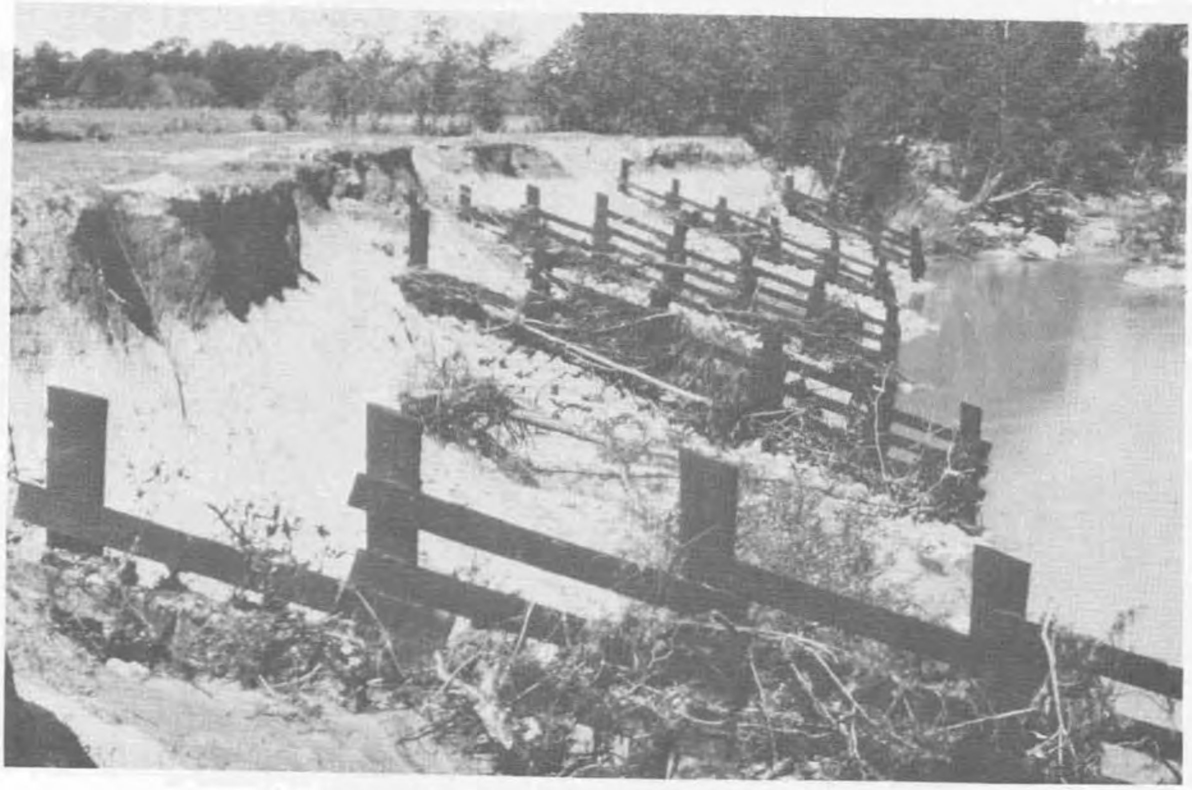

Figure 10. Board Fence Retards

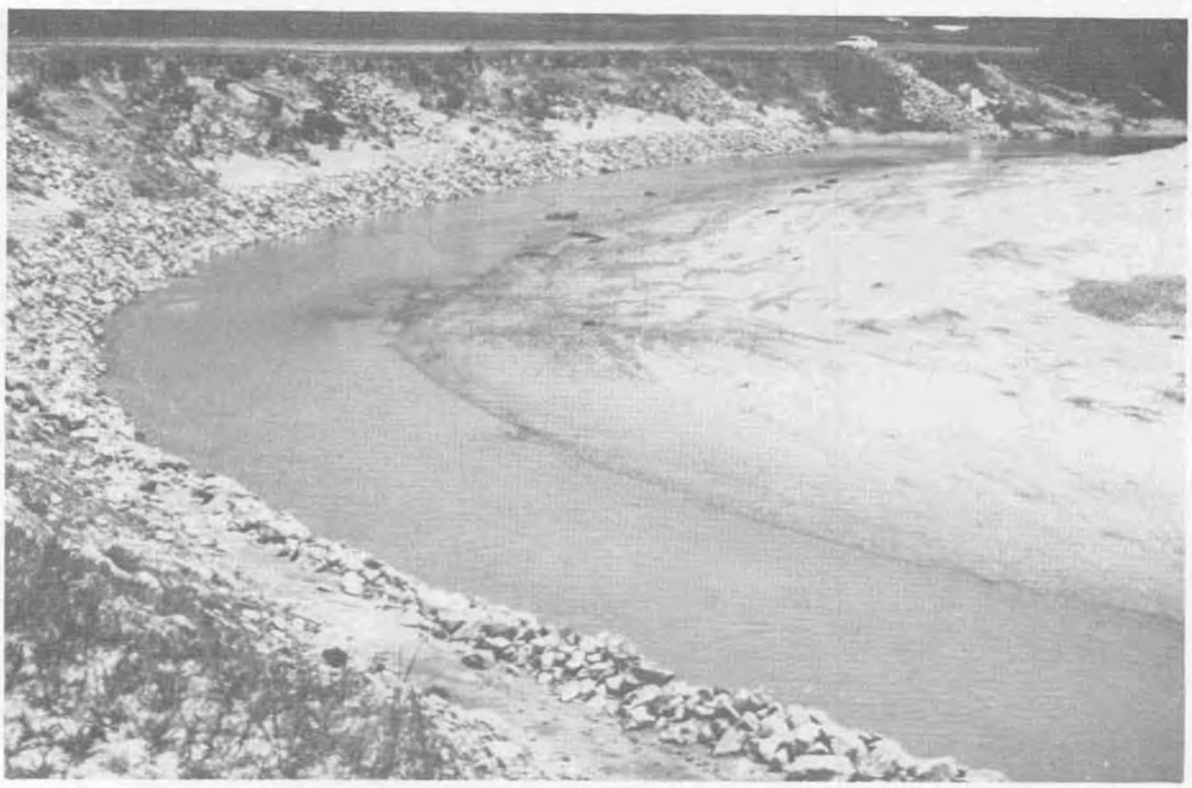

Figure 11. Longitudinal Stone Dike with Tie Back

Figure 12. Longitudinal Toe Protection Using Used Tires

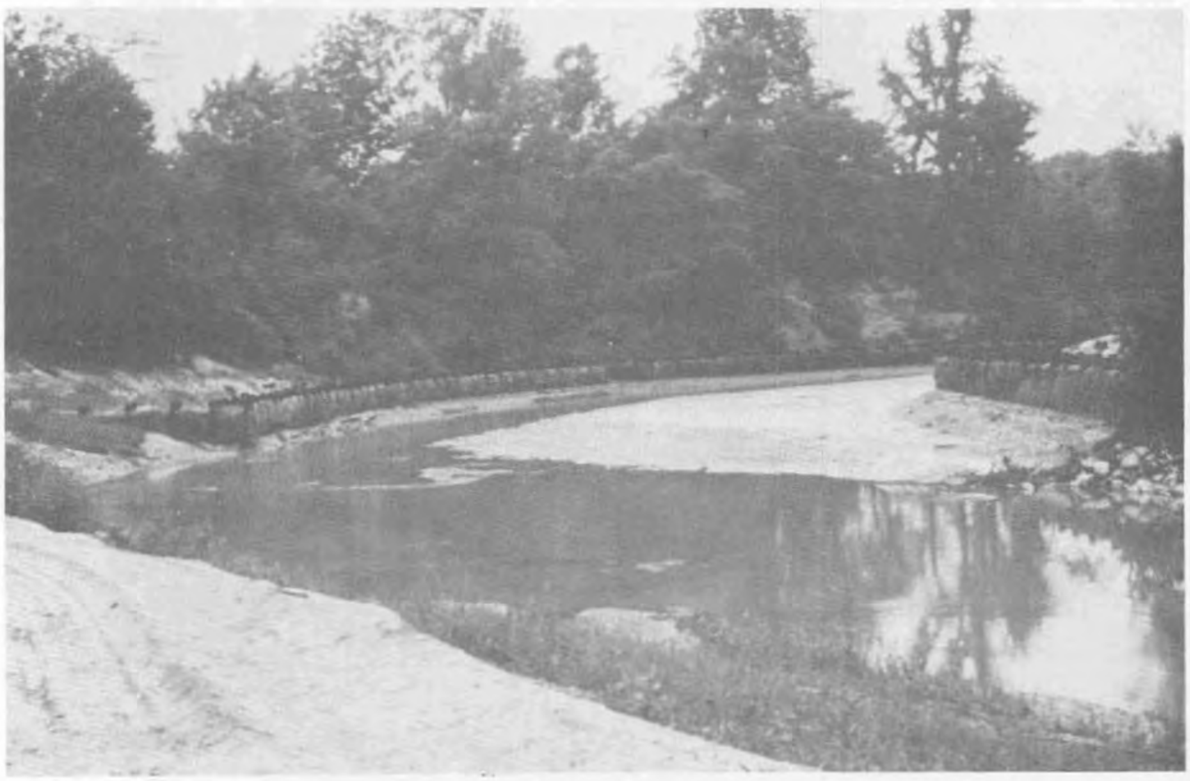

Figure 13. Longitudinal Toe Protection Using Hay

Figure 14. Placing Used Tire Revetment with Willow Stobs

Figure 15. 1 Year Later Note Willow Growth

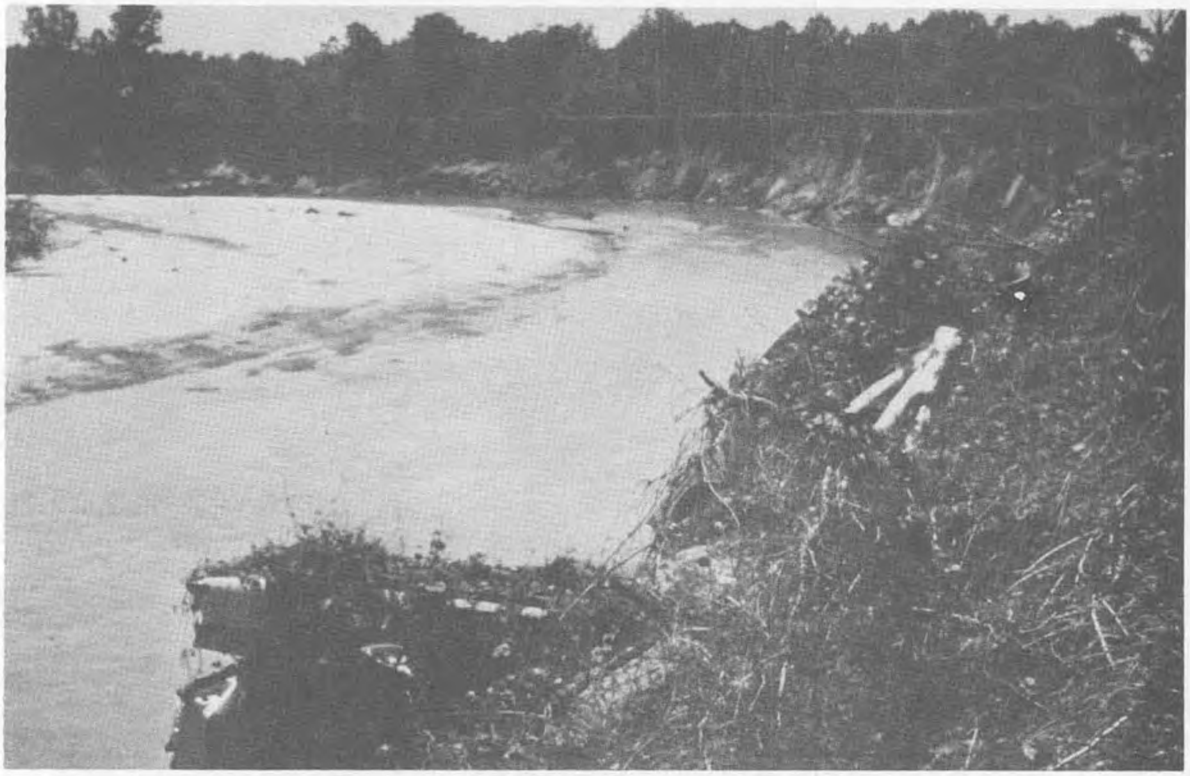

Figure 16. Before Bank Protection

Figure 17. 2 Years After Longitudinal Stone Dike with Tie Back

Figure 18. Placing Soil Cement Sack Revetment

Figure 19. Soil Cement Sack Revetment in Place

Figure 20. Before Bank Protection

Figure 21. Longitudinal Stone Dike with Upper Bank Seeding

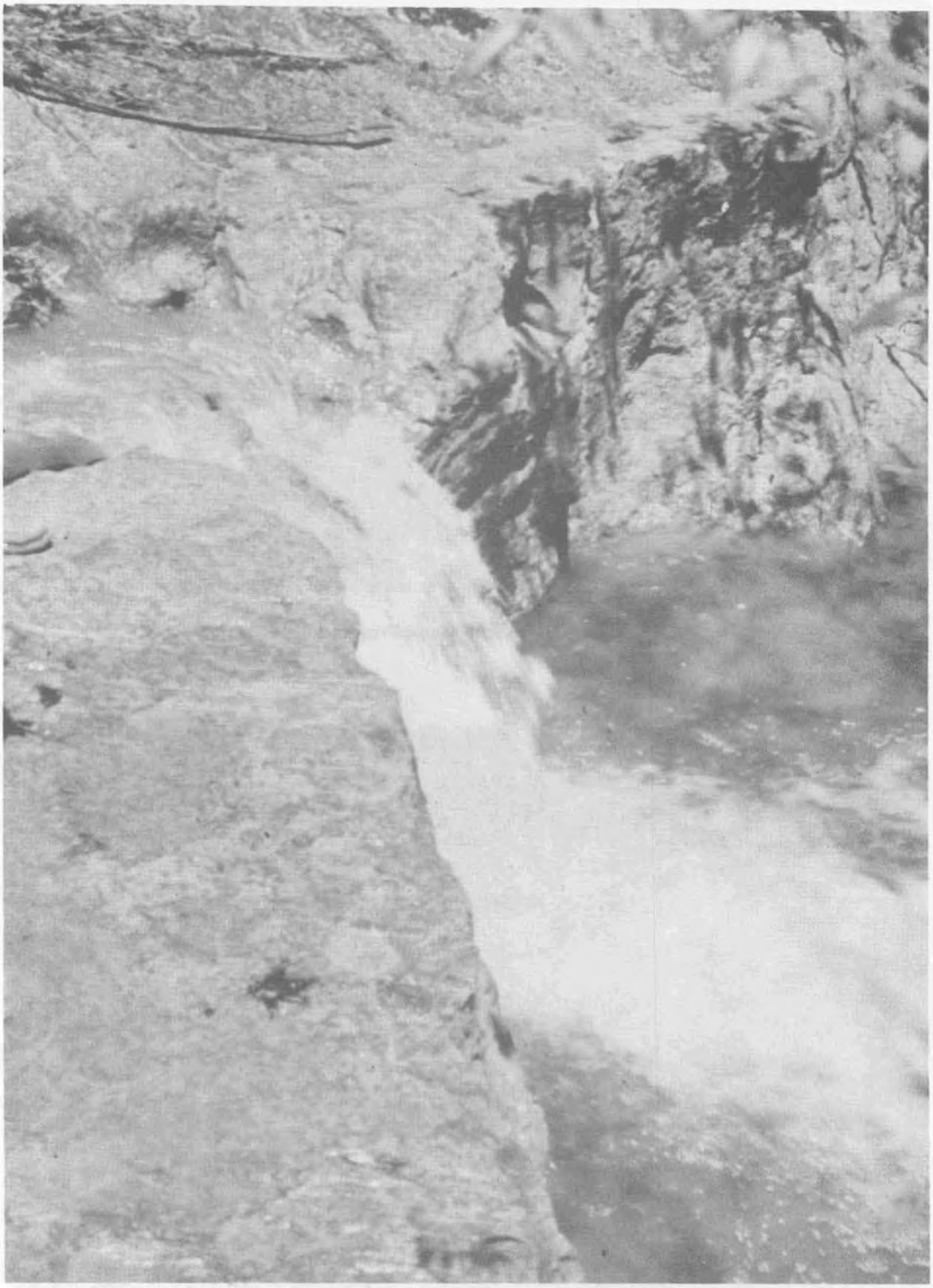

Figure 22. Head Cut on Perry Creek

Figure 23. Grade Control Structure