



Photo 7-37 A close-up of bench of Site 14 midpoint

the tributary include an alluvial fan and the early to mid-Holocene surfaces. Earlier work conducted by Overstreet and Anderson further indicates that this site contains thick historical alluvium (Overstreet 1985a, Anderson 1991).

Causative factors for bank retreat at this site include flood-flow oversteepening and rapid recession slumping, wave and rework-transport of deposited sediments within berm and bench areas, and piping-related cantilever and block failures (see Photo 7-36). The thalweg sailing line is remote from this site; however, heavy fleeting activities surrounding this site generate significant waves (see Photo 7-37 for evidence of wave erosion). A combination of Type A and Type B characterizes Site 14.

15. Site 15 at RM 576.0 LDB (Pool 12)

This left-bank island site in a fleeting area, shown in figure 7-51, is located about 7 miles downstream from Lock & Dam No. 12, along the inside bank of a minor bend. An upstream view of the site is shown in Photo 7-38. Three bank sections measured in the

field are shown in figures 7-52 through 7-54. The bank soils are primarily MST to CST and the soil near the water's edge is FS. Subaqueous sediments are sand (VFS-FS). Failed revetment stone was observed along the bench, as indicated in figure 7-53.

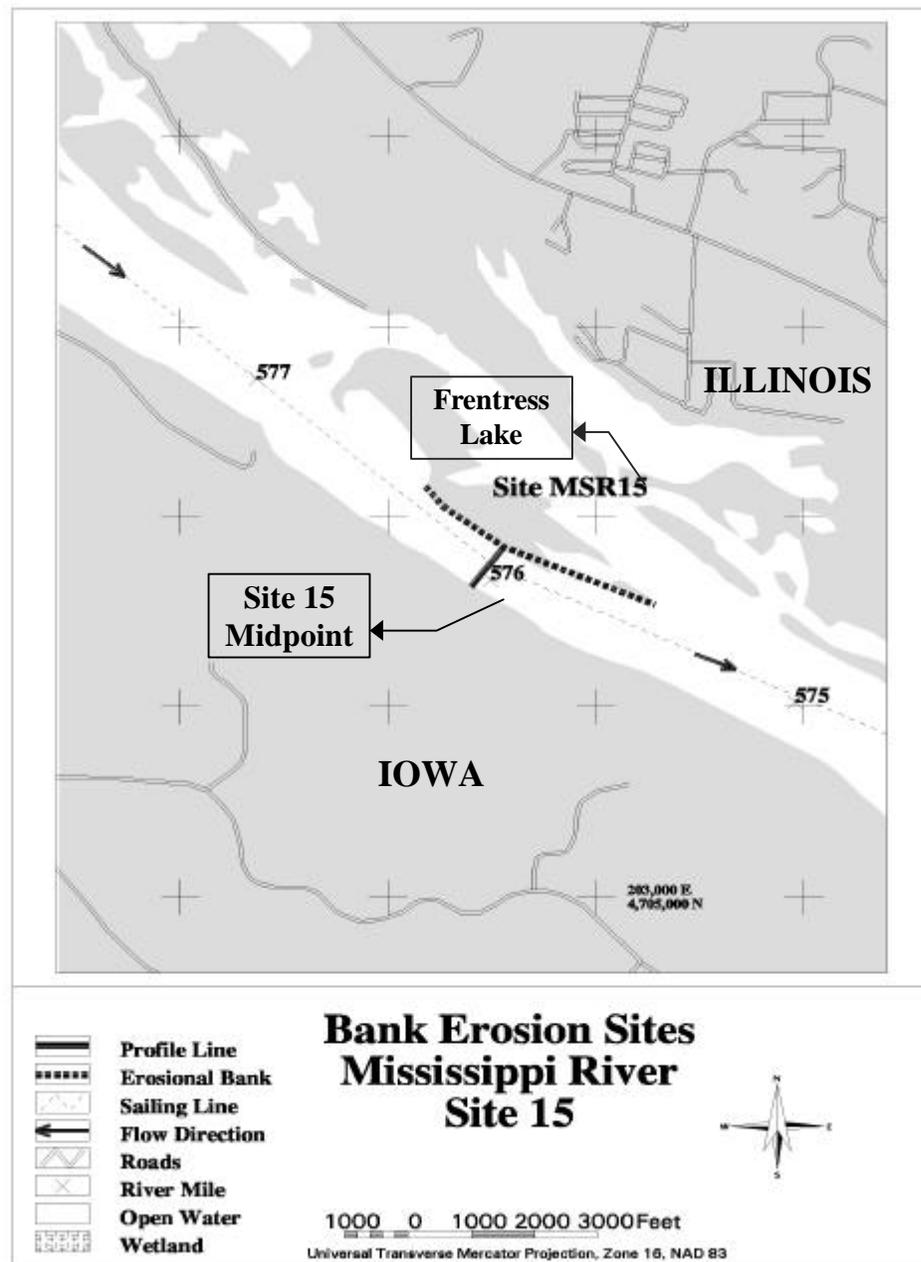


Figure 7-51 A site map showing Mississippi River Site 15



Photo 7-38 An upstream view of Site 15 midpoint

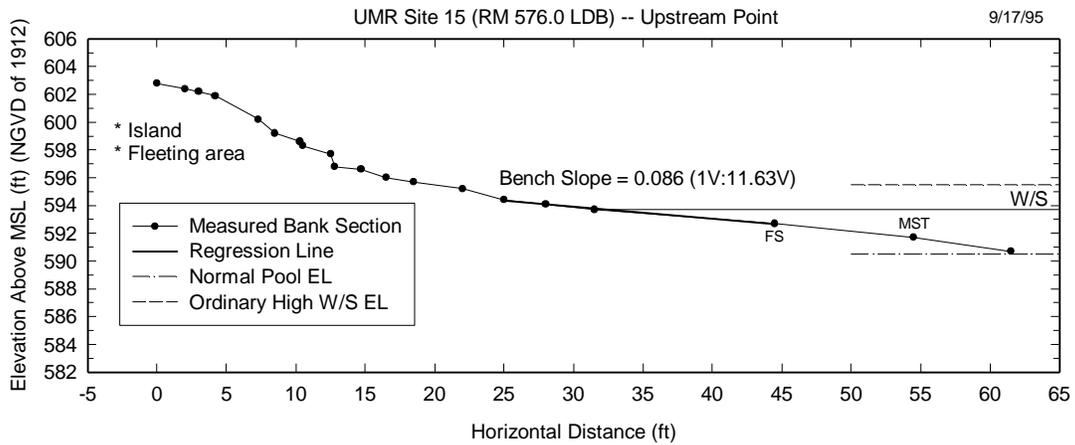


Figure 7-52 Bank section measured at Site 15 upstream point

The site is on a late Holocene island, and two sampling tube cores advanced at the site showed thick historical alluvium to at least 10 ft, as shown in figure 7-53. Archaeological site 11JD124 is located approximately 1 mile upstream from the erosion site, and site 11JD126 is about 1 mile downstream.

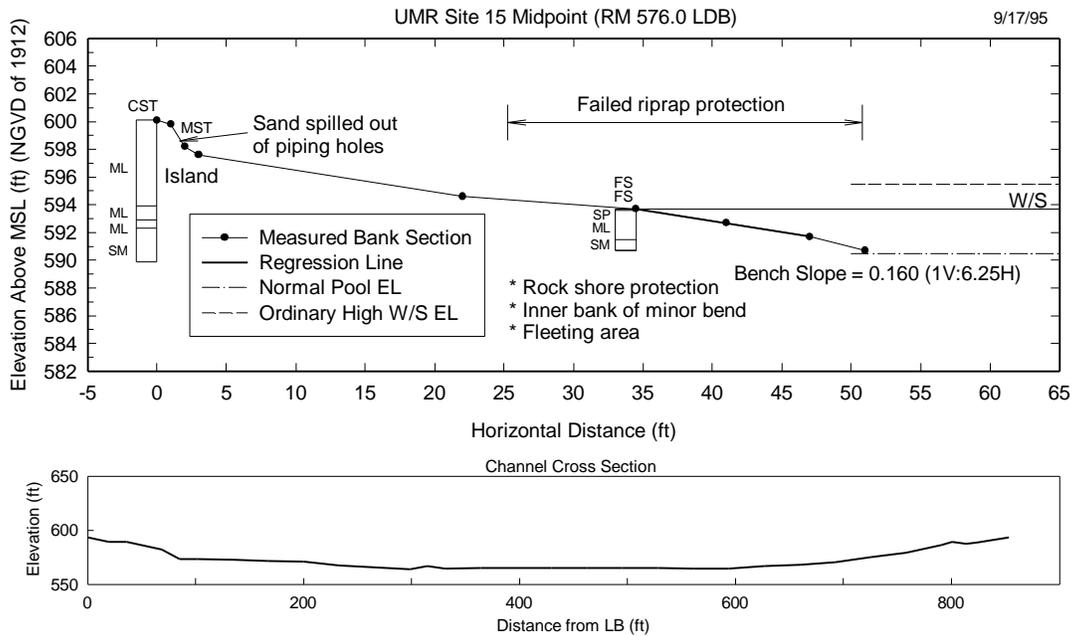


Figure 7-53 Bank section and channel cross section measured at Site 15 midpoint

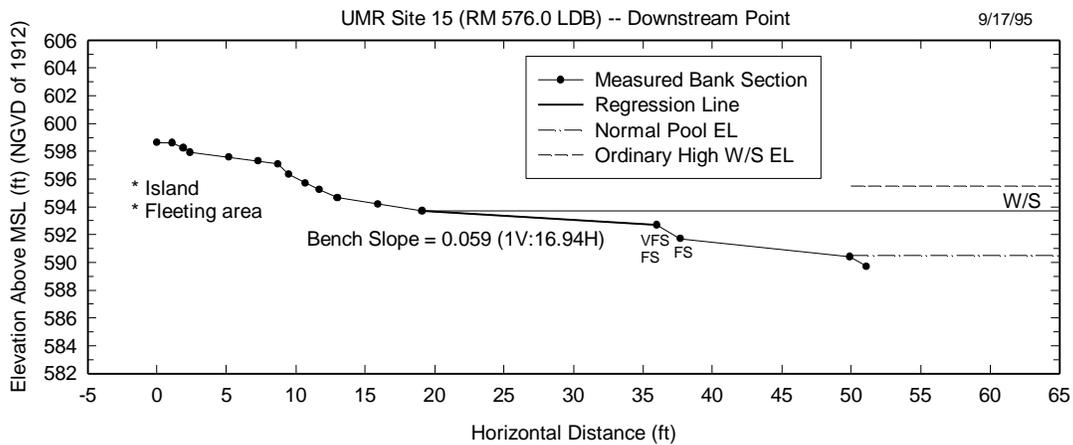


Figure 7-54 Bank section measured at Site 15 downstream point

Evidence of severe erosion was observed where barges were moored. Heavy infestation of zebra mussels was observed on riprap materials as well as on moored barges. Photo 7-39 shows the bankline disturbed by mooring activities. There were some piping features within the scarp, and fine sand at the midpoint section was being displaced by piping (see Photo 7-40). Causative factors for bank retreat at this site include wave

erosion and rework-transport of failed soils and recently deposited sediments, piping-related failures. This site has been subject to barge run-up and beaching. The site can be classified as Type C.



Photo 7-39 Disturbed bankline of Site 15 midpoint



Photo 7-40 Hidden piping feature of Site 15 midpoint

16. Site 16 at RM 551.9 LDB (Pool 13)

This left-bank island site on the inside of a bend, shown in figure 7-55, is located 4.8 miles downstream from Lock & Dam No. 13. Side, upstream, and downstream views

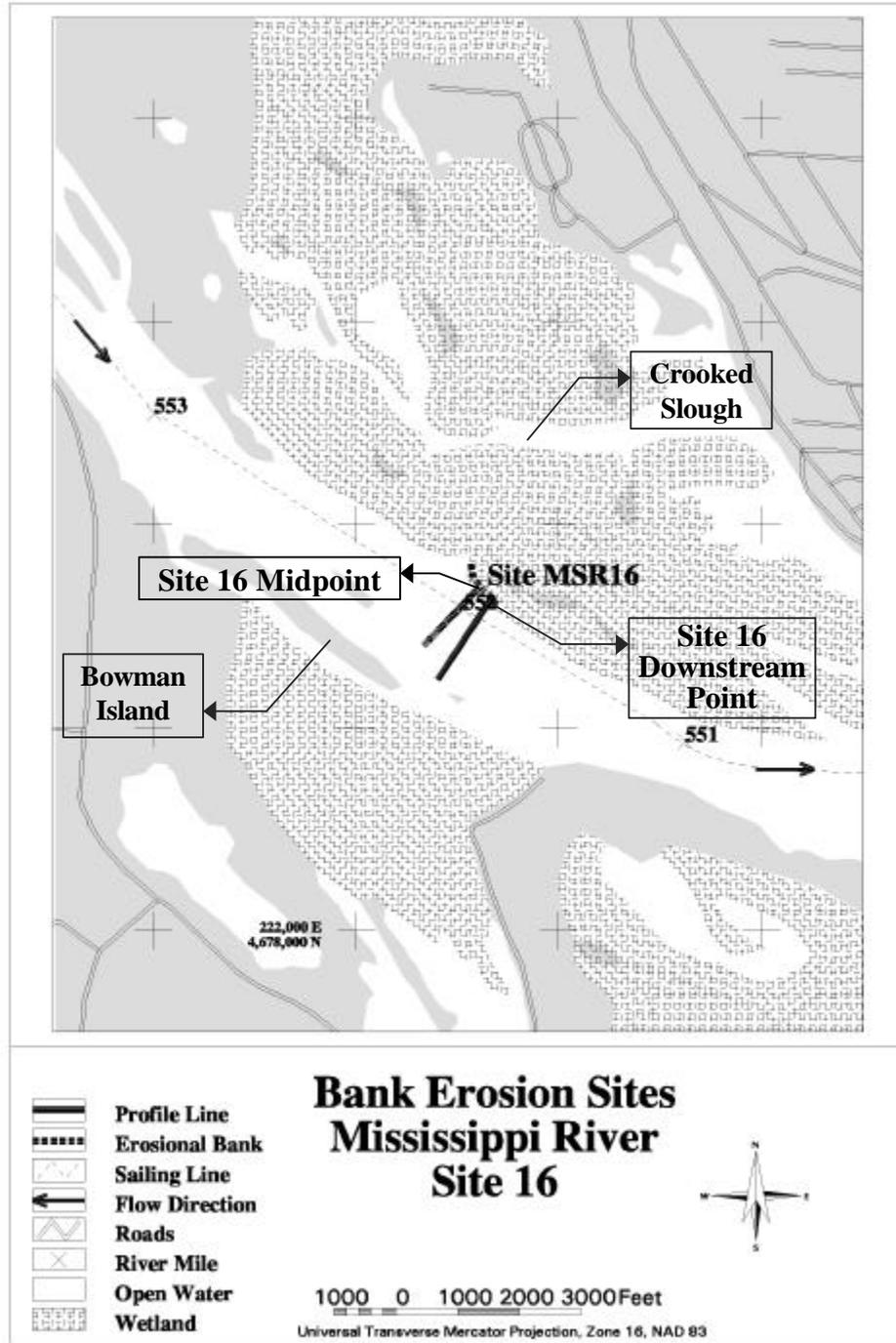


Figure 7-55 A site map showing Mississippi River Site 16

of this site are shown in Photos 7-41, 7-42, and 7-43, respectively. Photo 7-44 shows a close-up view of the scarp. Three bank sections were taken at this erosion site and are shown in figures 7-56 through 7-58. The bank soils consist primarily of silt (FST-MST)



Photo 7-41 A side view of Site 16 midpoint



Photo 7-42 An upstream view of Site 16 midpoint



Photo 7-43 A downstream view of Site 16 midpoint



Photo 7-44 A close-up view of Site 16 midpoint

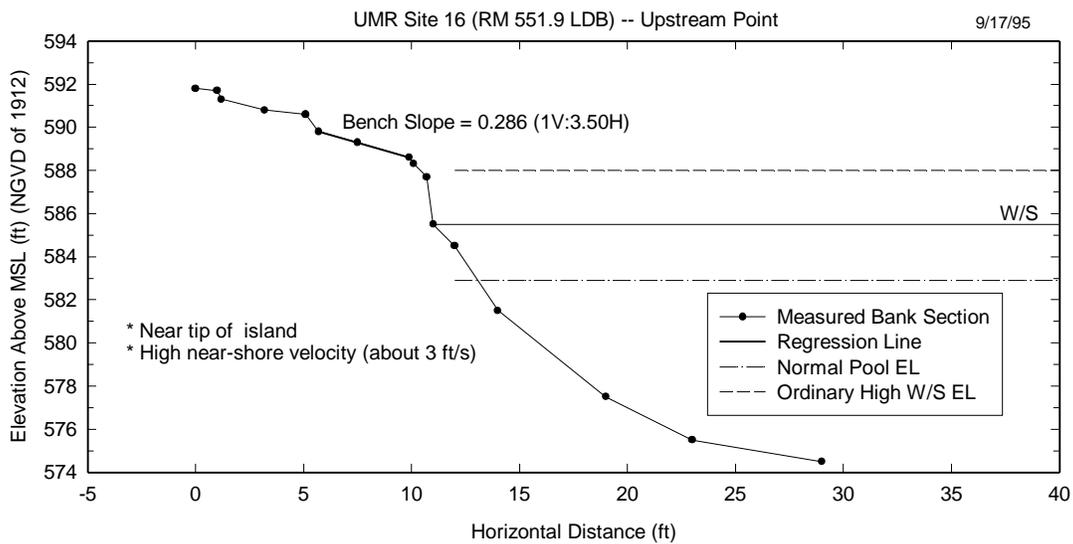


Figure 7-56 Bank section measured at Site 16 upstream point

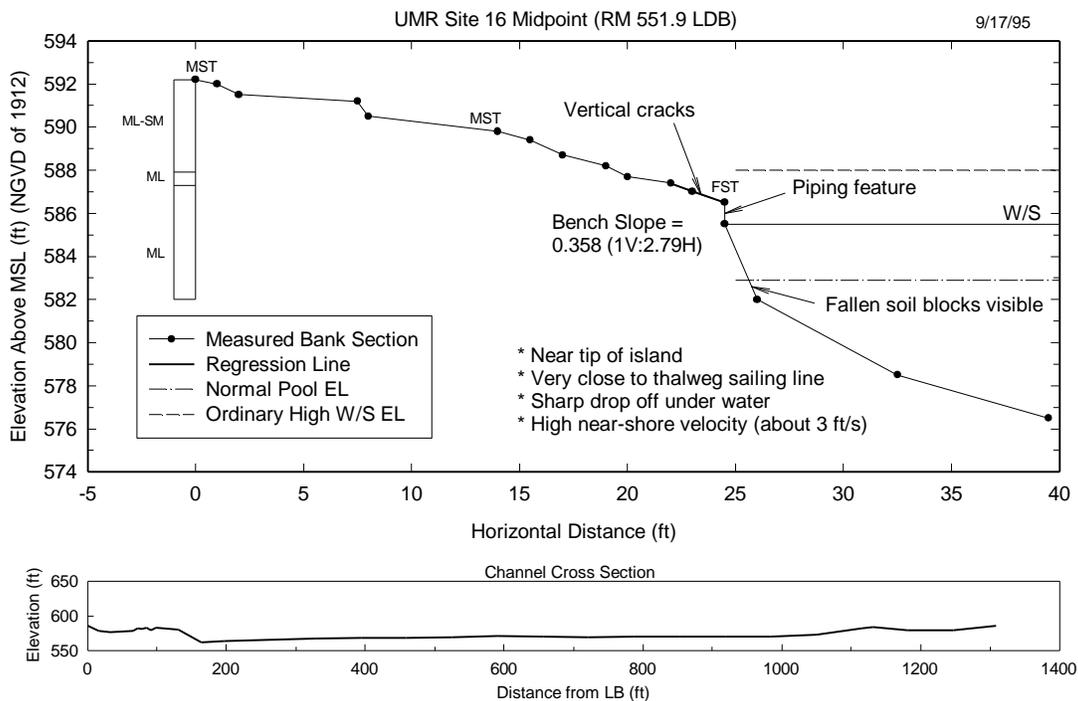


Figure 7-57 Bank section and channel cross section measured at Site 16 midpoint

and subaqueous sediments are silt (VFST-MST). The site is very close to the thalweg and evidence of severe flood-related channel erosion was visible. The near-bank flow velocity was estimated to be about 3 ft/s, at the time of the field study. At the downstream point, a rock pile was found, about 60 ft off the water's edge.

The core sample indicated historical alluvium at least 3 ft thick, overlying a poorly drained very late Holocene surface. Older Holocene surfaces and late Wisconsinan outwash terraces occur closer to both east and west valley walls. A well developed paleosol is buried by late Holocene eolian sand on a nearby late Wisconsinan outwash terrace at the Savana Army Depot at RM 549.6. Within the channel, flood flows appear to have eroded the outwash terrace, and destabilized the terrace slope. Destabilization appears to have occurred from the 1993 flood event because earlier work found the outwash terrace slope to be apparently stable (Benn et al. 1989).

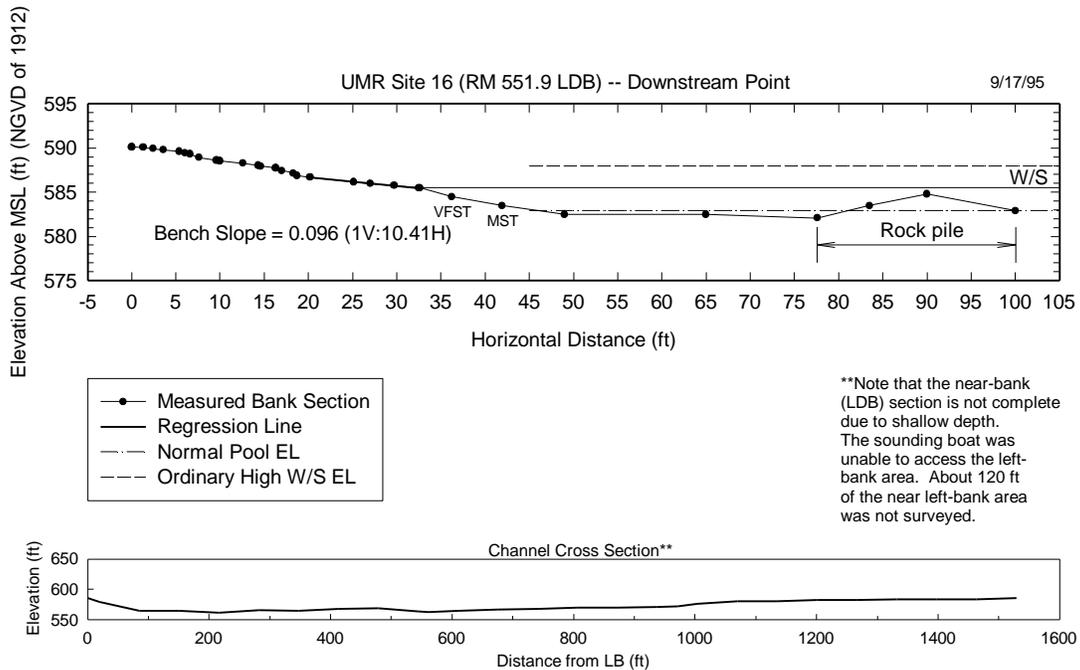


Figure 7-58 Bank section and channel cross section measured at Site 16 downstream point

Both at the upstream section and the midpoint section, the scarp contained piping features, and fallen soil blocks were found in the water. Causative factors for bank retreat at this site include flood-flow related oversteepening and recessional slumping, lower-bank piping-related cantilever and block failures, wave and flow rework-transport actions, and secondary currents. Type C characterizes Site 16.

17. Site 17 at RM 512.7 LDB (Pool 14)

This site is a mid-channel island site in a rather straight river reach, 9.8 miles downstream from Lock & Dam No. 14, as shown in figure 7-59. Upstream and downstream views of the midpoint site are shown in Photos 7-45 and 7-46, respectively. Photo 7-47 shows an upstream view of the toe of the island, and Photo 7-48 shows wave removal of sand from the bench cover near the toe of the island. Substantial downstream accretion of the island since 1984 can be seen in figure 7-59. In order to investigate bank erosion characteristics on the island, five bank sections were taken along the channel side and two sections were taken along the back channel (see figures 7-60 through 7-66). The bench area cover is primarily sand with recently deposited silt. Subaqueous sediments are medium sand (MS) at the upstream limit, coarse silt (CST) at the midpoint section, and CST on top of FS at the downstream limit, indicating the reduction in bed-material particle size along the island. The island is located within two large wing dams which extend toward the main channel from the left bank approximately 1,700 ft, and immediately downstream from Beaver Slough along the right bank. Beaver Slough is heavily used by barge traffic, and the area across from this island site is a busy fleeting site. The upstream tip of this island is eroded and the toe of the island appears to be extending downstream, indicating that the island is shifting downstream.

This island is apparently late to very late Holocene age. Three sampling tube cores showed the historical alluvium thickness varying from about 4.0 ft to 6.0 ft. Below the historical deposits, a weakly developed very late Holocene soil was found. The sampling tube core taken at the midpoint section showed a second buried organic enriched surface (A_{cg} horizon) at about 9.2 ft below the surface.

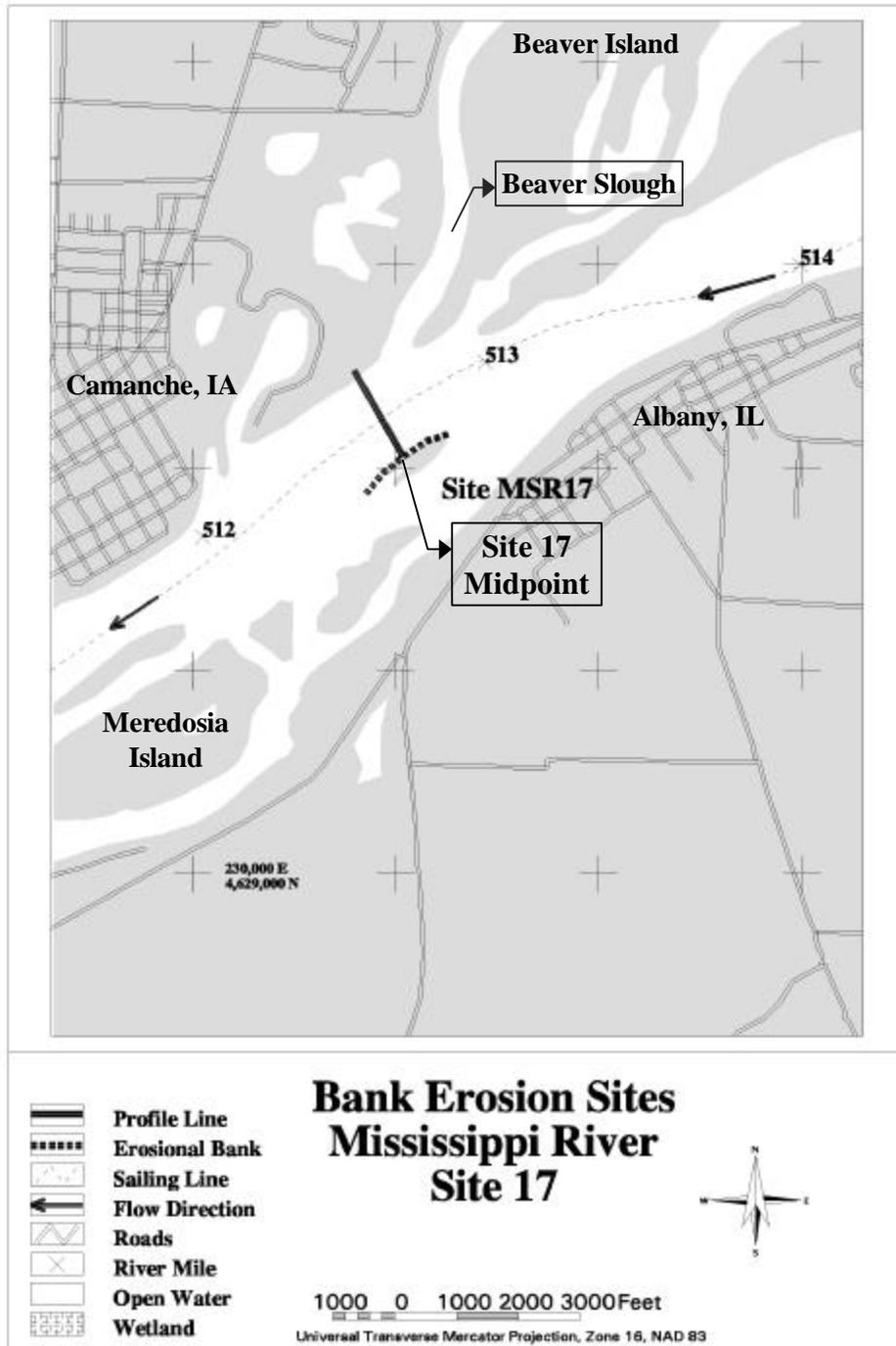


Figure 7-59 A site map showing Mississippi River Site 17



Photo 7-45 An upstream view of Site 17 midpoint



Photo 7-46 A downstream view of Site 17 midpoint



Photo 7-47 An upstream view of toe of island of Site 17



Photo 7-48 Sand removal near toe of island of Site 17

Causative factors for bank retreat at this site include flood erosion, wave and flow rework-transport actions, and piping-related collapse. Because the site is remote from the thalweg sailing line, erosion potential due to traffic-generated waves appears to be minor. Eroded bank types for these seven sections are characterized by Type D and Type E, as listed in table 7-5b.

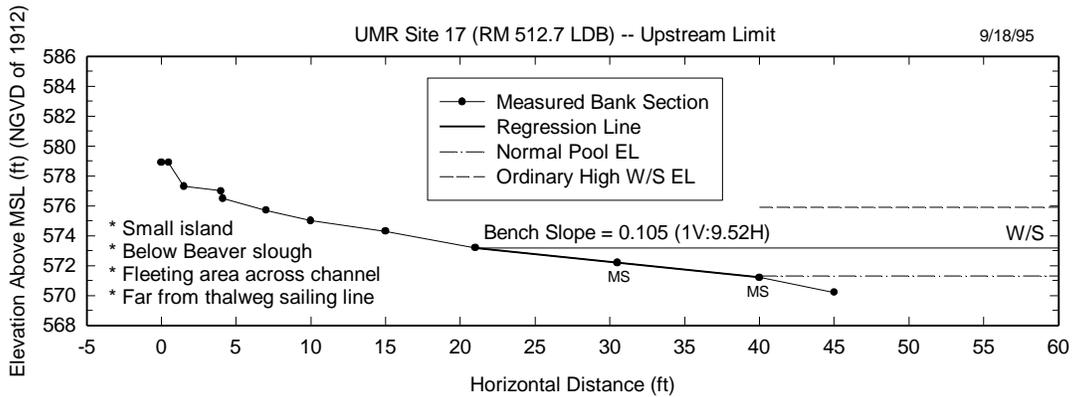


Figure 7-60 Bank section measured at Site 17 upstream limit

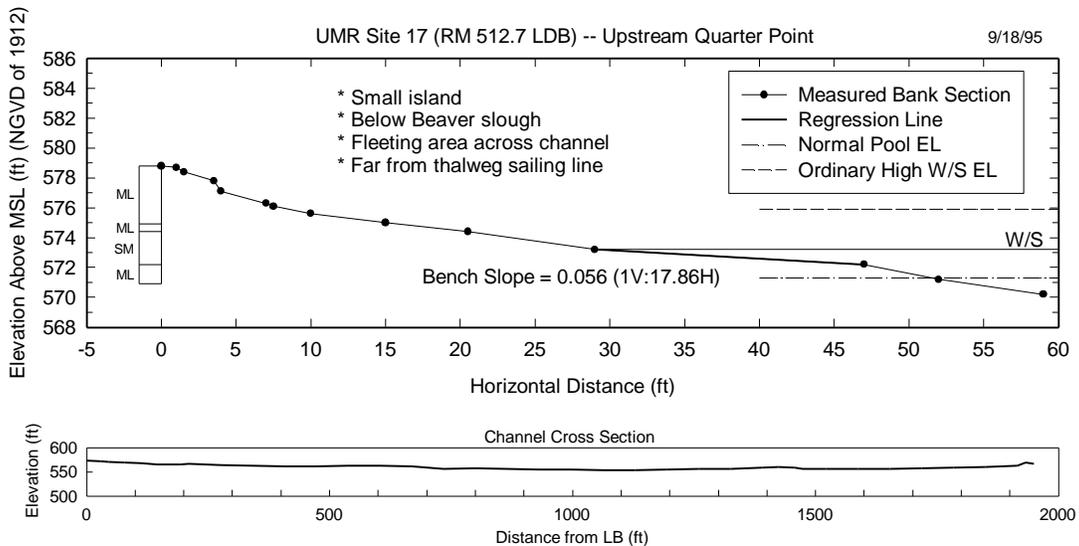


Figure 7-61 Bank section and channel cross section measured at Site 17 upstream quarter point

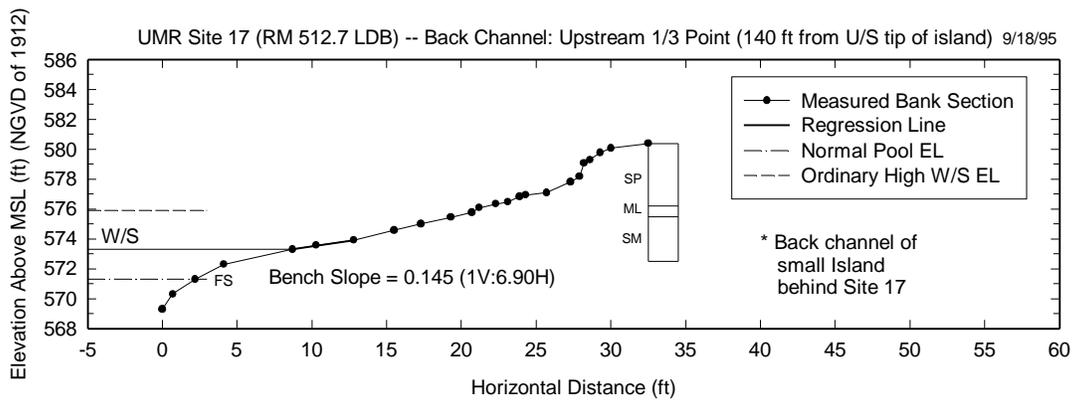


Figure 7-62 Bank section measured at Site 17 back channel upstream 1/3 point

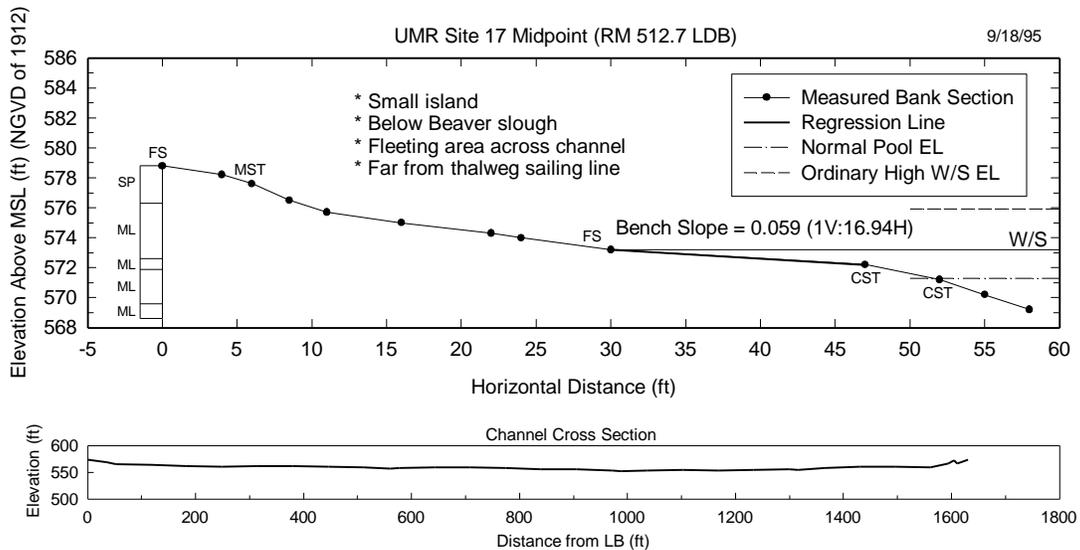


Figure 7-63 Bank section and channel cross section measured at Site 17 midpoint

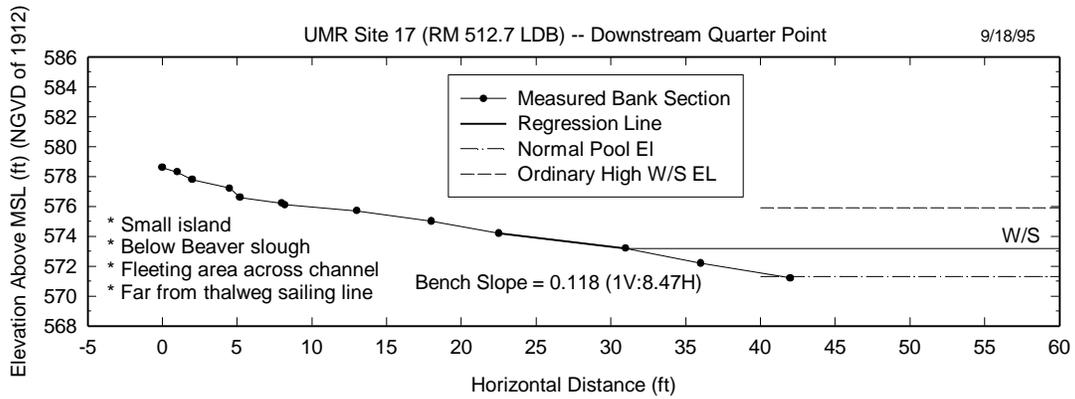


Figure 7-64 Bank section measured at Site 17 downstream quarter point

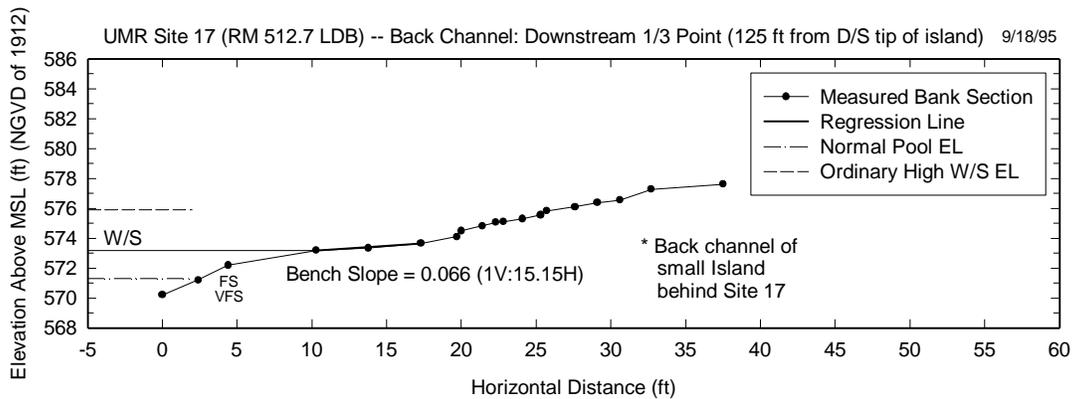


Figure 7-65 Bank section measured at Site 17 back channel downstream 1/3 point

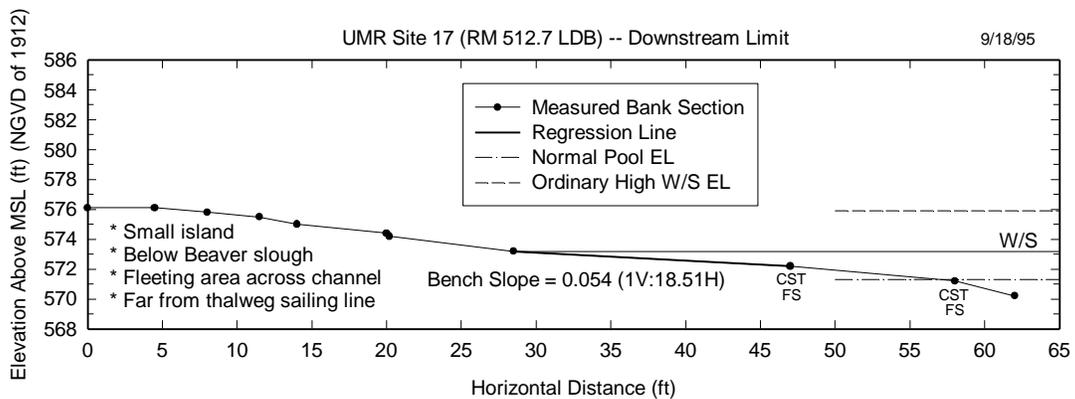


Figure 7-66 Bank section measured at Site 17 downstream limit

18. Site 18 at RM 509.2 RDB (Pool 14)

This right-bank island site, shown in figure 7-67, is located on Camanche Island in a straight reach of the MR. The island is covered by dredged material. Photo 7-49 shows

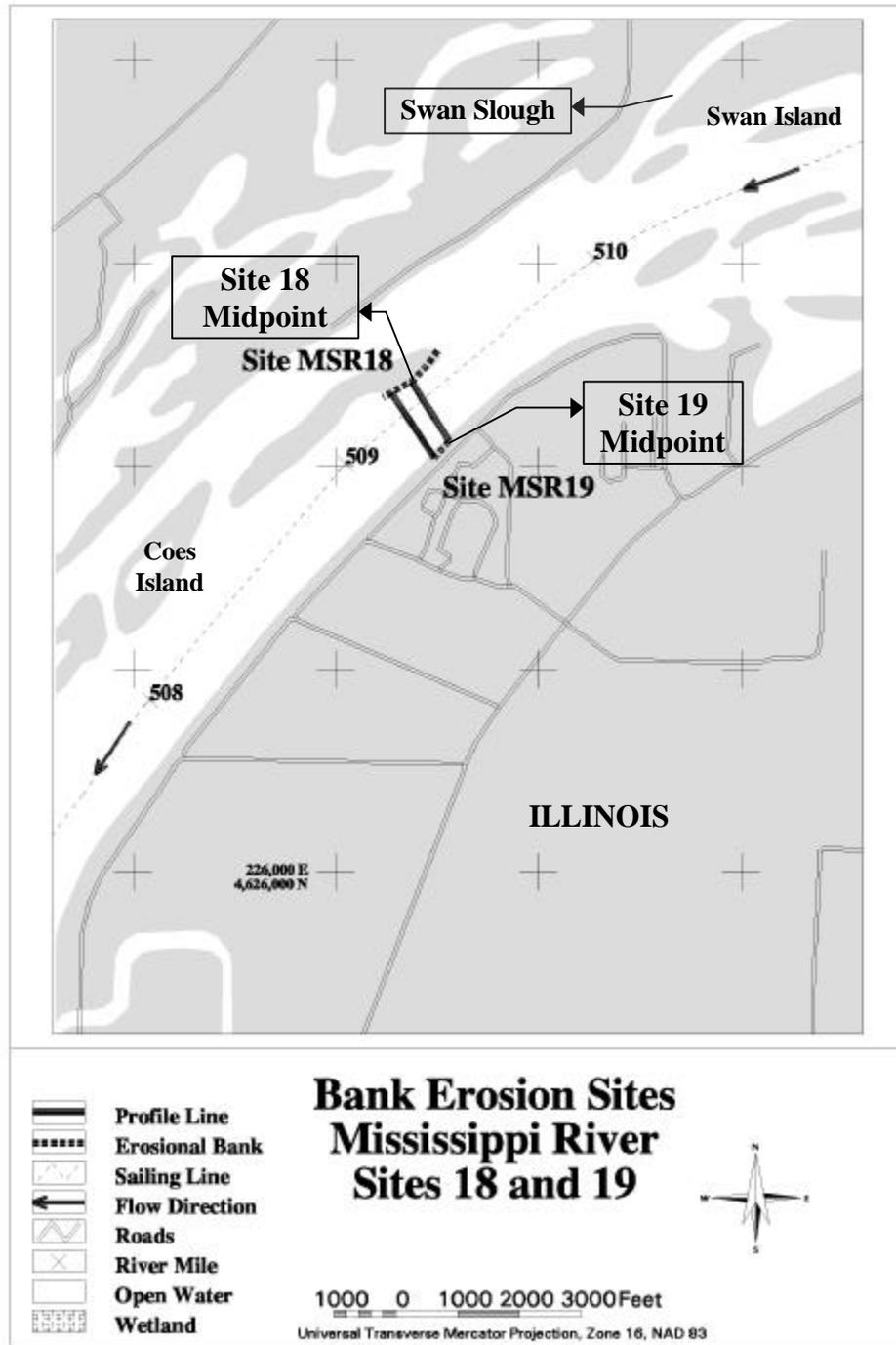


Figure 7-67 A map showing Mississippi River Sites 18 and 19



Photo 7-49 An upstream view of Site 18 midpoint



Photo 7-50 A close-up view of Site 18 midpoint

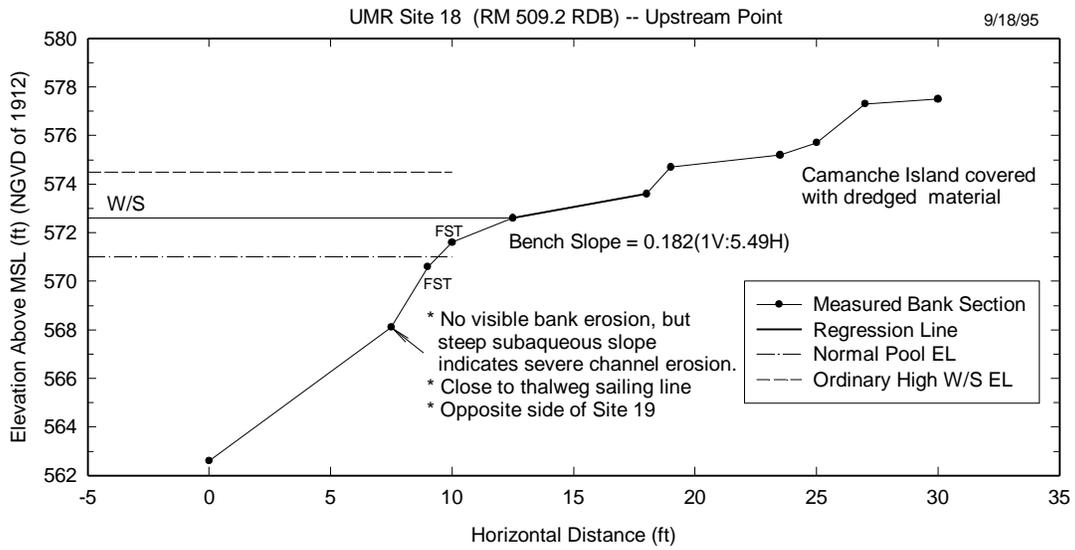


Figure 7-68 Bank section measured at Site 18 upstream point

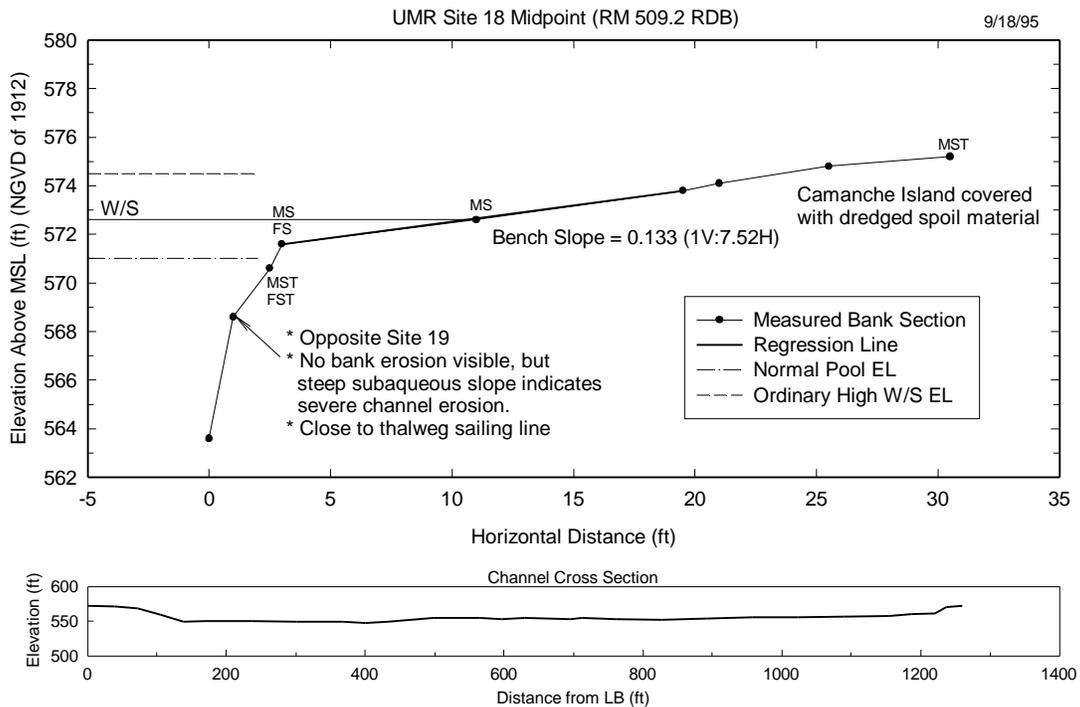


Figure 7-69 Bank section and channel cross section measured at Site 18 midpoint

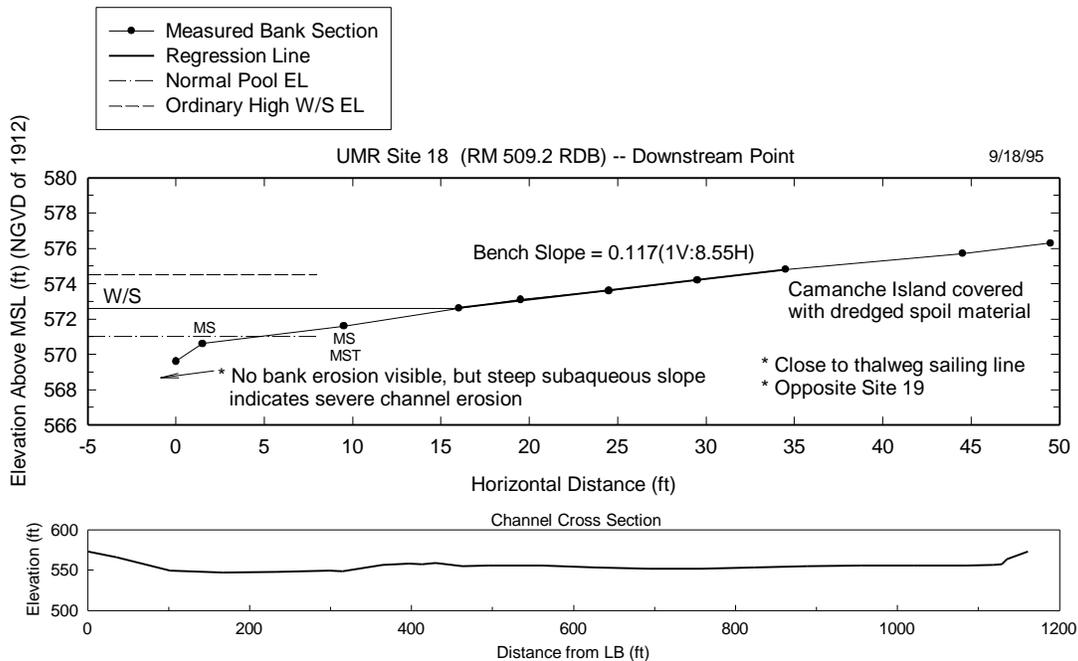


Figure 7-70 Bank section and channel cross section measured at Site 18 downstream point

an upstream view of the site, and Photo 7-50 shows a close-up view of the bankline. Three bank sections were taken at this site and they are shown in figure 7-68 through 7-70. No bank erosion was visible; however, very steep subaqueous bed slopes indicate severe channel erosion at this site.

As can be seen in figure 7-69, the scarp of the subaqueous bank is practically vertical at the midpoint section. Causative factors for bank retreat at this site include primarily undercutting by currents, and wave and rework-transport of recently deposited sediments within berm and bench areas. Because of the closeness of the channel thalweg to this site, potential for further in-channel flood-flow erosion exists at this site. This site is characterized by a combination of Types D, E, and F.

19. Site 19 at RM 509.2 LDB (Pool 14)

This site is located opposite Site 18 across the straight reach of the MR channel. The site is located along a Wisconsin outwash terrace which is occupied by factories.

Photo 7-51 shows an upstream view of the site. The bank face was covered by tall weeds and shrubs, as can be seen in Photo 7-52. Two bank sections were taken at this site and



Photo 7-51 An upstream view of Site 19 midpoint



Photo 7-52 A perpendicular view of Site 19 midpoint

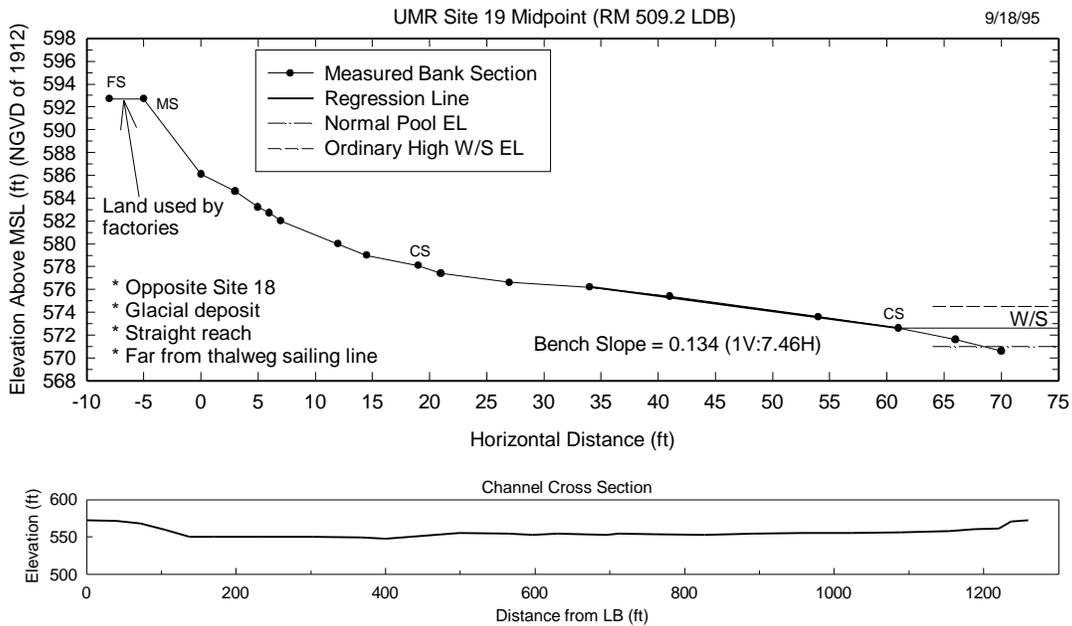


Figure 7-71 Bank section and channel cross section measured at Site 19 midpoint

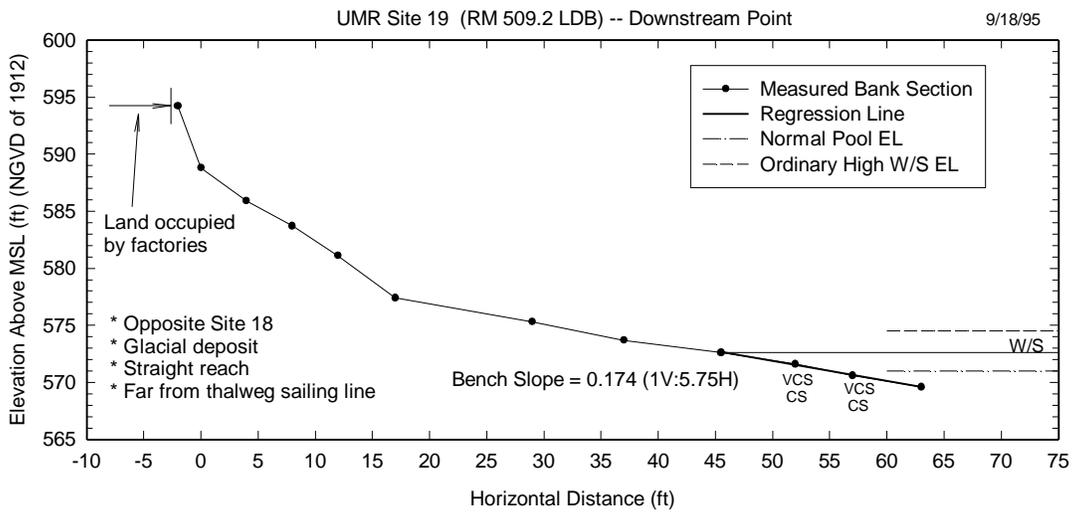


Figure 7-72 Bank section measured at Site 19 downstream point

are shown in figures 7-71 and 7-72. The bank soils are primarily sand, ranging from FS to CS.

As shown in figure 7-72, subaqueous bed sediments (CS and VCS) are much coarser than the bank soil, indicating high fine-sediment transport along this site. Causative

factors for bank retreat at this site include flood-flow undercutting followed by cantilever and slab failures, debris slides, piping, and wave and flow rework-transport actions within bench-area sand cover. Type F characterizes Site 19.

Note that there is no Site 20.

21. Site 21 at RM 466.7 LDB (Pool 16)

This left-bank island site, shown in figure 7-73, is located in a straight reach, 9.8 miles upstream from Lock & Dam No. 16 and 16.2 miles downstream from Lock & Dam No. 15. This small, mid-channel island lies in the Andalusia Gorge across from Andalusia Island which extends approximately 9 miles from RM 464.0 to RM 473.0 along the left bank. A side view of the midpoint section is shown in Photo 7-53. As at Site 17, seven detailed bank sections were taken around the island at this site and they are shown in figures 7-74 through 7-80. The bank soil is silt (MST-CST) with sandy silt lenses. Subaqueous soil consists of layers of silt (FST-CST) and sand (VFS-FS). There are some piping features at the upstream tip of the island, as shown in figure 7-74, and the bench slope there is 0.295. The bench slope appears to decrease in the downstream direction, as was the case for Site 17. At the downstream end of the island, flow depth was extremely small; depth was only 3 ft even 570 ft riverward from the water's edge. It appears that this island is moving downstream. There are a series of wing dams along the right river bank opposite this site, and the river cross section near the right bank is quite complex, as can be seen in figure 7-77 for the midpoint section.

The site is located on a small late Holocene island. Small areas of older Holocene and late Wisconsinan surfaces occur abutting the narrow valley. Core samples showed historical alluvium thicknesses ranging from about 4.3 ft to 4.6 ft. Below the historical deposits, a weakly developed, poorly drained, late to very late Holocene soil was found.

Causative factors for bank retreat at this site include flood erosion, piping and collapse, wave and flow rework-transport of failed soils and recently deposited sediments, and piping failure. This island site is very close to the thalweg sailing line, and there is potential for wave erosion of failed soils and recently deposited sediments which mantle

the benches. Bank types for these seven sections can be classified as Type C or Type D, as listed in table 7-5b.

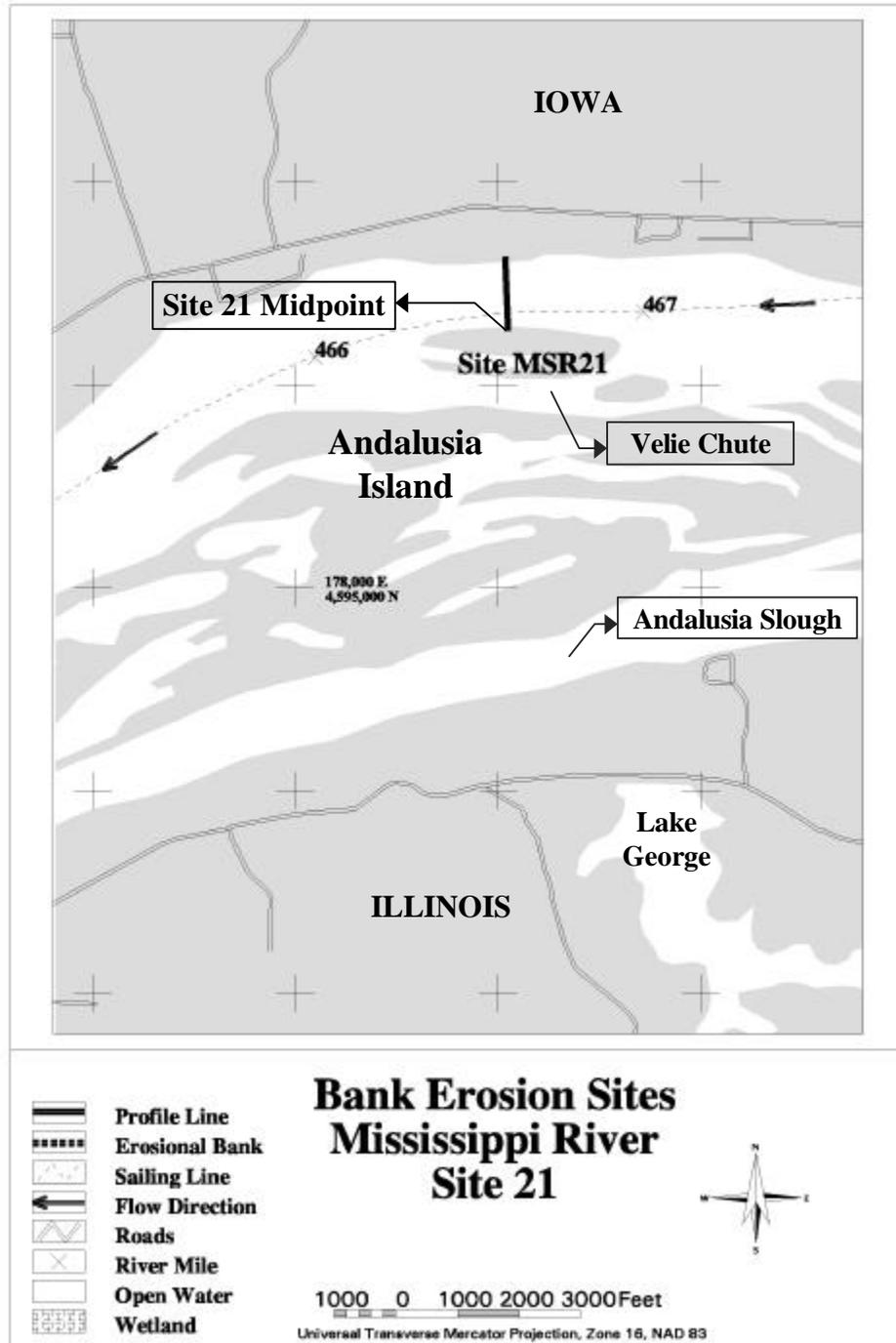


Figure 7-73 A site map showing Mississippi River Site 21