

At the midsection, the d_{50} varied from 0.015 mm at the top surface of the bank to 0.013 mm at the upper portion of the scarp. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied between 1V:15.0H and 1V:5.6H, and the subaqueous bench extends more than 70 feet. Soils on the scarp were cohesive. The site can be classified as a combination of types 4 and 5 (figures 6-21 and 6-22, and table 6-4). Piping related internal erosion weakens the bank. Soils exposed and displaced by bank failures are susceptible to removal by wave and current actions during normal stages. Traffic is heavy at this site and could add to the tractive forces by waves and currents.

Table 6-20. Site 10

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	439.7	<ul style="list-style-type: none"> Bench (underwater) (slopes varied between 1V:14.9H and 1V:5.6H) 	<ul style="list-style-type: none"> d_{50} (core) @ 2' of water = 0.025
75	440.1	<ul style="list-style-type: none"> Bench (underwater) 	
50	440.4	<ul style="list-style-type: none"> Bench (underwater) 	
25	441.8	<ul style="list-style-type: none"> Scarp/berm Berm slope = 1V:2.7H 	
10	445.4	<ul style="list-style-type: none"> Scarp (slope varied between 1V:0.8H and 1V:0.56H) 	<ul style="list-style-type: none"> d_{50} varied (0.013-0.015)
0-9	>445.4	<ul style="list-style-type: none"> Top of the bank 	<ul style="list-style-type: none"> $d_{50} = 0.018$

Note: Pool level gage of Peoria Pool @ RM 157.7 was used for stage histogram. WSE = 440.5'; OHW = 441.4'; NP = 440.0'.

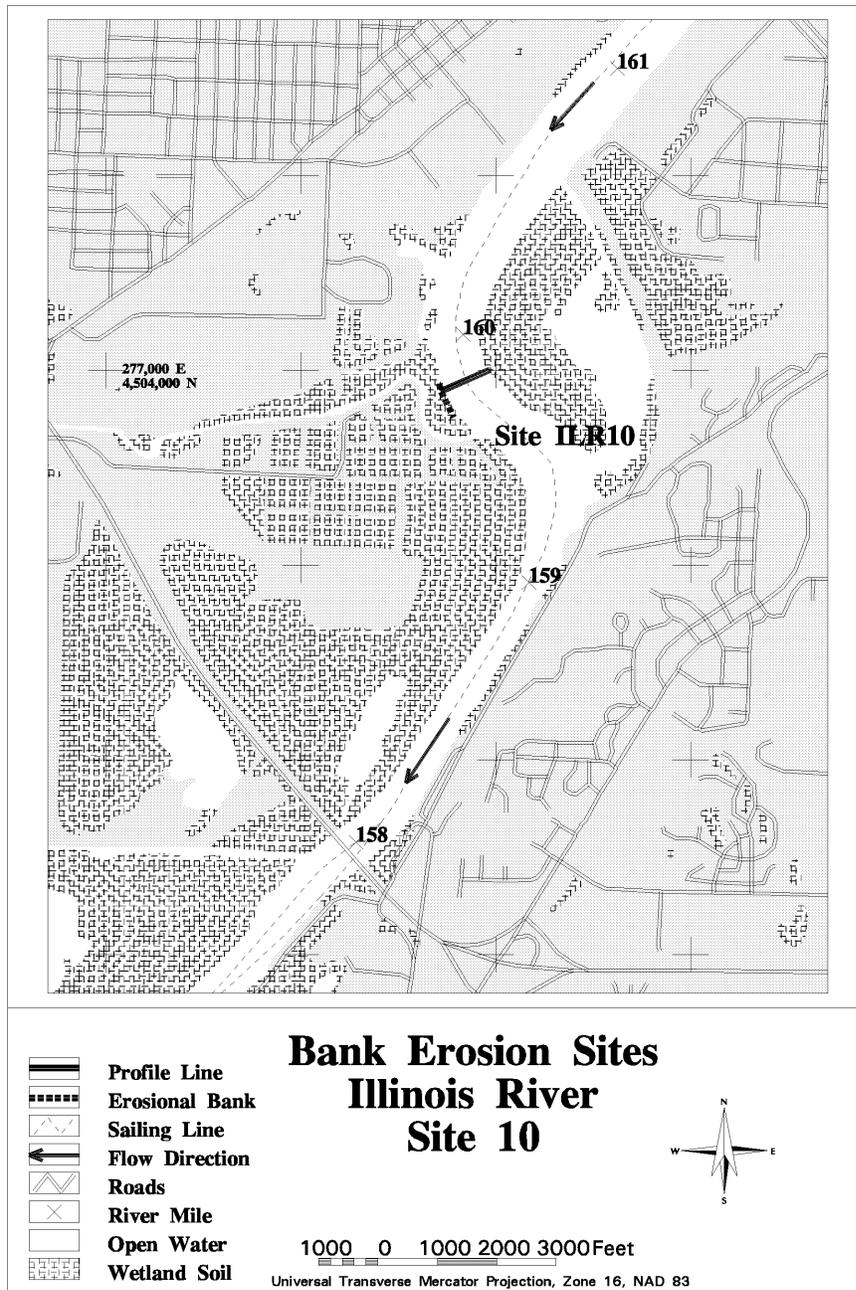


Figure 6-70. Location of site 10 on the Illinois Waterway



Figure 6-71. Site 10 on the Illinois Waterway

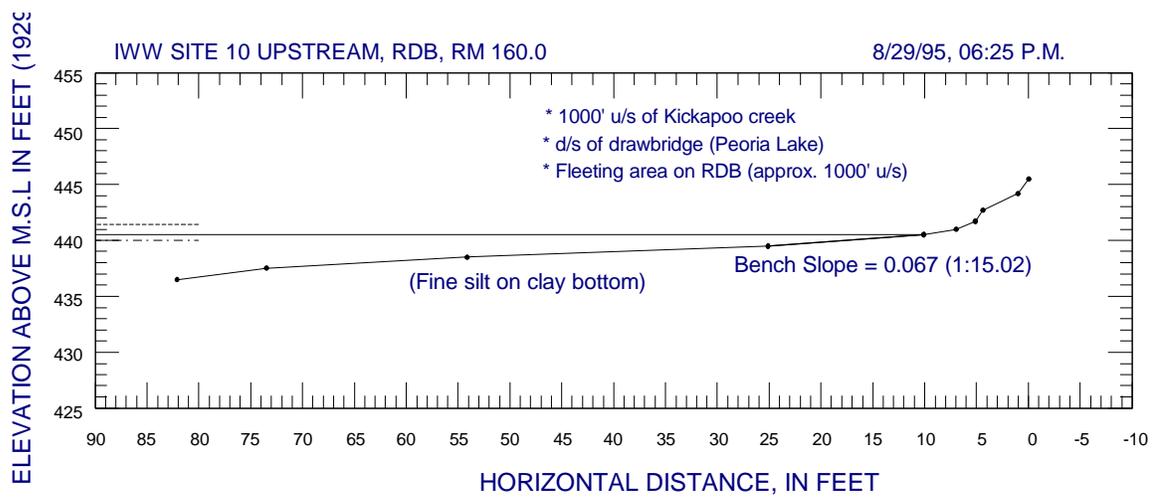


Figure 6-72. Bank sections at site 10

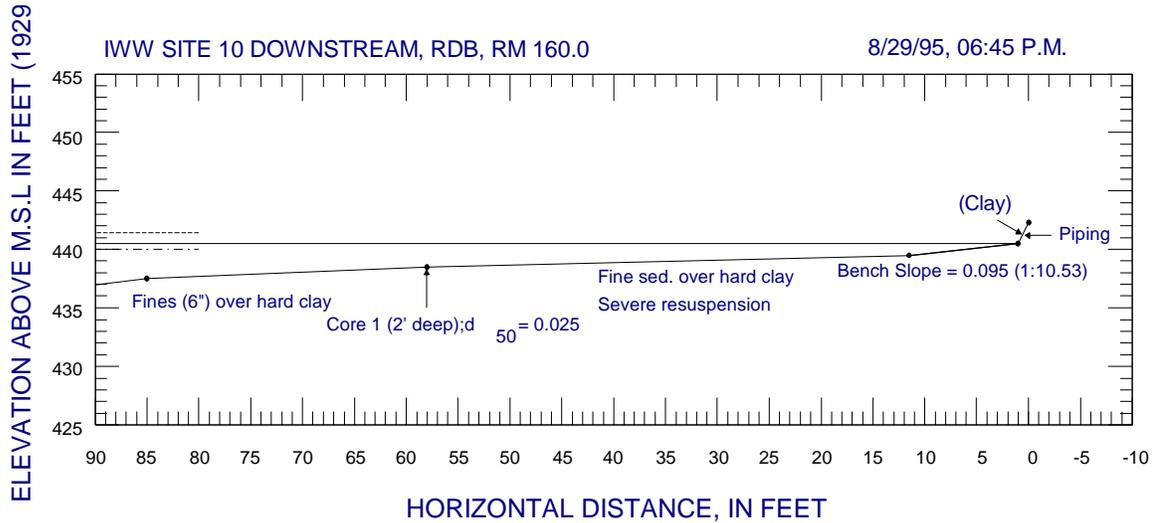
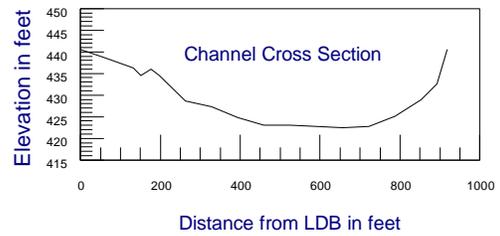
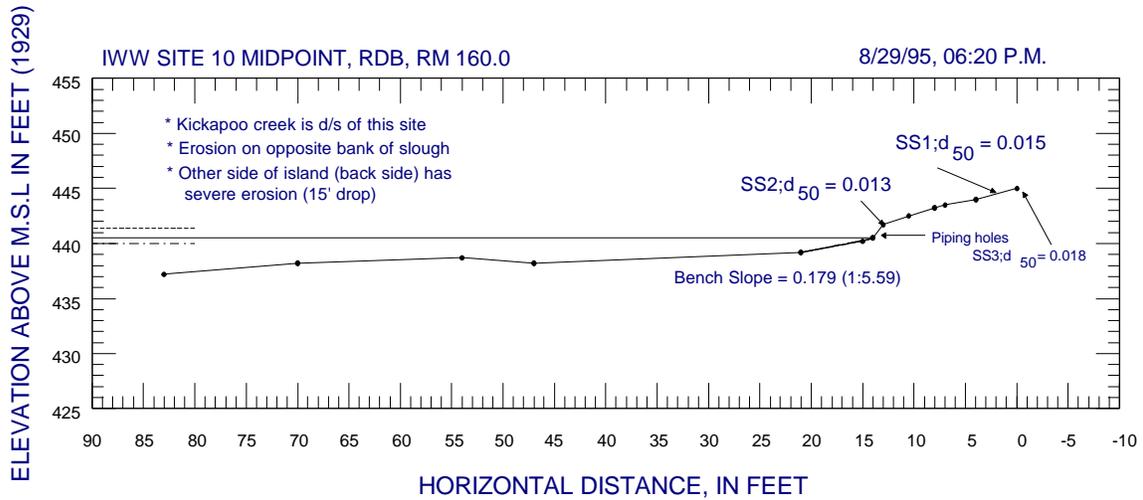


Figure 6-72. Bank sections at site 10 (concluded)

Site 11, La Grange Pool, 8/30/95. This site is located on the RDB at RM 155.3. The reach is fairly straight, but the site is at the entrance to a sharp bend between RM 154.5 and 149. Other surrounding structures include the Peoria L&D upstream at RM 157.8 and a docking facility approximately 500 feet downstream. Figure 6-73 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-74 shows a photograph of the site.

The navigation sailing line is near the RDB at site 11, (the distance from the navigation chart is about 250 feet). Lick Creek enters the IWW from the LDB at RM 156.5. Bhowmik and Schicht (1980) noted some erosion on both banks around RM 156, while Hagerty (1988) noted dredged material cited on the navigation chart for both banks.

Figure 6-75 shows the three measured bank sections and a reduced cross section. The whole bank is mildly sloped with a small scarp remote from the water at the top of the bank. Trees with exposed roots exist at the crest of the bank, above a weed zone and a bare bench with several small wave scarps covered with recent sediments. The OHW is 440.8 feet and NP is 429.5 feet above msl. Stage fluctuations at the upper part of the pool are generally large, and banks often are presented with mildly sloped benches. The OHW can reach the upper part of the bank close to the base of a small scarp at the downstream section. Table 6-21 shows the recurrence frequencies for various stages at this site.

At the midsection, the d_{50} varied from 0.235 mm at the top of the bank to 0.158 mm from the upper part of a core sample at a water depth of about 2 feet. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied slightly between 1V:11.2H and 1V:9.0H. This site is classified as type 6 (figure 6-23 and table 6-4). Wave actions are primarily responsible for rework and transport of failed soil or recently deposited sediments on the bench at various stages within the normal range of pool level fluctuations.

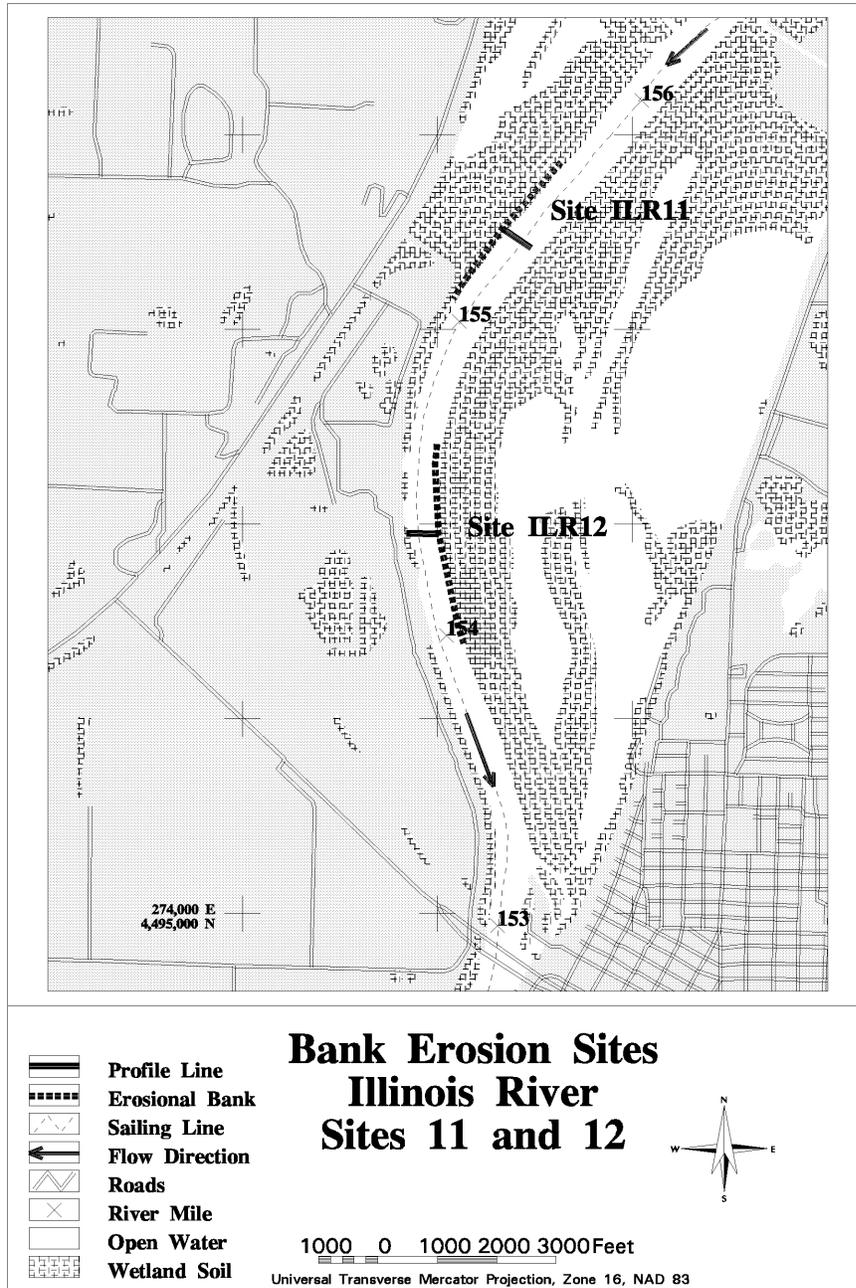


Figure 6-73. Locations of sites 11 and 12 on the Illinois Waterway



Figure 6-74. Site 11 on the Illinois Waterway

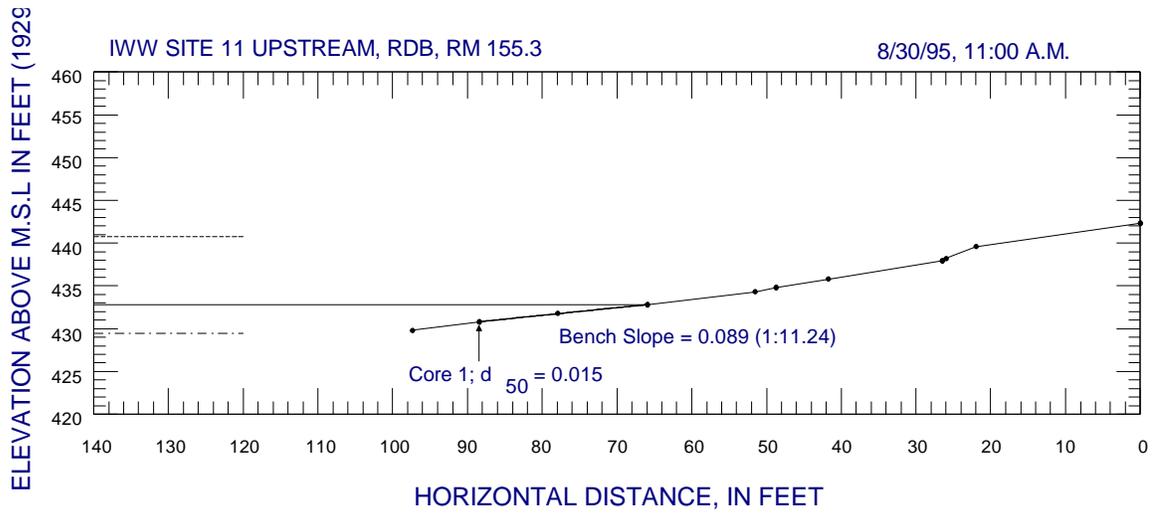


Figure 6-75. Bank sections at site 11

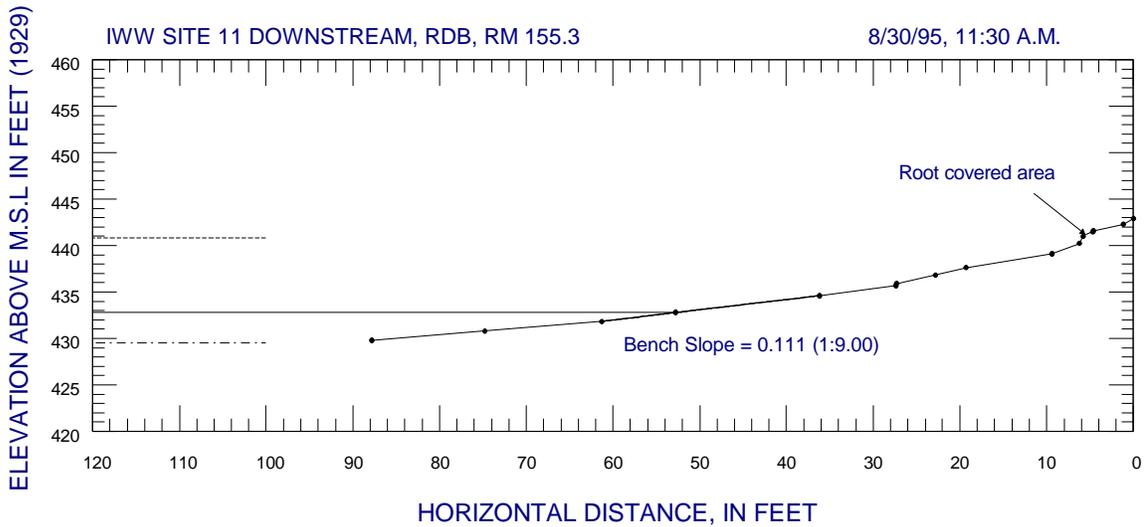
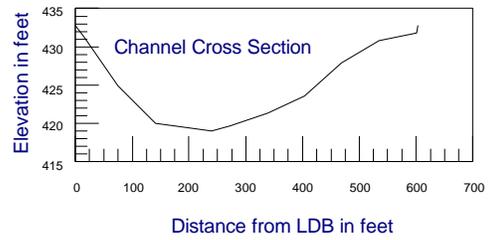
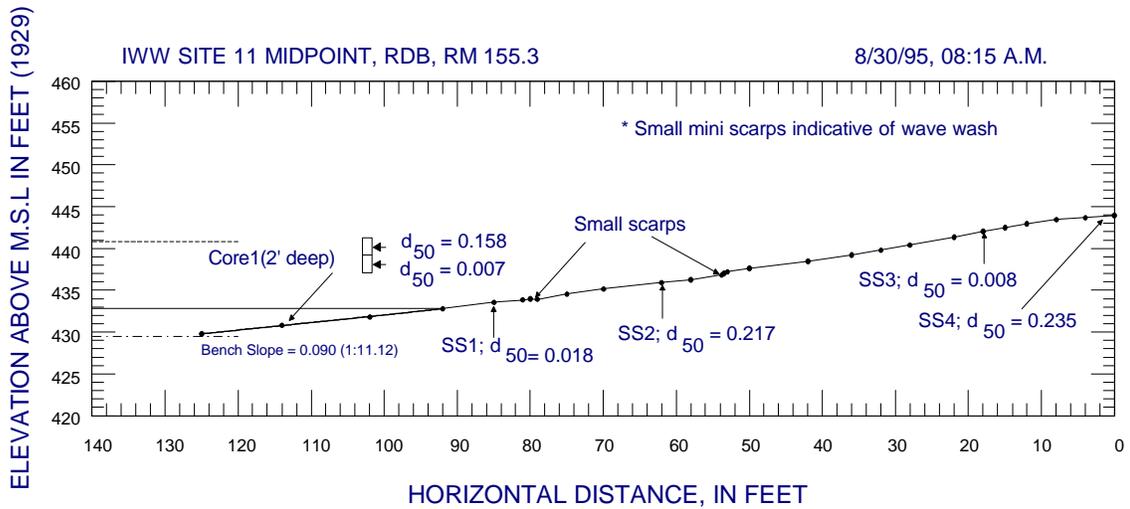


Figure 6-75. Bank sections at site 11 (concluded)

Table 6-21. Site 11

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	431.65	<ul style="list-style-type: none"> • Bench (underwater), slopes varied between 1V:11.2H and 1V:9.0H 	<ul style="list-style-type: none"> • d₅₀ (core) @ 1' of water = 0.015 • d₅₀ (core) 2' of water varied (0.007-0.158)
75	432.95	<ul style="list-style-type: none"> • Bench 	<ul style="list-style-type: none"> • d₅₀ varied (0.018-0.217)
50	436.0	<ul style="list-style-type: none"> • Small scarps • Berm 	
25	441.1	<ul style="list-style-type: none"> • Scarp 	<ul style="list-style-type: none"> • d₅₀ = 0.008
10	444.25	<ul style="list-style-type: none"> • Top of the bank 	<ul style="list-style-type: none"> • d₅₀ = 0.235
0-9	>444.3		

Note: Tail water gage of Peoria Pool @ RM 157.7 was used for stage histogram. WSE = 432.8'; OHW = 440.8'; NP = 429.5;.

Site 12, La Grange Pool, 8/30/95. This site is located on the LDB at RM 154.4 on the inside of a mild bend; a sharp bend is present downstream from the site. A power plant across the river has docking facilities for barges. The Lake of the Woods is located approximately 1,000 feet behind this bank. Figure 6-73 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-76 shows a photograph of the site.



Figure 6-76. Site 12 on the Illinois Waterway

Site 12 is about 320 feet from the sailing line, and no major tributary enters the IWW at this location. Bhowmik and Schicht (1980) and Hagerty (1988) noted erosion on both sides of this reach of the waterway.

An obvious scarp was present at the water's edge. Figure 6-77 shows the three measured bank sections and a reduced cross section. The wide bench has a mild slope. At the top of the bank, tall trees and a scarp were hidden behind a belt of tall weeds and young willows. Vegetation formed a band approximately 90-100 feet wide on the bank. A berm was present inside the vegetation zone and its soils were desiccated. The open bench area was wet and clayey, and had piping features. The OHW is 440.7 feet and NP is 429.5 feet above msl. At OHW, the water would submerge some of the vegetation on the bank. Small scarps in the vegetation zone were below the OHW level and the scarp at the upstream section was at the water's edge. Table 6-22 gives the recurrence frequencies for various stages at this site.

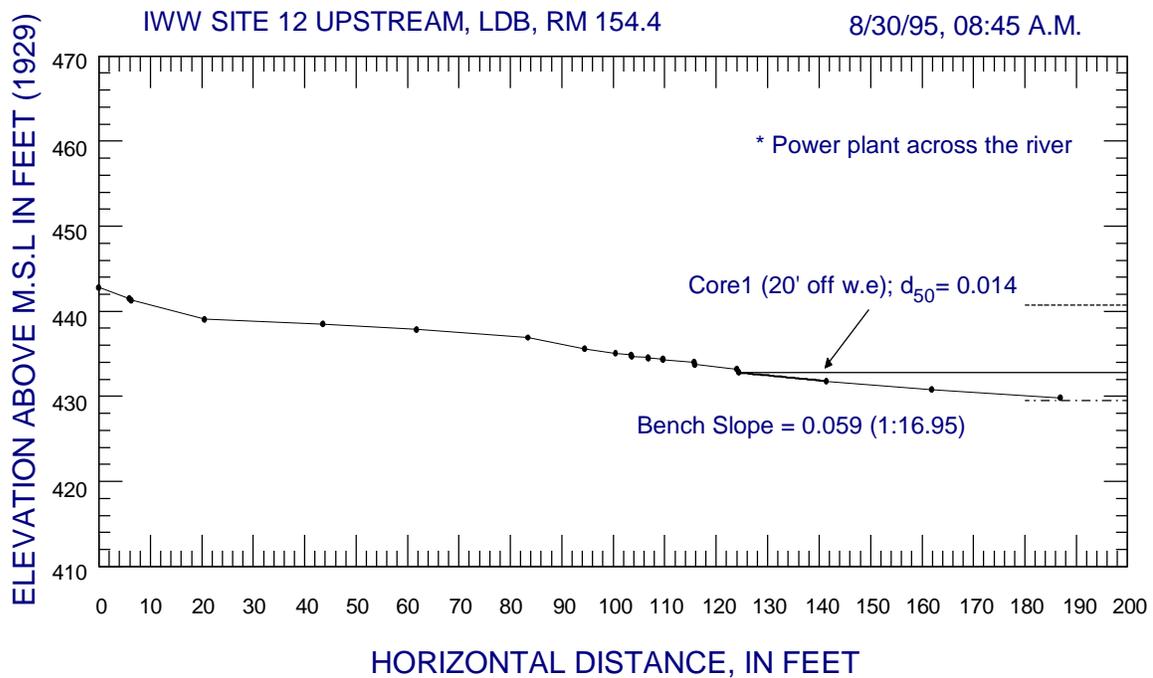


Figure 6-77. Bank sections at site 12

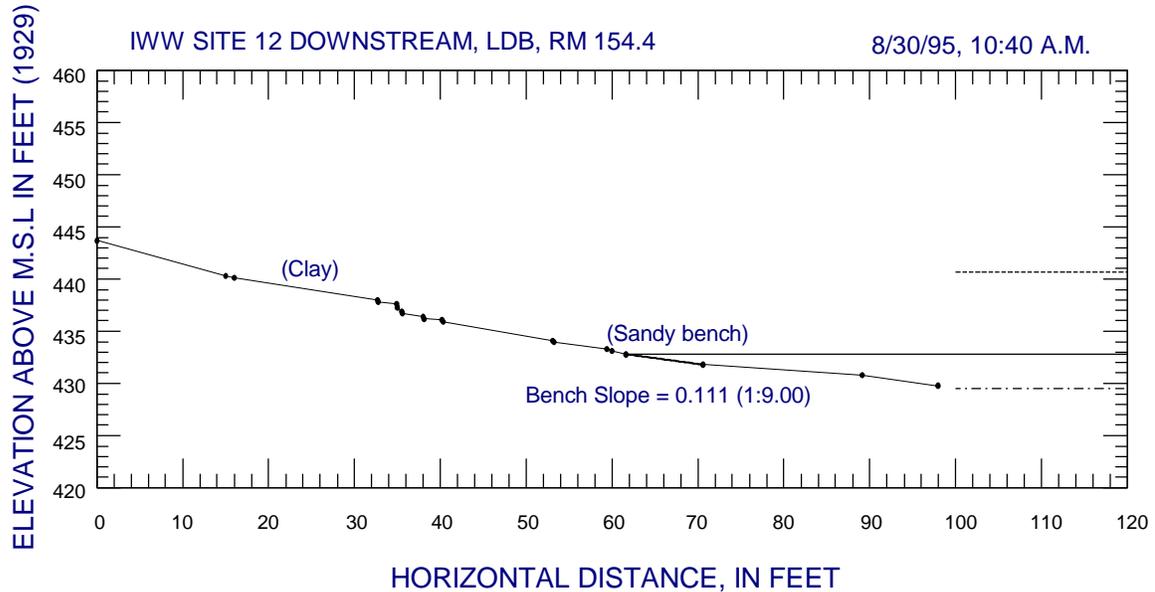


Figure 6-77. Bank sections at site 12 (concluded)

Table 6-22. Site 12

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	431.65	• Bench (underwater)	• d_{50} (core) varied (0.014-0.022)
75	432.95	• Bench (slope varied between 1V:16.9H and 1V:9.0H)	• d_{50} varied (0.046-0.077)
50	436.0	• Bench	
25	441.1	• Scarp	
10	444.25	• Top of the bank	• $d_{50} = 0.046$
0-9	>444.3	• Top of the bank	

Note: Tail water gage of Peoria Pool @ RM 157.7 was used for stage histogram. WSE = 432.8'; OHW = 440.7'; NP = 429.5'.

At the midsection, the d_{50} varied from 0.046 mm at the top surface of the bank to 0.022 mm at the top portion of a core sample at a water depth of about 1 foot. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied between 1V:16.9H and 1V:9.0H. This site is classified as type 5 (figure 6-22 and table 6-4). Wave action is suspected to be one of the main mechanisms for

erosion, because of the scarps on the sloping bank. Piping also was noted at the lower subaerial bench. Rework and transport could be significant at various stages within the normal range of pool-level fluctuations at this site.

Site 13, La Grange Pool, 8/30/95. This site is located on the LDB at RM 150.6 on the outside of a sharp bend. A 3 by 5 barge tow would have considerable difficulty in maneuvering through this sharp bend. A delta at the upstream end (RM 150.9) near the mouth of a small creek further reduced the maneuvering space for barge tows and increased flow velocity. The Chicago and Northwestern Railway bridge crosses the river at RM 151.2. All these factors may be responsible for changes in bank sections from upstream to downstream. Figure 6-78 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-79 shows a photograph of the site.

The site is about 370 feet from the sailing line, and there are two barge canals for a coal pit on the LDB at RM 150.9. Hagerty (1988) marked this site as severely eroded and included it as a study site. Bhowmik and Schicht (1980) did not mark this site but marked a reach at the downstream end at about RM 149.5-150.0. A vertical scarp was present right at the water's edge. When tows pass near this bank reach, direct impact is likely, especially when water stages are low. There were multiple scarps on the upper bank. Dredged materials had been deposited here, and two layers of different soils were observed on the bank. There were dense small holes on the bank surface, which may be created by worms. Bhowmik and Schicht (1980) and Hagerty (1988) referenced erosion on both banks at this river mile.

At the midsection, the d_{50} varied from 0.117 mm at the top surface of the bank to 0.005 mm at the upper portion of a core sample at a water depth of about 2 feet. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Materials on the scarp are cohesive. This site can be classified as type 4 (figure 6-21 and table 6-4). Under normal stages, waves and turbulence created by traffic are causes for bank erosion. Rework and transport by current at stages within the normal range of pool level fluctuation can be significant. Seepage and nesting worms can also weaken bank strength.

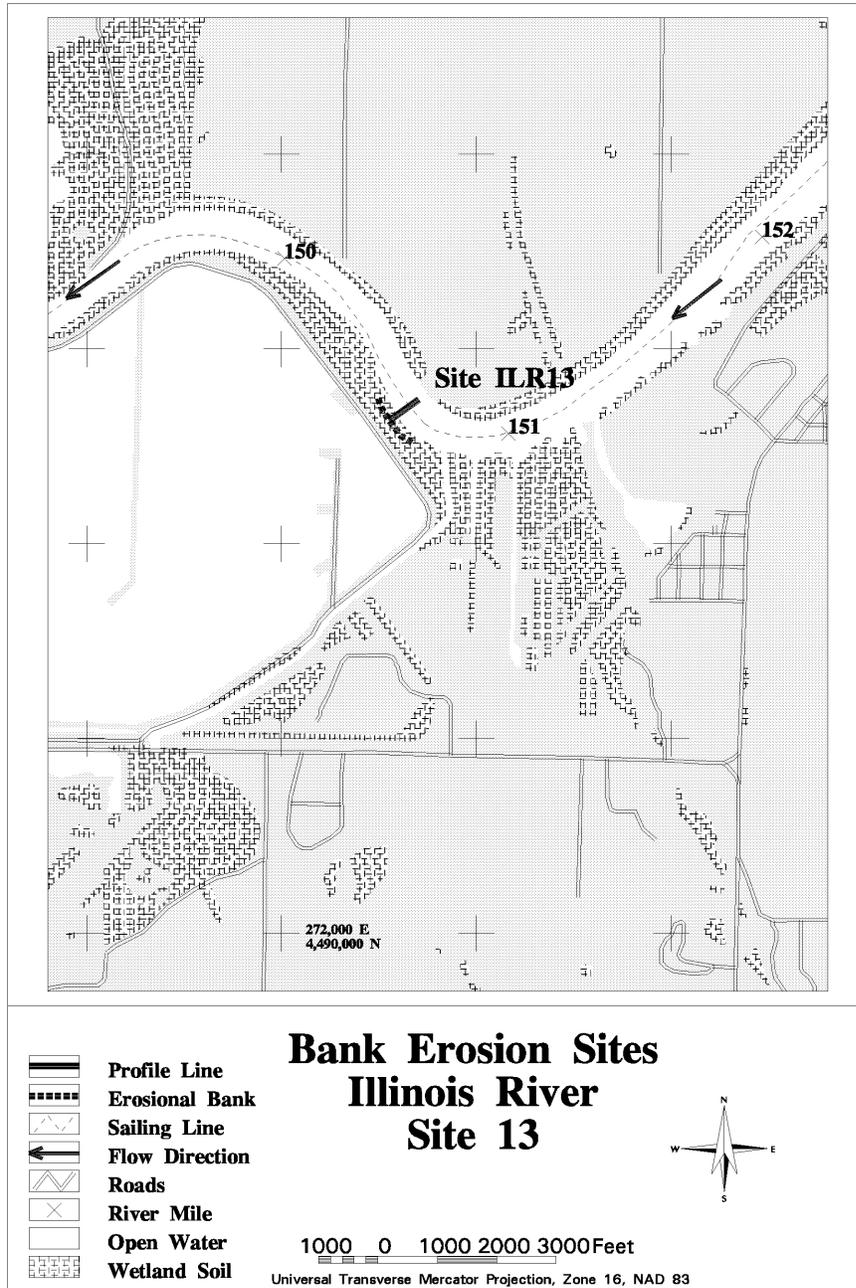


Figure 6-78. Location of site 13 o the Illinois Waterway



Figure 6-79. Site 13 on the Illinois Waterway

Figure 6-80 shows the three measured bank sections and a reduced cross section. The OHW is 440.5 feet and NP is 429.5 feet above msl. The NP elevation is about at the base of the berm, and the OHW reaches the upper part of the bank. Table 6-23 gives the stages for various recurrence frequencies at this site.

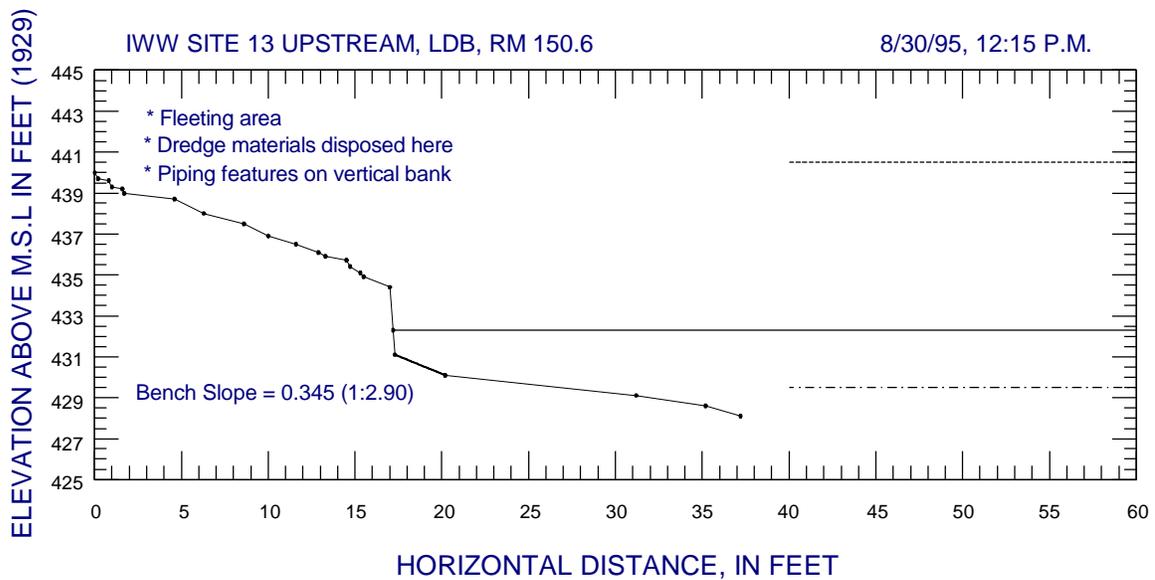


Figure 6-80. Bank sections at site 13

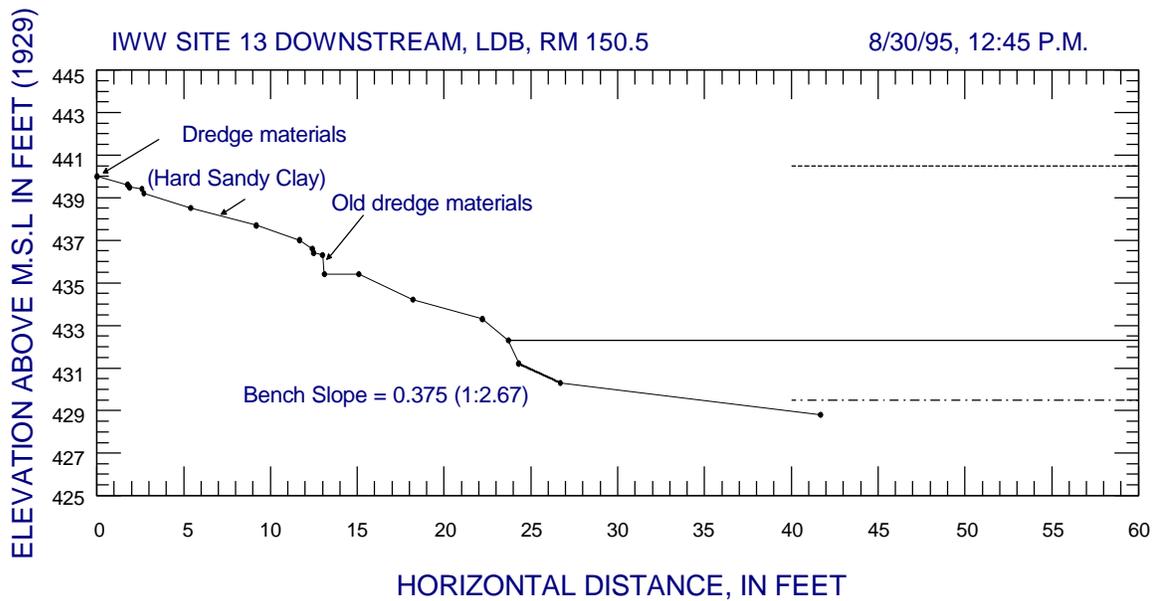
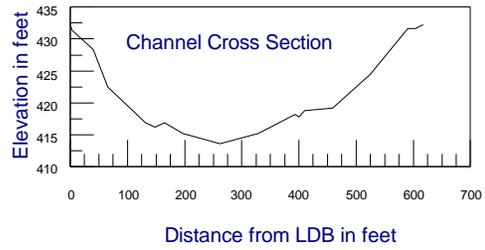
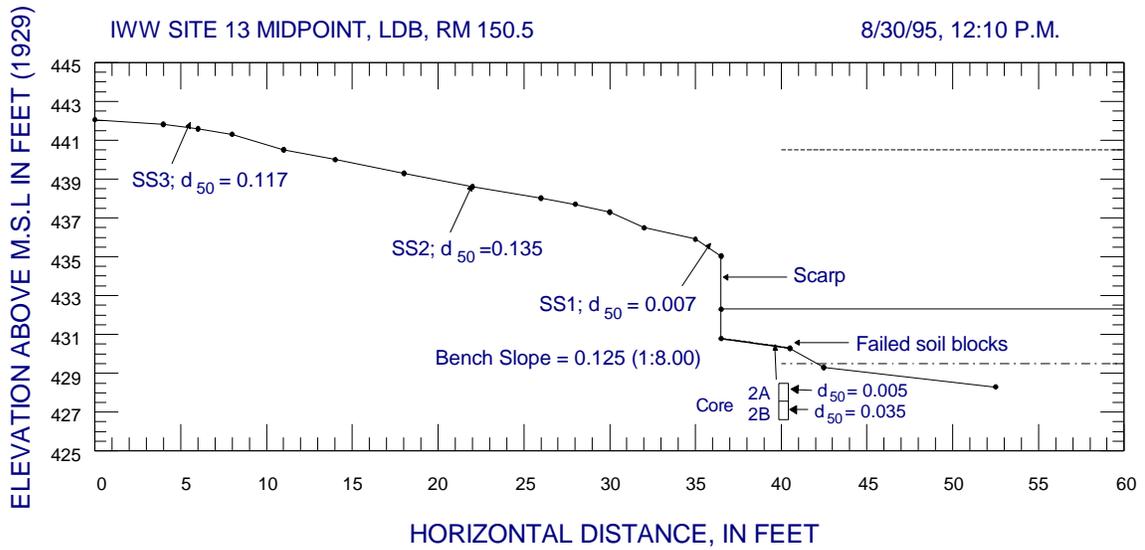


Figure 6-80. Bank sections at site 13 (concluded)

Table 6-23. Site 13

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
<90	<430.0	<ul style="list-style-type: none"> • Bench (underwater), slopes varied between 1V:10H and 1V:8.5H 	<ul style="list-style-type: none"> • d_{50} (core) 2' of water varied (0.005-0.035)
90	431.3	<ul style="list-style-type: none"> • Scarp/berm, slopes of scarp: 1V:0.58H to 1V:0.09H 	
75	432.5	<ul style="list-style-type: none"> • Scarp/berm • Berm slopes vary between 1V:4H and 1V:2.6H 	
50	435.8	<ul style="list-style-type: none"> • Top of the bank/scarp 	
25	440.7		<ul style="list-style-type: none"> • d_{50} varied (0.117-0.135)
10	443.99		
0-9	>444.0		

Note: Gage on the Illinois River near Kingston Mines, IL @ RM 145.4 was used for stage histogram. WSE = 432.3'; OHW = 440.5'; NP = 429.5'.

Site 14, La Grange Pool, 8/30/95. This site is located on the RDB at RM 129.3, at the beginning of an inside bend. Upstream from RM 129.9, the river is fairly straight. Figure 6-81 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-82 shows a photograph of the site.

Site 14 is about 270 feet from the sailing line, and no major tributary enters the IWW at this location. Approximately 600 feet behind this site is the East Liverpool Levee System. Bhowmik and Schicht (1980) marked erosion on the opposite bank on an island. Hagerty observed erosion on this bank but not on the opposite bank. Trees are close to the bank crest at many locations at this site, and some roots extended beyond the bank face. A scarp about 1.5 feet high was located on the upper part of the bank, which was covered by seasonal grasses. Several breaks in the bank sections appeared to correspond to different erosion mechanisms at this site. Dislodged peds and some micro-scale piping existed on a bare bench area. The bench between the scarp and the water's edge was covered with moist, soft clay.

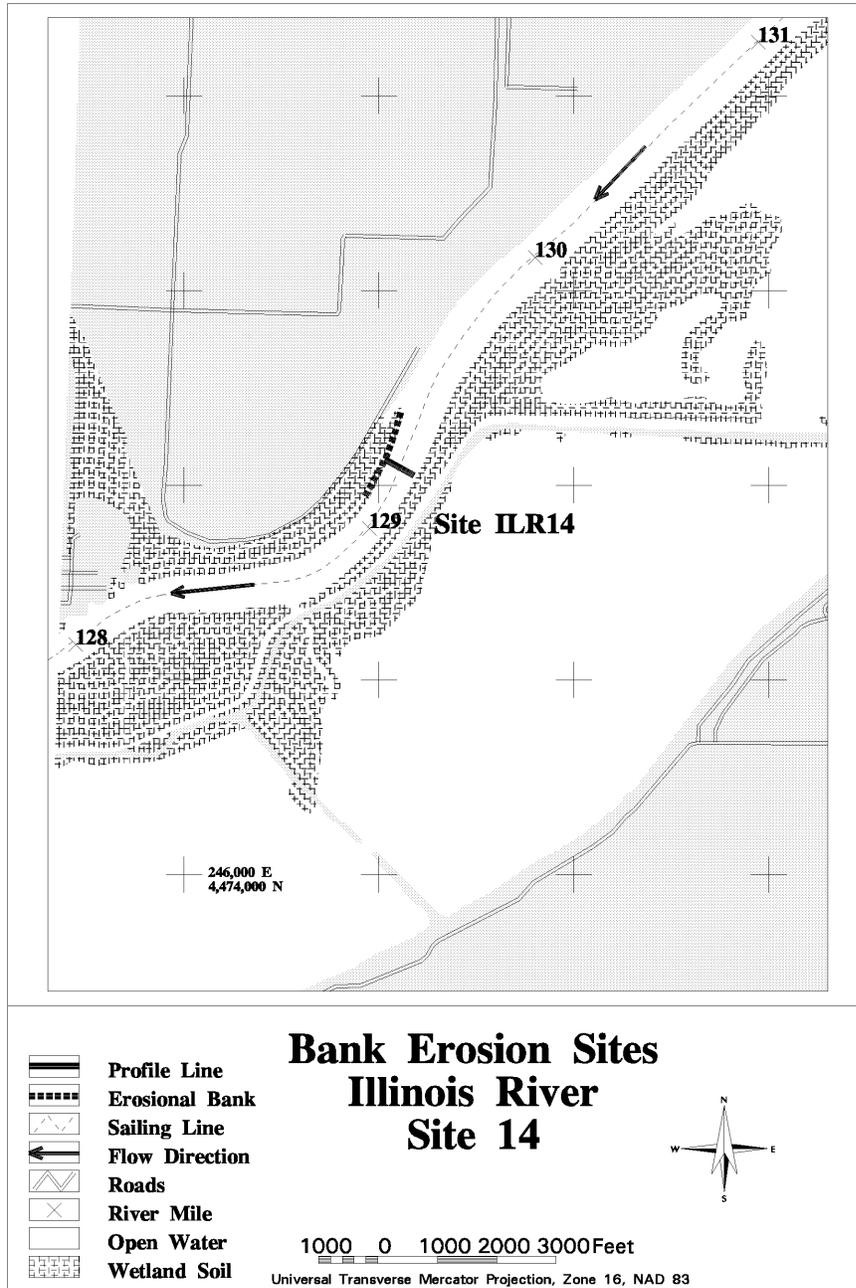


Figure 6-81. Location of site 14 on the Illinois Waterway



Figure 6-82. Site 14 on the Illinois Waterway

Figure 6-83 shows the three measured bank sections and a reduced cross section. The OHW is 438.5 feet and NP is 429.5 feet above msl. A scarp was noted at the downstream section, where the NP elevation matched the base of the scarp. The OHW elevation is about the same height as the short scarp at the midsection, and any stages higher than the OHW elevation will top the bank (see table 6-24 for the recurrence frequencies for various stages).

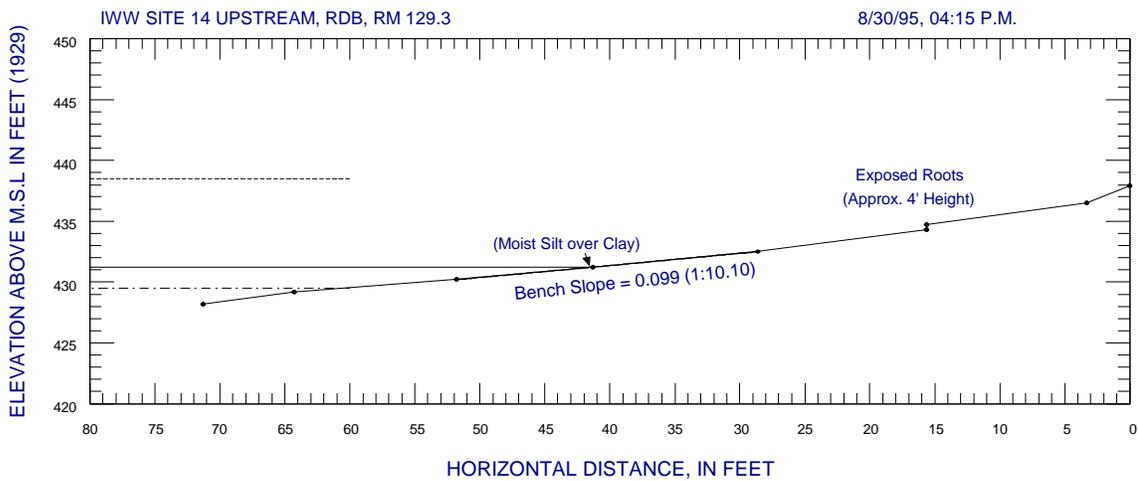


Figure 6-83. Bank sections at site 14

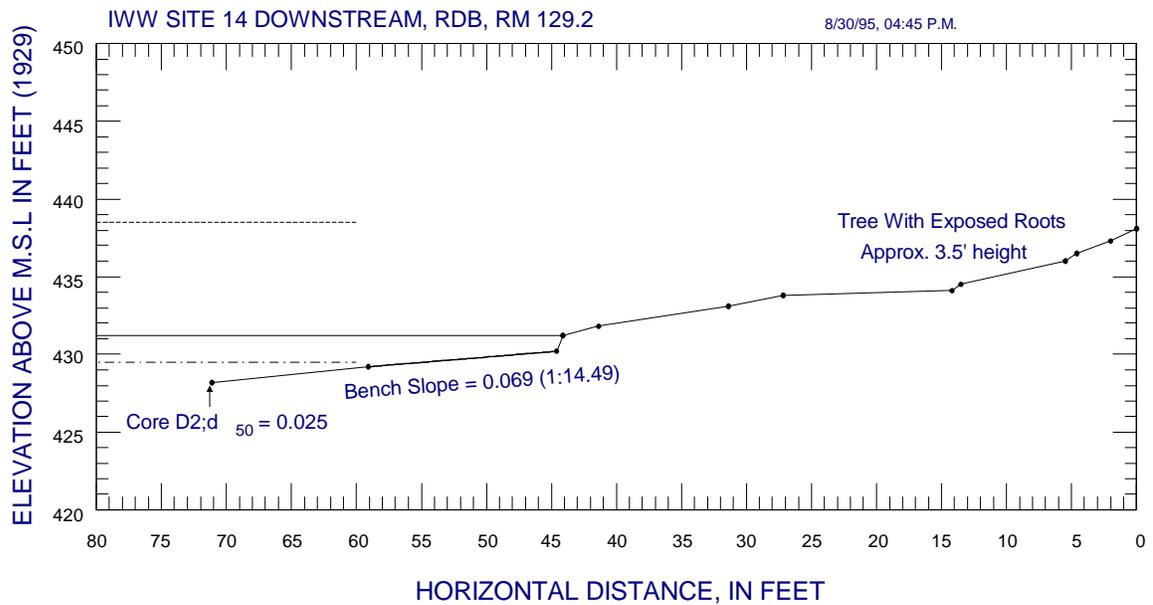
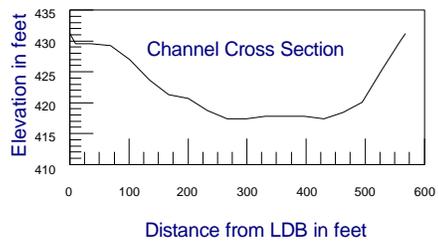
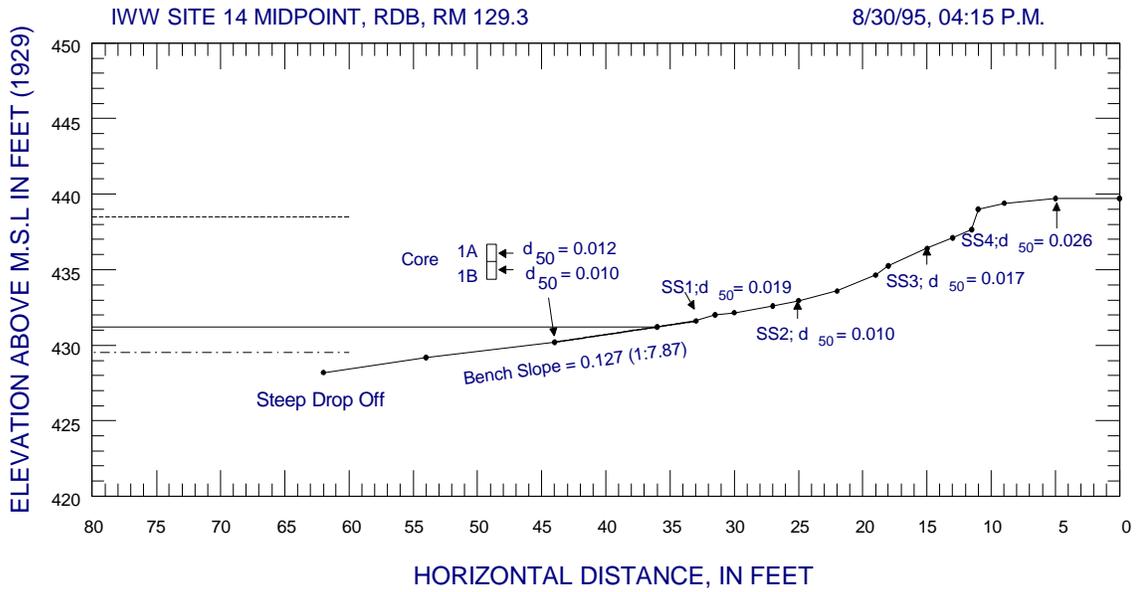


Figure 6-83. Bank sections at site 14 (concluded)

Table 6-24. Site 14

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	430.9	<ul style="list-style-type: none"> Bench (underwater). slopes vary between 1V:14.5H and 1V:7.9H 	<ul style="list-style-type: none"> d₅₀ (core) varied (0.010-0.012)
75	432.3	<ul style="list-style-type: none"> Bench 	<ul style="list-style-type: none"> d₅₀ varied (0.010-0.019)
50	435.3	<ul style="list-style-type: none"> Berm (slopes varied between 1V:4.6H and 1V:2.6H) 	<ul style="list-style-type: none"> d₅₀ = 0.017
25	440.0	<ul style="list-style-type: none"> Top of the bank 	<ul style="list-style-type: none"> d₅₀ = 0.026
10	443.1		
0-9	>443.1		

Note: Gage on the Illinois River near Copperas Creek @ RM 139.9 was used for stage histogram. WSE = 431.2'; OHW = 438.5'; NP = 429.5'.

At the midsection, the d₅₀ varied from 0.026 mm at the top surface of the bank to 0.012 mm at the upper part of a core sample at a depth of about 1 foot of water. Gradation plots of bank soils and nearshore sediment are presented in appendix F. The detailed cross section and coordinates are shown in appendix G.

Bench slopes varied from 1V:10.1H at the upstream section to 1V:7.9H at the midsection. The slope for the subaqueous bench was 1V:14.5H below a water's edge scarp at the downstream section. The site is classified as type 4 (figure 6-21 and table 6-4). The subaerial bench was wet due to poor drainage. Wave wash, in combination with piping, appeared to have created the downstream small scarp on the bench. Rework and transport of failed soils and recently deposited sediments at stages within the normal range of pool-level fluctuations could be significant.

Site 15, La Grange Pool, 8/30/95. This site is located at the RDB at RM 116.5, where an embankment lies on the outside of a gentle bend. The embankment is part of the Lacey, Langellier, West Matanzas & Drainage Levee System. Figure 6-84 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-85 shows a photograph of the site.

The site is about 310 feet from the sailing line. No major tributary enters the IWW at this location. Bhowmik and Schicht (1980) noted erosion along a long stretch of this side of the river, while Hagerty (1988) marked dredged material at the site as well as some old dredged material on

the opposite bank. Tall grass covered the bank face, with scarps inside the grass zone. The bench below the grass zone contained a series of small scarps.

Figure 6-86 shows the three measured bank sections and a reduced cross section. The OHW is 437.0 feet and NP is 430.8 feet above msl. The NP elevation corresponds to a break in the subaqueous slope. From figure 6-86, the OHW elevation corresponds to the base of a small scarp.

At the midsection, the d_{50} varied from 0.008 mm at the top surface of the bank to 0.265 mm at the upper part of a core sample at a water depth of about 2 feet. The nearshore sediment was stratified. Gradation plots of bank soils and nearshore sediment are presented in appendix F. A detailed cross section is shown in appendix G.

Bench slopes varied from 1V:8.1H at the upstream section to 1V:11H at the downstream section. This site is classified as a combination of types 3 and 5 (figures 6-20 and 6-22, and table 6-4). The existing scarp was located at higher elevations that could be caused by floods. The peds indicated seepage activities. Rework and transport by waves and currents on failed soils or recent sediments could also be important at this site.

Table 6-25. Site 15

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	430.1	<ul style="list-style-type: none"> Bench (underwater) (slopes varied between 1V:11H and 1V:8.1H) 	<ul style="list-style-type: none"> d_{50} (core) varied (0.03-0.299)
75	431.1	<ul style="list-style-type: none"> Bench 	<ul style="list-style-type: none"> $d_{50} = 0.363$
50	433.7	<ul style="list-style-type: none"> Bench 	
25	438.1	<ul style="list-style-type: none"> Berm/bench (slopes varied between 1V:3.5H and 1V:2.8H) 	<ul style="list-style-type: none"> $d_{50} = 0.008$
10	441.5	<ul style="list-style-type: none"> Scarp/berm (scarp slopes varied between 1V:0.45H and 1V:0.04H) 	
0-9	>441.5	<ul style="list-style-type: none"> Top of the bank 	<ul style="list-style-type: none"> $d_{50} = 0.008$

Note: Gage on the Illinois River near Havana, IL @ RM 119.6 was used for stage histogram. WSE = 430.8'; OHW = 437.0'; NP = 429.5'.

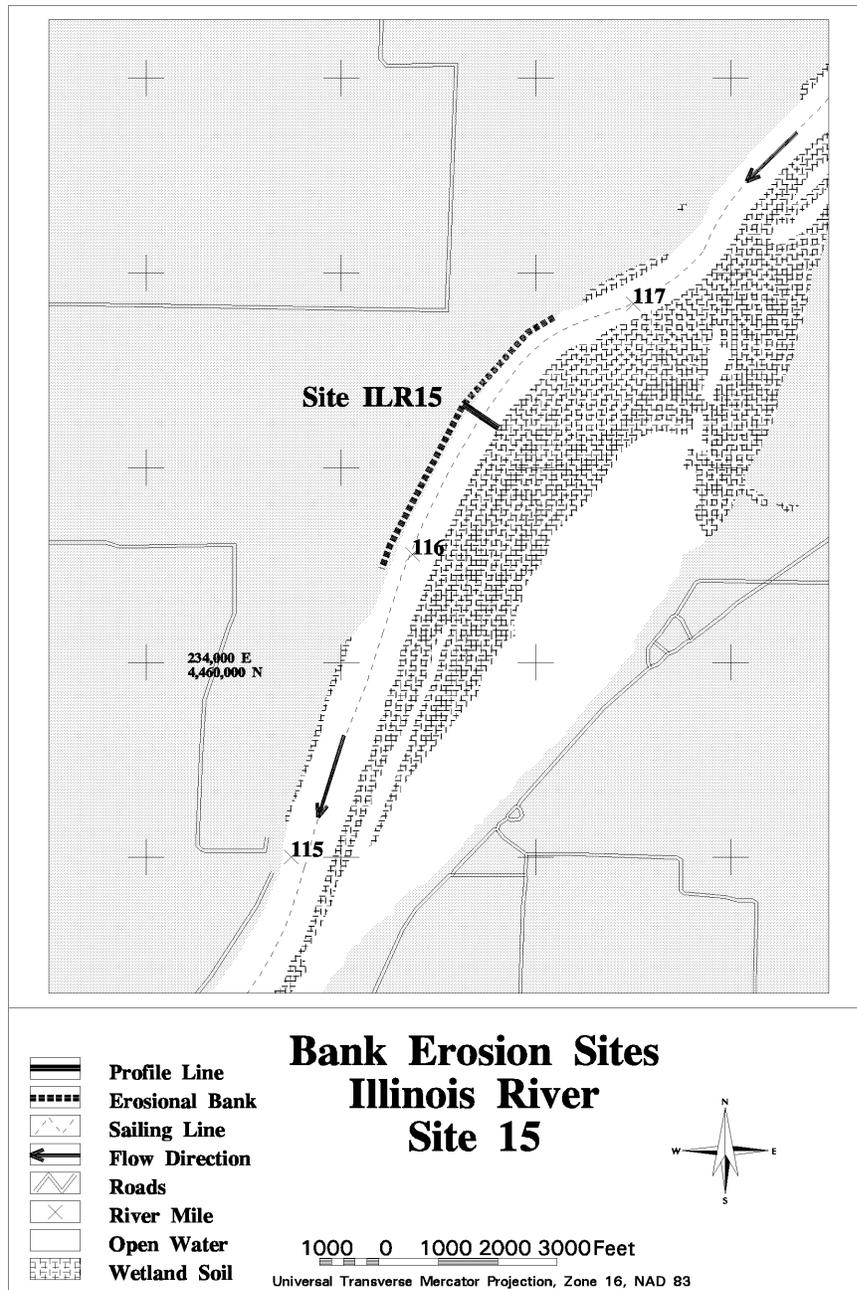


Figure 6-84. Location of site 15 on the Illinois Waterway



Figure 6-85. Site 15 on the Illinois Waterway

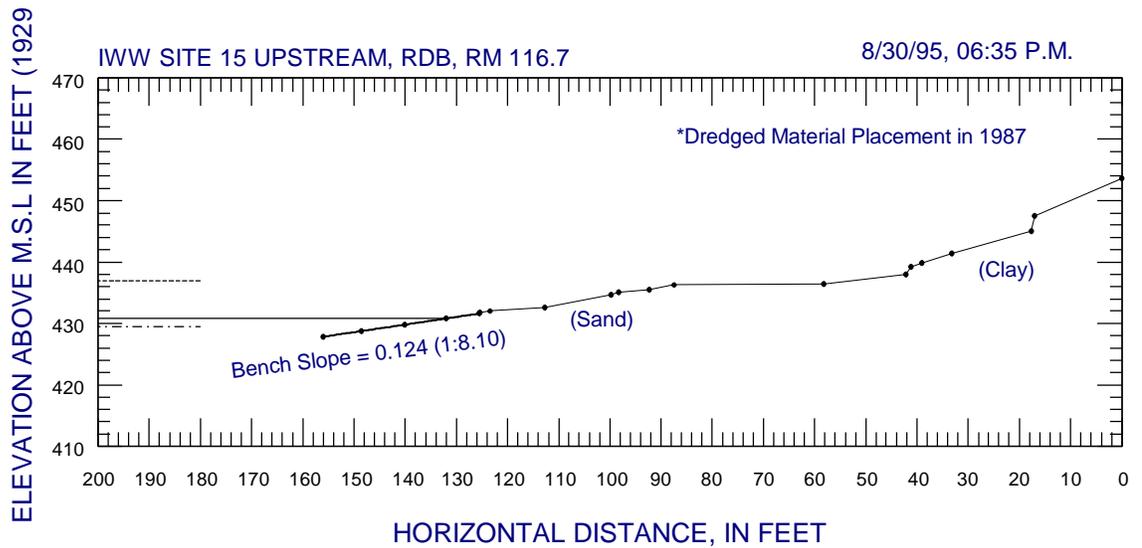


Figure 6-86. Bank sections at site 15

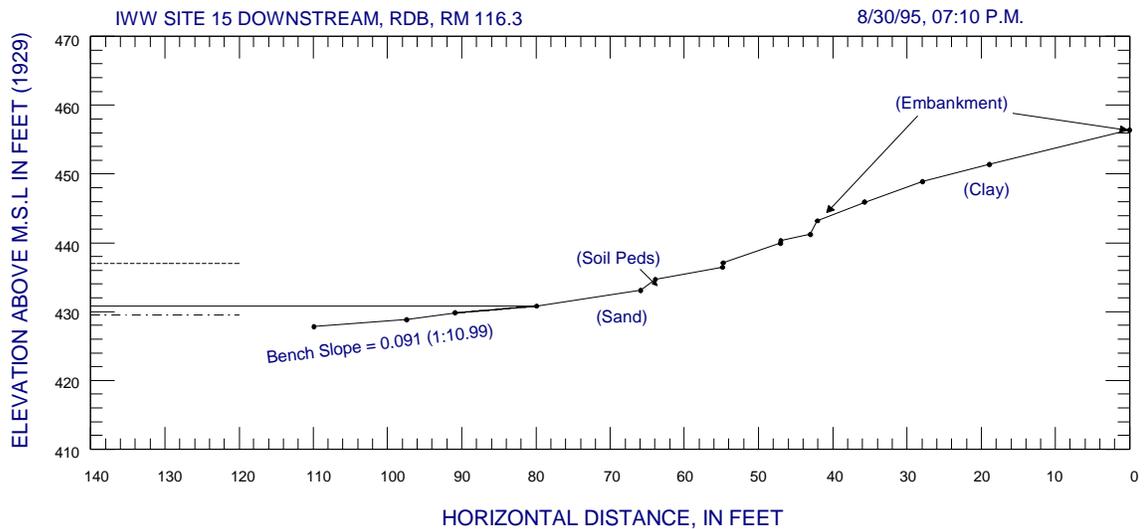
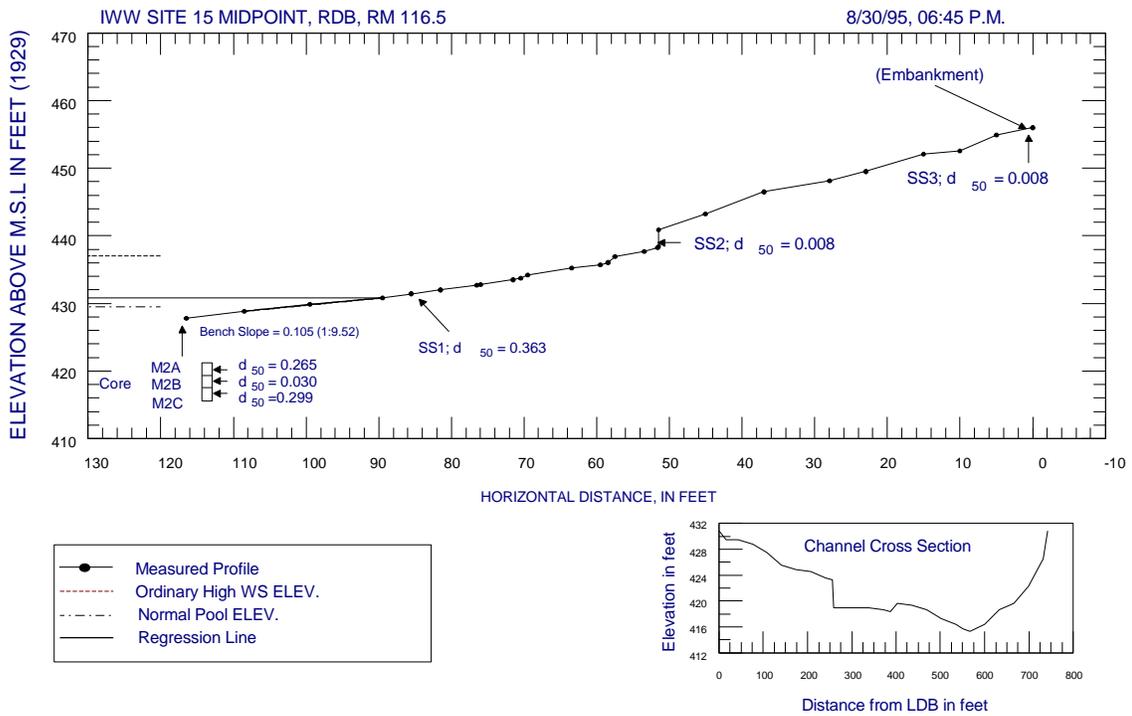


Figure 6-86. Bank sections at site 15 (concluded)

Site 16, La Grange Pool, 8/31/95. This site is located on the LDB of RM 109.5 at a crossover of a bend within the Anderson Lake Conservation Area. Figure 6-87 shows the position of the site on a GIS-based map of the Illinois navigation chart, and figure 6-88 shows a photograph of the site.

Site 16 is about 250 feet from the sailing line, and large lakes are located on both sides of the river. No tributary enters the IWW at this location. According to Bhowmik and Schicht (1980), erosion was occurring at an upstream reach above RM 110.2 on both sides of the river, but approximately between RM 109.5 and 109.8, only an LDB reach was eroded. Hagerty (1988) indicated both banks were eroded. The present study also observed that both banks were eroded. Large debris (dead trees) crowded the bank. There was also a steep scarp near the upstream section, and the opposite side was designated as site 17.

Trees were present at the bank crest, and the bank had an almost vertical scarp. Fine roots extended over the upper portion of the bank. At the bottom of the scarp, sparse vegetation had grown on the berm. A bare bench with a series of small scarps extended to the water's edge. The bench is covered with desiccated clay and holes dug by microorganisms. A passing barge generated fairly large bow-push and drawdown, stranding some juvenile fish on the bench.

Figure 6-89 shows the three measured bank sections and two reduced cross sections. The OHW is 435.7 feet and NP is 429.9 feet above msl. The NP elevation corresponds well to a break in the subaqueous bench slope. Water at the OHW elevation generally reaches the base of the scarp or submerges part of the scarp; higher stages (table 6-26) overtop the bank. Most of the lower scarp and recent sedimentation were observed between NP and OHW.

Table 6-26. Site 16

<i>Percentage of occurrence</i>	<i>Stage above msl, in ft</i>	<i>Topographical features</i>	<i>Bank/bed material, mm</i>
90	430.1	<ul style="list-style-type: none"> Bench (underwater) (slopes varied between 1V:14.5H and 1V:7.0H) 	<ul style="list-style-type: none"> d₅₀ (core) varied (0.005-0.015)
75	431.1	<ul style="list-style-type: none"> Bench 	<ul style="list-style-type: none"> d₅₀ = 0.015
50	433.7	<ul style="list-style-type: none"> Berm/bench (slopes varied between 1V:3.9H and 1V:2.3H) 	<ul style="list-style-type: none"> d₅₀ = 0.010
25	438.1	<ul style="list-style-type: none"> Scarp (slopes varied between 1V:0.48H and 1V:0.26H) 	
10	441.5	<ul style="list-style-type: none"> Top of the bank 	<ul style="list-style-type: none"> d₅₀ = 0.011
0-9	>441.5		

Note: Gage on the Illinois River near Havana, IL @ RM 119.6 was used for stage histogram. Gage is 10.1 miles away from the site. WSE = 430.6'; OHW = 435.7'; NP = 429.9'.