DRAFT

PLANNING AND DESIGN ANALYSIS
AND
ENVIRONMENTAL ASSESSMENT

UPPER MISSISSIPPI RIVER SYSTEM--
ENVIRONMENTAL MANAGEMENT PROGRAM
(UMRS-EMP)

SCHENIMANN CHUTE HABITAT REHABILITATION AND ENHANCEMENT PROJECT

CAPE GIRARDEAU COUNTY, MISSOURI

SECTION 1103, WRDA 1986

JUNE 2003

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DRAFT

Date: 27 Jul 00
(Revised 16 Jun 03)
Division: MVD
District: MVS

UMRS-EMP HREP PROJECT FACT SHEET

1. **Project:** Upper Mississippi River System - Environmental Management Program (UMRS-EMP), Schenimann Chute Habitat Rehabilitation and Enhancement Project.

Congressional District: U.S. Rep. Jo Ann Emerson, MO-8

2. **Authority:** Section 1103, Water Resources Development Act of 1986, as amended

3. **Location:** Schenimann Chute is located along the right descending bank of the Mississippi River, from approximately river mile 57.2 to river mile 62.3. It lies 5 miles north of Cape Girardeau, Missouri, in Cape Girardeau County (**See EA, Page 3, Figure 1**). There is approximately 273 acres of aquatic area within the chute. Private landowners own the properties to the west of the chute, and WestVaco Timber Company owns the island to the east. Schenimann Chute is one of 23 side channels that remain along the 202 miles of Open River between St. Louis, Missouri and Cairo, Illinois, at the mouth of the Ohio River.

4. **Problem:** Schenimann Chute has been degraded by the accumulation of sediment, and an associated loss of habitat diversity (see **Table 1**). Without action, this side channel will become part of the adjacent land, thus eliminating an important habitat component of the open river ecosystem. An opportunity existed to identify and evaluate modifications for the restoration of the side channels with a primary focus on the endangered pallid sturgeon and a secondary focus on other riverine fish species. The project's goals and specific planning objectives are summarized as follows:

TABLE 1. SUMMARY OF PROJECT RELATED PROBLEMS/ GOALS & OBJECTIVES/MEASURES.

PROBLEM	GOALS	OBJECTIVES	MEASURES
Degraded river/side channel connectivity due to prior sedimentation	Restore river/side channel connectivity	Reduce sedimentation	a, b, c, d, e, f
		Reduce anoxic conditions	a, b, c, d, e, f
		Provide year-round aquatic organisms access	a, b, c, d, e, f
Degraded fish overwintering habitat due to lack of depth diversity	Provide fish overwintering habitat	Increase depth diversity	a,b,c,d,e,f,g
Degraded fish reproductive habitat due to uniform substrate and flow conditions	Provide fish spawning/rearing habitat	Increase diversity of substrate & flow velocity	a, b, c, d, e, f, g

Measures Code: a. no action
b. dredging
c. closure structure notching
d. hardpoints
e. pile dike removal
f. entrance dike realignment
g. chevron dike

5. Alternative Plans Considered. Planning criteria against which project alternatives were formulated and evaluated included: alternative completeness, effectiveness, efficiency and acceptability.

Various goals, objectives, and alternative measures were formulated to address the project's identified problems and opportunities, as described in **Table 1**. From these measures three distinctly different types of alternative plans were formulated: **Plan A** - No action, **Plan B** - Extensive Dredging, and **Plan C** - Structural modifications (with or without limited dredging). **Plan C** was further subdivided into a variety of different micro-modeled options as indicated in **Table 2. Appendix E** provides the details of the micro-model effort. The results of the micro-model study provided the basis for the recommended plan (Appendix E, page E-17).

TABLE 2. STRUCTURAL ALTERNATIVE MEASURES CONSIDERED IN ANALYSIS.

PLAN OPTION	HARD POINTS/NOTCHING	SELECTIVE DREDGING	PILE DIKE 57.9	CHEVERON /DREDGE MATERIAL PLACEMENT	DIKE 62.5
C-1	No	None	Left In Place	N/A	No
C-2	Yes	Below Closure 58.2	Remove	Thalweg	No
C-3	Yes	Below Closure 58.2	Remove	Chevron	No
C-4	Yes	Below Pile Dike 57.9	Left In Place	Thalweg	No
C-5	Yes	Below Pile Dike 57.9	Left In Place	Chevron	No
C-6	Yes	Below Closure 58.2	Notched	Thalweg	No
C-7	Yes	Below Closure 58.2	Notched	Chevron	No
C-8	Yes	None	Left In Place	N/A	No
C-9	No	None	Left In Place	N/A	Realign/Notch

A generalized evaluation of the three plans was performed using the four planning criteria. The results are shown in **Table 3**. It was concluded from this summary that Plans A and B would not be further pursued.

TABLE 3. PLANS EVALUATION SUMMARY.

PLAN	COMPLETENESS	EFFECTIVENESS	EFFICIENCY	ACCEPTABILITY	RANK
A	L	L	L	L	L
B	M	M	L	L	L-M
C	H	M	M	H	M-H

L = Low degree of achievement
M = Moderate degree of achievement
H = High degree of achievement

The **Plan C-1** to **C-9** options were evaluated further by subjecting them to cost effectiveness and incremental cost analyses. The detailed data used in these analyses is described in **Appendix G** for costs, and **Appendix F** for habitat outputs. The final results of the evaluation (described in further detail in EA **Section VIII**) indicated that the **Plan C-5** option as being the most cost-effective management plan. This plan has an output of 3,087 Average Annual Habitat Units (AAHUs) at an Average Annual Cost of $164,390 (or $53 per AAHU). However, due to sponsor preference, **Plan C-7** with an output of 3,350 AAHUs at an Average Annual Cost of $179,264 (or $54 per AAHU) was designated as the project's Recommended Plan. Half of Plan C-7's identified benefits would accrue to the large lotic guild species that includes the federally endangered pallid sturgeon.

6. **Description of Recommended Plan.**

Plan Components. The proposed project (**Plan C-7**) includes the notching of existing stone dikes, the placement of hardpoints, dredging the lower chute below closure 58.2 (approximately 75,000 cubic yards of sand placed within a chevron protected area), and the placement of revetment at selected locations. In the **Environmental Assessment, Page 5-7, Figure 2** provides the general site plan for the project. The plan's details are depicted and described in the **Attachment 1, Section 1** Design Plates, and the **Section 2** Plans and Specifications. Construction would occur in three phases: dike notching; rock placement; and then dredging.

The alterations would allow scouring to occur at higher flows creating holes and a sinuous flow pattern through the side channel. The project would improve aquatic habitat diversity by moving sediment, reducing bank erosion, creating scour holes and plunge pools and deepening the downstream connection with the river. The resulting deep water would provide off-channel habitat for the Federally Endangered pallid sturgeon; over wintering, spawning and rearing habitat for fishes. No major declines or benefits to migratory waterfowl and shorebirds, or other terrestrial/aquatic animals are expected to result from this project.

While the final results of the ICA evaluation indicated that Plan C-5 was the most cost-effective management plan, the Scheniman Chute Project Team is selecting Plan C-7 as the recommended plan. The reasoning for selecting a plan other than the most cost effective plan is due to benefits that would accrue to the large lotic species guild that includes the federally endangered pallid sturgeon.

The reason that C-5 is more cost effective than C-7 is the extent of dredging. Plan C-7 provides a notch in the lower woodpile dike and allows for dredging to occur up to the closure 58.2 by allowing for the passage of a dredge. Otherwise, the plans are the same with respect to other features. Because the dredging leads for more usable overwintering area, and more bathymetric diversity, there are benefits associated with plans C-7 that are not associated with plan C-5. Since we are gaining benefits, especially with shovelnose sturgeon (related to the federally endangered pallid sturgeon, and assumed to have similarities in its habitat use) and the paddlefish (species of management concern on the Mississippi River), the benefits for habitat outweigh the benefits of making the project less costly by not dredging. Plan C-7 still maintains a good habitat/cost ratio.

7. **Financial Data:** The total estimated cost of this project is $2,768,400 (see **TABLE 4** financial summary, **Appendix G** Costs Estimate, and **Appendix Q** Project Management Plan). Under Section 906(e) of the 1986 Water Resources Development Act, first costs of general design and construction of the project would be 100% Federal based on benefits to species listed as threatened and endangered (pallid sturgeon). The annual operation, maintenance, repair and rehabilitation costs would be 100% non-Federal, and are estimated to be $8,557. During the life of the project, the annual cost of physical and biological monitoring is estimated to be $9,100. The initial phase of the post-construction monitoring would be at cost to the federal government. Any subsequent repeat monitoring desired by the state, would be conducted as a non-Federal cost by the State of Missouri.

8. **Views of Sponsor:** The recommended plan is similar to the initial plan suggested by the 1996 micro-model. MDOC is in agreement with and supports the recommended plan configuration. The sponsor also agrees to sign a memorandum of agreement stipulating that it is responsible for 100 percent of the project's OMRR&R costs (see **Appendix A** Letter of Intent and Draft O&M Agreement).

9. **Views of Federal, State, and Regional Agencies:** As reflected by its Draft Fish and Wildlife Coordination Act Report (**Appendix D**), the U.S. Fish and Wildlife Service concurs in the proposed modification. The service has emphasized the importance of this area to the federally endangered pallid sturgeon, and its contribution to the general health of the Middle Mississippi River. Any additional comments from the various agencies will be addressed in **Appendix B** of the Final PDA/EA.

10. Status of Environmental Statutes Compliance: The attached Environmental Assessment (EA) was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. This documentation was distributed to Federal, State, and regional agencies and the general public as noted in the **Appendix C** distribution list. The EA also includes an unsigned copy of the project's Draft Finding of No Significant Impact (FONSI). District responses to public comments on the draft PDA/EA will be documented and circulated as **Appendix B** to the final PDA/EA. The draft EA also addresses key elements of the Clean Water Act Section 404(b)(1) guidelines. Water Quality Certification has been requested from the Missouri Department of Natural Resources. Compliance documentation is contained in **Appendix I** for cultural resources, **Appendix J** for Hazardous, Toxic and Radioactive Waste, and **Appendix N** for cumulative impacts.

11. Significant Effects: This project will be the first side channel renovation project under the EMP program on the Middle Mississippi River. Benefits are expected for a wide array of fish species. In particular, the endangered pallid sturgeon is expected to benefit directly from this project. This side channel restoration is believed to be consistent with, and contributes to, the Pallid Sturgeon Recovery Plan (Dryer and Sandovol, 1993).

12. Implementation Schedule:

The key project milestones are presented below (See **Appendix P** for additional details).

a. Initiate Construction: Scheduled for October 2004

b. Project Completion: Approximately March 2005

13. Supplemental Information:

a. Legal Issues. Initially several legal issues were raised by CEMVS-PM-N, and subsequently reviewed by the District's Office of Counsel (**Appendix L**). During plan formulation the following issues were further researched and addressed:

(1). Necessity of Cost Share Sponsor. Early on, a Corps policy was raised on the need for a non-federal cost-share partner for projects involving land acquisition. However, subsequent planning led to the elimination of real estate as a project feature, and thus the issue became moot.

(2.) O&M Cost for 100% Federal Funded EMP Projects. This issue will reflect the current policy and guidance within the EMP program that requires all O&M responsibility be borne by the local sponsor, in this case the Missouri Department of Conservation (MDOC).

b. Threatened and Endangered Species and the Necessity of Cost Share Sponsor. Corps policy within the Environmental Management Program was minimally used regarding threatened and endangered species. Water Resources Development Act (WRDA) of 1986, Section 906.e identified first costs of projects related to a nationally threatened and endangered species as 100% federal. Therefore, first costs of the Schenimann Chute project will be 100% federal, with no cost to the non-federal sponsor. MVD gave preliminary approval to this cost-share concept in its 4 Apr 03 PRP approval letter.

c. Quality Control and Technical Review. The PDA/EA is a document subject to quality control/assurance guidance. To accomplish this task, the District developed and implemented a Quality Control Plan (QCP) for the project study. That plan is included in **Appendix K**. Consistent with that plan, a completed Continuing Authorities Program quality control checklist (used as a guideline for Independent Technical Review Team (ITRT) review), and a signed draft Certification Sheet is provided in **Appendix K** of this report. Comments received from the ITRT were minor in nature.

The most substantive comment received focused on the recommended plan, identified as C-7 versus the cost effective alternative of C-5. A number of ITR members identified this comments and the team addressed the comment in the following manner:

Project Delivery Team Response: The team felt that the habitat gained by dredging from the lower wood pile dike to the rock closure 58.2R outweighed the cost increase, due to the endangered specie justification. In addition, through sequencing the projects construction, it is believed that hydraulic dredging quantities may be reduced while realizing the required bathymetric profile. The sequencing will allow natural high flow events to scour the lower end of Schenimann Chute.

Environmental Branch: Several comments were received that identified questions surrounding project features:

- Sequencing
- Habitat type land cover
- Chevrons
- Terrestrial and Aquatic Habitat

Project Delivery Team Response: The team will utilize sequencing within the project to reduce additional dredging. Regarding habitat types, the team felt the endangered specie component and increased habitat area was more important than an isolated backwater area. Chevron construction is being utilized at the downstream end of the project. However, chevron construction in side channel doesn't meet the goals and objectives identified by the sponsors. Chevrons would provide additional sedimentation areas in the shadows of the chevrons, this habitat is not desired within the side channel. This project is specifically targeted at the aquatics of the UMRS, therefore no terrestrial component was included in the project.

Engineering Division: Chevron feature not included in plates of construction features.

Project Delivery Team Response: The chevron will be shown and identified on the drawing in plan view and typical sections.

d. VE Analysis. A Value Engineering (VE) analysis was performed in December 2002. The Value Engineering Report is provided in (**Appendix O**). Additional analysis of VE proposals will be performed during the Preconstruction, Engineering, and Design phase (PED) phase of the project.

e. Documentation Report. Originally, it was anticipated that the total estimated project costs would be less than $2 million. On that basis the District proceeded with a Planning Design Analysis (PDA) Report. During plan formulation the project cost increased based on additional detail and analysis, it is now estimated to be approximately $2.7 million. Due to the simplicity of the project, the District believes there is not sufficient cause to change the reports format to a more detailed document such as a Definite Project Report.

f. Consistency. Appendix M includes a consistency check between the project as it was originally envisioned in the PRP and now in the PDA. The current project concept is, for the most part, similar to the originally proposed PRP concept.

g. Monitoring. Appendix Q provides the project's performance assessment. The plan will cost $9,100 per year to implement over a period extending up to 53 years. By agreement with the sponsor, MVS will fund the baseline monitoring and some portion of post-construction monitoring. MDOC will accept total responsibility for any monitoring (including costs) that occurs beyond that point.

14. Recommendations:

I have weighed the accomplishments to be obtained from the proposed habitat improvements at the Schenimann Chute Habitat Rehabilitation and Enhancement Project area against project costs and have considered the alternatives, impacts, and scope of the proposed project. In my judgment, the proposed project is a justified expenditure of Federal funds. I recommend that this UMRS-EMP project be approved. The total estimated project cost is $2,768,400 of which all first costs would be a Federal cost according to Section 906(e) of WRDA 1986. I further recommend that this project be approved for construction funding.

_____ _____

Date

C. Kevin Williams
Colonel, U.S. Army
District Engineer
St. Louis District

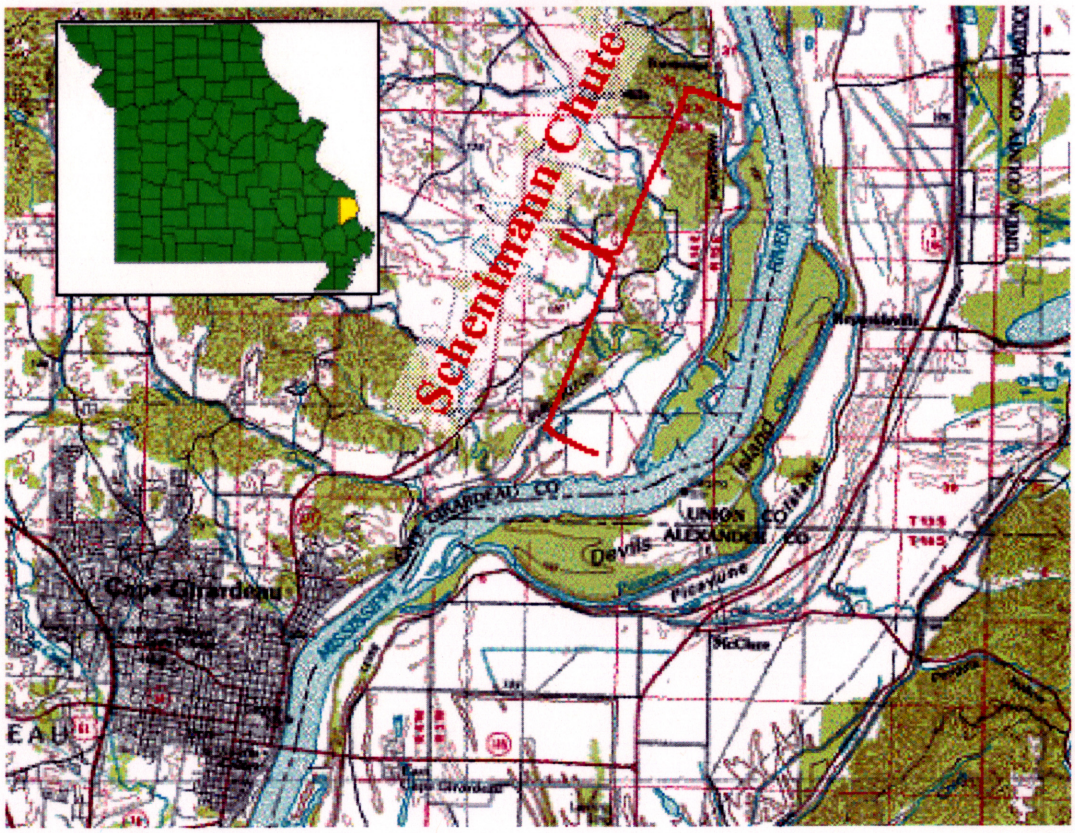

Figure 1. Vicinity map showing Schenimann Chute and surrounding area.

TABLE 4. ECONOMIC AND FINANCIAL DATA FOR SCHENIMANN CHUTE HREP RECOMMENDED PLAN

(All costs in thousands of dollars)

a. Estimated Implementation Costs: (October 2001, price level)		b. Economic Data: (6.125, 50-year life)	
Federal	$ 2,768.4	Annual Charges: (Includes $OM&R)	$179.3
Non-Federal	$0.0	Annual Benefits (AAHUs):	3,350
Total *	$2,768.4	AA$/AAHU:	$54 **

c. Allocations to Date:	Federal	Non-Federal
Planning and Design Analysis	$200.0	$0.0
Total	$200.0	$0.0

d. Remaining Requirements:		
Planning and Design Analysis	$30.7	$0.0
Construction	$2,537.7	$0.0
Total	$2,568.4	$0.0

e. Total Allocations:	$2,768.4	$0.0

Notes:

* Total project cost is federally financed. Section 906(e) of WRDA 1986 indicates the first costs of habitat enhancement shall be a Federal cost when such enhancement is designed to benefit species that have been listed as threatened or endangered by the Secretary of the Interior under the terms of the Endangered Species Act, as amended (16 U.S.C. 1531, et seq).

* * Based on the District's experience with UMRS-EMP projects, a fisheries habitat project that yields less than $2,000 per AAHU represents a reasonable level of output for the funds expended.

ENVIRONMENTAL ASSESSMENT
WITH
DRAFT FINDING OF NO SIGNIFICANT IMPACT

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM

SCHENIMANN CHUTE
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

June 2003

U.S. Army Corps of Engineers
St. Louis District
Environmental Planning Branch (CEMVS-PM-EA)
1222 Spruce Street
St. Louis, Missouri 63103-2833
Commercial Telephone Number: (314) 331-8478

SCHENIMANN CHUTE
HABITAT REHABILITATION AND ENHANCEMENT PROJECT

This document constitutes the District's Environmental Assessment (EA) for the above named project. The EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, and its format has been adjusted to also address regulatory compliance considerations in accordance with the Clean Water Act Section 404(b)(1) guidelines.

I. INTRODUCTION

Since the early 20th century, the Mississippi River has been modified in order to provide for the needs of navigation and flood protection. On the Middle Mississippi River (MMR), or the reach of river between the mouths of the Missouri and Ohio Rivers, this has been accomplished primarily by the construction of dikes, the closure of secondary channels, dredging of the main channel, and the construction of levees. Despite levees and navigation modifications, the MMR still forms a complex mosaic of main and side channels, floodplain, and seasonally inundated wetlands that support a large number of fish, amphibians, reptiles, birds, and mammals, many which are federally or state listed as rare, threatened, or endangered. While these habitats still exist, their condition and function have been degraded over time.

II. NEED FOR PROJECT

Natural resource managers on the MMR as well as the Upper Mississippi River System (UMRS) have been conducting initial planning for future habitat protection and restoration work over the last several years, with an emphasis on navigation pool/river reach scales. On a broad scale, under the auspices of the Environmental Management Program, a habitat needs assessment (HNA) was conducted cooperatively among state and federal agencies **(U.S. Army Corps of Engineers, 2000).** Needs and restoration goals cited by the HNA to provide for a more natural desired future condition of the MMR included the following: 1) Create or restore 25,000 acres of backwater and secondary channel habitat, of which 7,000 acres should be isolated backwaters; 2) Increase the amount of prairie, marsh, and forest by about 100,000 acres; 3) Restore geomorphic process that create and maintain sand bars and shoals.

In the St. Louis District, state and federal resource agencies, with the Corps, have developed a habitat restoration and conservation plan for side channels on the MMR. The *Middle Mississippi River Side Channels; A Habitat Rehabilitation and Conservation Vision* **(U.S. Army Corps of Engineers, 2000)** proposes that a critical need to implement restoration and enhancement measures for the conservation of side channel habitats exists. It cites all the remaining side channels on the MMR, their current condition, and prescribes basic methods of restoration, and lists possible authorities that may be utilized to fund such efforts. It also ranked the side channels based on need for restoration, and Schenimann Chute falls in the category of "high priority".

There is also a need to restore side channels for the benefit of pallid sturgeon, a Federally endangered species. The Pallid Sturgeon Recovery Plan (**U.S. Fish and Wildlife Service, 1993**) and the Service's Final Biological Opinion for Operation and Maintenance of the 9-Foot Navigation Channel on the Upper Mississippi River System (dated April 2000), identified past, present and ongoing loss of habitat diversity in the Middle Mississippi River (MMR) as a major factor impacting the endangered pallid sturgeon. As a result, the Reasonable and Prudent Alternative identified in that document specifically included implementation of a long-term habitat restoration program which placed high priority on the restoration of side channels and sandbars to benefit all life stages of pallid sturgeon.

Based on the fact that there is a push to restore side channels on the MMR, and among these Schenimann Chute is considered a high priority among river resource managers, this project study was initiated. The project, if implemented, will begin to meet the goals set forth in the HNA and the MMR side channels vision, and provide a much needed habitat to the myriad of aquatic species that utilize side channel habitat during all or portions of their life cycles.

III. PROJECT LOCATION

Schenimann Chute is located along the right descending bank of the Mississippi River, from approximately river mile 56.5 to river mile 62.5. It lies 5 miles north of Cape Girardeau, Missouri, in Cape Girardeau County (**Figure 1**). There are approximately 273 acres of aquatic area within the chute. Schenimann Chute is one of 23 side channels that remain along the 202 miles of open river between St. Louis, Missouri and Cairo, Illinois, at the mouth of the Ohio River.

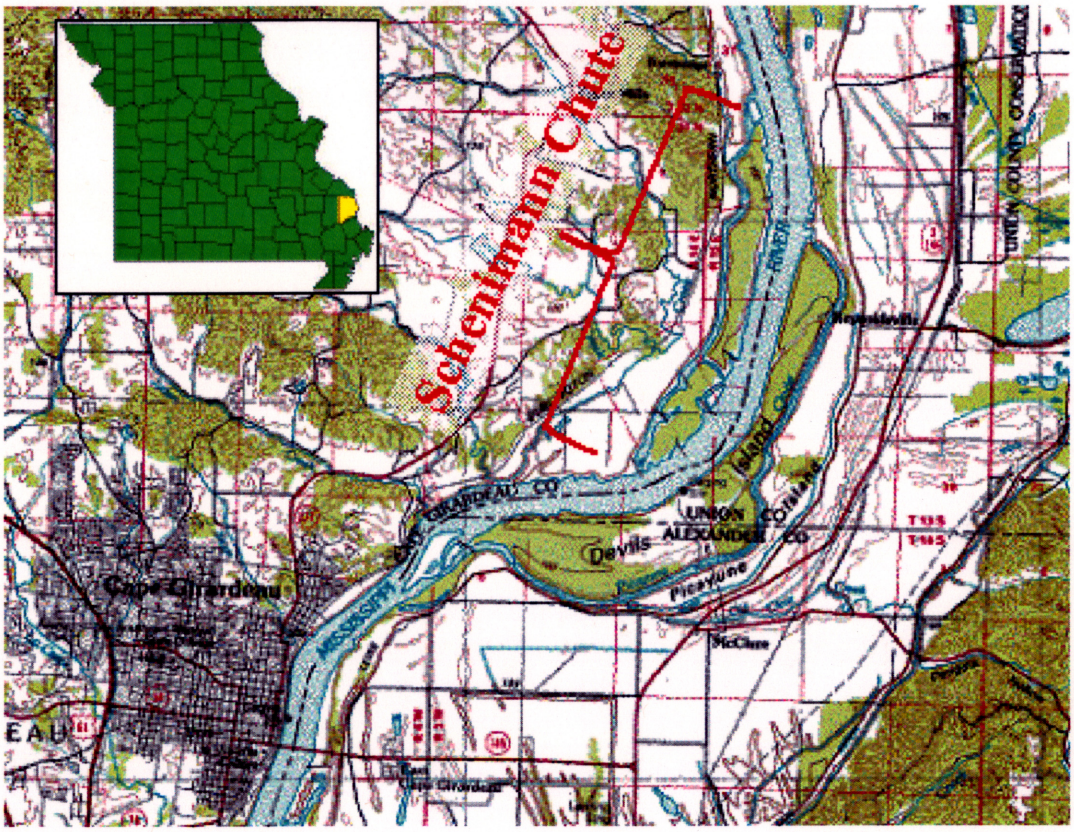

Figure 1. Vicinity map showing Schenimann Chute and surrounding area.

IV. AUTHORITY

The Upper Mississippi River System Environmental Management Program (UMRS-EMP) was authorized by congress under the Water Resources Development Act (WRDA) of 1986 (PL 99-662). The purpose of this authority is to restore and enhance the ecology of the Upper Mississippi River (Cairo, IL to St. Paul, MN). WRDA of 1999 reauthorized the EMP program as a continuing authority type program within the Corps of Engineers jurisdiction.

V. CURRENT CONDITIONS

1. PHYSICAL CHARACTARISTICS

The side channel is unique in that it has an interior tributary on the upper end, which drains hundreds of acres of wooded upland. The tributary (Bainbridge Creek) is a wet weather stream and may be inundated by the river under high stages. The contribution of sediment from this tributary is negligible. The side channel is dissected by closing structures, which create four isolated chambers. The three main rock closure structures were originally dikes 59.8R, 58.7R, and 58.2R, which were constructed before the island and side channel formed. Several wooden pile dikes were constructed from the original

right descending bankline of the main channel, which is now the right descending bankline of the side channel. Some of the dikes extended nearly 3500 feet into the main channel. The island now covers the middle portion of the dikes. The ends of the dikes have since been rock covered and extend into the main channel. For reference, please see **Figure 2** for a plan view of Schenimann Chute land cover, current features and proposed features.

The first chamber (northern most) is the longest and is characterized by the confluence of Bainbridge Creek, two old pile dike structures, and a connection to the main river at stages as low as 8 feet (Cape Girardeau gage). The second chamber is slightly shorter and very sandy, with the exception of the plunge pool below the structure dividing chambers 1 and 2 (some gravel), and above the structure dividing chambers 2 from 3 (silty). The second chamber also contains an inlet from the main river that enters about mid-way and a pile dike just below this inlet (not shown). The third chamber is the shortest of the four, uniform in depth, and has no internal structures or unique features. The fourth and final chamber is divided mid-way by a pile dike. The substrate is mostly sand. This chamber becomes disconnected from the main river at stages below 12 foot Cape gage. **Figure 3** shows photos of different aspects of Schenimann at a 14 foot stage on the Cape gage, and generally represents average low river stages (August – February monthly mean stages vary from 15ft. – 12ft Cape gage).

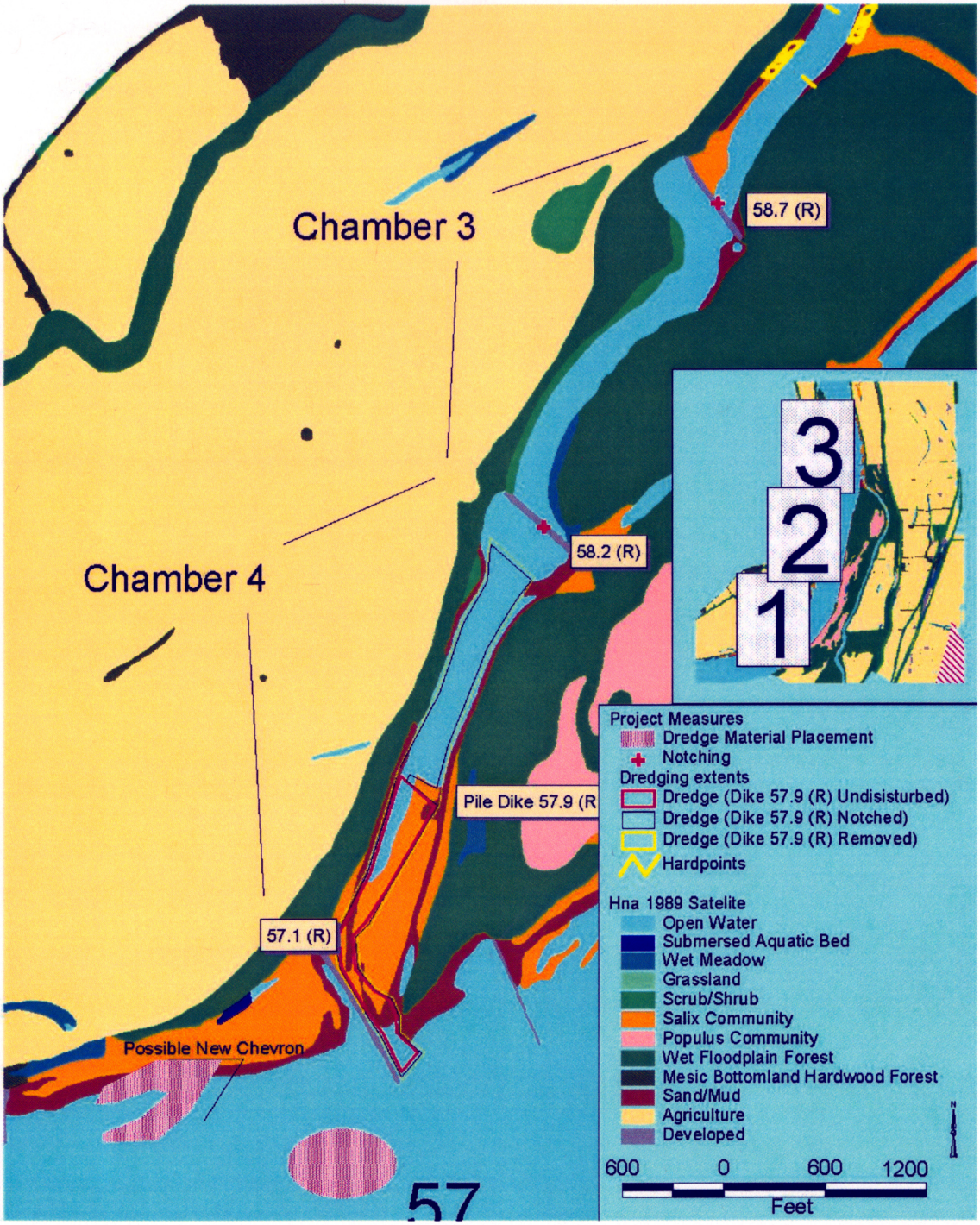

Figure 2. Plan view of Schenimann Chute, showing land cover, current features and proposed features (1 of 3).

Figure 2. Plan view of Schenimann Chute, showing land cover, current features and proposed features (2 of 3).

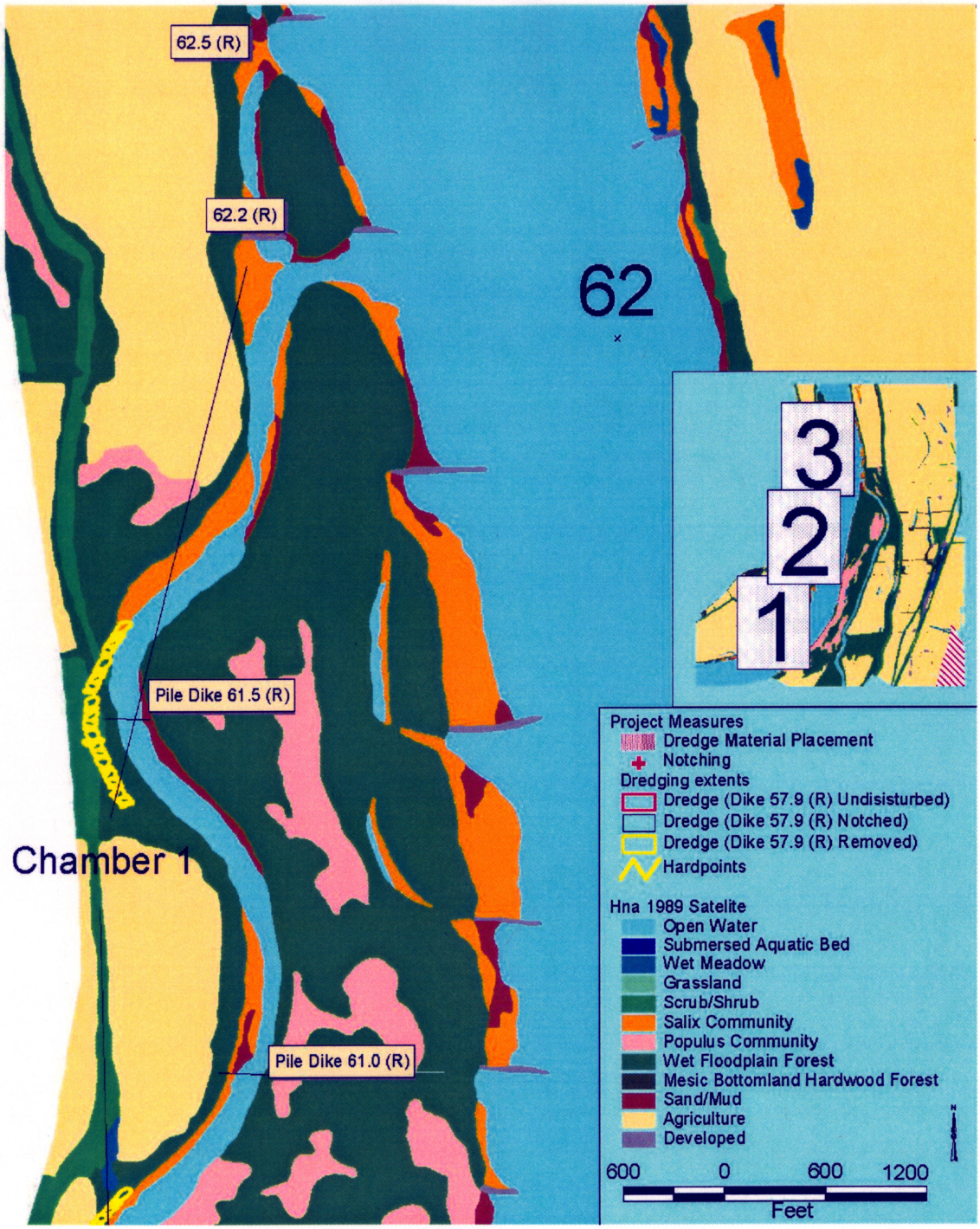

Figure 2. Plan view of Schenimann Chute, showing land cover, current features and proposed features (3 of 3).

Figure 3. Schenimann Chute at different locations along its length at a river stage of 14 feet on the Cape Girardeau gage. Photos show: from vantage points one and two the uppermost entrance from the chute and from the river; vantage point three shows the main entrance to the chute from the river; vantage point four looks up Bainbridge Creek from the chute; vantage point five looks downstream at an old wooden pile dike; from vantage point six, an old wooden dike from upstream and up close; vantage point seven is looking downstream from the upstream rock closure structure, (note the deep scour hole); vantage point eight shows the exit point of the chute.

2. HISTORIC PROPERTIES CHARACTARISTICS

There are no known historic properties (prehistoric or historic archaeological sites, structures) within the project area. The Archaeological Survey of Missouri does not have any sites recorded in the project area (ASM Identification Number 01-7-522). The sites reported on their Request for Information form (**Table 1**) are all at least one-half mile from the project area. No steamboat wrecks have been reported from the project area (F. Terry Norris, personal communication, July 9, 2001). Native American Tribes are being contacted to determine if they attach importance to this area.

Table 1. Recorded archaeological/historic sites within the vicinity of project site.

Results of ASM File Search									
Topo	Township	Range	Quarter Sections	Land Grant	Section	Northing	Easting	Site Name	Site Number
McClure	31N	14E		2276	50				23CG109
McClure	31N	14E		2276	50				23CG112
McClure	31N	14E		2275	50				23CG117
McClure	31N	14E		2276	50	4135220	279600	GBY	23CG118
McClure	31N	14E		2276	50	4135180	279500	ALIEN	23CG119
Cape Girardeau	31N	14E			50	4130785	276565	St. Vincent's #1	23CG273
Cape Girardeau	31N	14E			50	4132560	276250		23CG301

Moreover, most, if not all land adjacent to the Chute was recently accreted by the Mississippi River within the last 100 or less years and therefore will not contain prehistoric archaeological sites. As described in Section V.1, all land on the left descending (east) bank was created by pile dikes placed from the then right descending (west) Mississippi bank into the river channel in the early 1930's. This land accretion and chute development is documented by aerial photographs taken in 1932, and 1935 during dike construction, and another aerial photograph taken in 1965 after full development of the left descending bank of the chute or "islands"(**Figure 4**). In addition, unpublished information/map by Claude Strauser, District Potamologist, document that various parts of the land on the Chute's right descending (west) bank was reworked by the Mississippi around 1919, 1907 and/or 1899 (Strauser, no date). Supporting this, the soils on both sides of the Chute have been classified as Caruthersville series and Commerce series which both formed in recent alluvium along the Mississippi River (Festervand 1981:70, 79).

3. BIOLOGICAL CHARACTERISTICS

The lack of connectivity to the main river and the shallow to absent water conditions create harsh environments (high dissolved oxygen variability and stratification, warmer summer temperatures) for its inhabitants. A variety of riverine fish and invertebrate species that utilize secondary channel habitat may be eliminated from the chute as deeper water becomes anoxic. Santa Fe Chute, a side channel with connectivity problems similar to those encountered at Schenimann, appears to have major depletion occurring

during the fall related to increasing temperatures, high organic loading, and channel isolation (Hrabik, pers. comm.). **Figure 5** shows the points at which the Schenimann Chute side channel is isolated during mean monthly stages. This loss of connectivity may not only cause water quality problems, but may also cause fish to become entrapped, and on severe years, cause fish kills resultant of water quality degradation.

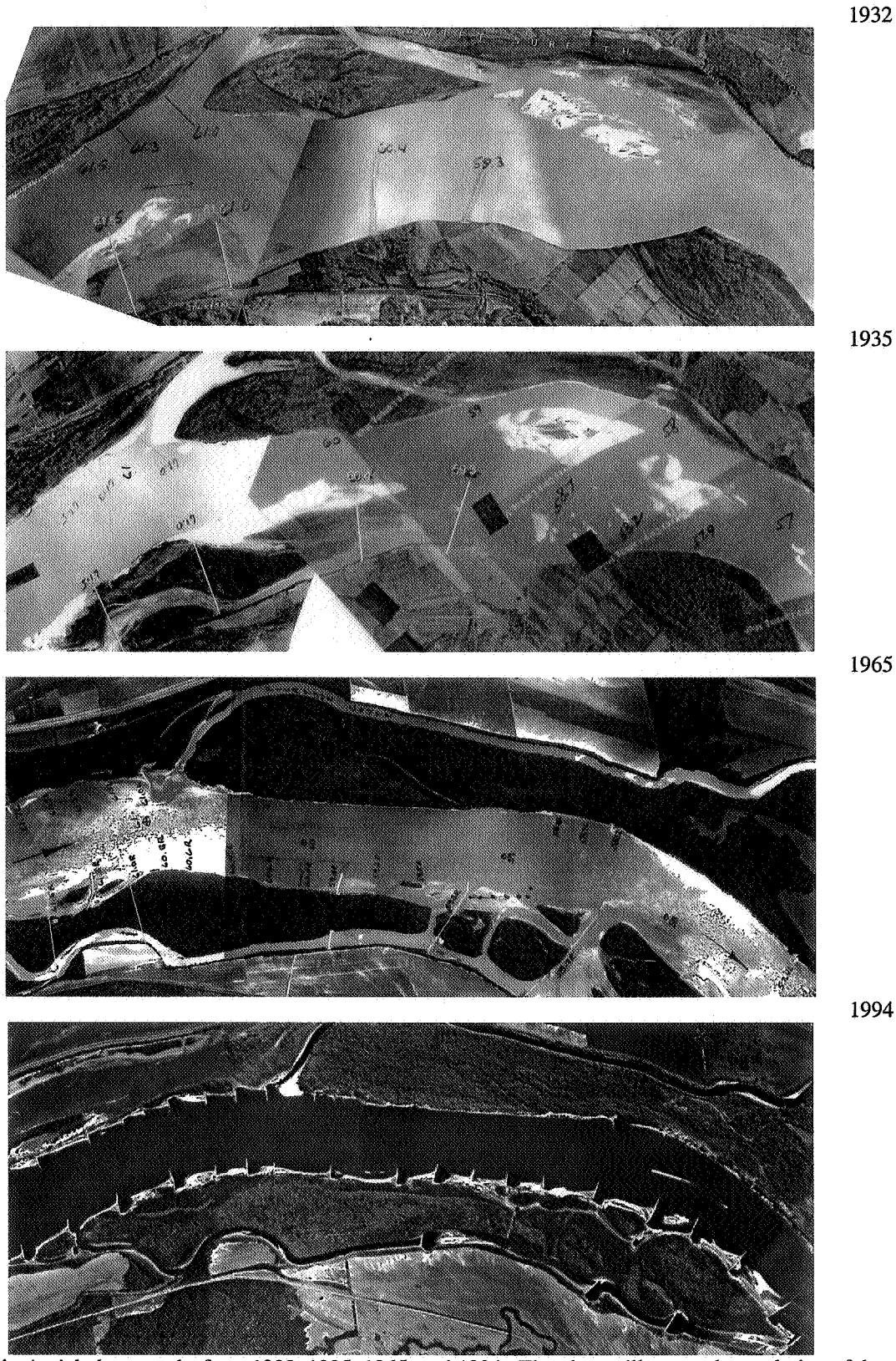

Figure 4. Aerial photographs from 1932, 1935, 1965, and 1994. The photos illustrate the evolution of the chute formation due to the placement of river control structure, and that what was once the right bank of the Mississippi is now the right bank of Schenimann Chute.

Figure 5. Connectivity of Schenimann Chute at mean monthly stages for the months of January through December. Note that the connectivity of the chute is limited to primarily the spring months (1 of 3).

Figure 5. Connectivity of Schenimann Chute at mean monthly stages for the months of January through December. Note that the connectivity of the chute is limited to primarily the spring months (2 of 3).

Figure 5. Connectivity of Schenimann Chute at mean monthly stages for the months of January through December. Note that the connectivity of the chute is limited to primarily the spring months (3 of 3).

VI. PROJECT ALTERNATIVES

1. PROBLEMS AND OPPORTUNITIES

The natural meandering processes that the MMR historically experienced has been altered. Through the establishment of the 9 foot navigation channel project, wing dikes, revetments, closing structures and bendway weirs have fixed the channel in place, disrupting this dynamic process that created and maintained a diversity of habitat types. Off channel habitats that were regularly formed through natural river process are now slowly being aggraded without new habitats being formed. Because the river has been "locked in place" in the MMR, side channel restorations are deemed necessary to restore habitats that used to naturally be formed.

Deposition of sediment in the Schenimann Chute project area has gone from a diverse aquatic area to an increasingly homogenous aquatic area, and will eventually convert to a terrestrial habitat. Sediment deposition and closing structures have resulted in a loss of accessibility of the side channel from the main channel for aquatic organisms seeking winter refuge, rearing areas, and suitable spawning habitat. The lack of flow through the channel in the summer and fall can be detrimental to water quality in the chute, leading to anoxic conditions intolerable to many native MMR species.

An opportunity exists to construct measures that could vastly improve the diversity and productivity of the Schenimann Chute project area.

2. GOALS AND OBJECTIVES

The goals of the project are to maintain a river connection to Schenimann during seasonal low flows, and reestablish the ability of water to flow from its entrance to its mouth during average seasonal flows (**Table 1A**). This will be done in order to allow aquatic organisms access to important side channel habitat that currently is inaccessible during certain times of the year. It is believed that various aquatic organisms will use the area for different life stage requisites, such as spawning, rearing, feeding, and over-wintering refuge. Creating year long connectivity and adding structures within the chute to provide scour and meandering patterns will diversify the aquatic habitat provided by the chute (mainly depth and substrate diversity) which will be beneficial to a variety of aquatic organisms, including the federally endangered pallid sturgeon. Increased depth diversity and improved flow should elongate the life of this side channel and improve water quality. By allowing connection during the winter, refuge within the chute will be accessible to fish seeking habitat off of the main channel.

Table 1A – Project Goals and Objectives

Project Goals, Objectives, and Measures Available	
Goal/*Objectives*	Potential Enhancement Features
Restore main channel connectivity with side channel	
Reduce future rates of sedimentation that will eventually lead to aquatic to terrestrial habitat conversion	Dredging
	Closure structure notching
	Hardpoint installation
	Pile dike removal
	Change entrance dike alignment
Reduce potential for anoxic conditions that can inhibit survival of aquatic organisms	Dredging
	Closure structure notching
	Hardpoint installation
	Pile dike removal
	Change entrance dike alignment
Provide year long accessibility of chute to aquatic organisms	Dredging
	Closure structure notching
	Hardpoint installation
	Pile dike removal
	Change entrance dike alignment
Provide habitat for fish overwintering refuge	
Increase depth diversity	Dredging
	Hardpoint installation
	Chevron dike construction/dredge material placement
Provide habitat for spawning and rearing fishes	
Increase diversity of substrate and flow velocity	Hardpoint installation
	Chevron dike construction/dredge material placement

3. ALTERNATIVES

In general, the alternatives below in Table 2 (with the exception of alternative 9) are a varied mixture of five different measures. It was important that the measures evaluated would create environmental diversity and enhancements while at the same time ensuring the integrity of the Mississippi River navigation channel.

The following alternative measures were combined in various ways to create eight structural alternative plans for further analysis (**Table 2**). Refer back to **Figure 2** to view detail of the alternatives.

- **Hard points/Notching** - The upper reaches of Schenimann Chute, between Miles 62.2 and 60.6, should be left unmodified. This reach contained adequate diversity because of the numerous bends located in this area. Also, construct a series of 15 alternating dikes or hard-points to an elevation near top of bank in Schenimann Chute between Miles 60.5 to 59.0 to create additional physical and biological diversity, and to cause channel creation in some of the areas experiencing sedimentation. All hard points or dikes shall be level crested at elevation top of bank. In addition, widen and deepen the existing notches in closure structures 59.8(to elevation of 10 foot Cape Gage), 58.7 (to elevation of 6 foot Cape Gage), and 58.2 (to elevation of 2 foot Cape Gage) to allow better accessibility throughout Schenimann Chute. Notches are planned to have a bottom width of 50 foot. Although the deepened notches were not tested in the micro model, experience has shown that this would not negatively impact the hydraulic or sediment transport characteristics of the side channel or the integrity of the navigation channel, but would provide for boat and fish passage during most river stages.

- **Dredging** - Artificially dredge the lower end of Schenimann chute to -3 LWRP to create connection to the main channel at the lower end and to provide deep-water habitat to fish. Dredging was simulated in the model and it appeared that dredge cuts would maintain themselves for a significant portion of the project life of 50 years. Various extents of this measure from the mouth to as far as the southern most closure structure at RM 58.2 (based on the disposition of dike 57.9 mentioned below) were evaluated in the habitat analysis, but not the micro model. It was assumed during habitat analysis that the removal of entire pile dike may encourage additional deposition upstream of the pile dike in the future, but that a dredge cut to -3 LWRP would return to its current condition sometime around year 25 post project.

- **Pile Dike 57.9 Removal, Notching, or Leaving in Place** - To dredge the whole lower end to the first rock closure structure, the pile dike at RM 57.9 would have to be removed or notched to allow dredge access, so various alternative included the removal of, notching, or the leaving in place of this pile dike.

- **Dredge Material Placement into Thalwag or Chevron** – The placement of dredge material was a variable analyzed specifically in the habitat analysis. Placement into the thalwag would result in no positive or negative impacts to Schenimann Chute. Placement of spoil material behind a chevron would create island and sandbar habitat for fish, and the chevron would create a diversity of depths and substrates due to its impacts to velocities. A chevron does not currently exist near Schenimann Chute, so one would have to be constructed under that option. The chevron would be placed just down stream of Schenimann Chute in the main channel border area.

- **Changes in the alignment and notches in Dike 62.5** – This alternative was tested in the micro model, but was only analyzed in one of the action alternatives, as the model revealed that this alternative would have negative impacts to the navigation channel.

Table 2. Nine structural alternatives analyzed in this report.

Structural Alternative Measures Considered In Analysis					
	Hard points/Notching	Dredging	Pile Dike 57.9	Dredge Material Placement	Dike 62.5
Alternative C-1	No	None	Left In Place	N/A	No
Alternative C-2	Yes	Below Closure 58.2	Remove	Thalweg	No
Alternative C-3	Yes	Below Closure 58.2	Remove	Chevron	No
Alternative C-4	Yes	Below Pile Dike 57.9	Left In Place	Thalweg	No
Alternative C-5	Yes	Below Pile Dike 57.9	Left In Place	Chevron	No
Alternative C-6	Yes	Below Closure 58.2	Notched	Thalweg	No
Alternative C-7	Yes	Below Closure 58.2	Notched	Chevron	No
Alternative C-8	Yes	None	Left In Place	N/A	No
Alternative C-9	No	None	Left In Place	N/A	Realign/Notch

VII. ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

1. PHYSICAL IMPACTS

A sedimentation study was completed in order to evaluate a number of environmental design alternatives and modifications in the Schenimann Chute complex. The study utilized a physical hydraulic micro-model as a means to aid biologists and engineers in creating a potentially more diverse physical and ecological habitat condition throughout the study reach. The results of this study are summarized in a report by the Corps of Engineers (Corps) dated May 2000. This study led to the following physical impact conclusions.

Changes in the alignment and notches in Dike 62.5R at the entrance to Schenimann Chute had negative effects to the main channel. Modifications to this structure caused

deposition in the navigation channel that could halt commercial navigation and require future dredging. The design did not divert additional flow into the side channel and the bed response within the chute remained unchanged by the modifications.

The addition of several alternating hard-points or dikes in the middle of Schenimann Chute created additional physical diversity in the bed of the channel. Areas of alternating scour holes and depositional areas as well as areas of fast and slow velocity flow were created by a series of these structures.

Depths in the lower end of Schenimann Chute were maintained after material was artificially removed and several flow events had taken place in the model. The model tests indicated that the Mississippi River main channel formed a backwater area at the lower end of the side channel. This area experienced less sediment transport because of lower energy and velocity of flow. Therefore, dikes, which need energy to move sediment, did not work as well in this area as artificially dredging deep areas to create habitat. Artificial dredge cuts in this area may remain for several years.

Based on the above, and professional judgment, assumptions were made on the physical attributes of Schenimann Chute for purposes of the biological analysis. The future without project condition assumed that at 25 years in the future there would only be a spring connection between Schenimann Chute and the Mississippi River. At 50 years in the future the side channel would be totally disconnected from the river. The substrate and depth would become increasingly homogenized over 50 years, reverting to terrestrial floodplain forest community.

A number of assumptions were also made concerning the future with project condition. These include maintaining and improving flow and connectivity until 25 years into the future. At 50 years in the future, sedimentation will once again restrict flow and connectivity in the side channel to the point that presently exists. The same assumptions apply to depth diversity in the side channel.

2. HISTORIC PROPERTIES IMPACTS

The project is being planned to avoid any effect to significant historic properties. As discussed above (**Section V.2.**), most if not all the land with the project area has been accreted within the last 100 years or less.

Most construction will be confined to accreted lands, previously disturbed areas or will be modification of existing dikes. All project alternatives will avoid impacts from the following project elements:

1) Enlarging existing notches in dikes at river miles 58.2, 58.7, 59.8;

2) Notching or removing dike river mile 57.9;

3) Dredging near the mouth of the Chute to remove material deposited since chute formation in the 1930's; dredging will not extend below the 1930's chute bottom;

4) Disposing of dredge material on left descending (east) bank or island, or in the Mississippi River (thalweg or chevron alternatives);

5) Constructing on accreted ground a) seven hard points on the left descending (east) bank or bank revetment or b) northern bank revetment on right descending (west) bank.

Proposed project elements that are not located in accreted ground and therefore could impact historic properties are:

1) Construction of eight hard points on right descending (west) bank (Alternatives 2 - 8);

2) Construction of southern bank revetment on right descending (west) bank. (Alternatives 2 - 8);

3) Any use of "upland area" (floodplain which may not be recently accreted land such as, constructing haul roads, staging or storing equipment (will be determined during Construction phase).

When the exact location of each of these elements has been selected, each will be surveyed to locate any historic properties. Elements on the right bank must be surveyed during low water, usually October. In the highly unlikely event any cultural properties are located, these will be evaluated for National Register eligibility, in consultation with the Missouri Historic Preservation Officer and appropriate mitigation completed before construction.

All existing dikes in the project area were constructed in the early 1930's (1932 and 1935 aerial photographs). No dikes predating this period are present in the 1932 aerial photograph. The dikes were constructed of wood pile or stone or stone over wood pile. According to project engineers, these dikes are similar to thousands of others along the Mississippi River.

In the highly unlikely event archaeological deposits or historic sits are discovered during the project, construction activity in the immediate area will halt until the site is evaluated. The site will be protected from construction impacts until its eligibility for the National Register is determined, in consultation with Missouri Historic Preservation Officer and any appropriate mitigation is complete.

3. BIOLOGICAL IMPACTS – AQUATICS

The fish species that were utilized in the analysis included the smallmouth buffalo (*Ictiobus bubalus*), sauger (*Stizostedion canadense*), shovelnose sturgeon (*Scaphirhynchus platorynchus*), paddlefish (*Pylodon spathula*) and flathead catfish (*Pylodictis olivaris*). These species were selected because they are characteristic of the Middle Mississippi River, they cover three reproductive guilds and two habitat guilds, and they are considered important fishes from a recreational and commercial fishery standpoint. A guild is a group of species that exploit the same environmental resources (e.g. habitats) in similar ways (Root 1967). Habitat and reproduction are considered to be the most appropriate factors for grouping species of fish together since the goal of the project is to provide spawning, rearing, and overwintering areas for fish. In the habitat unit analysis for this project, the habitat guilds of "lentic (slackwater) large fishes", represented by smallmouth buffalo, paddlefish, and flathead catfish, and "lotic (flowing water) large fishes", represented by sauger and shovelnose sturgeon, were used for grouping and averaging benefits, since the project is designed to provide a diversity of flow throughout the side channel. Benefits were measured in average annual habitat units (AAHU's). While not evaluated, the project is also expected to produce benefits to the endangered pallid sturgeon (*Scaphirhynchus albus*). The pallid sturgeon habitat requirements are assumed to be nearly the same as the shovelnose sturgeon.

Based on professional opinion and the results of the micro-model, a number of assumptions were made about what the project area and vicinity would be like 25 and 50 years in the future with and without any project. These assumptions were necessary in order for biologists to complete a habitat benefits analysis of each of the alternatives presented. The future without project condition assumed that at 25 years in the future there would only be a spring connection between Schenimann Chute and the Mississippi River. At 50 years in the future the side channel would be totally disconnected from the river. The substrate and depth would become increasingly homogenized over 50 years.

A number of assumptions were also made concerning the future with project condition. These include maintaining and improving flow and connectivity until 25 years into the future. At 50 years in the future, sedimentation will once again restrict flow and connectivity in the side channel to the point that presently exists. The same assumptions apply to depth diversity in the side channel.

No Action Alternative – In the future without project condition, Schenimann Chute will become essentially unsuitable as riverine habitat for the fish species analyzed. There would continue to be problems with fish access into the chute and between the closure structures. There would also be continued declines in water quality, mainly dissolved oxygen, within the chute during the summer. Fish species associated with the summer water conditions experienced in isolated side channels include mainly gizzard shad *Dorosoma cepedinetum,* common carp *Cyprinius carpio* and other exotic Asian carp species. While there is currently a connection of the chute during the spring and early summer months, the degradation of the channel over time would cause the current side channel to gradually progress to contiguous backwater, isolated backwater, and

eventually forested floodplain, and would provide little to no benefits to river fish species targeted in this project.

With Project Alternatives - Different alternatives do show significant differences in benefits to the fish species evaluated, and jumps in benefits are apparent between differing groups of alternatives. The no action alternative and alternative nine both show no benefits as neither would result in changes to the physical properties of the chute. Alternative eight shows the first significant increase in habitat benefits as a result of increased diversity in the channel's physical characteristics and connectivity to the main channel that result from placement of hardpoints and notching of closing structures. Benefits are limited due to the lack of dredging at the south end of the chute. Alternatives two, four, and six show the next jump in habitat benefits which result from differing extents of dredging at the south end of the chute. This allows a flow through system at Schenimann. The last jump in benefits can be seen under alternatives three, five, and seven. The benefits are derived from the addition of a chevron dike. The dike would act to accept material dredged from the lower end of the chute, thus creating island habitat. The chevron would also add to the complexity of the hydraulics in the area, creating deposition and scour areas. This would both increase the diversity of the bathymetry and substrate in the project area. Table 3 shows the benefits of each alternative for each fish species analyzed for this project.

Table 3. Habitat units yielded from each project alternative for each fish species and guild analyzed.

	Large Lotic Guild			Large Lentic Guild				
Plan Option	**Shov. Sturgeon**	**Sauger**	***Average Large Lotic Guild***	**Sm. Buffalo**	**Paddlefish**	**Flathead Catfish**	***Average Large Lentic Guild***	***Lotic and Lentic Net AAHU***
	Net AAHU's	Net AAHU's		Net AAHU's	Net AAHU's	Net AAHU's		
C-1	0	0	*0*	0	0	0	*0*	***0***
C-2	1384.1	1363.5	*1373.8*	1331.8	1396.2	1374.9	*1367.6*	***2741.4***
C-3	1750.2	1586.8	*1668.5*	1522.9	1734.8	1664.1	*1640.6*	***3309.1***
C-4	1284.3	1174.6	*1229.45*	1208.3	1274.8	1293.3	*1258.8*	***2488.3***
C-5	1645.9	1393	*1519.45*	1394.4	1608.5	1578	*1527*	***3046.4***
C-6	1384.1	1363.5	*1373.8*	1331.8	1396.2	1374.9	*1367.6*	***2741.4***
C-7	1750.2	1586.8	*1668.5*	1522.9	1734.8	1664.1	*1640.6*	***3309.1***
C-8	1117.7	1020.8	*1069.25*	1048.8	1098.7	1153.7	*1100.4*	***2169.7***
C-9	0	0	*0*	0	0	0	*0*	***0***

2. BIOLOGICAL IMPACTS - WILDLIFE

The species utilized in the wildlife analysis included the false map turtle (*Graptemys pseudogeographica*) and the river otter (*Lutra Canadensis*). Though it was thought that benefits would not be greatly gained from these species, they are known to inhabit this type of habitat, and felt they would be most representative of wildlife that would possibly be using the area. According to the analysis, habitat quality for the river otter will decline in the future without project condition, essentially becoming unsuitable. Habitat quality

for the false map turtle will also decline, but not to a significant degree. Clearly the majority of benefits derived from any alternative are from fishery habitat enhancements. Wildlife species, while also an important component of the Middle Mississippi River, do not show significant gains or losses in any of the alternatives, and are assumed to not be significantly affected by a project. As aquatic projects such as Schenimann Chute are constructed in the future, benefits to wildlife could be assumed to increase, as increasing aquatic habitat diversity of the river would positively impact, for example, wildlife food availability. **Table 4** shows the benefits of each alternative for each wildlife species analyzed for this project.

Table 4. Habitat units yielded from each project alternative for wildlife species analyzed.

Plan Option	Otter AAHU's	Turtle AAHU's	*Wildlife Net AAHU's*
	Net AAHU's	Net AAHU's	
C-1	0	0	***0***
C-2	0	40.8408	***40.8***
C-3	0	40.8408	***40.8***
C-4	0	40.8408	***40.8***
C-5	0	40.8408	***40.8***
C-6	0	40.8408	***40.8***
C-7	0	40.8408	***40.8***
C-8	0	40.8408	***40.8***
C-9	0	15.7248	***15.7***

VIII. COST EFFECTIVENESS AND INCREMENTAL COST ANALYSIS.

Environmental plan evaluation consists of a comparison of the environmental outputs and the economic costs of alternative plans. The cost effectiveness analysis and incremental cost analysis procedures provide a structured framework to assist in environmental plan evaluation. The following analysis was accomplished by utilizing the planning methodology incorporated in the Institute of Water Resources/Waterways Experiment Station's Cost Effectiveness and Incremental Cost Analysis program. Every possible combination of solutions is derived and a total cost and total output estimated is calculated for each combination. The program then conducts cost effectiveness analysis; first identifying the least cost combination for every possible level of output, and then identifying the cost effective set of combinations by screening out plans where more output could be provided by another combination at the same or less cost. Once the cost-effective set of combinations is identified, the program calculates the incremental cost and incremental output of moving from each combination to the next larger combination. The program also identifies the subset of the cost effective set which are the most efficient in production, or "best-buys", as scale increases from the smallest to the largest combination.

Alternatives evaluated included: the no action alternative, and various alternatives for dredging and placement of the dredge material. Habitat Evaluation Procedure (HEP) was

used for two species of wildlife and a modified version of the aquatic habitat appraisal guide was used for the rest of the species (explained in Habitat Analysis Appendix).

All study options except the no action alternative included hardpoints/notching. There were three options for dredging; 1. Dredging below the wooden pile dike with pile dike 57.9 left in place, 2. Dredging below the stone closure structure - removal of pile dike 57.9, and 3. Dredging below the stone closure structure - notching pile dike 57.9. There was also the option of placement of dredge material into the Thalwag or Chevron. It was assumed that all were combinable except there would be no option that included placement of dredge material if no dredging was included in the option. There were 8 possible alternatives identified. Cost effectiveness analysis identified 5 combinations. Incremental cost and output analysis was then completed. The program then identified the subset of the cost effective set which are the most efficient in production as the scale increases from the smallest to the largest combination. **Table 5** presents the cost-effective, least-cost combinations. All costs are at November 2001 price levels and were amortized at 6.125-percent assuming a 50-year life of the project. **Table 6** shows the cost-effective least-cost combinations with the incremental analysis. **Table 7** shows the final incremental cost analysis. The results of the incremental analysis indicate **Plan C-5** as being the most cost effective management plan.

Table 5. Cost-effective least-cost combinations

Plan Option	Total Cost	Average Annual Cost ($) *	Average Annual Habitat Units (*Lotic and Lentic Net AAHU+ Wildlife Net AAHU's*)
C-1	0	0	0
C-9	219,600	14,176	16
C-8	1,820,557	117,524	2,211
C-4	2,299,357	148,433	2,529
C-6	2,528,557	163,228	2,782
C-5	2,546,557	164,390	3,087
C-7	2,776,957	179,264	3,350

*50 years @ 6.125%

Table 6. Cost-effective least-cost combinations with incremental analysis

Plan Option	Average Annual Cost	Output AAHU's	Average Annual Cost/ Output (AAHU's)	Incremental Cost	Incremental Output	Incremental Cost/ Output
C-1	0	0	N/A	0	0	0
C-9	14,176	16	902	14,176	16	901.8
C-8	117,524	2,211	53	103,348	2,195	47.1
C-4	148,433	2,529	59	30,908	319	97.0
C-6	163,228	2,782	59	14,796	253	58.4
C-5	164,390	3,087	53	1,162	305	3.8
C-7	179,264	3,350	54	14,873	263	56.6

Table 7. Combinations for final incremental analysis

	Average Annual Cost	Output AAHU's	Average Annual Cost / Output (AAHU's)	Incremental Cost	Incremental Output	Incremental Cost/Incremental Output
C-1	0	0	0	0	0	0
C-5	164,390	3,087	53	1,162	305	3.8

IX. RECOMMENDED ALTERNATIVE

While the final results of the ICA evaluation indicated that Plan C-5 was the most cost-effective management plan, the Scheniman Chute Project Team is selecting Plan C-7 as the recommended plan. The reasoning for selecting a plan other than the most cost effective plan is due to benefits that would accrue to the large lotic species guild that includes the federally endangered pallid sturgeon.

The reason that C-5 is more cost effective than C-7 is the extent of dredging. Plan C-7 provides a notch in the lower woodpile dike and allows for dredging to occur up to the closure 58.2 by allowing for the passage of a dredge. Otherwise, the plans are the same with respect to other features. Because the dredging leads for more usable overwintering area, and more bathymetric diversity, there are benefits associated with plans C-7 that are not associated with plan C-5. Since we are gaining benefits, especially with shovelnose sturgeon (related to the federally endangered pallid sturgeon, and assumed to have similarities in its habitat use) and the paddlefish (species of management concern on the Mississippi River), the benefits for habitat outweigh the benefits of making the project less costly by not dredging. Plan C-7 still maintains a good habitat/cost ratio.

X. FEDERALLY ENDANGERED, THREATENED, AND OTHER RARE SPECIES: BIOLOGICAL ASSESSMENT

The following Federally endangered, threatened or proposed terrestrial species potentially may occur within or near the project site and have some potential for impact (Draft Fish and Wildlife Coordination Act Report, issued in September 2001).

SPECIES	STATUS	HABITAT
Pallid sturgeon *Scaphirhynchus albus*	Endangered	Mississippi River

POSITIVE EFFECT –

The Pallid Sturgeon was listed as an endangered species on September 6, 1990. It inhabits the Missouri River and the Mississippi River below the mouth of the Missouri. The proposed project will enhance summer flows thorough Schenimann Chute by improving connectivity of the chute with the main channel during low water. It is expected that water quality within the chute, such as dissolved oxygen levels, water

temperature, and pH will improve due to increased flow, thus improving the production of small fish and invertebrates. Small fish and invertebrates are important prey items for pallid sturgeon (**U.S. Fish and Wildlife Service, 1993**). It is assumed that the survival and reproductive success of prey fish species through this restoration project will likely enhance foraging opportunities and growth of the pallid sturgeon. Larval pallid sturgeon have been collected in recent years by the staff of the U.S. Fish and Wildlife Service Fisheries Resources Office in Columbia, MO in a restored side channel of the Lisbon Bottoms Unit of the Big Muddy National Fish and Wildlife Refuge on the Missouri River (Louise Mauldin,U.S. Fish and Wildlife Service,Pers. Comm.) While it is not known where the young sturgeon were spawned, it is known that the shallow off-channel habitats provided by the Lisbon Bottoms chute were being used by the young sturgeon as a refuge from the swift main channel currents. It can be assumed that if pallid sturgeon utilize restored side channels in the Missouri River, there is a high likelihood that they will utilize the same type of habitat in the Mississippi River that are available to them.

The project is also anticipated to provide improved connectivity to the main channel in the fall to winter months as well, and will provide more reliable access to most of the chute during lower water stages experienced during this time of year. Data collected in Schenimann Chute as part of the pre-construction monitoring of the habitat rehabilitation project show that shovelnose sturgeon, a closely related species to the pallid sturgeon, frequently use the scour holes below closing structures and overwinter in this area. By creating a deep, low-velocity off-channel area in the lower portion of Schneimann Chute, and improved access to the scour areas further interior of the chute, it will provide increased availability of, and potential overwintering habitat for pallid sturgeon as well.

In the MMR, pallid sturgeon have been shown to select for main channel border, downstream island tips, areas between wing dams, and scour areas off of wing dam tips **(Sheehan et. al., 2000).** Under the recommended alternative, a chevron will be placed at the downstream end of the project area, just downstream of the chute exit. The chevron will be used as the site for depositing dredge material, and will create island tip habitat. Destruction and alteration of habitats by human modification of the river system is believed to be the primary cause of declines in reproduction, growth and survival of pallid sturgeon, and the recovery of the species is unlikely if habitat elements of the Missouri and Mississippi River are not restored (USFWS, 1993). This project proposes to restore connectivity and diversity of Schenimann Chute, thus helping to restore a portion of the natural habitat elements of the river, which are thought to benefit pallid sturgeon. The species is well adapted to turbid waters and would not be impacted by the short-term construction related activities.

Indiana bat

Myotis sodalis	Endangered	Caves, mines; small stream corridors with well developed riparian woods; upland forests.

NO EFFECT –

The Indiana bat was officially listed as an endangered species on March 11, 1967 under the Endangered Species Preservation Act of October 15, 1966 (the precursor law to

the Federal Endangered Species Act). The Endangered Species Act of 1973 extended full protection to the species.

Indiana bats winter in caves or mines that satisfy their highly specific needs for cold (but not freezing) temperatures during hibernation. Thirteen winter hibernacula (11 caves and two mines) in six states were designated as Critical Habitat for the Indiana bat in 1976. In Missouri, six winter hibernacula are Designated Critical Habitat: Cave 021, Crawford County; Cave 009, Franklin County; Cave 017, Franklin County; Pilot Knob Mine, Iron County; Bat Cave, Shannon County; and Cave 029, Washington County. No caves or mines will be impacted by the proposed project.

During the summer, Indiana bats roost in trees and forage for insects primarily in riparian and upland forest. The most important characteristics of roost trees probably are structural(sloughing bark under which bats can roost) (U.S. Fish and Wildlife Service, 1999). The use of a particular tree appears to be influenced by weather conditions as well (temperature and precipitation) (Callahan 1993). For example, dead trees found in locations that are more open were utilized more often during cooler or drier days while interior live and dead trees were selected during periods of high temperature and/or precipitation. Some examples of trees that can exhibit sloughing bark characteristics within the study area include slippery elm (*Ulmus rubra*) cottonwood (*Populus deltoides*), Green ash (*Fraxinus pennsylvanica*), and oaks (*Quercus spp.*) (Callahan *et al.* 1997). This project should also not impact mature roost trees suitable for roosting because most of the construction and construction access will be limited to aquatic areas, and any encroachments on land (ex. rooting of dikes) will attempt to avoid mature trees. If mature trees were to be impacted (ex. access to the site is gained by land), the impacts would be coordinated with the U.S. Fish and Wildlife Service as well as the Missouri Department of Conservation. If impacts to suitable roost sites are to take place, the timing of impact would either be required to fall outside the moratorium date for protection of Indiana bat roost colonies (April 1 – September 30), or the area would be surveyed for bat colonies in coordination with the U.S. Fish and Wildlife Service and the Missouri Department of Conservation prior to any habitat disturbance.

This project is not anticipated to have site-specific impacts on Indiana bat habitat, or individually or cumulatively have an adverse impact on their population.

Bald eagle

Haliaeetus leucocephalus	Threatened	Breeding along large rivers.

NO EFFECT –

The Bald Eagle was listed as an endangered species in 1978 following a dramatic drop in population that began at the turn of the century. Its status was upgraded to Threatened August 11, 1995.

The majority of bald eagle sightings within the project area occur during winter. On the MMR, wintering birds typically occur between November 15 and March 1. Wintering bald eagles require night roosts located in sheltered timber stands near an abundant food

source such as fish, waterfowl, or carrion (Stalmaster, 1987). Winter use is highest where the river is ice-free and adequate perch sites are available. Schenimann Chute is located far enough south to provide open water feeding areas in the winter time, and bald eagles do tend to concentrate in this area. However, because the construction of this project will be limited to high water for accessibility of construction equipment from the river, and no terrestrial disturbances are anticipated, impacts to winter roost sites or perching sites is not expected.

Nesting usually occurs in large trees with specific size and structure characteristics, and generally occurs in the same territories in subsequent years (Stalmaster, 1987). Nesting sites are also selected based on relative distances to shorelines of lakes or rivers and usually away from human disturbance. Two bald eagles nest have been located in the general vicinity of Schenimann Chute. A nest was observed in 1998 just upstream at approximate river mile 66.5 on the Illinois side of the river. Another nest was observed downstream on Marquette Island at approximate river mile 49.0. If any bald eagles are found to be nesting at, or in the immediate area of the proposed project site, actions will taken to avoid impacts during construction. This includes observance of seasonal restrictions, and setting up buffer zones that restrict access to areas within specified distance of nesting areas. Again, because no terrestrial disturbances are expected, direct impacts to summer nesting, roosting, or perch trees is expected.

This project is not anticipated to have site-specific impacts on bald eagle habitat, or individually or cumulatively have an adverse impact on their population.

Interior Least tern

Sterna antillarum	Threatened	Bare, alluvial and dredge spoil islands

POSITIVE EFFECT –

The interior least tern was listed as endangered in 1985. The severe decline in interior least tern populations is largely attributable to river channelization, irrigation diversion and damming along the species prime nesting ground. This species prefers riverine nesting areas that are sparsely vegetated sand and gravel bars within a wide unobstructed river channel. In Missouri, Interior least terns used to nest along the Missouri River and on the Mississippi River, especially where the two rivers joined. They are presently found only in the southeast portion of the state, generally south of MMR mile 80. They nest on dike fields and associated sand bars along the Mississippi River, at sand and gravel pits, ash disposal areas of power plants, along the shores of reservoirs and at other manmade sites. This project proposes the creation of sandbar type habitat through the placement of dredge material behind a chevron. During years when water levels are such that the sandbar would be exposed during the breading season, nesting could take place on this newly created site. Predation on the site would be minimal due to the isolation of the chevron form the bank.

Because there are no sandbars in the direct vicinity of construction, there should be no negative impacts on breading least tern pairs or colonies.

Sicklefin Chub *Macrhybopsis meeki*	Not Listed	large, turbid rivers with diverse depth and velocities forming braided channels, sand bars, sand flats, and gravel bars
Sturgeon Chub *Macrhybopsis gelida*	Not Listed	

POSITIVE EFFECTS-

On April 10, 2001, the U.S. Fish and Wildlife Service announced the finding that the Sicklefin and Sturgeon chub do not warrant listing as threatened of endangered species under the Endangered Species Act (Federal Register, Vol. 66, No. 75). While this is the case, the Service is still very much concerned about sicklefin and sturgeon chub populations, and they continue to monitor their populations.

The project will benefit the two chub species by providing connection to Schenimann Chute, in which enhancements to depth, velocity, and substrate diversity will occur. The chevron feature would also enhance these same features along the main channel border area. The species is well adapted to turbid waters and would not be impacted by the short term construction related activities.

XI. CUMMULATIVE EFFECTS

Appendix N attempts to assess the readily quantifiable cumulative impacts of habitat projects implemented under the Habitat Rehabilitation and Enhancement component of the Environmental Management Program (EMP) for the Upper Mississippi River System (UMRS). Cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (Council on Environmental Quality, 1987).

Natural ecological disturbances are predictable events that shaped the physical and evolutionary template of the UMRS. The pre-settlement river and surrounding landscapes developed over thousands of years of seasonal and cyclical natural disturbance. The native biota evolved around these predictable disturbances. Prior to widespread European settlement of the region, the UMR Basin was a diverse landscape of tallgrass prairie, wetlands, savannas, and forests. Human activities over the past 150 years (agriculture, urban use, etc.) have resulted in the present landscape that is highly developed. Land and river use became much more intensive and some of the historic disturbance mechanisms such as flood and fire were moderated, leading to less natural disturbance, and a more human controlled environment. Land use for agricultural and urban development altered native plant communities and watershed function. Crops, lawns, parking lots, and buildings replaced native plant communities in the uplands and floodplains. Upland development altered basin hydrology, allowing water to run off the land quicker than it did with native plant cover. This rapid run off carries more sediment and nutrients to waterways than the predevelopment landscape did. Floodplain

development also converted native plant communities to other cover types, but the floodplains were also isolated from the rivers by flood protection levees. The mechanisms supporting commercial navigation and the ecological response to them differ along the length of the river, but most responses appear to result in decreased habitat diversity and quality. Navigation pools in the north of river mile 200 have permanently flooded large areas that used to be susceptible to seasonal flooding, and navigation structures have ended the meandering ways of the UMR below RM 200. Because of the human induced changes in the UMR, plant communities do not reflect their former distributions, and animal populations and ranges have been effected to some degree, leading to Federal threatened or endangered status for some.

The main problems facing habitats on the UMRS today include tributary effects of increased inflows of nutrients and sediment, decreased interaction of the floodplain with the main river, decreased structural diversity due to island erosion, sedimentation, and leveed floodplain, and alterations to hydrology of the floodplain due to altered water levels in the pools. Most of the HREP projects have focused on utilizing several key methods for counter acting the effects of these problems. The methods include the following:

- Backwater Dredging - Create or restore overwintering fish habitat and depth diversity;
- Water Level Management (Dikes and Water Control Systems) - Reduce sediment deposition in backwater and wetland areas and manipulate water levels to promote aquatic plant and invertebrate production, and restore waterfowl resting and feeding habitat;
- Islands - Restore aquatic and migratory waterfowl habitat by providing physical conditions necessary for the re-establishment of aquatic plant growth and reduce wind and wave action;
- Shoreline Stabilization - Prevent shoreline erosion and create fish habitat;
- Secondary Channel Modifications - Preserve aquatic habitat by reducing sedimentation in backwater areas;
- Aeration - Restore aquatic habitat by improving water quality;
- Other (e.g., dike or wing dams alterations, potholes, land acquisition) - Complement to one of the other project types.

As of February 28, 2002, a total of 77 sites in UMRS either already completed or under construction, in the planning or design phase, or identified as possible future sites, but not yet initiated. There are 32, 22, and 23 projects within the St. Paul, Rock Island, and St. Louis Districts, respectively. Of these, there are 58 projects that have been constructed, or are far enough in planning to have well defined methods of rehabilitation. Of the 58, 57% utilized dredging to some extent to increase depths or reconnect main channel to off channel habitats, 40% incorporate construction of levees and other structures that allow for independent water level management or protection from sedimentation, 28% included shoreline stabilization, 24% involved island restoration or protection.

Because the rehabilitation often necessitates the clearing of trees to enable construction of project features, impacts to bottomland forests must occur. St. Louis Projects requiring tree removal will over time increase the extent and continuity of floodplain forest because the projects include plans to convert other project areas to bottomland forest by reestablishing forest communities. Plantings at these sites include mostly hard mast species, planted on existing ridges or slightly elevated berms, or elevated dredge disposal areas in order to increase forest diversity and food for many species of wildlife. The cumulative impact of St. Louis' habitat projects on bottomland forest is minor. Quantitative data describing bottomland forest impacts for the Rock Island or St. Paul District have not been included due to time constraints.

Many of the St. Louis District HREP's involve the construction of a low riverside dike/levee around the perimeter of the project area. This feature is typically built to the 3- or 4-year frequency flood elevation. Benefits of these levees include the prolonging the life of existing backwater areas by excluding minor flooding (and thus much of the sediment entering the site), providing for interior water level management, thereby increasing the predictability of providing food resources for wetland wildlife, such as migratory waterfowl and shorebirds. Also, low levees can protect young-of-the-year fish overwintering in backwater areas from the cold temperatures of winter floods, which can threaten survival. Other than retarding the rate of sedimentation, the chief effect on the levee- protected terrestrial habitats is the creation of a slightly drier hydrologic regime, due to the prevention of minor flooding. Consequently, fewer small floods in EMP-HREP project areas may promote the natural regeneration of native oaks. An adverse impact of these low levees is that they isolate the floodplain from the river to some degree. These levees prevent the exchange of riverine fish and other aquatic' organisms with backwater areas when river stages are below the levee's crown elevation. Likewise, they prevent the import of nutrients from the river into backwater and terrestrial areas, and the export of organic debris from these areas into the river. However, these processes still occur when bigger floods overtop the levee. To minimize the adverse effect to fish movement, which is most critical during the spring and fall, open topped fish passage/water control structures have been constructed or are planned at most of the St. Louis Projects that involve levees. Induced flooding from the HREP levees in the St. Louis District were also shown to have minimal impacts to flood stages experienced on the Mississippi. Quantitative data describing effects of levees in the Rock Island or St. Paul District have not been included due to time constraints.

Land cover/ land use changes for pre and post project conditions have not been completed for all of the EMP projects to date, but two examples have been completed for this assessment to demonstrate cause and effect relationships of HREP projects to land cover. The sites were chosen based on the availability of recent data, and to display two different but common restorations that occur under the EMP program. One site is the Pool 8 islands restoration phase 1 and 2, and the other is Dresser Island in Pool 26, which is a water level control type of project for the production of moist soil plants (waterfowl management). While the utility of vegetation to suggest change can be somewhat misleading when seasonal effects are taken into account, the data presented on the two projects show the targeted change occurring. For Pool 8 Islands, open water has been

reduced indirectly proportional to submersed aquatic plant beds, which was the overall physical change expected within the boundaries of both phases of the project. For Dresser Island, the main project related change that can be seen is the decrease in permanently flooded aquatic plants and an increase in seasonally flooded plant communities. This is to be expected in a water level control unit managed for moist soil plants.

Animal species are typically chosen as the targets or recipients of intended habitat improvements. While threatened and endangered species, furbearers, migratory birds, or other wetland species are usually included in management directives, waterfowl/migratory water birds and fish have been the focus of EMP- HREP projects. Of the 58 HREP projects that have been constructed, or are far enough in planning to have well defined methods of rehabilitation, about 50% are targeted toward both waterfowl and fish. About 30%, of the sites include measures targeted toward improving habitat conditions for mainly UMR fish species, and nine, or approximately 15% are primarily targeted towards waterfowl or other migratory water birds. All of the projects are assumed to have positive or neutral impacts to other riverine plants and animals.

The distribution of HREP's is rather uniform throughout the UMRS, but there are gaps in the system where projects are not located. Of the projects that are constructed, under construction, or in the planning and design phase, there are two project sites on the Minnesota River, six on the Illinois, and fifty-six project sites on the Mississippi. The most significant gap is the lower 201 miles of the Mississippi River, from Lock and Dam 26 at Alton, Illinois to Cairo. This reach includes pool 27 and the open river. The scarcity of existing public lands along this river segment is the main reason for the lack of EMP-HREP projects. Other gaps are to the north, and include pools 2-3, 12, 15, and 19- 20 on the Mississippi. (From St. Paul to Alton -from mile 847 to mile 201 -there are 25 pools on the UMR, each one averaging about 26-river miles in length). Like the open river, there are no projects in pool 2 because of a scarcity of public lands. The gap in pool 3 is due to the combination of a scarcity of public lands, and the current lack of interest by the Minnesota Department of Natural Resources to cost share EMP-HREP projects on a considerable amount of state-owned land. Lands in pools 12, 15, 19 and 20 are mainly privately held. Until the land would become available, projects will not occur in those sites. In the gap below pool 26 (lower UMR) it is expected that more projects will be built within the reasonably foreseeable future as there has been much interest amongst the partner agencies and non-governmental organizations to restore side channel habitats, and there is expected to be significant purchases of land by the USFWS to expand the Mississippi River Wildlife Refuge. It is reasonable to expect that as EMP-HREP projects become more numerous and more closely distributed throughout the UMRS, synergistic effects will occur ("the whole is greater than the sum of *its* parts"). At the present time, there is no methodology available to quantify this anticipated effect.

The size of HREP projects on the UMRS is varied. St. Paul District tends to have the smallest sites (average about 600 acres), and the Rock Island District the largest (average about 2,400 acres). Sites in the St. Louis District average about 1,700 acres. However, sites in all three Districts range widely in size, from as small as 20 acres to as large as 7,300 acres. Over all, most habitats affected by EMP-HREP projects are aquatic. In all

the districts, the selected HREP sites tend to have land cover mainly consisting of open water and floodplain forest, and generally 5% or less of the project sites consisting of other vegetation cover types. In the St. Paul District, HREP sites mostly tended toward open water, submersed and floating leaved aquatic vegetation, and bottomland forest. Rock Island shows the same tendencies for cover type as St. Paul, but a greater proportion of land cover is in floodplain forest. The St. Louis District again shows open water being the dominant cover type, but the HREP sites have very little in the way of submersed and floating leaved aquatic vegetation, with more vegetation consisting of floodplain forest. These habitat proportions tend to coincide with the proportions found within the floodplains of the respective regions. However, cropland is not represented as heavily within HREP project boundaries as it is in the rest of the floodplain. This is probably mainly due to the fact that most projects have focused on rehabilitating areas already managed for wildlife, and most HREP projects lie riverward of large agricultural areas within large protective levees, which are privately owned.

The outline of the UMRS floodplain can be used as the boundary of the ecosystem in which EMP-HREP projects lie. There is approximately 113,000 acres (177 square miles) within all 77 projects identified (not all have been constructed yet). This is relatively small when compared with the nearly 2.65 million acres (or about 4100 square miles) of the UMRS. This equates to approximately 4.5% of the total UMRS floodplain, from bluff to bluff, that has been or will be affected in terms of habitat improvements.

All EMP-HREP project areas are monitored before and after construction to determine if project goals and objectives are met. Goals and objectives are often stated in terms of anticipated improvements to habitat conditions and water quality, and reductions in rates of sedimentation. Monitoring evidence to date suggests that EMP-HREP projects are achieving their site-specific environmental objectives. The EMP-HREP projects can be characterized as demonstrations, and are very limited in scope. The program is working only a fraction of the total habitat area of the UMRS. If all planned program activities turn out to be a failure (and there is no evidence to indicate that this will be the case), it would not represent an irreversible, catastrophic impact on the river's ecosystem. The program can be viewed as an ongoing learning experience of large-scale habitat alteration attempts on the river system. As the authority of the program has been extended with no end date in the future, it is planned that the program will learn as it goes, incorporating new thoughts and innovative designs to restore habitats on the river.

XII. OTHER ENVIRONMENTAL AND PUBLIC INTEREST FACTORS CONSIDERED

1. OTHER ENVIRONMENTAL FACTORS CONSIDERED

1). Special Aquatic Sites (wetlands, mudflats, coral reefs, pool and riffle areas, vegetated shallows, sanctuaries and refuges, as defined in 40 CFR 230.40-45): Approximately 273 acres of side channel habitat would be restored/enhanced at Schenimann Chute. The impacts of construction on this site would be beneficial to the chute.

2). Biological Availability of Possible Contaminants in Dredged or Fill Material: If an evaluation of the dredging site indicates that the dredged material is not a "carrier of contaminants", testing may not be necessary. Such situations are most likely to arise if: the dredged material is composed primarily of sand, gravel and/or inert materials; the sediments are from locations far removed from sources of contaminants; the sediments are from depths deposited in pre-industrial times and not exposed to modern sources of pollution. Two grab samples of sediment at Schenimann Chute were taken on 26 July 2001. Upon analysis it was determined that sample 1 taken at the northern most project area was determined to contain 94% sand and the sample obtained at the southern end of the Chute contained 98% sand. Upon observing the characteristics of the soil material on the bank lines sand was the predominant material of the entire project area. Since the sediment samples indicated that the materials to be dredged were sand no further testing was performed for the 401certification (per the Missouri Water Quality Standards).

3). Substrate: The Schenimann Chute alternatives (except alternative nine and the no action plan) were designed in order to create depth diversity by creating a meandering channel, plunge pools, and areas of scour through notching of existing and the creation of other rock structures. The substrate is anticipated to maintain predominantly sand, but it is expected that gravel and coarser sand will be exposed due to the increased flows within the chute during low water periods and diversity in velocities caused by the created and modified structures. An increase in organic substrates within the chute and eventually closure of the chute will occur under the no action plan and alternative nine.

4). Currents, Circulation or Drainage Patterns: Because the hardpoint structures are designed in such a way as to have the opposite bank rip-rapped, current related problems such as bank erosion is not expected to be a newly created problem at each hardpoint site. Also, rip-rap is being placed on two northern bends of the chute where erosion is currently a problem. Because of the design features mentioned, alternatives two through seven, which are planned to increase flow allowed by the notching of closures and dredging of accreted sand should not create additional bank erosion problems. This additional flow will allow better circulation of water that would otherwise stagnate under current conditions, thus improving the availability of oxygen and reducing temperatures within the chute. The no action alternative and alternative nine would not improve circulation through the side channel. Circulation will be enhanced somewhat in alternative eight, however, during low water periods, the lack of a dredge cut in the lower end will prevent water from freely flowing through the chute.

5). Suspended Particulates; Turbidity: Because water will be moving through the chute during the whole year under alternatives two - seven, turbidity is expected to increase because of the influence of the turbidity of the main channel. It is expected that any increases in turbidity as a result of project construction will be short term. The no action alternative and alternative nine will show no changes from current conditions.

6). Water Quality (temperatures, salinity patterns, and other parameters): Under alternatives two through seven, water quality, particularly temperature and dissolved oxygen should improve. Alternative eight should show some improvement in water quality due to the notches placed in closing structures, however will be limited improvement due to the remaining sand plug on the lower end of the chute. The no action alternative and alternative nine will show no changes from current conditions.

7). Flood Control Functions: There will no impacts of this project on any flood control functions.

8). Storm, Wave, and Erosion Buffers: Any problems with erosion will be short lived during the construction of the improvements.

9). Erosion and Accretion Patterns: Erosion and accretion patterns may be slightly impacted during construction, but will improve upon the establishment of the site's structural improvements.

2. Human Use Characteristics and Impacts.

1). Existing and Potential Water Supplies; Water Conservation; Water Related Recreation: Water supplies and water conservation will not be affected by the project. While not the direct output of the modification, tangible benefits for some consumptive and non-consumptive recreational activities would also accrue from the reforestation project.

2). Recreational and Commercial Fisheries: The area is not actively managed as a fisheries resource. No commercial fisheries is located in the project area. No adverse long-term impacts to resident fish populations are anticipated, and therefore no lasting secondary influence of the project on recreational the fisheries is expected.

3). Aesthetics of the Aquatic Ecosystem. The aesthetics of the river ecosystem will be slightly impacted during the time of construction, but will improve in the long-term with reforestation and the enhanced habitat and wildlife observation opportunities it will provide.

4). Parks, National and Historic Monuments, National Seashores, Wildlife and Scenic Rivers, Wilderness Areas, Research Sites, etc: There are none of the above within the project limits.

5). Traffic/Transportation Patterns: Traffic patterns at the TSA may be slightly impacted during the construction phase of the project. Upon completion of the project, conditions will return to normal.

6). Safety: The project will not in itself pose a safety hazard. Work crews will follow standard safety procedures during the installation of the project.

7). Air Quality: Some dust and fumes will be created during project implementation, but no residents will be affected.

8). Noise: Noise will be generated as a result of project implementation, but no residents will be adversely affected.

9). Prime and Unique Farmland (7 CFR Part 658): This project will solely take place in aquatic habitats, and there will be no impacts or disturbances to prime or unique farmland in the area.

10). General Water Quality: Water quality should not be negatively affected by the project.

11). Environmental Justice in Minority Populations and Low-Income Populations E.O. 12898: This project will not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. There will be very little in the way of negative impacts, other than short-term disturbances to the chute itself.

12). Floodplain Management E.O. 11988: This executive order states that "Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains..." The very purpose of this project is to restore natural and beneficial values served by the off channel habitat in Schenimann chute. The project will not affect flooding in areas upstream of the project site.

XIII. COORDINATION

The proposed project at Schenimann Chute has been coordinated with respective state and Federal agencies by telephone and written correspondence (APPENDIX C).

Missouri Department of Conservation
Missouri Department of Natural Resources
U.S. Natural Resources Conservation Service
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
Advisory Council on Historic Preservation

XIV. APPLICABLE ENVIRONMENTAL LAWS AND REGULATIONS:

The recommended plan was evaluated for compliance with applicable environmental guidelines. The plan will be in partial of full compliance with these guidelines. Full compliance will be achieved as noted.

Environmental Requirements	
Federal Law/Executive Order	**Compliance (as of April 02)**
Bald Eagle Protection Act (16 U.S.C. 668)	FC
Clean Air Act (42 U.S.C.§§ 7401-7671g)	FC
Clean Water Act (33 U.S.C. 1251 et seq.)	PC(1)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §§ 9601-9675)	FC
Endangered Species Act (16 U.S.C. 1531 et seq.)	FC
Farmland Protection Policy Act (7 U.S.C. 4201 et seq.)	FC
Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)	PC(2)
Food Security Act of 1985 (16 U.S.C. §§ 3801-3862)	FC
National Environmental Policy Act (NEPA) (42 U.S.C. 4321-4347)	PC(3)
National Historic Preservation Act (16 U.S.C. 470 et seq.)	PC(4)
Noise Control Act (42 U.S.C. §§ 4901-4918)	FC
Resource, Conservation and Rehabilitation Act (RCRA)(42 U.S.C. 6901 et seq.)	FC
Floodplain Management, E.O. 11988	FC
Protection and Enhancement of the Cultural Environment, E.O. 11593	FC
Protection and Enhancement of the Environmental Quality, E.O. 11514	FC
Protection of Wetlands, E.O. 11990	FC
Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, E.O. 12898	FC
FC= Full Compliance	
PC= Partial Compliance	
Source: U.S. Army Corps of Engineers, St. Louis District	
(1) Compliance will be attained upon completion of public 404 review, and subsequent 401 water quality and 404 certification	
(2) Compliance will be attained upon receipt of Final Fish and Wildlife Coordination Act Report	
(3) Compliance will be attained after full public review and subsequent signing of Findings of No Significant Impact	
(4) Compliance will be attained after all required consultations, investigations, reports, and coordination have been completed	

XV. ENVIRONMENTAL ASSESSMENT PREPARERS:

The St. Louis District staff members responsible for preparing this document are as follows:

Mr. Michael Thompson, Project Manager

Role: Project Manager

Mr. Eric Laux, Fisheries Biologist
Role: EA Coordinator/Environmental Impact Analysis/Endangered Species/Habitat Analysis

Mrs, Suzanne Harris, Archaeologist
Role: Historic Properties Compliance

Mr. Mike Ricketts, Regulatory Specialist
Role: Regulatory Permits, Section 10 and 404

XVI. LITERATURE CITED

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XVI. DRAFT FINDING OF NO SIGNIFICANT IMPACT

SCHENIMANN CHUTE
UPPER MISSISSIPPI RIVER SYSTEM (UMRS)
ENVIRONMENTAL MANAGEMENT PROGRAM (EMP)
HABITAT REHABILITATION AND ENHANCEMENT PROJECT (HREP)

I. I have reviewed and evaluated the documents concerning the above-proposed Schenimann Chute UMRS EMP HREP, located on the right descending bank of the Mississippi River, from approximately river mile 56.5 to river mile 62.5. As part of this evaluation, I have considered the alternatives shown in the following table. These alternatives are explained in detail within the report.

Structural Alternative Measures Considered In Analysis

	Hard points/Notching	Dredging	Pile Dike 57.9	Dredge Material Placement	Dike 62.5
Alternative C-1	No	None	Left In Place	N/A	No
Alternative C-2	Yes	Below Closure 58.2	Remove	Thalweg	No
Alternative C-3	Yes	Below Closure 58.2	Remove	Chevron	No
Alternative C-4	Yes	Below Pile Dike 57.9	Left In Place	Thalweg	No
Alternative C-5	Yes	Below Pile Dike 57.9	Left In Place	Chevron	No
Alternative C-6	Yes	Below Closure 58.2	Notched	Thalweg	No
Alternative C-7	Yes	Below Closure 58.2	Notched	Chevron	No
Alternative C-8	Yes	None	Left In Place	N/A	No
Alternative C-9	No	None	Left In Place	N/A	Realign/Notch

Preferred Alternative: I have weighed the outputs to be obtained from the implementation of each of the alternatives against its estimated cost and have considered the impacts identified and the overall scope. In my judgment, alternative 7 is the preferred alternative.

II. The environmental consequences of the entire alternative on the physical, biological, socioeconomic, and cultural resources and engineering feasibility have been evaluated. Those factors that were influential in my review included:

A. The project is anticipated to greatly improve the habitat value of Schenimann Chute and the adjacent Mississippi River for native fish species and will not negatively impact other wildlife.

B. Federal and state listed endangered and threatened species will not be adversely impacted.

C. Aside from temporary disturbances, no long-term significant impacts to natural or cultural resources are anticipated.

D. There would be no loss of prime farmland.

E. Prior to the proposed award of contract, all applicable Federal and state regulations regarding water quality will be reviewed to assure compliance.

III. Based on the disclosure of the impacts contained within the Environmental Assessment, no significant impacts to the environment are anticipated. The proposed project has been coordinated with the appropriate resource agencies, and there are no significant unresolved issues or any significant affect to the human environment. Therefore, an Environmental Impact Statement will not be prepared prior to proceeding with proposed Schenimann Chute HREP.

_____
Date

_____
Charles K. Williams
Colonel, U.S. Army
District Engineer

ATTACHMENTS

ATTACHMENT 1

DESIGN PLATES

DRAWING INDEX

PLATE NO.	TITLE
1 of 1	Site Map
1 of 8	Plan and Profile View, Bankline Survey 61.5(R)
2 of 8	Plan and Profile View, Bankline Survey 60.8(R)
3 of 8	Plan and Profile View, Bankline Survey 60.8(R)
4 of 8	Plan and Profile View, Bankline Survey 59.8(R)
5 of 8	Plan and Profile View, Bankline Survey 59.8(R)
6 of 8	Plan and Profile View, Bankline Survey 58.7(R)
7 of 8	Plan and Profile View, Bankline Survey 58.2(R) & 57.9(R)
8 of 8	Plan and Profile View, Bankline Survey 58.2(R) & 57.9(R)

ILLLINOIS

PRELIMINARY

SUBJECT TO CHANGE

MISSOURI

SCHENIMANN CHUTE

PICAYUNE CHUTE

DUSKY BAR

SWIFT SURE TOWHEAD

HAMBURG LANDING

DEVILS ISLAND

KINNEY POINT

FLORA CREEK

LITTLE FLORA CREEK

FLOW

DIKE 61.5 R

DIKE 60.8 R

STONE PROTECTION

STONE PROTECTION (TYP)

DREDGE

NOTCH EXIST DIKES

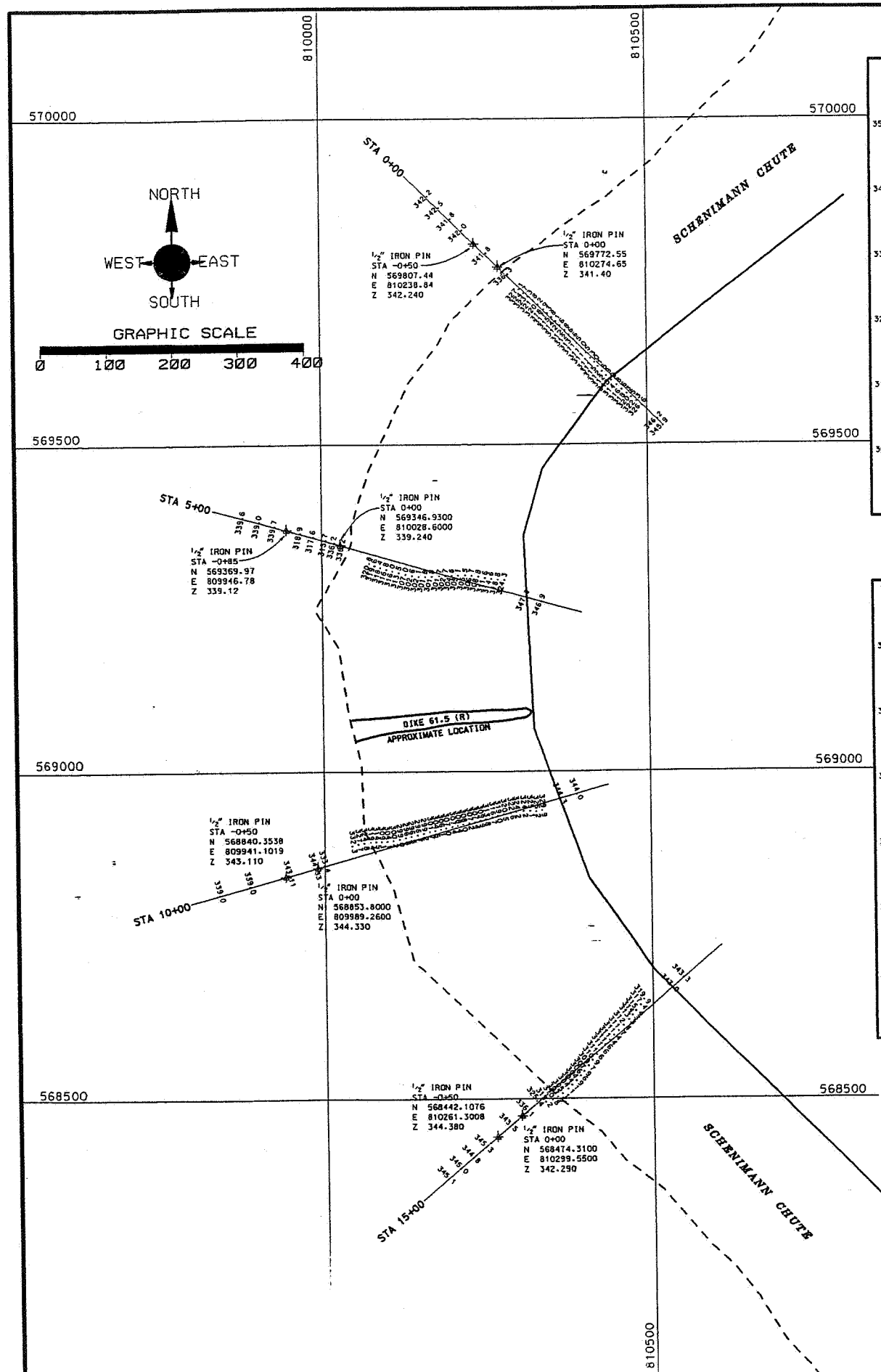
US Army Corps of Engineers St. Louis District

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS ST. LOUIS, MISSOURI

MISSISSIPPI RIVER FY 02 AWARD SCHENIMANN CHUTE MILE 61.7 TO MILE 57.0

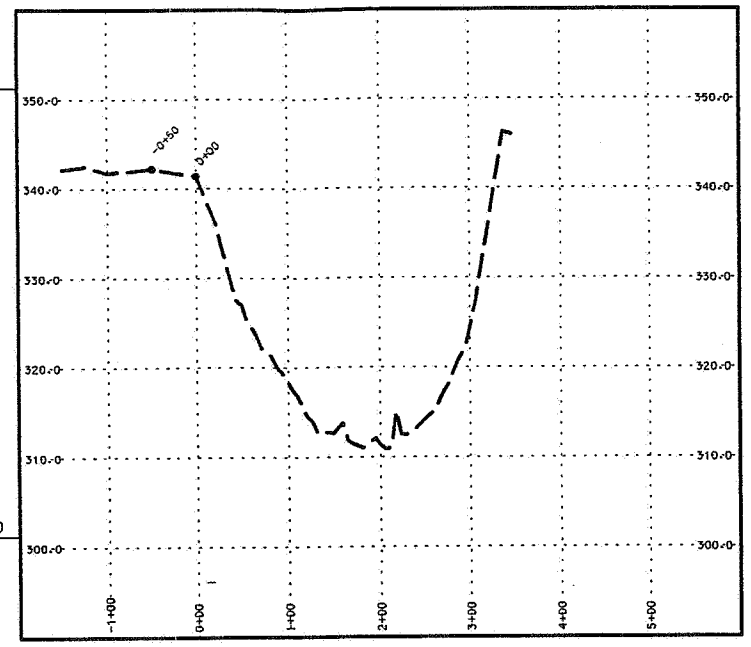
SITE MAP

PLATE NUMBER 1 OF 1

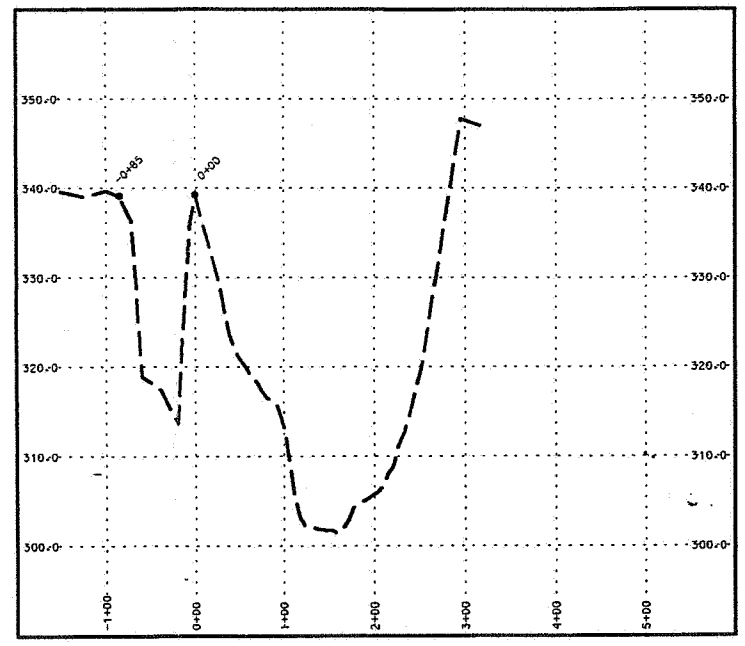


LOOKING UPSTREAM

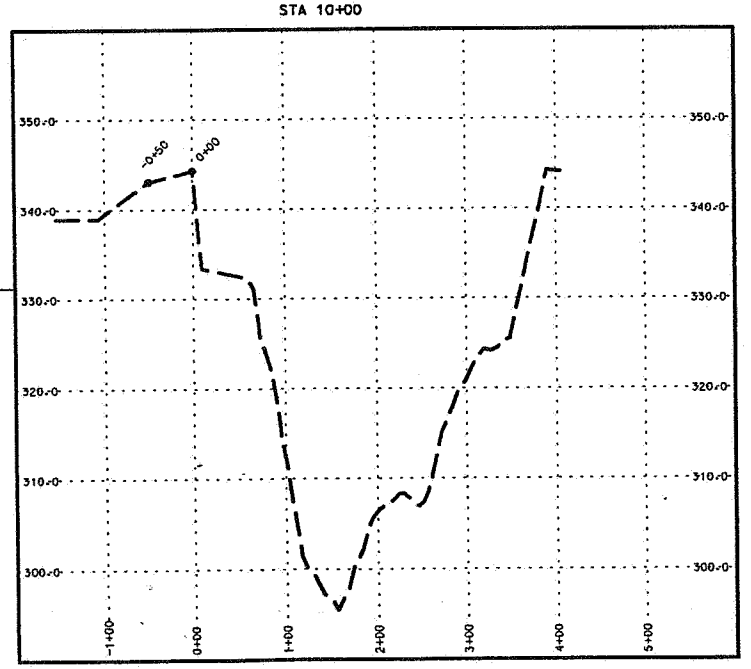
STA 0+00



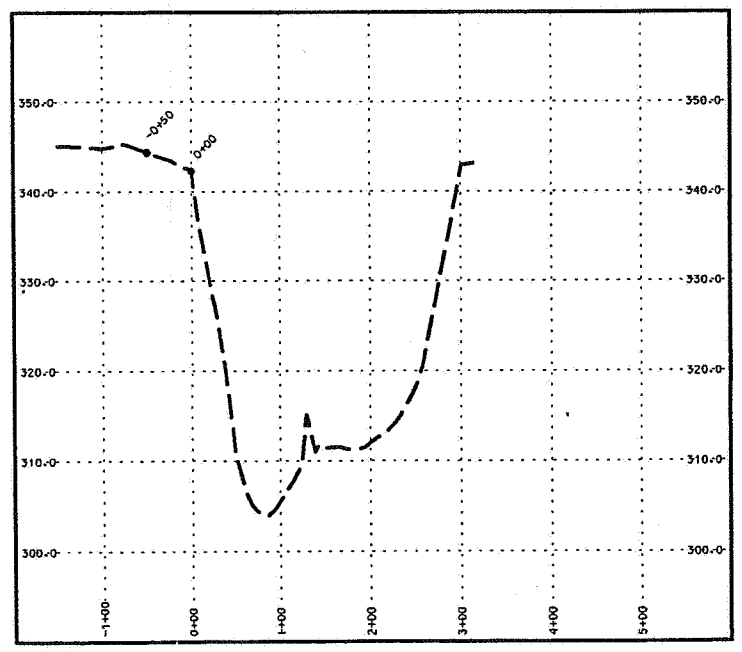
STA 5+00



STA 10+00



STA 15+00



NOTES:

1. SOUNDED APRIL 11, 2001. BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON APRIL 9 AND MAY 2, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM DGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

PRELIMINARY
SUBJECT TO CHANGE

US Army Corps of Engineers
St. Louis District

GAGE RECORD

	CAPE GIRARDEAU	GRAND TOWER	WATER SURFACE	ST. LOUIS
ZERO NAVD	304.65	321.95		378.84
MSB	82.1	81.9		1960
L.W.R.P.	306.9	323.3		1944
31598	X	X	X	X
31599	X	X	X	X
31600	X	X	X	X

REMARKS AND REVISIONS TO DATA: CONTROL AND DATUM: HORIZONTAL DATUM: NAD27 (FEET) VERTICAL DATUM: NGVD29 (FEET)

Survey Date:

SUBMITTED:
JAMES I. KEIM
Chief, Engr. Data Mngt. Sect.

FILE NUMBER
T:\h_hydro\RIVER-SURVEYS\CHUTES\SCHENIMANN\DGN\
Plot date 07-FEB-2002 08:04
Plot scale:

Surveyed by:	Drawn by: A. BERMAN	Ckd by: X
	Reviewed by: J. KEIM	APPROVED: BRADFORD M. STRAUSER Chief, Design Branch

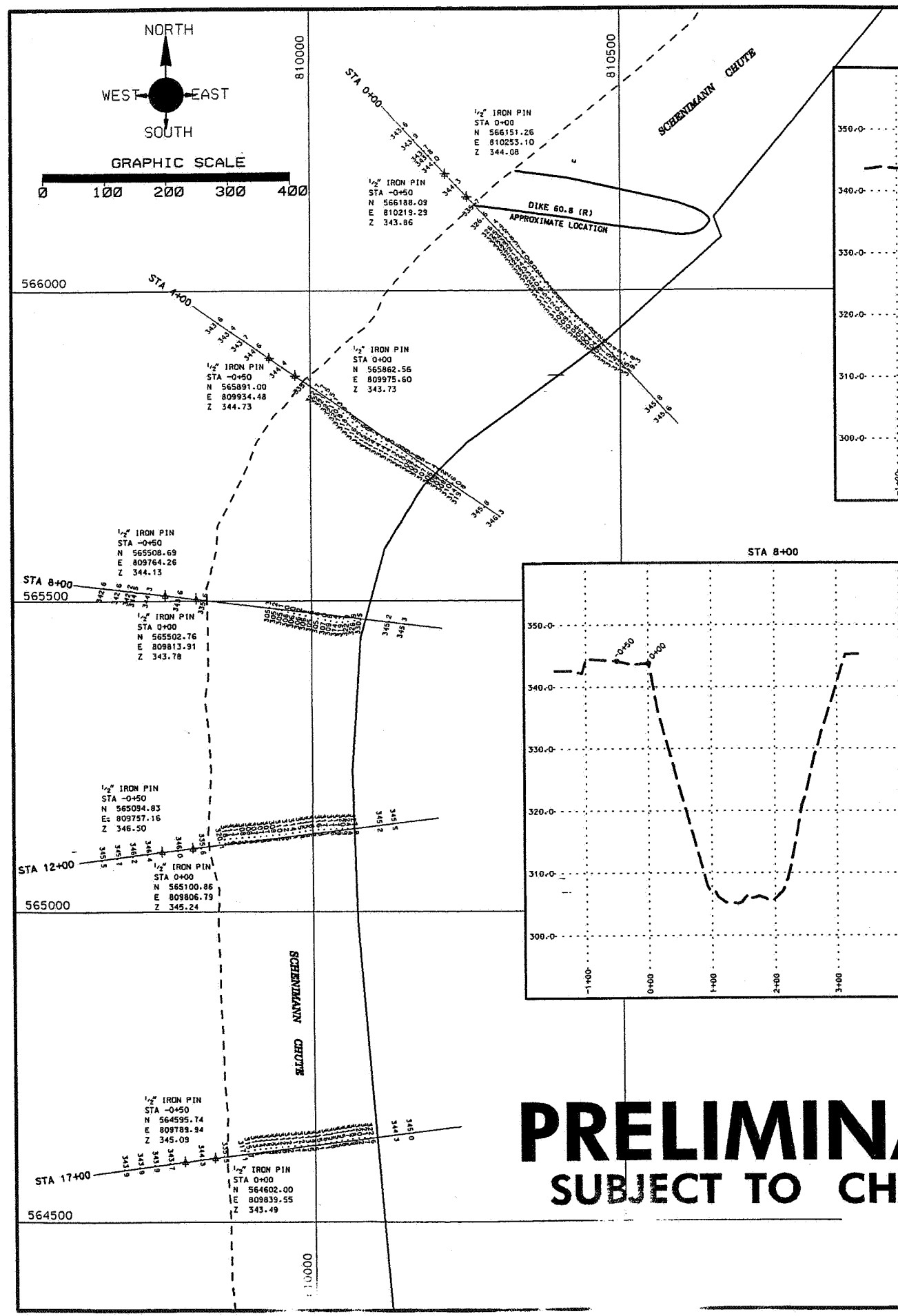
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHENIMANN CHUTE
MILE 81.7 TO MILE 57.0

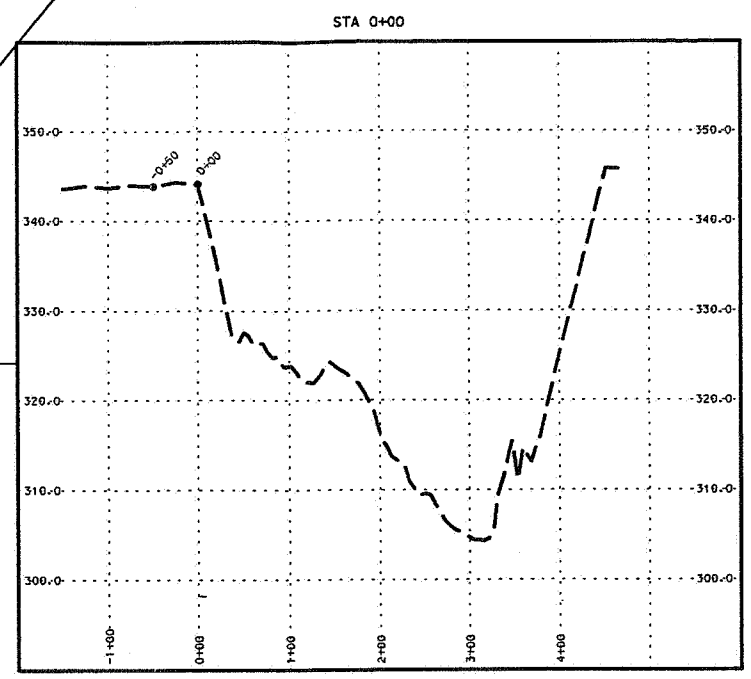
THE INFORMATION SHOWN IS FOR LAW ENFORCEMENT USE BY AGENCIES OF THE STATE OF MISSOURI AND IS NOT TO BE USED FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF THE U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

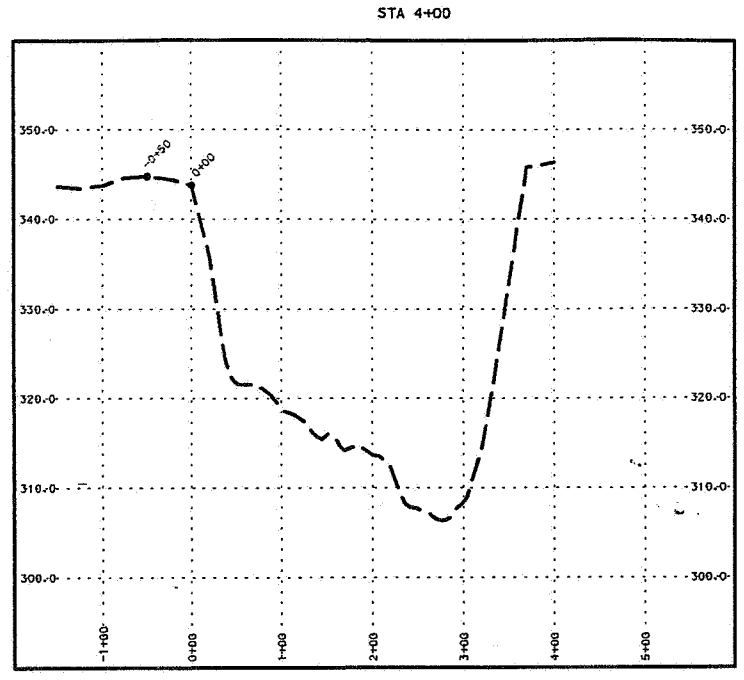
PLAN AND PROFILE VIEW
BANKLINE SURVEY 81.5 (R)

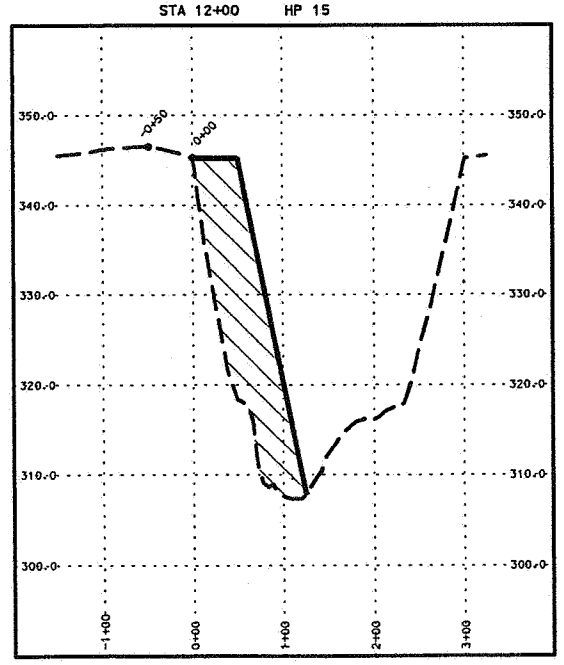
PLATE NUMBER
1 OF 8

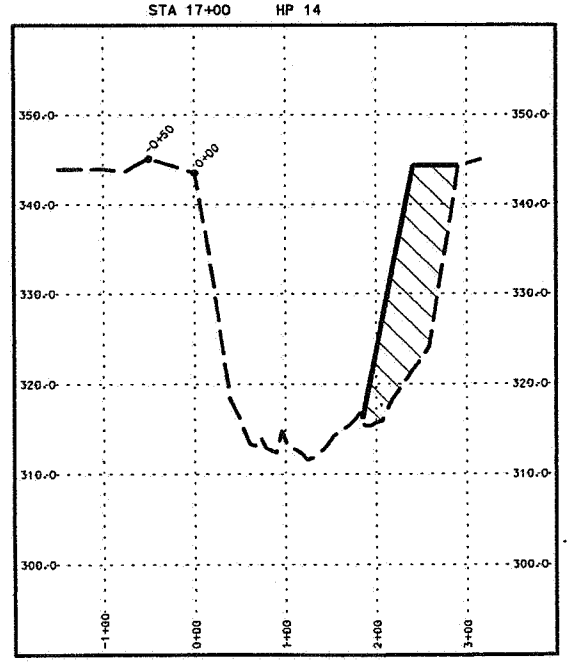


LOOKING UPSTREAM









PRELIMINARY
SUBJECT TO CHANGE

NOTES:

1. SOUNDED APRIL 11, 2001, BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON APRIL 9 AND MAY 2, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM DGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

US Army Corps of Engineers St. Louis District

GAGE RECORD

	WATER SURFACE	GRAND TOWER	CAPE GIRARDEAU	ST. LOUIS
ZERO M.S.V.D.	1865	321.63	304.98	379.84
L.W.R.P.	315.89	324.5	309.9	380.0
		810	821	779.4
MARKS GAGE DATUM	X	X	X	X
	X	X	X	X
	X	X	X	X

Surveyed by: | Survey Date:
Drawn by: A. BERMAN | Chkd by: X | SUBMITTED: JAMES L. KIRM, Chief, Engr. Data Mngt. Sect.
Reviewed by: J. KIRM | APPROVED: RICHARD M. STRAUSSER, Chief, Geospatial Branch
File name: PLAN&PROFILE SURVEY\CHUTES\SCHEN\SCHEN_PLAN_PROFILE.dgn
Plot date: 07-FEB-2002 12:29
Plot scale:

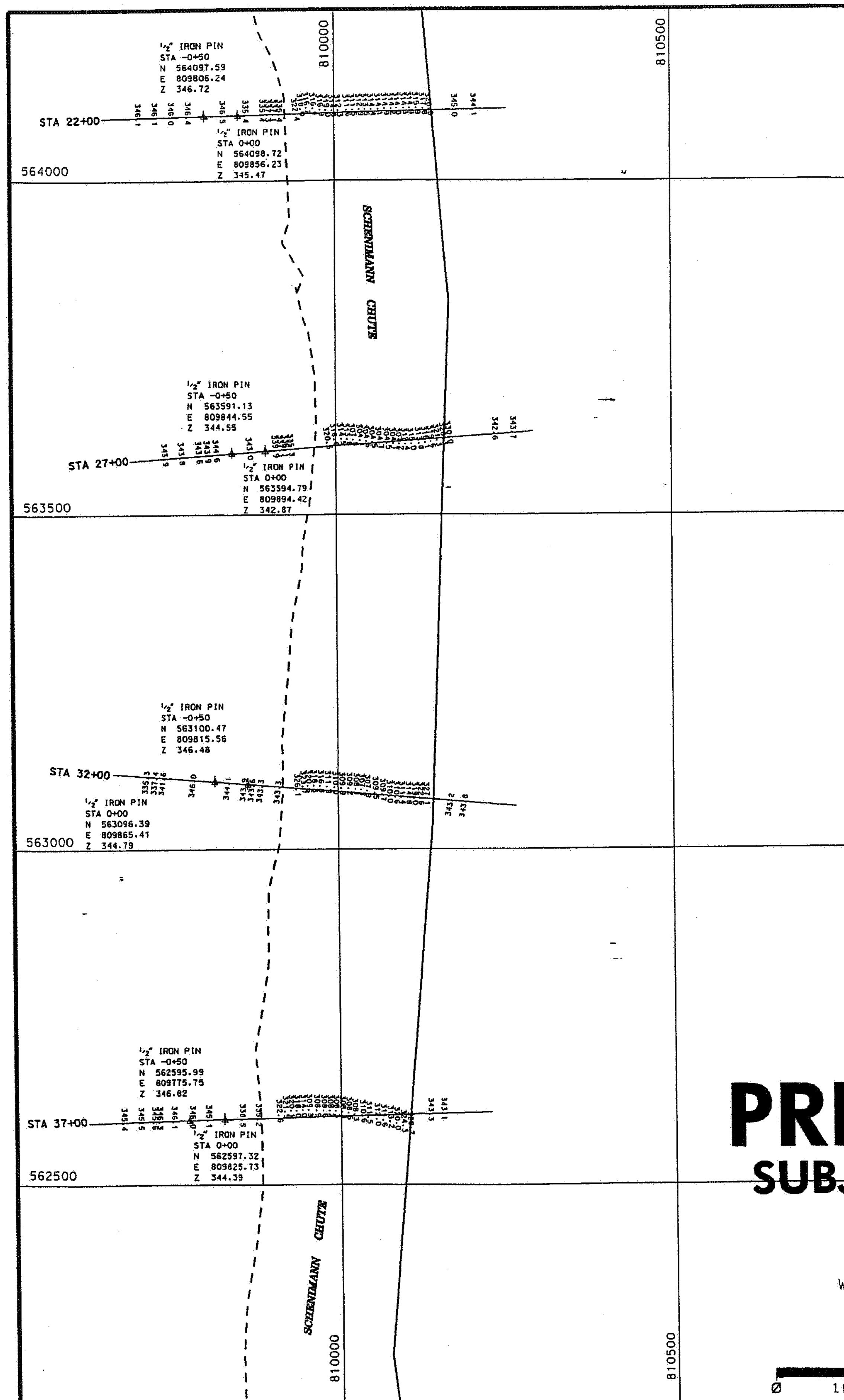
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHENIMANN CHUTE
MILE 61.7 TO MILE 67.0

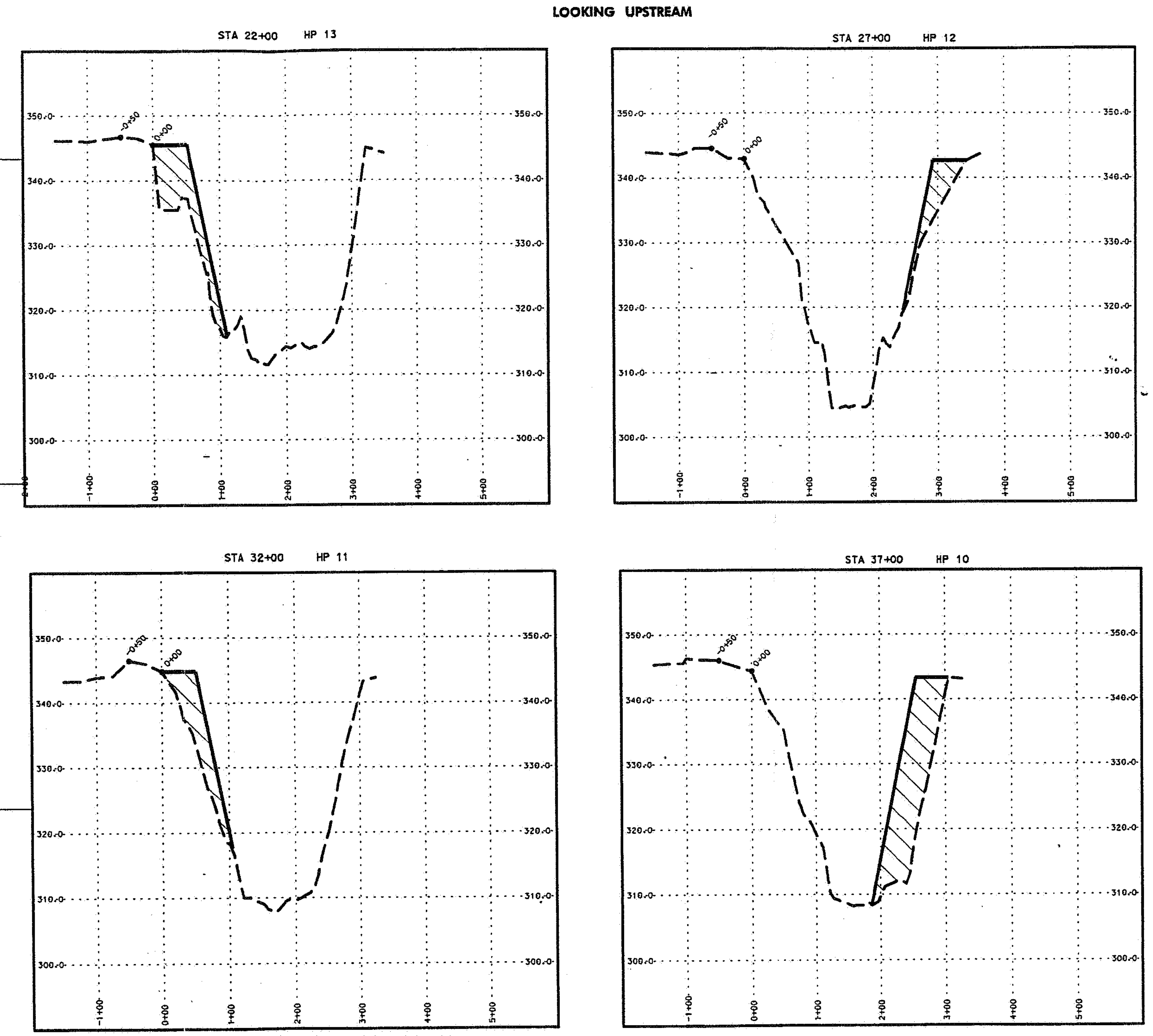
PLAN AND PROFILE VIEW
BANKLINE SURVEY 60.8 (R)

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE CONDITIONS OF THE RIVER AT THE TIME OF SURVEY. THE CONDITIONS MAY CHANGE AS ADJUSTING THE REGULATING STRUCTURES AT THAT TIME.

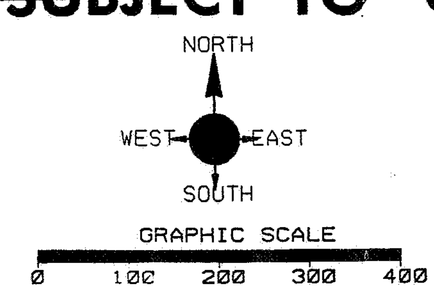
PLATE NUMBER
2 OF 8



LOOKING UPSTREAM



PRELIMINARY
SUBJECT TO CHANGE



1. SOUNDED APRIL 11, 2001, BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON APRIL 9 AND MAY 2, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM DGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

US Army Corps of Engineers
St. Louis District

GAGE RECORD

	WATER SURFACE	GRAND TOWER	CAPE GIRARDEAU	ST. LOUIS
ZERO N.G.V.D.		321.83	301.65	379.94
MILE		81.9	62.1	180.0
L.W.R.P.	313.80	325.5	308.9	378.4
				x
x	x	x	x	x
x	x	x	x	x

ELEVATIONS ARE REFERRED TO N.G.V.D.—CONTOURS ARE BELOW WEIGHT LOW WATER REFERENCE PLANE (L.W.R.P.) (DEPTHS IN FT)

Survey Date:
Surveyed by:
Drawn by: A. BERMAN | Ckd by: X
Reviewed by: J. KEIM
APPROVED: BRADFORD M. STRAUSER, Chief, Geospatial Branch
SUBMITTED: JAMES L. KEIM, Chief, Engr. Data Mngt. Sect.
File name: T:\HYDROSUR\SURVEY01\CHUTES\SCHENIMANN\608.DGN
Plot date: 07-FEB-2002 08:18
Plot scale:

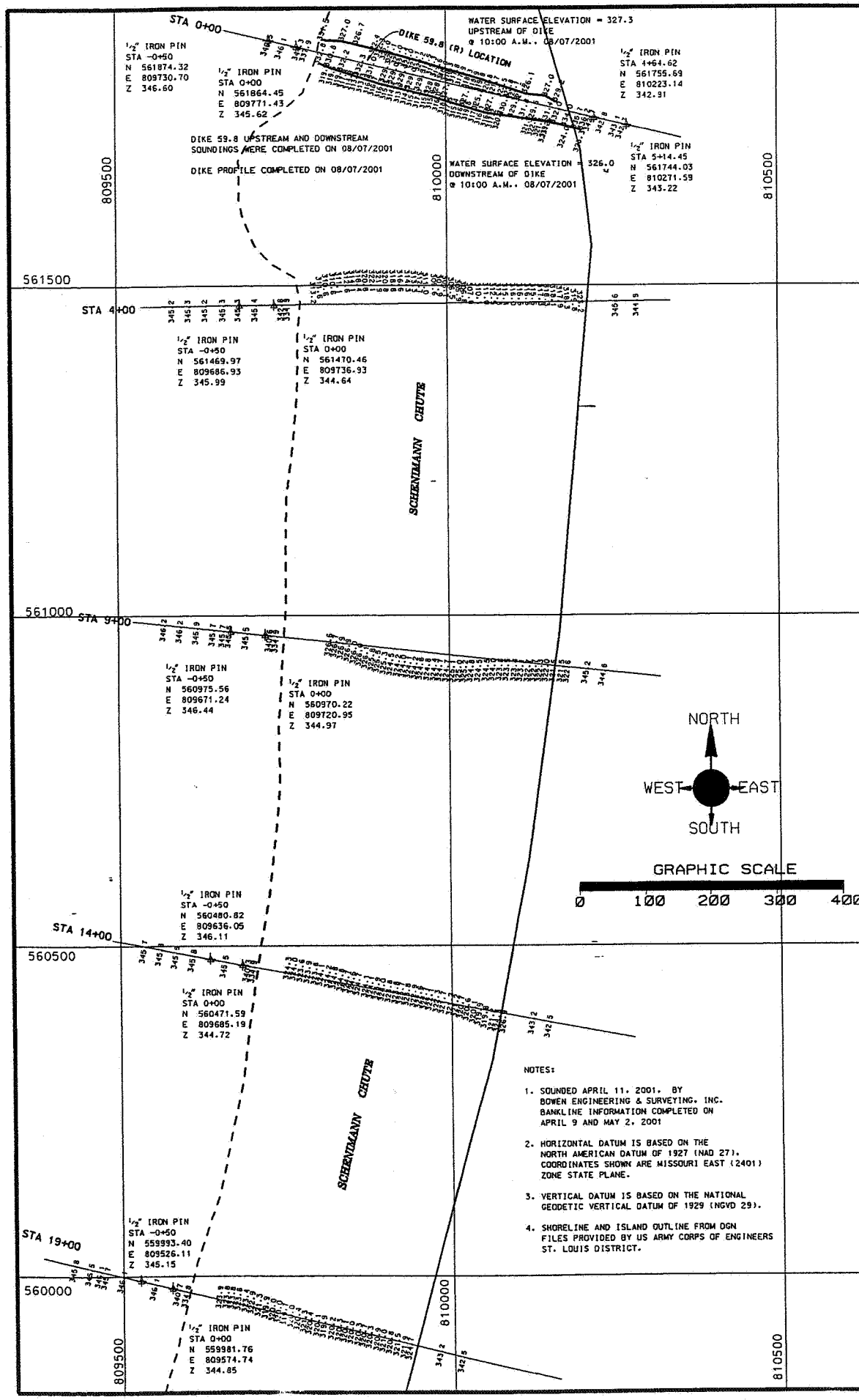
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHENIMANN CHUTE
MILE 61.7 TO MILE 67.0

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

PLAN AND PROFILE VIEW
BANKLINE SURVEY 60.8 (R)
X

PLATE NUMBER
3 OF 8

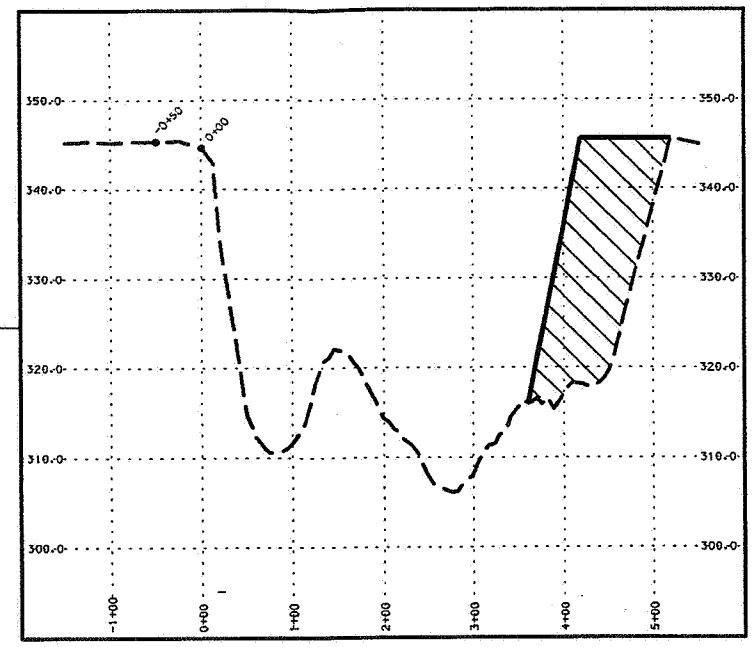


NOTES:

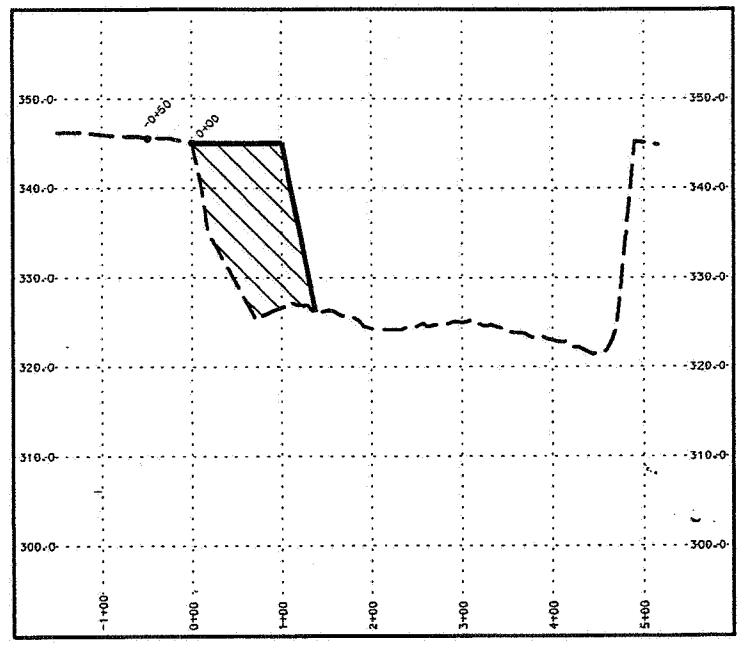
1. SOUNDED APRIL 11, 2001, BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON APRIL 9 AND MAY 2, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM DGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

LOOKING UPSTREAM

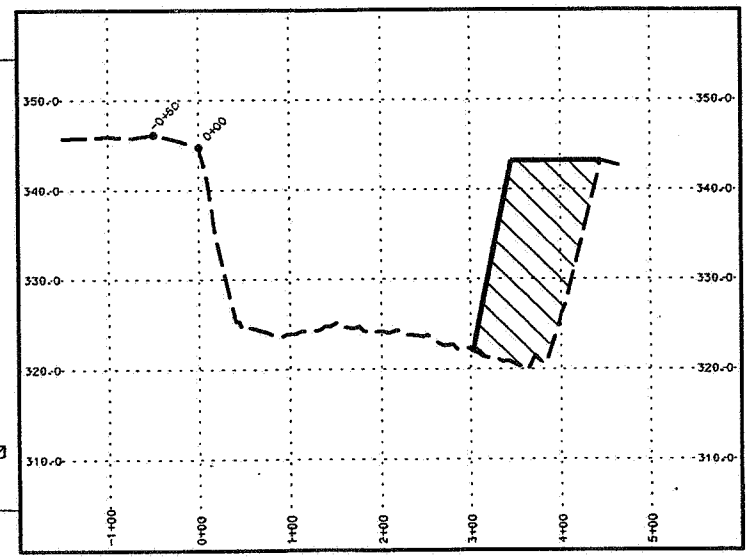
STA 4+00 HP 9



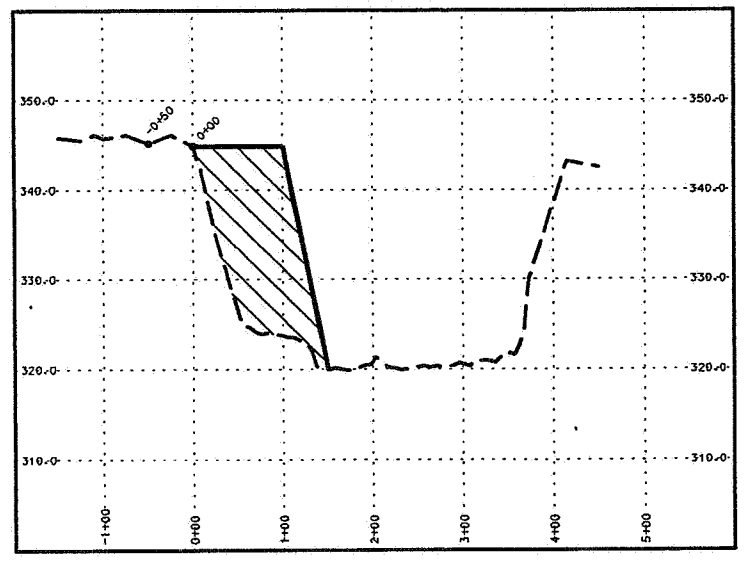
STA 9+00 HP 8



STA 14+00 HP 7



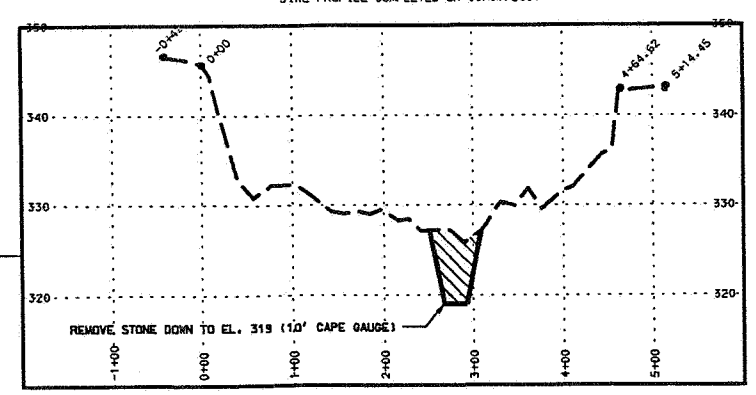
STA 19+00 HP 6



STA 0+00 – CENTERLINE PROFILE OF DIKE 59.8

DIKE 59.8 UPSTREAM AND DOWNSTREAM SOUNDINGS WERE COMPLETED ON 08/07/2001

DIKE PROFILE COMPLETED ON 08/07/2001



PRELIMINARY
SUBJECT TO CHANGE

US Army Corps of Engineers
St. Louis District

GAGE RECORD

	WATER SURFACE	GRAND TOWER	CAPE GIRARDEAU	ST. LOUIS
ZERO AGVA.		351.65	344.66	419.94
M.S.L.*		419	62.1	1850
L.W.R.P.	311.58	353.3	356.9	374.4
	X	X	X	X
	X	X	X	X
	X	X	X	X

*ESTIMATED AND REFERENCED TO NGVD. REFERENCE PLANE 0.243 (BASIN STAT.)

Surveyed by:
Drawn by: A. BERNAUH
Chkd. by: K
Reviewed by: J. KOSH
Survey Date:
SUBMITTED: JAMES L. KOSH, Chief, Engr. Data Mngt. Sect.
APPROVED: BRADFORD M. STRAUSER, Chief, Geotechnical Branch
File name: P:\GIS\PROJECTS\SURVEY\01-CHUTES\SCHERNMANN\DGN\SCHERNMANN-DIKE.dgn
Plot date: 07-FEB-2002 08:13
Plot scale: 1

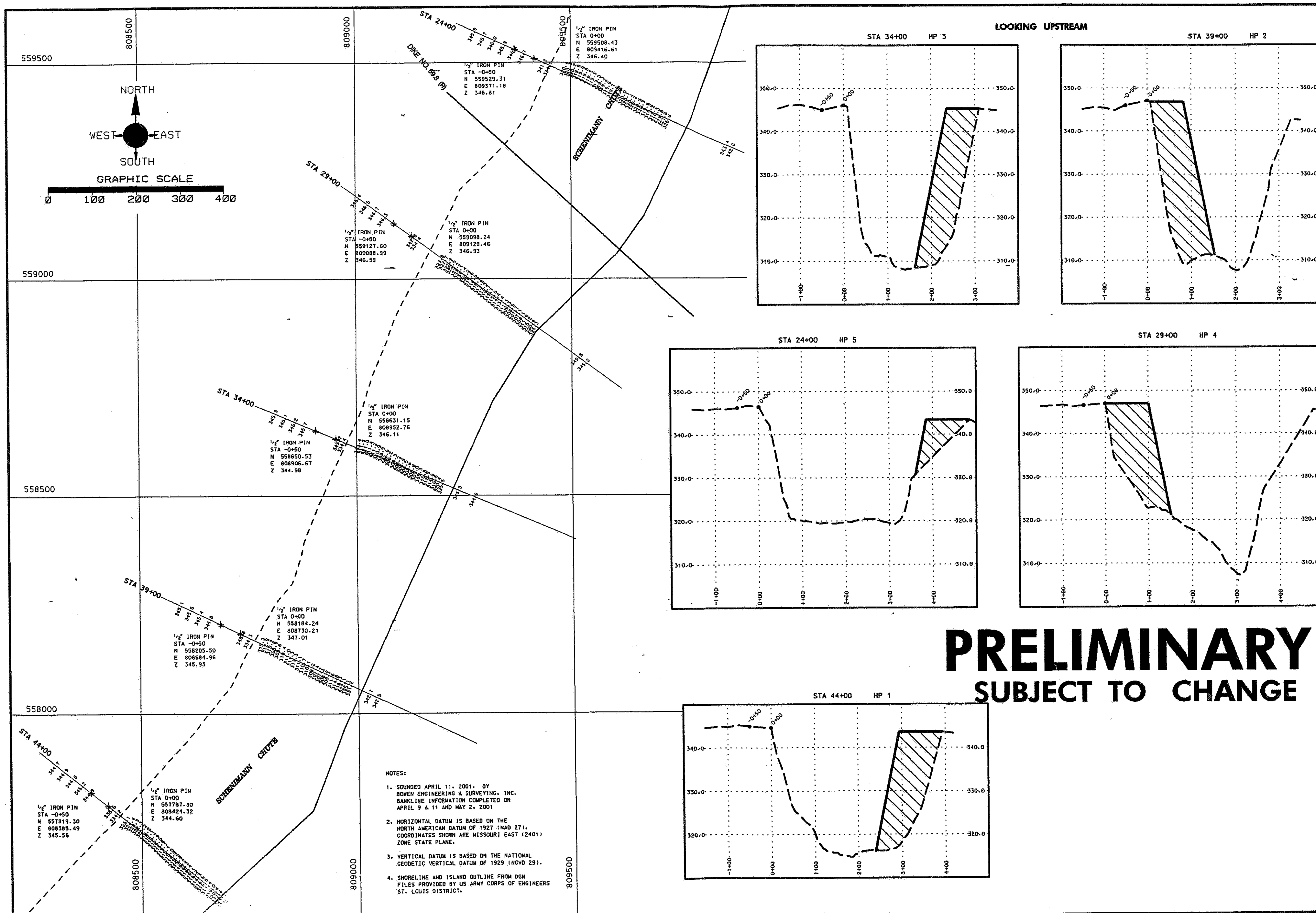
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHERNMANN CHUTE
MILE 61.7 TO MILE 67.0

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE BEST AVAILABLE DATA AT THE TIME OF PUBLICATION AND IS SUBJECT TO REVISION AS ADDITIONAL INFORMATION BECOMES AVAILABLE.

PLAN AND PROFILE VIEW
BANKLINE SURVEY 59.8 (R)

PLATE NUMBER
4 OF 8



US Army Corps of Engineers St. Louis District

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

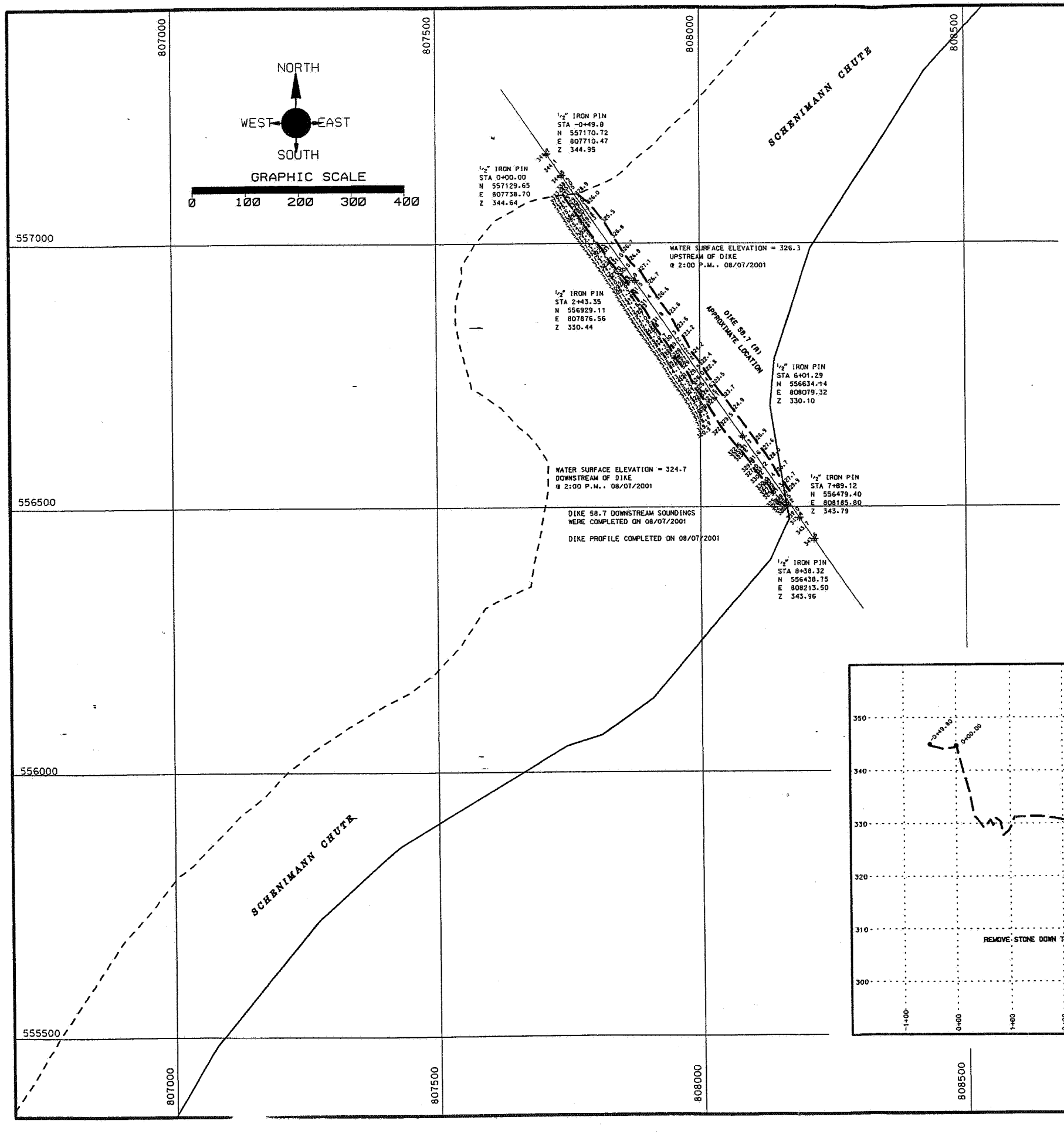
MISSISSIPPI RIVER
FY 02 AWARD
SCHENIMANN CHUTE
MILE 61.7 TO MILE 57.0

Surveyed by: | Survey Date:
Drawn by: A. BERMAN | Ckd by: X
SUBMITTED: JAMES L. KEIM, Chief, Engr. Data Mngt. Sect.
Reviewed by: J. KEIM
APPROVED: BRADFORD M. STRAUSER, Chief, Geospatial Branch
File name: T:\HYDROSUR\SURVEY01\CHUTES\SCHENIMANN\PP98.DGN
Plot date: 07-FEB-2002 09:13
Plot scale:

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME

PLAN AND PROFILE VIEW
BANKLINE SURVEY 59.8 (R)

PLATE NUMBER
5 OF 8

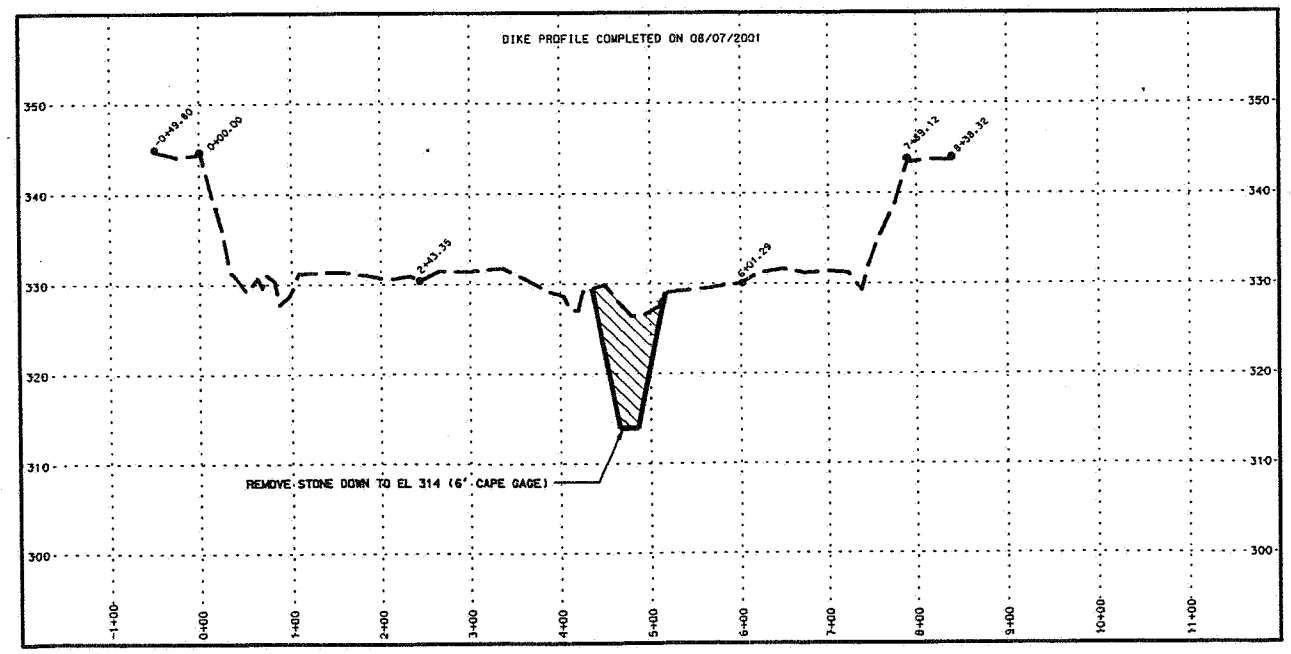


NOTES:

1. SOUNDED AUGUST 7, 2001, BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON AUGUST 7, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM DGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

PRELIMINARY
SUBJECT TO CHANGE

STA 0+00 – DIKE 58.7 CENTERLINE PROFILE **LOOKING UPSTREAM**



US Army Corps of Engineers
St. Louis District

GAGE RECORD

	WATER SURFACE	GRAND TOWER	CAPE GIRARDEAU	ST. LOUIS
ZERO NGVD		331.90	304.88	09.194
MLLW		419	392.1	378.50
L.W.R.S.P.	375.86	353.3	326.4	X
		X	X	X
		X	X	X
		X	X	X

ESTABLISHED AND REVISED TO DATE - SOUNDING AND BEACH CHANGE DATA FROM REFERENCE PLANE 8.0 FEET ABOVE MSL

Surveyed by:
Drawn by: A. BERNAUH
Qld by: K
Reviewed by: J. KOSH
SUBMITTED: JAMES L. KOSH Chief, Engr Data Mgt. Sect.
APPROVED: RAYMOND M. STRAUSER Chief, Geospatial Branch
Survey Date:
T:\HYDRO\SURVEYS\CHUTES\SCHENIMANN\DGN\SCHENIMANN_PLAN_PROFILE_58.7(R).dgn
Plot date: 07-FEB-2002 09:14
Plot scale: 1

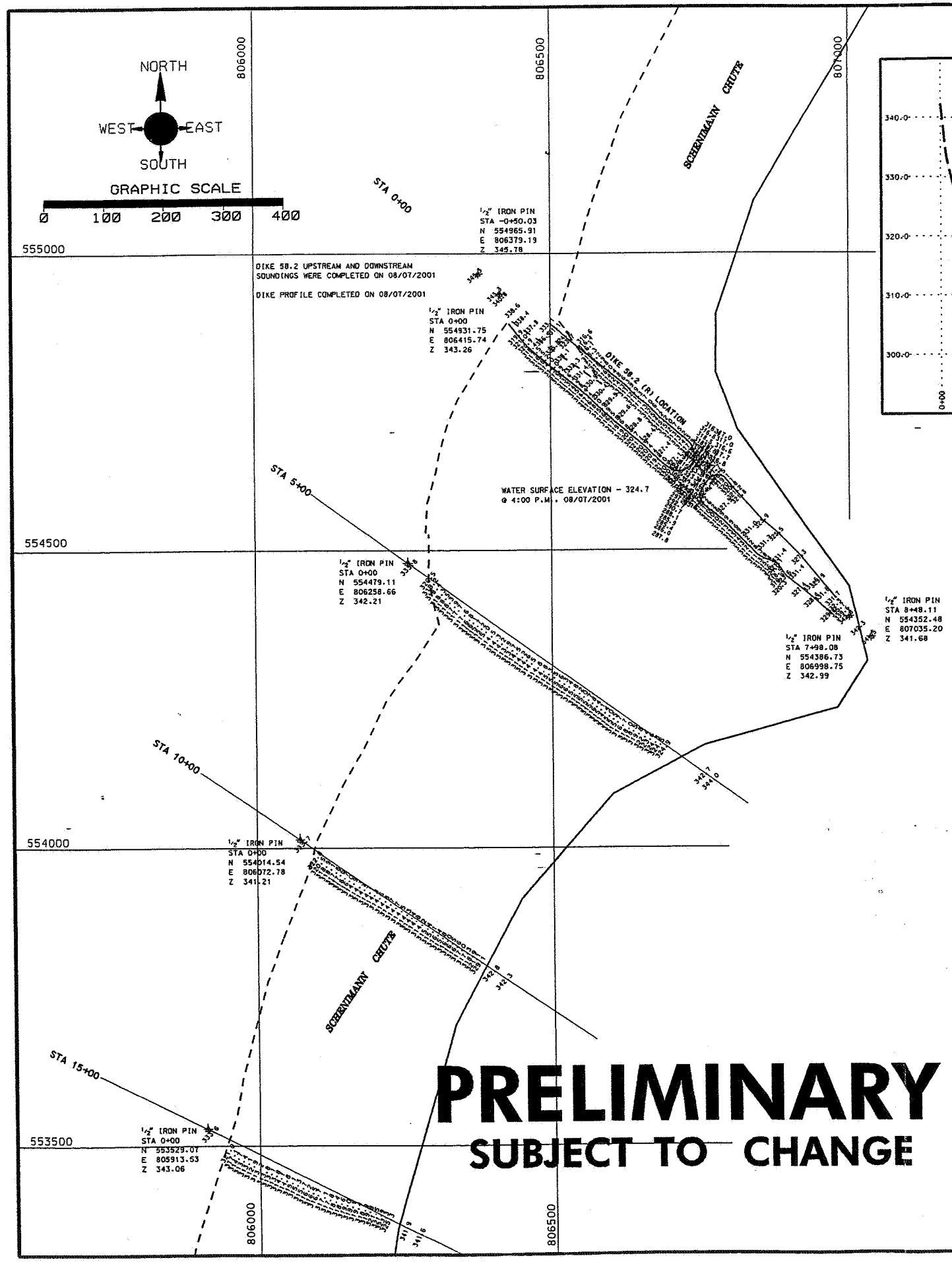
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHENIMANN CHUTE
MILE 61.7 TO MILE 67.0

THE INFORMATION SHOWN ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE BY OR UNDER THE DIRECTION OF THE UNDERSIGNED AND CONFORMS TO THE MINIMUM STANDARDS AS PRESCRIBED FOR SURVEYS WITHIN THE STATE OF MISSOURI

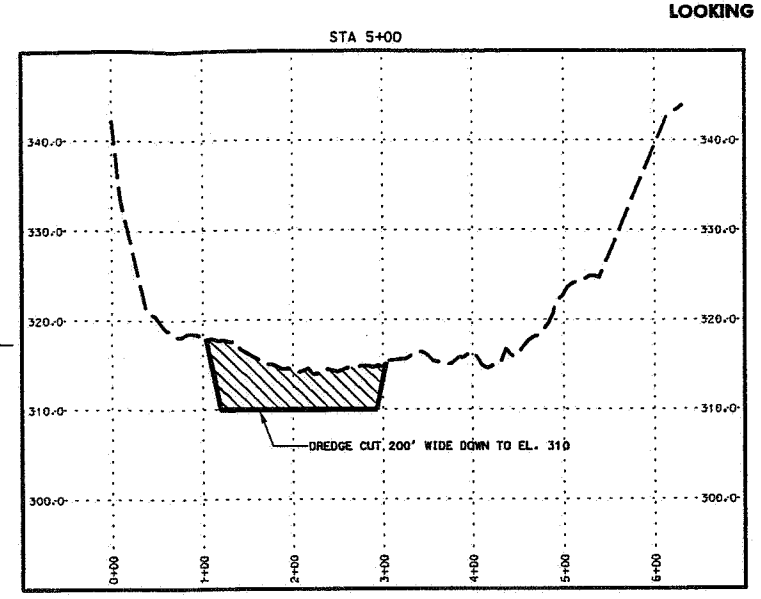
PLAN AND PROFILE VIEW
BANKLINE SURVEY 58.7 (R)
X

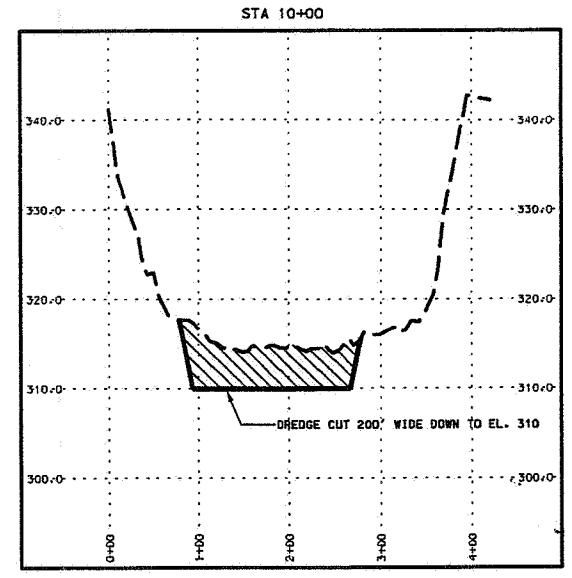
PLATE NUMBER
6 OF 8

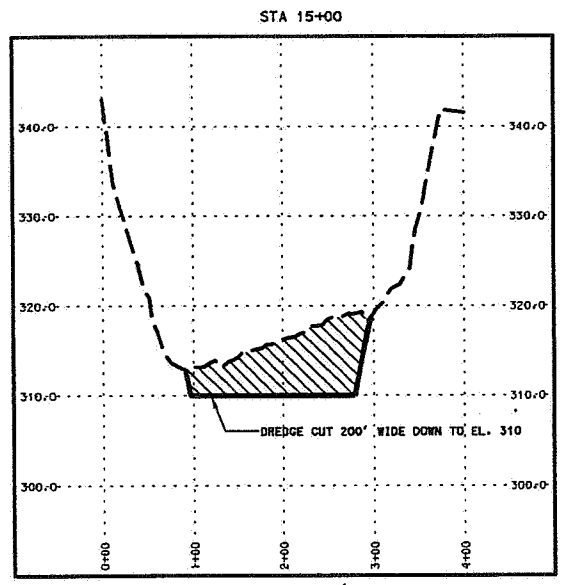


PRELIMINARY
SUBJECT TO CHANGE

LOOKING UPSTREAM



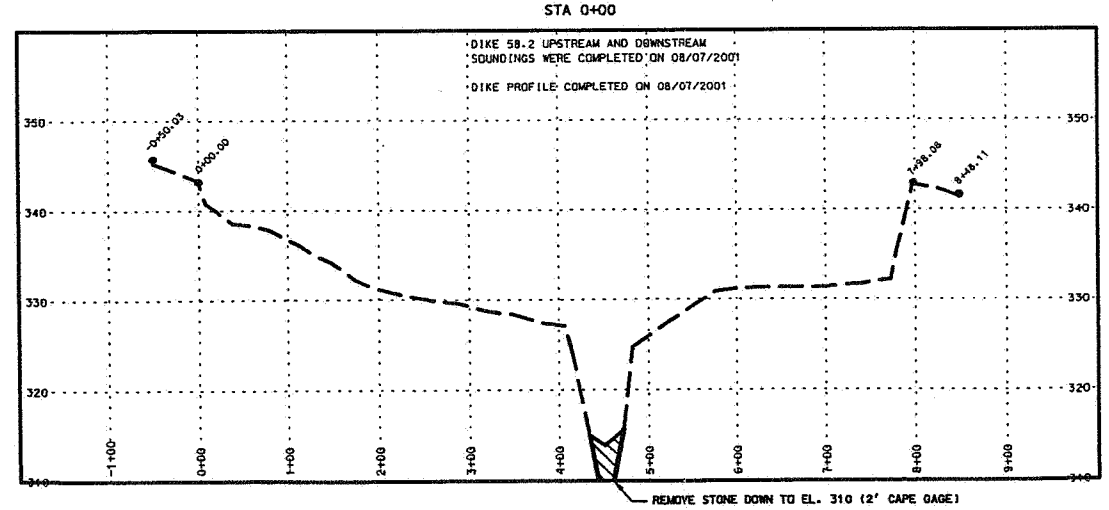




NOTES:

1. SOUNDED APRIL 11, 2001, BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON APRIL 9 & 11 AND MAY 2, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM OGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

STA 0+00



US Army Corps of Engineers
St. Louis District

GAGE RECORD

	WATER ELEVATION	GRAND TOWER	CAPE GIRARDEAU	ST. LOUIS
ZERO NGVD:		291.65	304.66	378.94
MSL:		618	631	150.0
L.W.R.P.:	315.68	358.5	369.9	378.4
	X	X	X	X
	X	X	X	X
	X	X	X	X

ELEVATIONS ARE REFERRED TO DATUM OF GAGES AND CONVERTED TO NGVD 29 DATUM

Surveyed by:
Survey Date:

Drawn by: A. BERMAN
Chkd by: JK

Reviewed by: J. KEIM

SUBMITTER: JAMES L. KEIM, Chief, Engr. Data Mngt. Sect.

File name: H:\HOME\USERS\931\CAD\ESIS\SCHEN\MAINVIEW2.X 07-FEB-2002 07:59
Plot date: 07-FEB-2002 07:59
Plot scale:

APPROVED: BRADFORD M. STRAUSER, Chief, Geospatial Branch

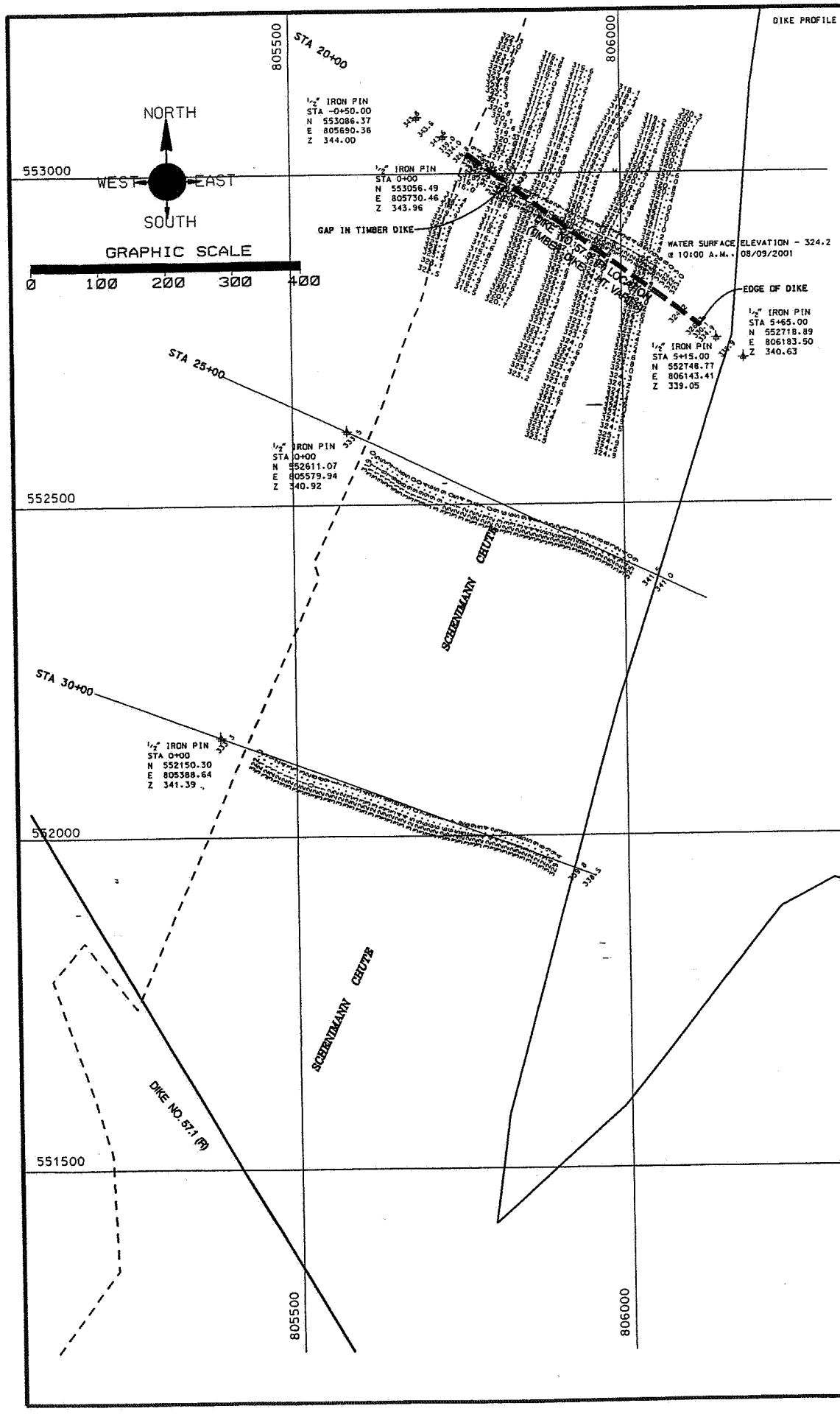
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHENIMANN CHUTE
MILE 61.7 TO MILE 57.0

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE BEST AVAILABLE DATA AT THE TIME OF PUBLICATION AND IS SUBJECT TO REVISION AS ADDITIONAL CONDITIONS EXISTING AT THAT TIME

PLANAND PROFILE VIEW
BANKLINE SURVEYS 58.2 (R) & 57.9 (R)

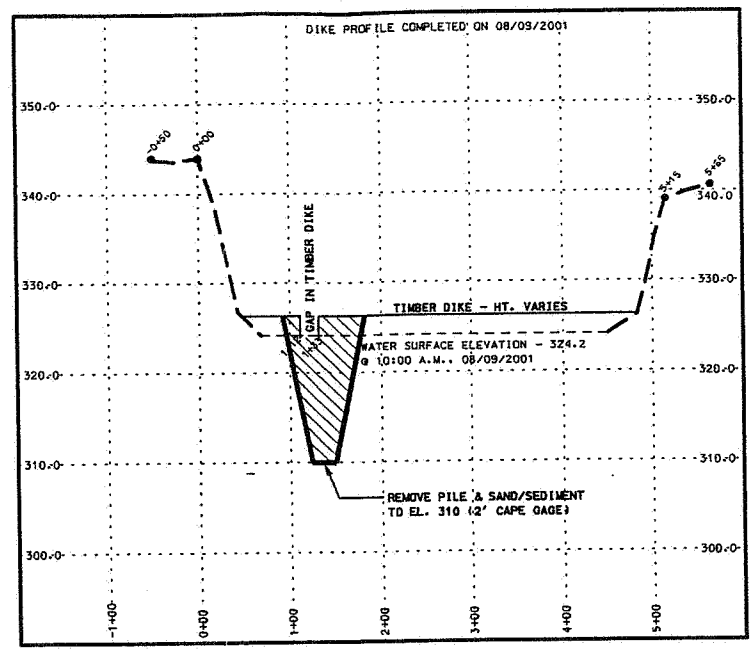
PLATE NUMBER
7 OF 8



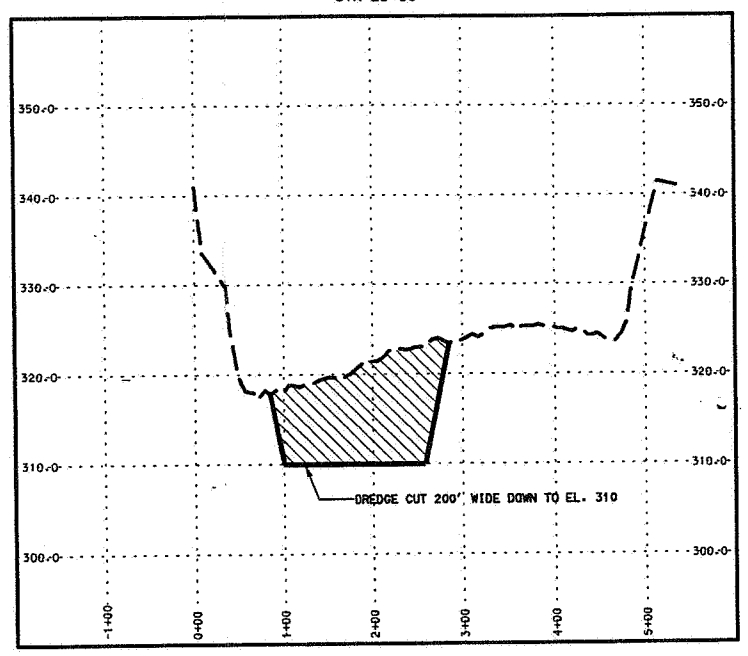
DIKE PROFILE COMPLETED ON 08/09/2001

LOOKING UPSTREAM

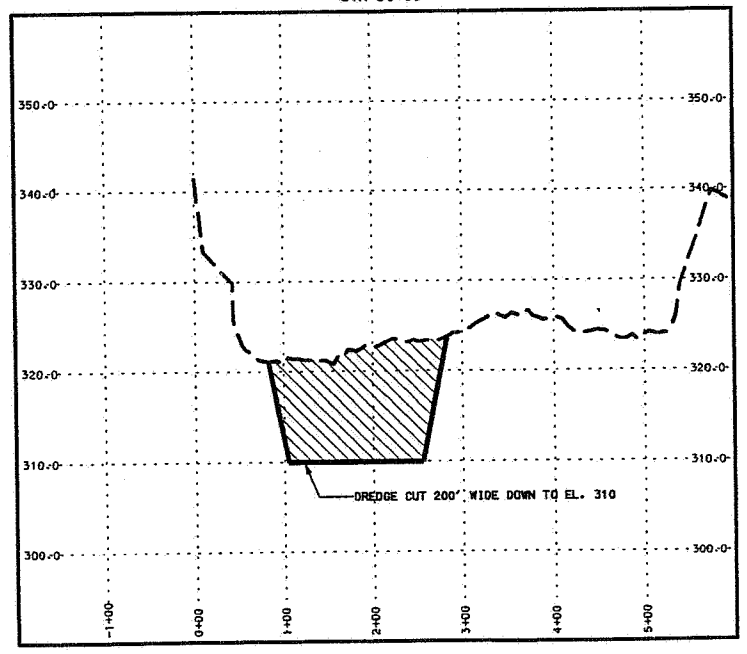
STA 20+00 DIKE 57.9 (R)



STA 25+00



STA 30+00



NOTES:

1. SOUNDED APRIL 11, 2001, BY BOWEN ENGINEERING & SURVEYING, INC. BANKLINE INFORMATION COMPLETED ON APRIL 9 & 11 AND MAY 2, 2001
2. HORIZONTAL DATUM IS BASED ON THE NORTH AMERICAN DATUM OF 1927 (NAD 27). COORDINATES SHOWN ARE MISSOURI EAST (2401) ZONE STATE PLANE.
3. VERTICAL DATUM IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29).
4. SHORELINE AND ISLAND OUTLINE FROM DGN FILES PROVIDED BY US ARMY CORPS OF ENGINEERS ST. LOUIS DISTRICT.

PRELIMINARY
SUBJECT TO CHANGE

US Army Corps of Engineers
St. Louis District

GAGE RECORD

	WATER SURFACE	GRAND TOWER	CAPE GIRARDEAU	ST. LOUIS
ZERO NGVD.		351.95	351.66	379.94
MSD		410	411	410.5
L.W.R.R.	315.58	358.5	359.9	379.4
	X	X	X	X
	X	X	X	X
	X	X	X	X

ELEVATIONS ARE REFERENCED TO DATUM INDICATED (SEE LOCK MASTER, ATTENDANT OR RIVER GAUGE STATION)

Surveyed by:
Drawn by: A. BERMAN
Ckd. by: JK
Reviewed by: J. KEIM
APPROVED: JACKSONVILLE M. STRAUSSER
Chief, Construction Branch

SUBMITTED: JAMES L. KEIM
Chief, Engr. Data Mngt. Sect.

File name: P:\MISSRIVER\SURVEY\01-CHUTES-SCHERNMANN\02 1 to 5 PLOT.dgn
Plot date: 07-FEB-2002 12:41
Plot scale:

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER
FY 02 AWARD
SCHERNMANN CHUTE
MILE 61.7 TO MILE 57.0

THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF SURVEYS MADE BY THE ST. LOUIS DISTRICT, CORPS OF ENGINEERS AS INDICATED ON THE SURVEY DATA SHEETS AND AS SHOWN HEREON. ADDITIONAL SURVEYS MAY BE MADE AT A LATER DATE.

PLANAND PROFILE VIEW
BANKLINE SURVEYS 59.2 (R) & 57.0 (R)

PLATE NUMBER
8 OF 8

ATTACHMENT 2