



**US Army Corps
of Engineers**
Rock Island District

OPERATION AND MAINTENANCE MANUAL

BAY ISLAND

REHABILITATION AND ENHANCEMENT

UPPER MISSISSIPPI RIVER

ENVIRONMENTAL MANAGEMENT PROGRAM

POOL 22

RIVER MILES 311 - 312

MARION COUNTY, MISSOURI

NOVEMBER 1995

**OPERATION AND MAINTENANCE MANUAL
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1. INTRODUCTION.

a. Purpose and Scope.

(1) This manual serves as a guide for the operation and maintenance of Bay Island Rehabilitation and Enhancement. It provides operation and maintenance instructions for the major features of this environmental management project. The instructions are consistent with the general procedures presented in the March 1990 Definite Project Report. This document is written for project and management personnel who are familiar with the project and does not contain detailed information which is common to site personnel or which is presented in other existing manuals or regulations.

(2) The intent of the operating instructions is to provide information which allows orderly and efficient use of the constructed features to meet project goals and objectives. The intent of the maintenance instructions is to present preventative maintenance information consisting of systematic inspections and subsequent corrective actions which should ensure long-term utilization of equipment and features. A timely preventative maintenance program reduces and virtually eliminates breakdown of essential equipment and prevents major damage to constructed features by early corrective action.

(3) This manual provides the general standards of maintenance and establishes an initial frequency of maintenance inspections which should ensure satisfactory project performance.

b. Use of Manual.

(1) This manual is divided into the following sections: Section 1: Introduction; Section 2: Historical Summary; Section 3: Description of Project Features; Section 4: Inspections; Section 5: Operation and Maintenance of Project Features; and Section 6: Performance Monitoring and Assessment.

(2) Sections 2 and 3 present historical summaries and descriptions of actual features constructed for this project. Section 4 includes project inspection procedures, and Section 5 presents operation and maintenance instructions for each project feature. Section 6 summarizes monitoring activities conducted through construction as well as an overview

of continued monitoring actions. Performance monitoring is considered necessary to properly evaluate effects of the constructed project features.

(3) The attached drawings have been included to provide general project “as-built” plans and typical sections.

2. HISTORICAL SUMMARY.

a. Authorization and Location.

(1) This project is authorized by the Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The project was funded and constructed under this authorization by the U.S. Army Corps of Engineers, Rock Island District, in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the Missouri Department of Conservation (MDOC).

(2) The Bay Island complex encompasses approximately 650 acres of aquatic, wetland, and terrestrial habitat. It is located in Pool 22 on the Missouri side of the Upper Mississippi River navigation channel between river miles (RM) 311 and 312, approximately 1 mile north of the city of Hannibal, Missouri.

b. Planning and Construction Activities.

(1) Table 2.1 provides a summary of planning and construction activities.

TABLE 2.1
SUMMARY OF PLANNING AND CONSTRUCTION ACTIVITIES

Project Phase	Purpose	Responsible Agency	Item	Date	Remarks
Pre-project	Identify and define problems and establish need of project	Corps/USFWS	Fact Sheet		
			Submitted to ASA	MAR 87	1/
			Approved by ASA	MAY 88	--
Design	Quantify project objectives, perform preliminary design, satisfy NEPA and permit requirements, develop performance evaluation plan, obtain project approval for construction.	Corps	Definite Project Report		
			Draft	SEP 89	--
			Final	MAR 90	--
			Approved	SEP 90	--
			NEPA Compliance		
			SHPO Concurrence	22 SEP 89	--
			Public Review	18 FEB 90	--
			FONSI for EA	23 MAR 90	2/
			Permits		
			Section 401	06 OCT 89	--
Construction	Finalize plans and specifications, obtain operation and maintenance agreement, advertise and award construction contract, construct project.	Corps	Plans and Specifications		--
			Final	DEC 90	--
			Approved	FEB 91	--
			Real Estate		
			O&M Agreement	DEC 90	Ref. App. A

TABLE 2.1 (Continued)
SUMMARY OF PLANNING AND CONSTRUCTION ACTIVITIES

Project Phase	Purpose	Responsible Agency	Item	<u>Significant Events</u>	Date	Remarks
Post- Construction	Operate and maintain project.	MDOC	Levee/Structures/Tree Planting			
			Awarded		JUL 91	--
			Substantially Complete		NOV 94	
			Post-Flood Tree Planting			
			Advertised		MAR 94	
			Awarded		APR 94	
			Substantially Complete		NOV 94	
						Reference Sections 4 and 5
	Perform evaluation monitoring.	Corps				Reference Section 6

Notes:

^{1/} Assistant Secretary of the Army

^{2/} A FONSI was completed by both Corps and USFWS.

(2) Goals and objectives were formulated during the design phase. Table 2.2 provides a summary of project objectives.

TABLE 2.2 PROJECT GOALS, OBJECTIVES AND ENHANCEMENT POTENTIAL				
Goal	Objective	Unit of Measure	Enhancement Potential Existing	Target
Enhance Wetland Habitat for Migratory Waterfowl	Provide controlled water levels during waterfowl migration-forested and non-forested	Acres	40	400
	Increase mast tree dominance - forested wetland	Acres	6.9	36.9
	Increase total wetland values for migratory waterfowl	Habitat ^{1/} Suitability Indices & Habitat Units	0.14 99.1	0.62 - 0.64 420.5-434.0

Note:

^{1/} See Section 6.

(3) The project was designed by the Rock Island District, U.S. Army Corps of Engineers, in cooperation with the USFWS and the MDOC. Design considerations and investigations are presented in the Definite Project Report dated March 1990. The construction contract was supervised by the Rock Island District.

(4) The construction contract, number DACW25-91-C-0057, was awarded to Northwest Construction Corporation, Ellisville, Missouri, on 29 July 1991 in the amount of \$1,265,475. This bid was approximately 11% above the Government Estimate.

(5) In July 1993, a flood of record on the Mississippi River resulted in flooding to the project just prior to its completion. Seeding of the project was the only remaining item to be completed. The major damage caused by the Great Flood of 1993 to the project was the inundation and subsequent loss of the mast tree plantings. The levees and structures were all overtopped and remained submerged until October 1993. In addition to scattered surface erosion, damages due to overtopping included loss of material along the Mississippi River side of the perimeter levee, minor riprap and choke stone displacement, sedimentation at the water control structures, and loss of granular surfacing

material on the access road. The pump control panel was also damaged by the flood. Modifications were made to the contract to repair the flood damage to the levee and structures. A new contract was awarded for the replanting of mast trees.

c. **Actual Project Costs.** The actual project costs are presented in Table 2.3.

TABLE 2.3 ACTUAL PROJECT COSTS						
Item	Description	Quantity	U/M	U/P	Amount	
BAY ISLAND, MISSOURI HABITAT REHABILITATION AND ENHANCEMENT PROJECT (DACW25-91-C-0057)						
0001	Mobilization and Demobilization	1	LS	\$ 13,060.00	\$ 13,060.00	
0002	Clearing and Grubbing					
0002A	Areas Cleared by Previous Timber Clearing Contract	30	AC	2,330.30	69,909.00	
0002B	All Other Areas	28	AC	3,828.00	107,184.00	
0003	Embankment	46,000	CY	4.25	195,500.00	
0004	Pump Station	1	LS	242,300.00	242,300.00	
0005	Water Control Structures					
0005A	Perimeter Levee, North	1	LS	135,405.00	135,405.00	
0005B	Perimeter Levee, South	1	LS	106,820.00	106,820.00	
0005C	Intermediate Levee	1	LS	72,215.00	72,215.00	
0006	Access Road Bridge	1	LS	105,315.00	105,315.00	
0007	Granular Surfacing	1,650	TN	13.13	21,664.50	
0008	Stone Protection, Riprap	1,925	TN	28.14	54,169.50	
0009	Landscaping					
0009A	Planting Acorns	3	AC	1,083.00	3,249.00	
0009B	Planting Seedling Trees	1	LS	11,285.00	11,285.00	
0009C	Planting Container Grown or Balled and Burlapped Stock	1	LS	32,495.00	32,495.00	
0010	Seeding	1	LS	37,550.00	37,550.00	
0011	Excavation for Ditches in Excess of that Required for Adjacent Embankment					
0011A	First 100 Cubic Yards	100	CY	8.17	817.00	
0011B	Over 100 Cubic Yards	3,000	CY	5.45	16,350.00	
				Subtotal	\$ 1,225,288.00	

TABLE 2.3 (Continued)
ACTUAL PROJECT COSTS

Item	Description	Quantity	U/M	U/P	Amount
				Subtotal	\$ 1,225,288.00
0012	Temporary Field Office	1	LS	18,200.00	18,200.00
0013	Work to be Performed by the Missouri Rural Electric Cooperative Utility Company	1	LS	12,790.00	12,790.00
0014	Work to be Performed by the Burlington Northern Railroad for Land Access to the Site	1	LS	7,090.00	7,090.00
0015	Monthly Telephone Bills				
0015 A	First \$500.00	500	DL	752.00	752.00
0015 B	Over \$500.00	900	DL	1,355.00	1,355.00
0016	Provide Survey Information	1	LS	5,385.82	5,385.82
0017	Obtain Alternate Borrow	4,500	CY	10.32	46,440.00
0018	Adjust Estimated Quantity of Item 0003	4,500	CY	4.25	(-19,125.00)
0019	Install 3/4" x 6" studs and place 3' of 2" graded rock in sheet pile structure	1	LS	595.07	595.07
0020	Pumping outside of normal operating hours for the South River Drainage District	1	LS	1,717.57	1,717.57
0021	Initial Mowing and Watering	1	LS	1,092.44	1,092.44
0022	Additional Mowing	2	EA	732.46	1,464.92
0023	Additional Watering	6	EA	1,339.33	8,035.98
0024	Dewatering System, Replace Subgrade Material	1	LS	9,483.65	9,483.65
0025	Install 875 Tree Shelters	1	LS	7,498.43	7,498.43
0026	Bond Maintenance	1	LS	1,915.97	1,915.97
0027	Pump Station Repair	1	LS	39,392.00	39,392.00
0028	Remove Debris, Reshape Levee, Fill Low Spots, Clean Structs.	1	LS	44,400.00	44,400.00
0029	Replace Granular Surface	720	TN	15.00	10,800.00
0030	Replace Riprap	75	TN	29.00	2,175.00
				Subtotal	\$ 1,426,746.85

TABLE 2.3 (Continued)
ACTUAL PROJECT COSTS

Item	Description	Quantity	U/M	U/P	Amount
				Subtotal	\$ 1,426,746.85
0031	Levee Seeding	35	AC	1,950.00	68,250.00
0032	Pump Station Cleanup	1	LS	3,400.91	3,400.91
TOTAL COST (DACW25-91-C-0057)					\$ 1,498,397.76
POST FLOOD TREE REPLANTING, BAY ISLAND (DACW25-94-C-0073)					
0001	Planting Acorns	3	AC	446.00	\$ 1,338.00
0002	Planting Seedling Trees	1	LS	18,429.00	18,429.00
0003	Tree Shelters / Stakes for Seedling Trees	1	LS	3,920.00	3,920.00
0004	Planting Container Grown or Balled and Burlapped Trees	1	LS	39,370.00	<u>39,370.00</u>
TOTAL COST (DACW25-94-C-0073)					\$ 63,057.00
TOTAL CONSTRUCTION					\$ 1,561,454.76
LANDS AND DAMAGES					1,640.66
PLANNING, ENGINEERING, AND DESIGN					586,395.87
CONSTRUCTION MANAGEMENT					159,065.15
TOTAL PROJECT COSTS					\$ 2,308,556.44

d. **Project References.** Table 2.4 summarizes related project references.

TABLE 2.4 PROJECT REFERENCES		
Title	Date	Purpose
Upper Mississippi River System Environmental Management Program, Definite Project Report (R-8) with Integrated Environmental Assessment, Bay Island, Missouri, Rehabilitation and Enhancement, U.S. Army Corps of Engineers, Rock Island District	Mar 90	Provided planning, engineering, and sufficient construction details of the selected plan for project approval purposes.
Construction As-Built	Nov 95	Provides as-built construction drawings.
Manufacturer's Data (Shop Drawings)	Nov 95	Provides detailed operation and maintenance instructions for specific pieces of equipment as recommended by the manufacturer.

3. DESCRIPTION OF PROJECT FEATURES.

a. **Project Data.** Table 3.1 presents a summary of project data.

TABLE 3.1 PROJECT DATA SUMMARY		
Item	Quantity	U/M
<i>Wetland Management Units</i>		
Perimeter Levee		
Embankment Fill	55,000	Cubic Yards
Length	19,194	Feet
Top Width	10 or 12	Feet
Top Elevation	469.0	MSL, station 0+00 to station 46+50
	469.0 to 468.0	MSL, varies from station 46+50 to station 121+00 and from station 67+17B to station 6+04B
	468.0	MSL, station 121+00 to station 124+50
Side Slopes	4:1	Horizontal : Vertical
Intermediate Levee		
Embankment Fill	10,165	Cubic Yards
Length	4,800	Feet
Top Width	10	Feet
Top Elevation	468.0	MSL
Side Slopes	4:1	Horizontal : Vertical
Pump Station		
Submersible Pump	1	6,000 gpm at 10.1 TDH
Operating Elevations		
Unit Maximum Elevation	466.0	MSL
Sump Floor Elevation	453.0	MSL
Electric Power Source		
Primary Supply	7,200	V, 1 phase
Transformer Size	37.5	kVA, 1 phase
Secondary Supply	120/240	V, 1 phase
Power Converter	30	hp, 3 phase
Inflow Pipe	24	RCP
Perimeter Levee Water Control Structures		
Concrete	54	Cubic Yards
Weir Length	20	Feet
Invert Elevation	462.0	MSL, South Unit
	462.5	MSL, North Unit
Intermediate Levee Water Control Structures		
Concrete	40	Cubic Yards
Weir Length	6	Feet
Invert Elevation	463.0	MSL
Access Road		
Length	6,150	Feet
Width	10	Feet with crushed stone surface
<i>Tree Plantings</i>		
Area	30	Acres

b. General Description. The Bay Island project consists of wetland enhancement by development of water level control and forest cover management. Water level control is provided by construction of low levee segments which are used to impound water during seasonal waterfowl migrations. Water is provided by a pump station, located along a river side channel. Forest cover management consists of thinning and planting to increase the quantity of mast-bearing tree species. A total of about 25 acres of bottom land forest, emergent wetland, and cropped ground has been converted to grass-covered levee. As proposed, 20 acres of bottom land forest will be selectively thinned to improve production. About 10 acres of cropland was planted to pin oak and pecan trees.

c. Water Level Control Through Wetland Management Unit (WMU)
Construction. Over 400 acres of the Bay Island project area can be impounded by the constructed earthen levees and associated water control structures to create a 240-acre forested north WMU and a 165-acre non-forested south WMU as shown on plate 1.

(1) **Water Control Plan.** During impoundment, the water surface elevation in the north WMU will be 464.0 feet mean sea level (MSL) and the water surface elevation in the south unit will be 466.0 MSL. Table 3.2 shows the areas of incremental water depths for various flooding heights for each WMU. The selected operating water levels are those that maximize the area with water less than 2 feet deep. Migratory waterfowl, in particular dabbling ducks, require water depths of 12 to 18 inches for access to food plants. The proposed water surface elevations represent those elevations which will give the greatest areal average of 12- to 18-inch depth with both management units. The selected water surface elevations represent maximum levels for design purposes; actual operation levels may be lower if desired.

The pump station for flooding the WMU is located in the south WMU. To flood the north WMU, water enters through the intermediate levee stoplog water control structure. The drainage ditch adjacent to the perimeter levee allows water to flow directly from the water source to the intermediate levee water control structure and then into the north WMU without flooding the south WMU. Both units gravity drain independently through separate perimeter levee stoplog water control structures into Clear Creek, allowing for completely independent operation (flooding and draining) of the two WMUs.

TABLE 3.2
WATER DEPTHS VERSUS HEIGHT

<i>South WMU</i>						
Top Elevation	Acres < 1' Deep	Acres 1' -2' Deep	Acres 2' -3' Deep	Acres 3' -4' Deep	Acres > 4' Deep	Total Acres Flooded
462	0.3	0	0	0	0	0.3
463	9.3	0.3	0	0	0	9.6
464	9.3	9.3	0.3	0	0	18.9
465	35.0	9.3	9.3	0.3	0	53.9
466	34.9	35.0	9.3	9.3	0.3	88.8
467	30.2	34.9	35.0	9.3	9.6	119.0
468	31.0	30.2	34.9	35.0	18.9	150.0

<i>North WMU</i>						
Top Elevation	Acres < 1' Deep	Acres 1' -2' Deep	Acres 2' -3' Deep	Acres 3' -4' Deep	Acres > 4' Deep	Total Acres Flooded
462	9.8	0	0	0	0	9.8
463	29.4	9.8	0	0	0	39.2
464	29.5	29.4	9.8	0	0	68.7
465	35.3	29.5	29.4	9.8	0	104.0
466	35.0	35.3	29.5	29.4	9.8	139.0
467	29.0	35.0	35.3	29.5	39.2	168.0
468	30.0	29.0	35.0	35.3	68.7	198.0

(2) Water Source. Ziegler Chute is the water source for flooding the units. To accommodate WMU management strategies, a minimum pumping capacity of 6,000 gpm is required. Because Ziegler Chute is a part of the Mississippi River, its water surface levels will fluctuate minimally and can easily supply water for a surface water intake pump. The average depth of Ziegler Chute in the vicinity of the pump station is 3 feet.

(3) Pump Station. The pump station has been sized to fill the north WMU in 15 days. This is the site management filling criterion which requires the greatest pumping capacity. Pump station plans and details are shown on plates 3 and 19.

The pump station is provided with a 6,000 gpm submersible propeller-type pump. This pump has the capacity to fill the forested unit in 15 days and to fill both units in 23 days total. The pump is housed in a vandal-resistant cast-in-place housing. The intake entrance is equipped with a trash rack. Underground electrical power is provided to the site, and all

necessary electrical equipment is located on an overhead platform in the vicinity of the pump station, as shown on plates 22, 23, and 24.

(4) Water Control Structures. Operation of the WMUs requires the use of three concrete stoplog water control structures (see plates 20 and 21). The perimeter levee water control structures are sized to preclude the need for an armored levee overflow section. The perimeter levee water control structures have four 5-foot stoplog bays. The intermediate levee water control structure has two 3-foot stoplog bays. All of the water control structures have a steel grate deck to allow for vehicle passage overhead.

(5) Levee Heights. To accommodate the water control plan, the minimum top elevation for the WMU perimeter and intermediate levee system is 468.0 MSL. This provides a minimum freeboard of 1.3 feet during filling operations.

From a flood protection standpoint, the perimeter levee provides slightly more than a 2-year level of protection. To minimize scour potential, the perimeter levee profile parallel to the Mississippi River is sloped upstream to provide for gradual overtopping during flood events greater than 2 years. Also, the water control structures are designed to allow sufficient inflow into the units such that head differential will be only 0.7 foot when overtopping does occur.

(6) Levee Borrow. Borrow for the perimeter and intermediate levees came from adjacent ditch excavations or was scraped from adjacent cropland as shown on plates 14 through 16. Plans and profiles are shown on plates 4 through 13. These ditches serve as an internal drainage system for the WMUs and facilitate the water control plan as described previously.

(7) Site Access. Access to the project is gained by a crushed stone access road. The majority of the eastern segment of the access road follows an existing access road alignment from the county road west of the project site to the west perimeter levee. The access road is shown on plates 2 and 7 through 8. The road is 10 feet wide and surfaced with 6 inches of crushed stone. The road is used by MDOC personnel for operation and maintenance activities and can be used by share croppers to access crop areas. The access road also facilitates delivery of materials for seeding and operation and maintenance of the pump station and structures.

A new prefabricated deck bridge with concrete abutments provides project access over Clear Creek. The span length is 42 feet and the deck width is 15 feet. The bridge carries a standard H20 loading designation. The bottom elevation of the bottom chord of the bridge is 464.0 MSL. This was designed to allow passage of a 100-year flow of Clear Creek plus the drainage outflow from the South River Drainage District (located immediately upstream of the project) with 1 foot of clearance (see plate 18).

Access to the site is controlled by MDOC to prevent public vehicular access to the refuge area and to minimize consequent disturbance.

d. **Cover Management.** The mast tree planting project consisted of selectively thinning approximately 20 acres of forest area in the north WMU, within which 5 blocks of balled and burlapped pin oak trees were planted, amounting to approximately 4 acres. In the south WMU, 7 acres of pin oak tree seedlings and 3 acres of acorns were planted. These areas are shown on plate 17. State and Corps of Engineers foresters recommended the pin oak planting sites. In the north WMU, areas with the poorest existing stock and possessing the most mature pecan trees were selected for underplanting with the chosen mast specie. Sites possessing the highest natural elevations, thereby minimizing inundation periods, were selected for pin oak planting in the southern WMU. The planting scheme was 4 acres of balled and burlapped trees, 23 acres of seedlings, and 3 acres of acorns.

4. **INSPECTIONS.**

a. **General.**

(1) An active maintenance program is based on inspections and subsequent servicing, adjustment, or repair. The two main objectives of inspections are to: (1) ensure project serviceability by timely and thorough inspections, thereby avoiding or reducing maintenance costs, and (2) document the condition of the project as a baseline for consideration of rehabilitation for project damage resulting from a major storm or flood event.

(2) The two types of inspections for the project are: (1) Project Inspection by the Site Manager, and (2) Joint Inspection by the Site Manager and personnel from the U.S. Army Corps of Engineers, Rock Island District.

b. **Project Inspection by Site Manager.**

(1) The Project Inspection should be performed by the Site Manager or appropriate representative for the purpose of noting routing deficiencies and initiating corrective actions. This inspection will be performed at periods not exceeding 12 months and will follow inspection guidance presented in subsequent sections of this manual. It is suggested that the inspection be conducted every May, which is representative of after-spring flood conditions. Other Project Inspections should occur as necessary after high water events or as scheduled by the Site Manager.

(2) A Project Inspection checklist has been developed as presented in Appendix B. It is suggested that the Site Manager furnish a copy of the completed checklist to the U.S. Army Corps of Engineers, Rock Island District, ATTN: CENCR-OD-S, Clock Tower Building, P.O. Box 2004, Rock Island, Illinois 61204-2004, immediately following each Project Inspection.

c. Joint Inspection by Site Manager and U.S. Army Corps of Engineers.

(1) Routine. A Joint Inspection by the Site Manager and the Corps of Engineers shall be made in accordance with ER 1130-2-339. The purpose of this inspection is to assure that adequate maintenance is being performed as presented in the Detailed Project Report and this manual. One exception to the maintenance requirements as found in the above stated regulation is in the mowing frequency (see section 5.b.(2) of this manual). This exception was mutually agreed upon by the Sponsor and the Corps of Engineers. The District Engineer or Authorized Representative should have access to all portions of the constructed project upon coordination with the Site Manager for this purpose.

(2) Catastrophic. A Joint Inspection by the Site Manager and the Corps of Engineers should be formally requested by the Site Manager immediately following a specific storm or flood event which causes damage exceeding the annual operation comparison of pre- and post-Project Inspections by the Site Manager. The Joint Inspections will be the basis for determining maintenance responsibility and potential rehabilitation by the Corps of Engineers.

5. OPERATION AND MAINTENANCE OF PROJECT FEATURES.

a. General.

(1) This section presents operation and maintenance instructions for the major project features which were designed and constructed to minimize operation and maintenance requirements.

(2) Steps will be taken by the Site Manager to correct conditions disclosed by Project Inspections or Joint Inspections. Regular maintenance repair measures will be accomplished during the appropriate season as scheduled by the Site Manager to ensure structure serviceability. Appropriate advance measures will be taken to ensure the availability of adequate labor and materials to meet contingencies.

(3) Project features should be continuously maintained and operated to obtain maximum benefits. No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project should be permitted upon the constructed features. No improvement should be passed over, under, or through the constructed features, nor should any excavation or construction be permitted within these features without prior approval by the Corps of Engineers, Rock Island District. Such improvements or alterations which are desirable and permissible should be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of

construction acceptable under standard engineering practice should be obtained from the District Engineer or, if otherwise obtained, should be submitted for approval. Drawings or prints showing improvements or alterations as finally constructed should be furnished to the District Engineer after completion of such work.

b. Perimeter and Intermediate Levees.

(1) Operation.

(a) During operational inundation periods, the levees should be inspected to be certain that:

- (i) There are no indications of slides or sloughs developing;
- (ii) Wave wash or scouring action is not occurring;
- (iii) No low reaches of levee below design grade exist which may be overtopped;
- (iv) No other conditions exist which might endanger the structure.

(b) Appropriate advance measures should be taken to ensure availability of adequate labor and materials to meet contingencies. Steps should be taken to control any condition which endangers the levee and to repair the damaged section. If additional riprap is needed to protect eroding banks, the material presented in Table 5.1, or equivalent material, should be used.

TABLE 5.1 RIPRAP REPLACEMENT MATERIAL (IOWA CLASS "D" RIPRAP)	
Stone Weight (Pounds)	Minimum Percent Larger Than
250	0
90	50
5	90

(2) Maintenance.

(a) The Site Manager should provide at all times such maintenance as may be necessary to ensure the serviceability of the levee in time of inundation. Measures

should be taken to promote the growth of sod, control burrowing animals, provide routine mowing (1 mowing per year) on the levees extending 5 feet horizontally from the toe of the levee, remove wild growth and drift deposits, and repair damage caused by erosion or other forces.

(b) Project inspections should be made by the Site Manager to ensure that the above maintenance measures are being effectively carried out and to be certain that:

- (i) no unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;
- (ii) no caving has occurred on either the landside or the riverside of the levee which might affect the stability of the levee section;
- (iii) no seepage, saturated areas, or sand boils are occurring;
- (iv) no revetment work or riprap has been displaced, washed out, or removed;
- (v) no action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sods;
- (vi) the crown of the levee is shaped to drain readily;
- (vii) there is no unauthorized grazing or vehicular traffic on the levee; and
- (viii) encroachments are not being made on the levee which might endanger the structure or hinder its proper and efficient functioning during times of inundation.

(c) Such inspections should be made prior to the beginning of an inundation period, immediately following major high water periods, and otherwise at intervals necessary to ensure the best care of the levee or one time per year as stated in Section 6. Steps should be taken to correct conditions disclosed by such inspections. Regular maintenance repair measures should be accomplished during the appropriate season as scheduled by the Site Manager.

c. Water Control Structures.

(1) Operation.

(a) When the WMUs are in use or water levels of the Mississippi River rise with heavy sediment loads, the stoplogs in the perimeter water control structures should be

installed to prevent sediment from entering Bay Island. The stoplogs should remain in place until:

- (i) heavy sediment flood water recedes;
- (ii) the WMUs are not in use;
- (iii) overtopping of the perimeter levee is anticipated. Overtopping occurs at an elevation of 468.0 at RM 311.0. This elevation correlates to a river stage of 17.6 feet at the Hannibal Gage (RM 309.0). The Site Manager should note that the access bridge is submerged at an elevation of 466.0 (RM 311) or a stage of 15.6 feet at Hannibal.

(b) A stoplog lifting hook is furnished with the project for the installation and removal of the stoplogs. This tool is intended for use at all three of the structures and should be stored in a secure place to allow ready use when needed.

(2) Maintenance.

(a) The water control structures should be inspected immediately following a high water event to determine whether seepage is taking place along the lines of its contact with the embankment. Corrective action should be taken upon discovery of any adverse conditions at the structures.

(b) Project inspections of the control structures should be made by the Site Manager to be certain that:

- (i) stoplogs, headwalls, staff gages, stoplog keepers steel rails posts and grating are in good operating condition;
- (ii) inlet and outlet channels are open;
- (iii) care is being exercised to prevent the accumulation of trash and debris near the structures; and
- (iv) erosion is not occurring adjacent to the structure which might endanger its function.

(c) Steps should be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

d. Interior Ditches.

(1) Operation. The interior ditches should be inspected immediately following major high water events. As soon as practicable after high water events, all snags and other debris should be removed from the ditches.

(2) Maintenance.

(a) Project inspections of the interior ditches should be made by the Site Manager to be certain that:

(i) the ditches are cleared of excessive debris, weed, and wild growth;

(ii) the ditches are not being restricted by the depositing of waste materials, building of unauthorized structures, or other encroachments;

(iii) banks are not being damaged by rain or wave wash and that no sloughing of banks has occurred.

(b) Steps should be taken to correct conditions disclosed by such inspections.

e. Pump Station.

(1) Operation. To inundate the WMUs, the pump must be activated manually. The pump also must be deactivated manually once the desired interior water elevations are achieved. Pumping to maintain interior elevations during WMU operation also will be by manual activation/deactivation. To recover a 0.5-foot drop in interior water level, approximately 5 days of pumping will be required. Once initial flooding is completed (by November 1), total water level drops during the impoundment period (November through February) due to seepage, infiltration, and evaporation are not expected to exceed 0.5 foot. The pump station and water control structures are equipped with staff gages to easily determine water levels in the WMUs.

(2) Maintenance. Pump station inspections should be performed by the Site Manager. Steps should be taken to correct adverse conditions disclosed by such inspections. The pump station inspection should include the following:

(a) Structure. Visually inspect all structural surfaces to discover any adverse conditions such as cracks, excessive corrosion, etc., of the concrete slab, steel sheet piling and elevated control platform. Conditions that may affect the integrity of the structure should be corrected as soon as practicable.

(b) Controls. All electrical controls and associated wiring should be examined closely and their overall condition assessed. Watertight connections should be

inspected for integrity. Any corroded, loose, or broken contacts should be cleaned tightened, and repaired as needed.

(c) Pump.

- (i) Pump should be observed for indications of improper operation or damage. Avoid operation of pump during sump cavitation or ice conditions. The pump will automatically shut down through the control and status unit located in the electrical panel on high stator winding temperature, stator casing leakage, or high lower bearing temperature. Periodically check the sump for proper water depth, especially prior to extended operation. Mud in the sump may be a cause for cavitation during operation.
- (ii) Site Manager should have an authorized representative conduct pump inspections and maintenance and repair work in accordance with, "Flygt PL-7050 Installation, Care, and Maintenance Manual." Ancillary equipment such as cables, level sensors, starter and monitoring equipment should also be periodically inspected. Damaged components should be repaired or replaced by a qualified mechanic or electrician.

(d) Trash Racks. Site Manager should check for trash accumulation at racks and clear as necessary. Should operating conditions or observations indicate trouble is developing and operating conditions will permit, inspections should be performed to investigate general condition.

(e) Sump. Site Manager should check for sedimentation in the sump of the pump station. Accumulated sediments in the sump may interfere with the proper operation of the pump and should be cleaned out prior to use of the pump.

f. Tree Planting.

(1) Operation. Specific operation requirements will be performed as determined by the Site Manager. Survival and growth of planted trees will be monitored by the Rock Island District for 5 years by periodically inspecting the planting sites. Remedial actions shall be taken by the Site Manager as necessary to ensure tree survival. The Site Manager should keep records of maintenance mowing, herbicide application, as well as record of inspections and any corrective actions taken to ensure survival. These records should be kept for a minimum of 5 years.

(2) Maintenance. Vegetation between planted trees should be controlled for a minimum of 2 growing seasons by either mowing or herbicide application. Vegetation between the planted rows should not be allowed to exceed a height of 1 foot during this maintenance period.

6. PERFORMANCE MONITORING AND ASSESSMENT.

a. General. The purpose of this section is to summarize monitoring and data collection aspects of the project. Table 6.1 presents the principal types, purposes and responsibility of monitoring and data collection. Table 6.2 summarizes actual monitoring and data parameters grouped by project phase, responsible agency, and data collection intervals. Changes to the monitoring plan should be coordinated with the USFWS, the MDOC, and the Corps of Engineers.

b. Post-Construction. Table 6.3 presents the post-construction evaluation plan. The monitoring parameters were developed to measure the effectiveness of the stated goals. The Site Manager should follow Table 6.3, as shown, to make annual field observations. These observations are summarized in checklist form in Appendix B. The annual field observations and the quantitative monitoring parameters will form the basis of project evaluation.

TABLE 6.1
MONITORING AND PERFORMANCE EVALUATION PLAN

Type of Activity	Purpose	Responsibility	Instructions
Pre-Project Monitoring	Establish need of proposed project features	Sponsor	--
Baseline Monitoring and Data Collection for Design	Establish baseline monitoring consistent with goals and objectives and meet specific requirements	Corps of Engineers	See plates 25 and 26
Construction Monitoring	Continue monitoring, assess construction impacts, and meet permit requirements	Corps of Engineers	Included in construction contract documents
Performance Evaluation Monitoring	Continue monitoring and assess performance of project relative to goal and objectives	Sponsor (field observations)	Table 6.2
		Corps of Engineers (quantitative)	Table 6.3
Analysis of Biological Responses	Evaluate predictions and assumptions made during initial WHAG analysis	USFWS	1/

1/ Annual waterfowl census data will be obtained from the USFWS to determine waterfowl response to the project.

TABLE 6.2
ANNUAL POST-CONSTRUCTION FIELD OBSERVATIONS ^{1/}

Goals	Objective	Unit of Measure	Enhancement Feature	Field Observation
Enhance Wetland Habitat for Migratory Waterfowl	Provide controlled water levels during waterfowl migration - forested and non-forested	Acres	Wetland Management Units - forested and non-forested	Presence of waterfowl
	Increase mast tree dominance - forested wetland	Acres	Mast tree plantings	Survival of plantings
	Increase total wetland values for migratory waterfowl	Habitat Suitability Indices & Habitat Units	All	Annual presence of waterfowl

^{1/} To be submitted to the Corps of Engineers by the USFWS with annual management report for Cooperative Agreement Lands.

TABLE 6.3
POST-CONSTRUCTION QUANTITATIVE MEASUREMENTS

Goals	Objective	Unit of Measure	Enhancement Feature	Monitoring Plan	Monitoring Intervals (years)
Enhance Wetland Habitat for Migratory Waterfowl	Provide controlled water levels during waterfowl migration - forested and non-forested	Acres	Wetland Management Units - forested and non-forested	Perform Areal Surveys	5 ^{1/}
	Increase mast tree dominance - forested wetland	Acres	Mast tree plantings	Timber Inventory	10
	Increase total wetland values for migratory waterfowl	Habitat Suitability Indices & Habitat Units	All	WHAG analysis	1, 15, 50

^{1/} First monitoring activity to occur in the first year after construction.

APPENDIX A

OPERATION, MAINTENANCE AND REHABILITATION AGREEMENT

REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING—P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

MEMORANDUM OF AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE UNITED STATES FISH AND WILDLIFE SERVICE

SUBJECT: Enhancing Fish and Wildlife Resources of the Upper Mississippi River System at Bay Island, Missouri

I. PURPOSE

The purpose of this Memorandum of Agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the Department of the Army (DA) and the U.S. Fish and Wildlife Service (USFWS) will operate in constructing, operating, maintaining, and rehabilitating the Bay Island, Missouri, separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

The project lands of the Bay Island, Missouri, separable element are managed under a cooperative agreement between the Department of the Interior, USFWS, and the U.S. Army Corps of Engineers, dated February 14, 1963. Subsequently, management of these project lands has been assumed by the Missouri Department of Conservation (MDOC) under a successive cooperative agreement between the USFWS and the MDOC.

II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features on the Bay Island, Missouri, are 100 percent Federal, and all operation, maintenance, repair, and rehabilitation costs are to be cost shared, 75 percent Federal and 25 percent non-Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of creating a reliable food supply for migratory water fowl; providing water level control on 400 acres of wetland; and providing 30 acres of mast tree dominance at Bay Island, Missouri.

IV. RESPONSIBILITIES

A. The DA is responsible for:

1. **Construction:** Construction of the project which consists of creating a reliable food supply for wetland dependent species, including migratory waterfowl; providing water level control on 400 acres of wetland; and providing 30 acres of mast tree dominance at Bay Island, Missouri.

2. **Major Rehabilitation:** Any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. **Construction Management:** Subject to and using funds appropriated by the Congress of the United States, the DA will construct the Bay Island, Missouri, Fish and Wildlife Enhancement project as described in the Definite Project Report, *Bay Island Refuge Rehabilitation and Enhancement*, dated March 1990, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If the DA encounters potential delays related to construction of the project, the DA will promptly notify the USFWS of such delays.

4. **Maintenance of Records:** The DA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. The DA shall maintain such books, records, documents, and other evidence for a minimum of 3 years after completion of construction of the project and resolution of all relevant claims arising therefrom, and shall make available at its offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the USFWS.

B. The USFWS is responsible for:

1. **Operation, Maintenance, and Repair:** Upon completion of construction as determined by the District Engineer, Rock Island, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report, *Bay Island Refuge Rehabilitation and Enhancement*, dated March 1990, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

2. **Non-Federal Responsibilities:** In accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662, the USFWS shall obtain 25 percent of all costs associated with the operation, maintenance, and repair of the project from the MDOC.

V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of construction of the project.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties:

USFWS: Regional Director
U.S. Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

DA: District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building - P.O. Box 2004
Rock Island, Illinois 61204-2004


EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

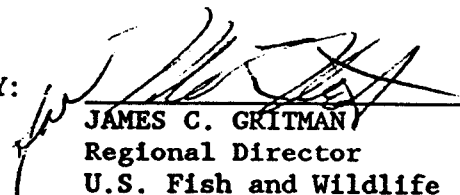
THE DEPARTMENT OF THE ARMY

THE U.S. FISH AND WILDLIFE SERVICE

BY:


JOHN R. BROWN
Colonel, U.S. Army
District Engineer

BY:


JAMES C. GRITMAN
Regional Director
U.S. Fish and Wildlife
Service
DEC 12 1990

DATE:

10 January 1991

DATE:

APPENDIX B

SITE MANAGER'S

PROJECT INSPECTION AND MONITORING RESULTS

**BAY ISLAND REHABILITATION AND ENHANCEMENT
OPERATION AND MAINTENANCE MANUAL**

**UPPER MISSISSIPPI RIVER ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 22, RIVER MILES 311 THROUGH 312
MARION COUNTY, MISSOURI**

SITE MANAGER'S PROJECT INSPECTION AND MONITORING RESULTS

Inspected By _____ Date _____

Type of Inspection: () annual () emergency-disaster () other

1. PROJECT INSPECTION.

<u>Item</u>	<u>Condition</u>
a. <u>Perimeter Levee</u>	
() Settlement, sloughs or loss of section	_____
() Wavewash, scouring	_____
() Overtopping erosion	_____
() Vegetative cover (mowing)	_____
() Burrowing animals	_____
() Unauthorized grazing or traffic	_____
() Encroachments	_____
() Unfavorable tree/shrub growth	_____
b. <u>Intermediate Levee</u>	
() Settlement, sloughs or loss of section	_____
() Wavewash, scouring	_____
() Overtopping erosion	_____
() Vegetative cover (mowing)	_____
() Burrowing animals	_____
() Unauthorized grazing or traffic	_____
() Encroachments	_____
() Unfavorable tree/shrub growth	_____
c. <u>Water Control Structure - North Perimeter Levee</u>	
() Stoplogs, stoplog keepers, stoplog slots	_____
() Concrete	_____
() Steel rails, rail posts, grating, fasteners	_____
() Displaced/missing riprap	_____
() Inlet and outlet channels	_____
() Erosion adjacent to structure	_____
() Sedimentation (culverts/approaches)	_____

<u>Item</u>	<u>Condition</u>
d. <u>Water Control Structure - South Perimeter Levee</u>	
() Stoplogs, stoplog keepers, stoplog slots	_____
() Concrete	_____
() Steel rails, rail posts, grating, fasteners	_____
() Displaced/missing riprap	_____
() Inlet and outlet channels	_____
() Erosion adjacent to structure	_____
() Sedimentation (culverts/approaches)	_____
e. <u>Water Control Structure - Intermediate Levee</u>	
() Stoplogs, stoplog keepers, stoplog slots	_____
() Concrete	_____
() Steel rails, rail posts, grating, fasteners	_____
() Displaced/missing riprap	_____
() Inlet and outlet channels	_____
() Erosion adjacent to structure	_____
() Sedimentation (culverts/approaches)	_____
f. <u>Flood/Drainage Ditch</u>	
() Debris	_____
() Unauthorized structures	_____
() Bank erosion	_____
g. <u>Pump Station</u>	
() Structure - steel	_____
() Structure - concrete	_____
() Structure - wood	_____
() Displaced/missing riprap	_____
() Electrical controls	_____
() Steel discharge pipe/flapgate	_____
() Forebay/sump (sedimentation)	_____
h. <u>Vegetation</u>	
() Mast Trees	_____
() Seeding	_____
i. <u>Access</u>	
() Bridge	_____
() Road - granular surfacing, etc.	_____
() Piers - riprap	_____

2. COMMENTS.

Site Manager

APPENDIX C
DISTRIBUTION LIST

DISTRIBUTION:

Mr. Rick Nelson
U.S. Fish and Wildlife Service
4469 48th Avenue Court
Rock Island, Illinois 61201

Mr. Robert H. Stratton
U.S. Fish and Wildlife Service
Mark Twain National Wildlife Refuge
1704 N. 24th Street
Quincy, Illinois 62301

Regional Director
U.S. Fish and Wildlife Service, Region 3
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Mr. Gordon Farabee
Missouri Department of Conservation
Box 180
Jefferson, Missouri 65102

Mr. Norman Stucky
Missouri Department of Conservation
P.O. Box 180
Jefferson City, Missouri 65102

Mr. Jack Boyles
Missouri Department of Conservation
Mississippi River District Office
Box 428
Hannibal, Missouri 63401

Mr. Ken Dalrymple
Missouri Department of Conservation
Upper Mississippi Wildlife Area
Box 201
Elsberry, Missouri 63343

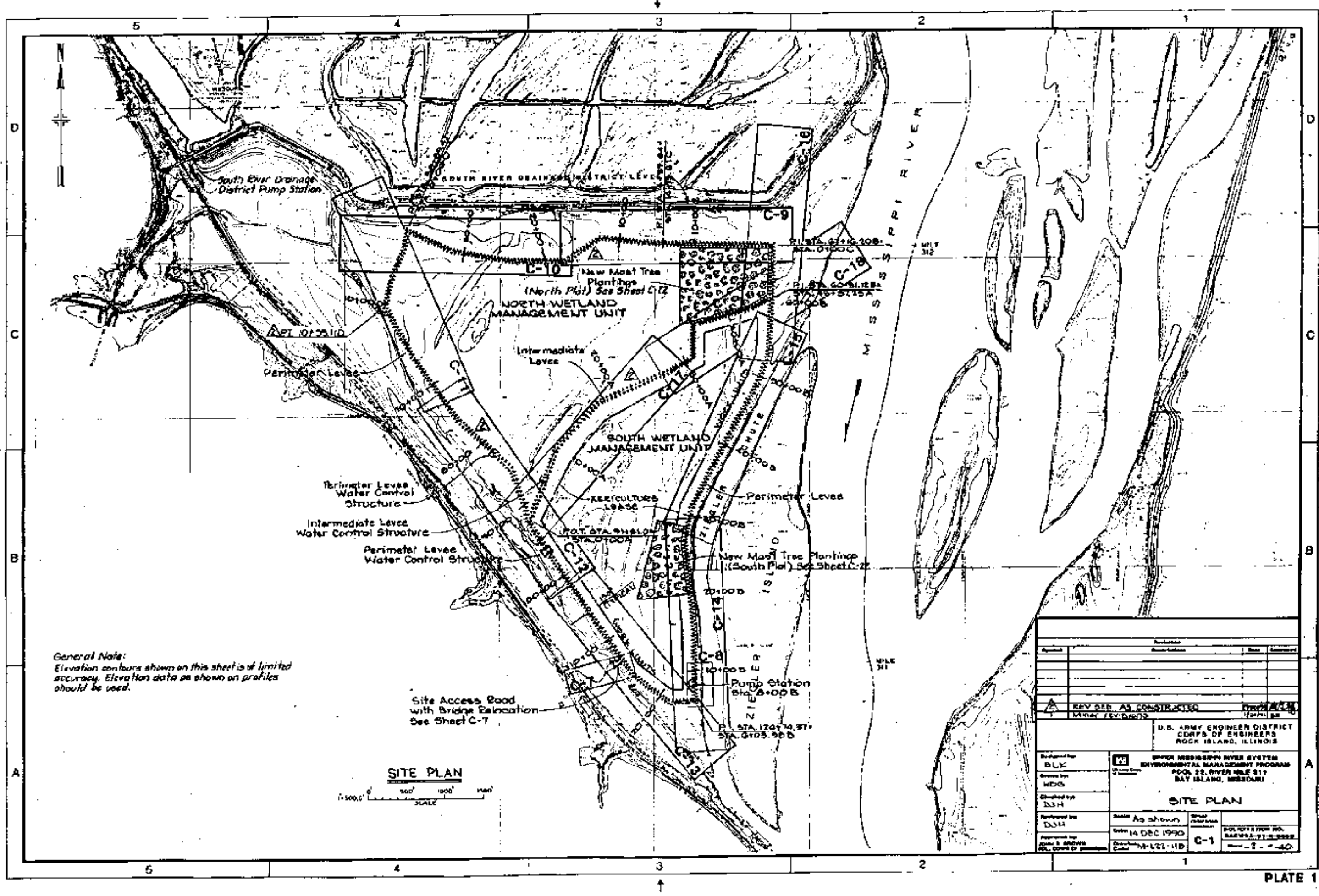
Mr. Art Suchland
Missouri Department of Conservation
Hannibal Forest District
Tower Plaza
655 Clinic Road, Box 324
Hannibal, Missouri 63401

Division Engineer
U.S. Army Engineer Division, North Central
ATTN: CENCD-PD/CENCD-CO
111 North Canal
Chicago, Illinois 60606

District Engineer
U.S. Army Engineer District, Rock Island
Clock Tower Building
P.O. Box 2004
Rock Island, Illinois 61204-2004

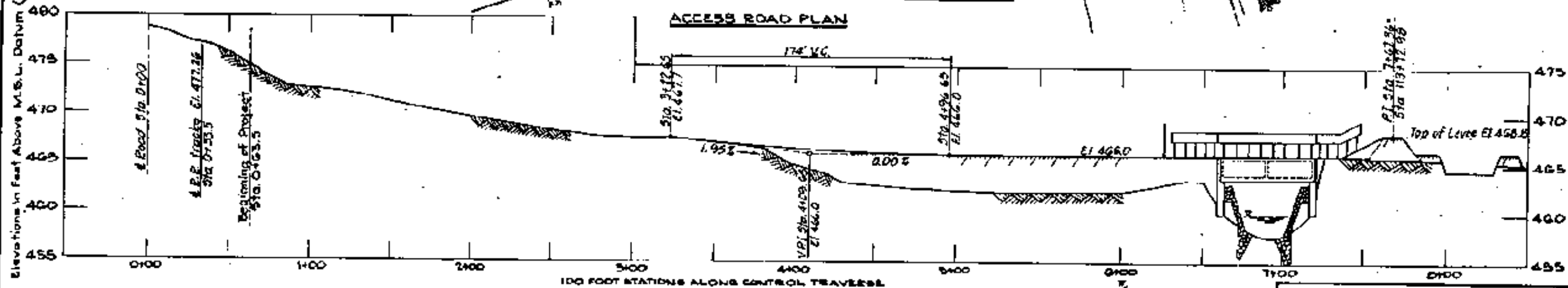
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CENCR-ED-DN (3) CENCR-OD-S
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CENCR-ED-H CENCR-PD-W
CENCR-CD

PLATES



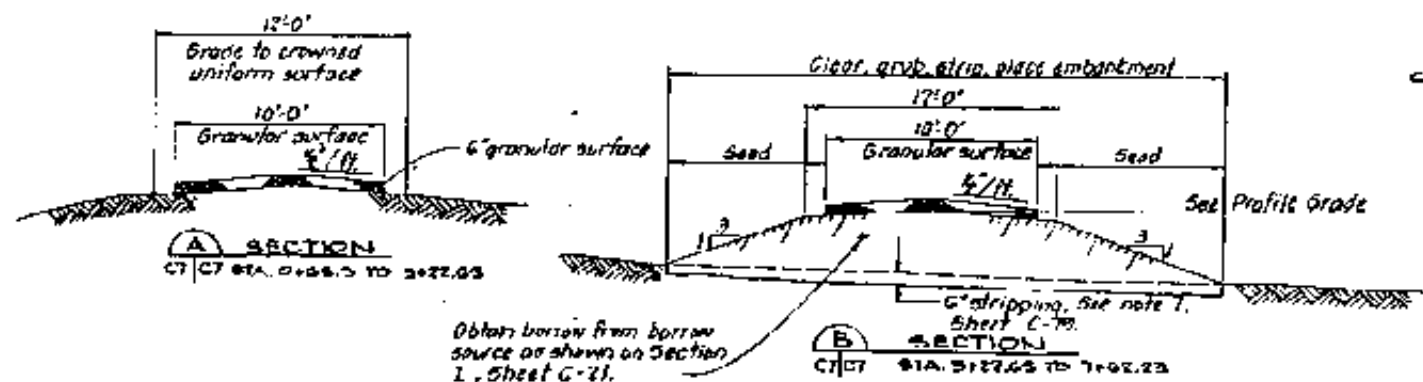
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Reviewed by DSH		Scale As shown	Sheet C-1
Approved by [Signature] Date 14 DEC 1990		Order 14 DEC 1990	Project C-1

Elevations in Feet Above M.S.L. Datum (1912 AD)



ACCESS ROAD PLAN

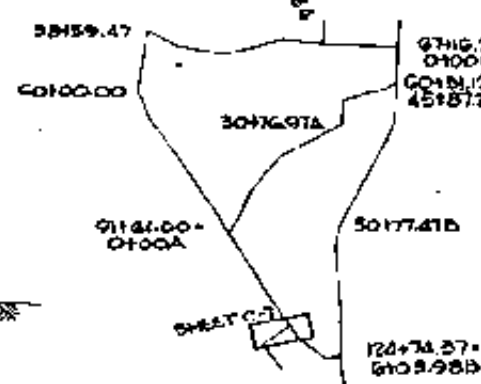
PROFILE



Field Book:
FC-90-9 pgs. G-7, Traverse
FC-90-9 pgs. D-11, "X" Sections & Profile

Obtain borrow from borrow
source as shown on Section
1, Sheet C-21.

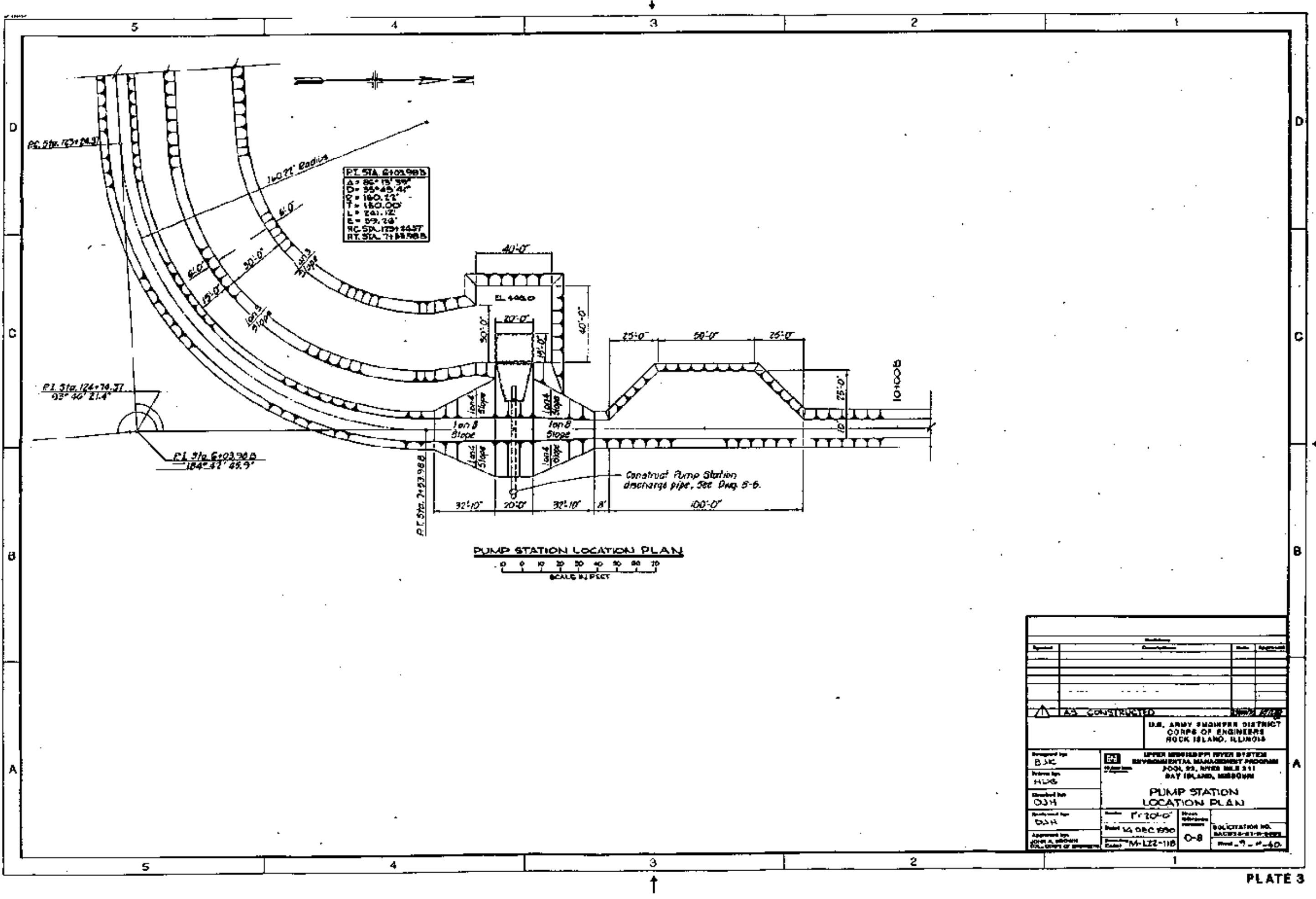
Obtain borrow from borrow
source as shown on Section
1, Sheet C-21.



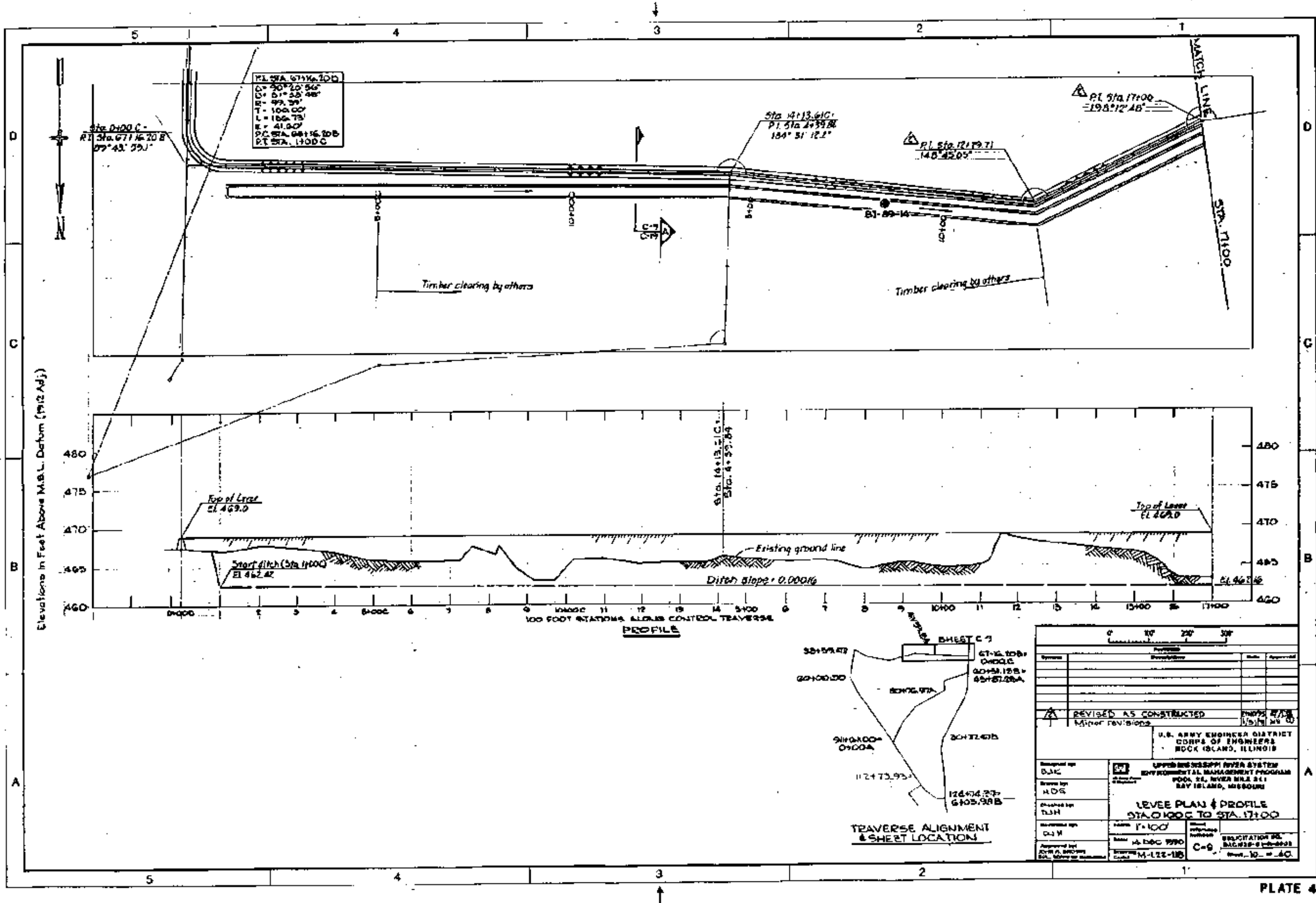
TRAVERSE ALIGNMENT
& SHEET LOCATION

- Existing Bridge Removal**
1. Contractor shall remove the existing bridge consisting of:
- 12' x 13' wood decking
- 12' depths 10' flange steel & concrete beams
- 6' x 3' foundation support posts with intermediate steel stringers
 2. Concrete bridge abutments may remain.
 3. Do not remove bridge until new bridge is complete.

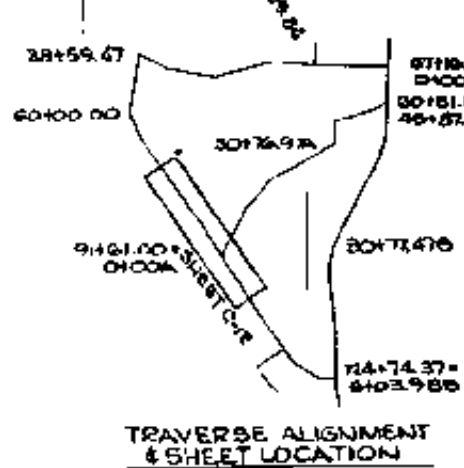
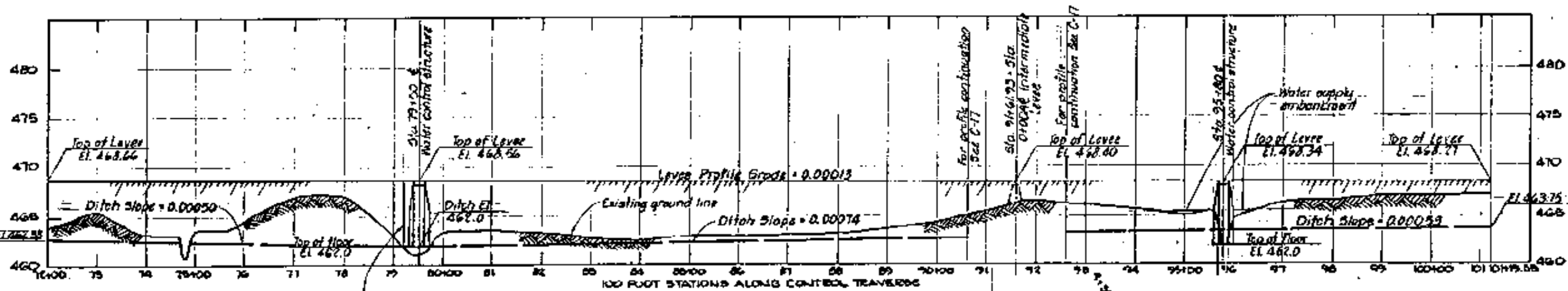
REVISIONS No. Description Date 1 REVISED AS CONSTRUCTED 12/21/84	
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Designed by BIC Drawn by MDG Checked by DJH Reviewed by DJH	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 28, RIVER MILE 331 BAT ISLAND, MISSOURI ACCESS ROAD PLAN AND PROFILE Scale 1" = 30'-0" Date 14 DEC 1990 Project M-LT-110 Sheet C-7
Approved by Date 8 APR 1991 For, Corps of Engineers	SECRETARY'S NO. 100-1-1-40



U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	
Prepared by BJC	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM P.O. 22, RIVER MILE 211 RAY ISLAND, MISSOURI
Reviewed by HUG	PUMP STATION LOCATION PLAN
Checked by OJH	Date: 12 DEC 1990
Drawn by OJH	Sheet: 1 of 1
Approved by JOHN A. BROWN Civil Engineer	Solicitation No. WACGS-81-1-2222 Sheet 1 of 1

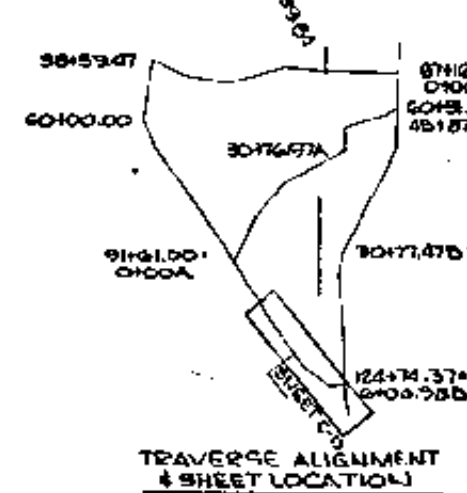
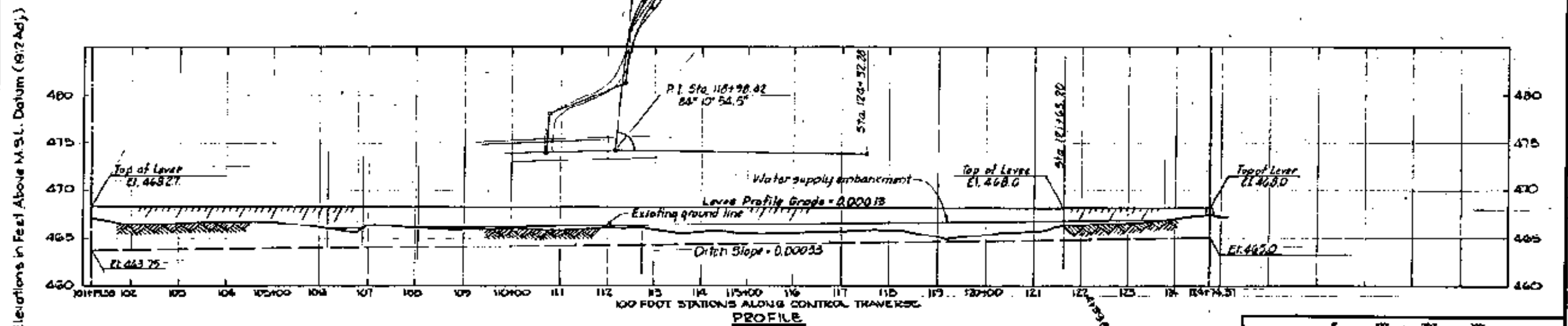
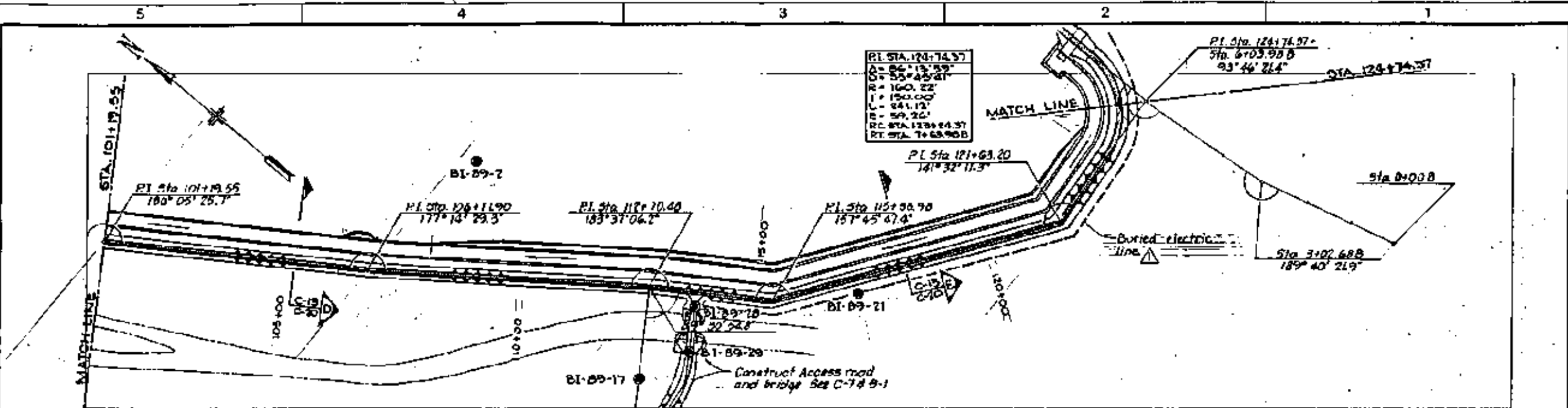


Elevations in Feet Above M.S.L. Datum (1922 Adj.)

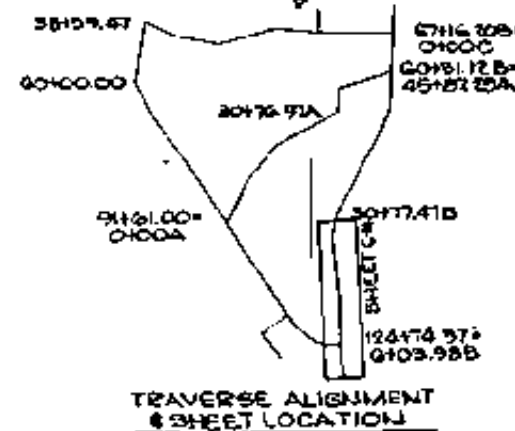
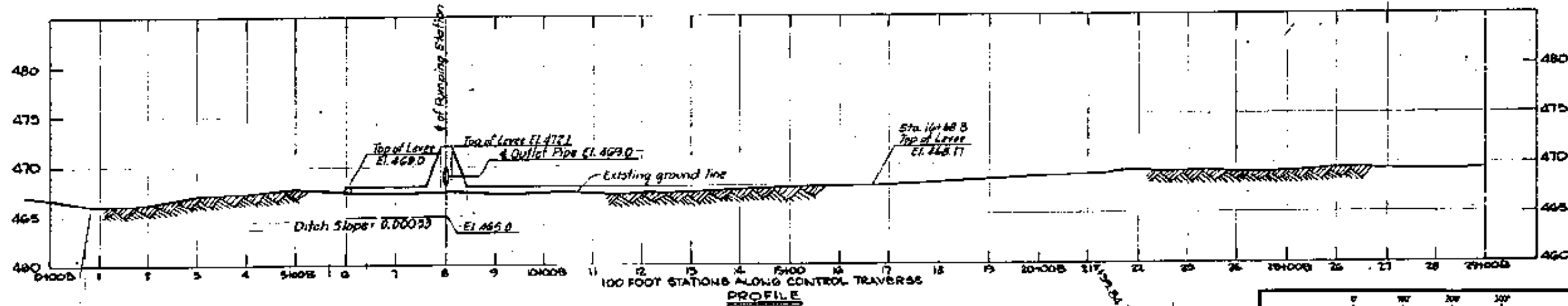


REVISIONS			
No.	Description	Date	By
1	REVISED AS CONSTRUCTED	10/1/78	WJH
2	Minor revisions	10/1/78	WJH

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	
Designed by RJK Drawn by HDS Checked by DJH Reviewed by DJH Approved by J. W. B. (Signature) Major, Corps of Engineers	UPPER MISSOURI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 23, RIVER MILE 211 BAY ISLAND, MISSOURI LEVEE PLAN & PROFILE STA. 72+00 TO STA. 101+55 Scale 1"=100' Date 4.000.1990 Drawing No. M-LT2-118 Sheet 13 of 40

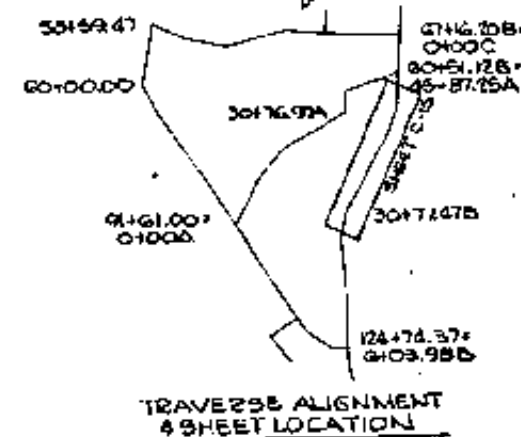
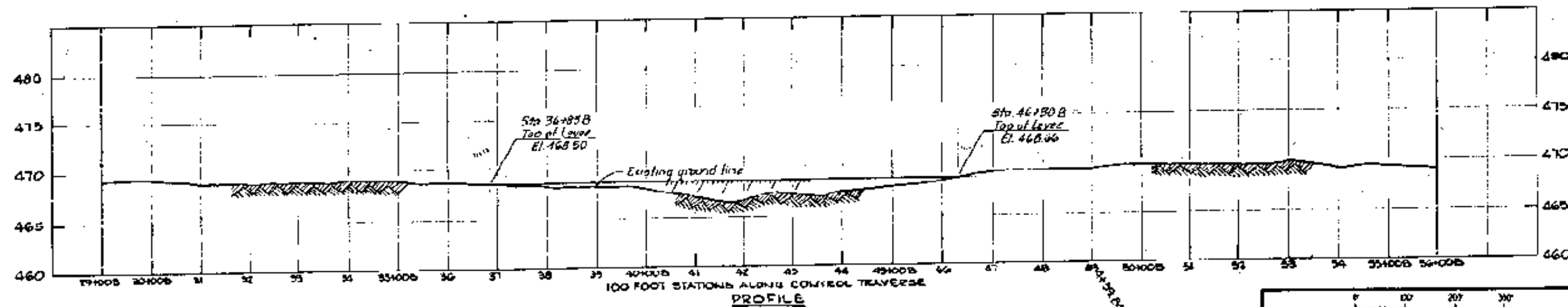
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Elevations in Feet Above M.S.L. Datum (1912 Adj.)

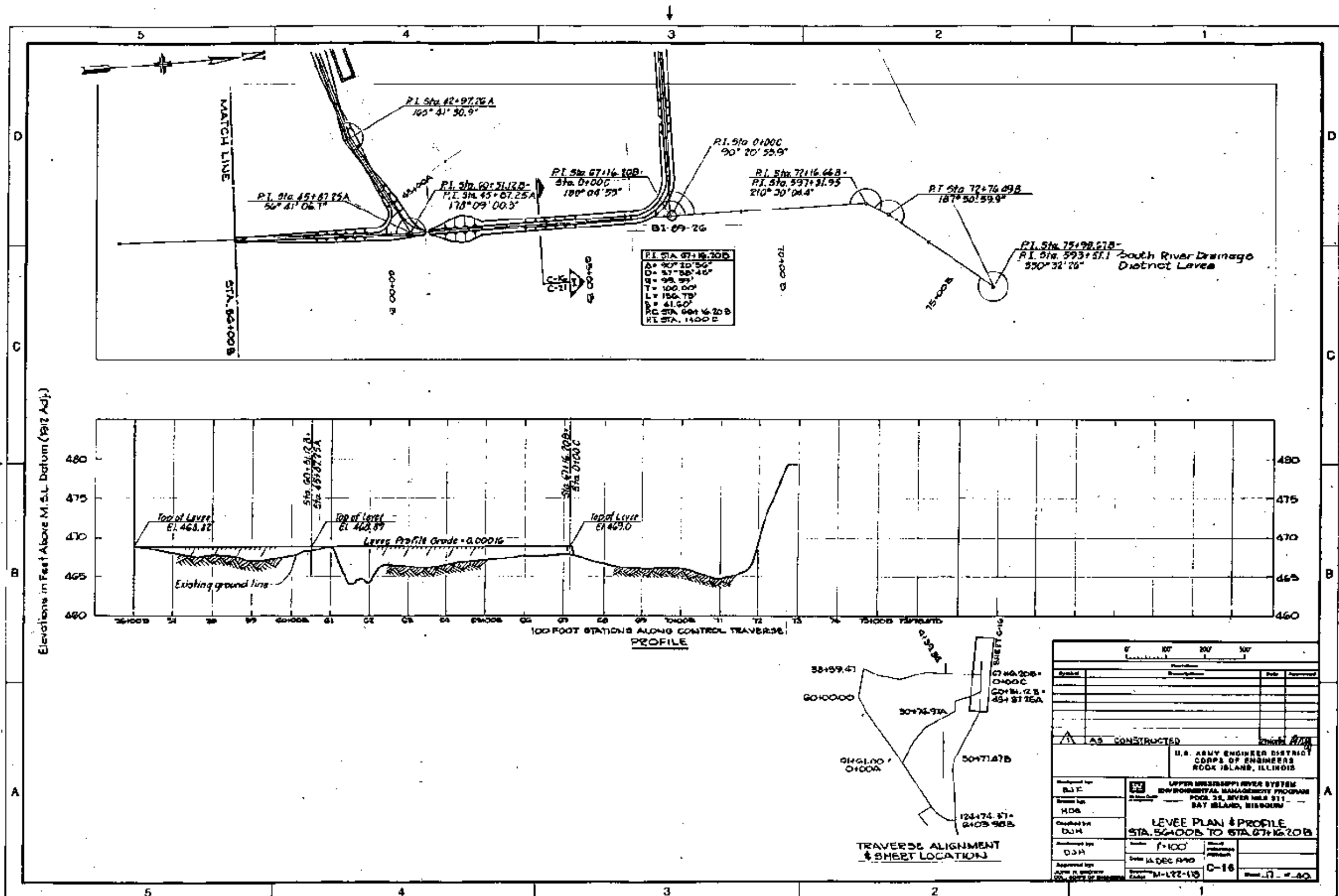


REVISIONS		APPROVALS	
Symbol	Description	Date	Approval
REVISIONS AS CONSTRUCTED			
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by B.J.K.	Checked by D.J.H.	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 22, RIVER MILE 331 RAY ISLAND, MISSOURI	
LEVEE PLAN & PROFILE STA. 0+000 TO STA. 28+000		SCALE: 1" = 100' DATE: 14 DEC 1950 DRAWN BY: M.L.T. (115)	
APPROVED BY: [Signature]		SOLICITATION NO. 50000-91-2-0000	

Elevations in feet Above M.S.L. Datum (1922 Adj.)



Scale 1" = 100'	
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 22, RIVER MILE 311 BAY ISLAND, MISSOURI	
LEVEE PLAN & PROFILE STA. 29+00.00 TO STA. 56+00.00	
Design by BJC	Check by HOG
Drawn by D-JH	Reviewed by D-JH
Approved by JON H. BROWN Major, Corps of Engineers	Date 11-22-10
Revision C-15	Revision 15-03



Elevations in Feet Above M.S.L. Datum (1912 Adj.)

Symbol	Description	Date	Approved
AS CONSTRUCTED			

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POSS. 25, RIVER MILE 511
BAY ISLAND, MISSOURI

LEVEE PLAN & PROFILE
STA. 54+00.00 TO STA. 76+00.00

Scale: 1"=100'

Date: 14 DEC 1990

Sheet: C-16

Project: M-122-118

Drawn: J. H. H. H.

Checked: J. H. H. H.

Approved: J. H. H. H.

WETLAND MANAGEMENT UNIT

CLEAR, GRUB, STRIP, PLACE EMBANKMENT, & SEED

CLEAR, GRUB, STRIP, EXCAVATE & SEED

6' Control line

EXCAVATE AS BORROW AND PLACE FOR EMBANKMENT

MINIMUM DEPTH VARIES, SEE DITCH PROFILE

(A) SECTION - PERIMETER LEVEL
STA. 0+00 TO STA. 2+00

WETLAND MANAGEMENT UNIT

CLEAR, GRUB, STRIP, EXCAVATE & SEED

CLEAR, GRUB, STRIP, PLACE EMBANKMENT, AND SEED

EXCAVATE AS BORROW AND PLACE FOR EMBANKMENT

MINIMUM DEPTH VARIES, SEE LEVEE PROFILE

ELEV. VARIES, SEE LEVEE PROFILE

(B) SECTION - PERIMETER LEVEL
C-10 C-19 STA. 20+00 TO STA. 0+00
C-11 STA. 0+00 TO STA. 11+56.95 & 0+00
C-12 STA. 00+00 TO STA. 19+25

WETLAND MANAGEMENT UNIT

6' Control line
CLEAR, GRUB, STRIP, PLACE EMBANKMENT & SEED

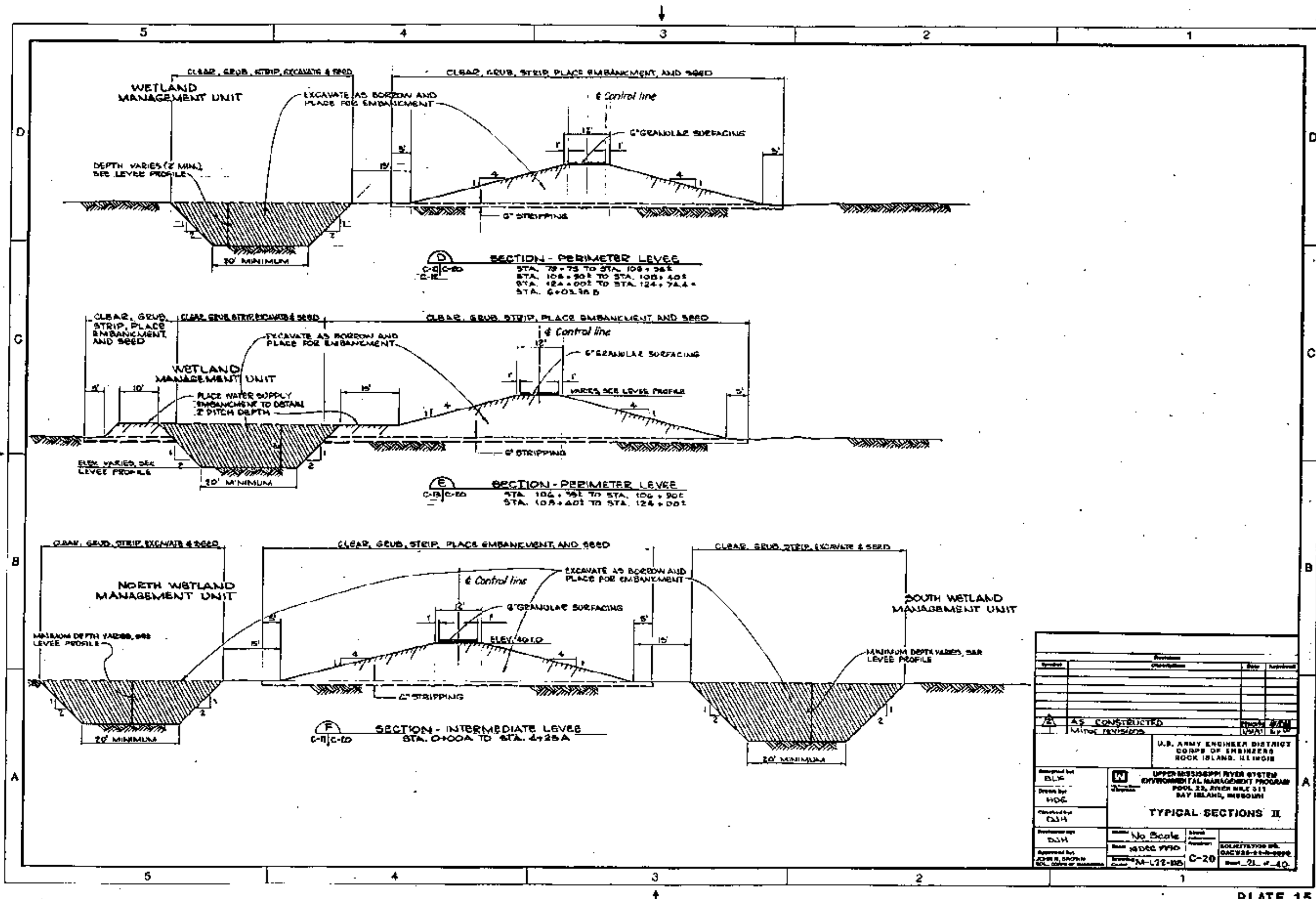
Obtain borrow from borrow source shown on Section A or B, this sheet or from Section I, Sheet C-21.

(C) SECTION - PERIMETER LEVEL
C-10 C-19 STA. 21+00 TO STA. 20+00

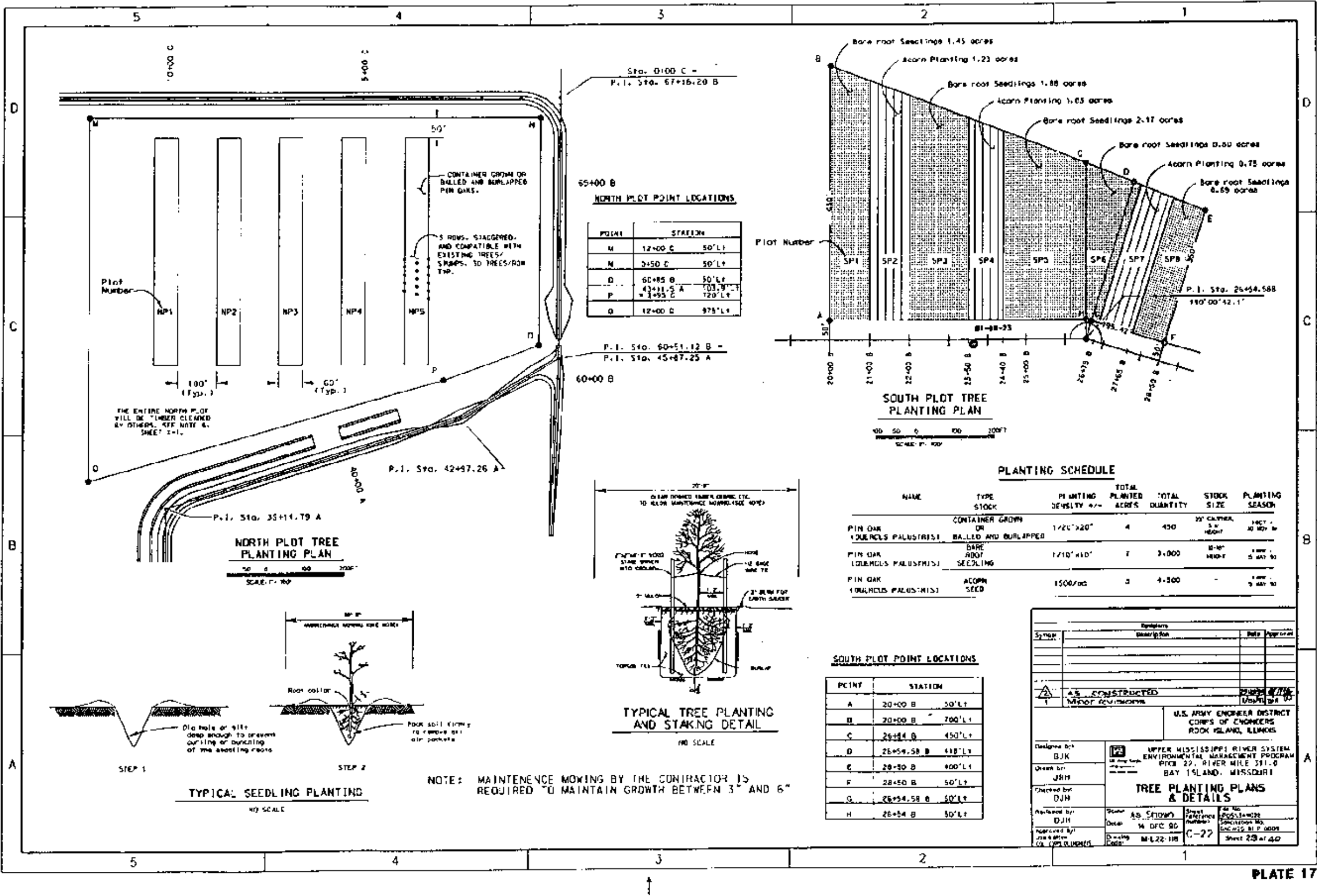
General Site Work Notes:

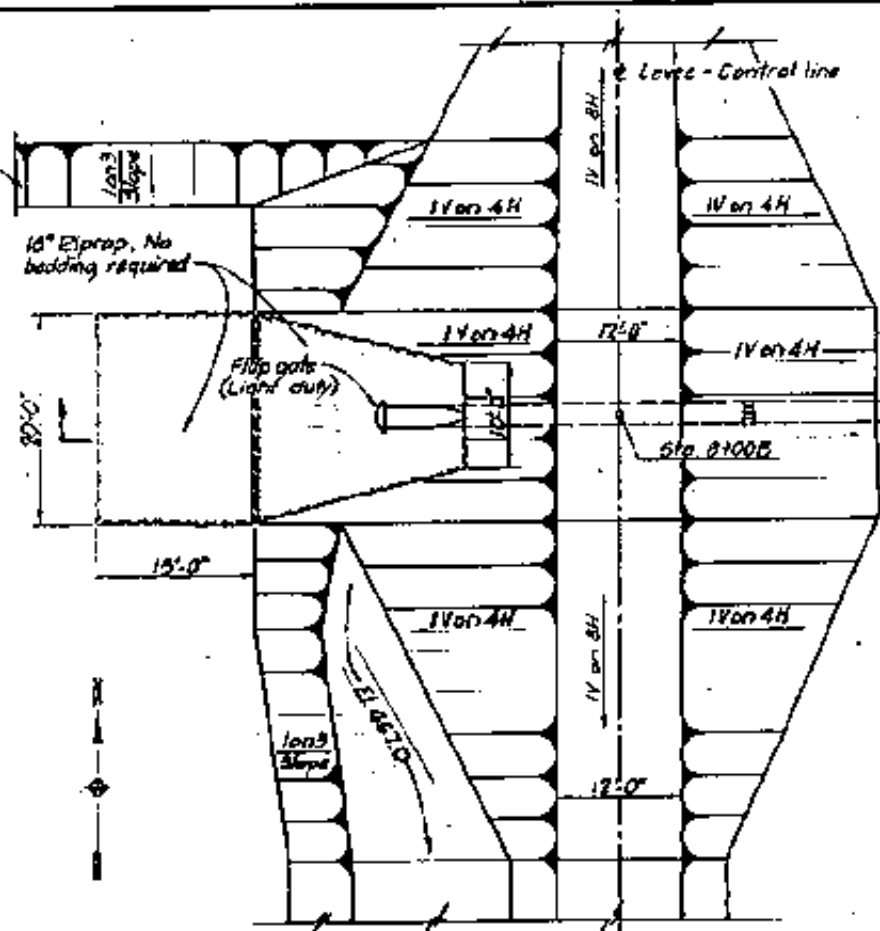
1. Final ditch widths and depths will be determined by embankment quantity, minimum widths and depths shown are required. Maximum depth of excavation is limited when sand layers/lenses are located. A minimum 2' clay layer above any sand layers/lenses shall remain undisturbed for excavations exceeding the minimum depth.
2. When additional borrow is needed (to meet adjacent embankment requirements) which exceeds the borrow minimum excavation widths and depths, priority of additional borrow shall be given to additional depth over width, consistent with Note #1 restrictions.
3. Should additional timber clearing width be required to meet adjacent embankment requirements consistent with notes #1 and #2, the CDE shall be notified for additional clearing pay item measurement purposes.
4. Should additional excavation be required to meet minimum widths and depths after adjacent embankment quantities are notified, the CDE shall be notified for excess excavation pay item purposes. Excess excavation shall be placed near Station 9+61 as shown on Sht C-12, with same 4:1 side slopes.
5. All adjacent borrow ditches are to be seeded above flat pool 61.459.5.
6. See Sheets C-9 thru C-18 for limits of timber clearing by others. See Note C, Sheet X-1 for clearing scope.
7. Stripping material shall be replaced on the laws at the same levee side slopes in a uniform manner after complete embankment placement and prior to seeding.

Project		Date	Revised
Description			
AS CONSTRUCTED		DATE	BY
MINOR REVISIONS			
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by BLK		Upper Mississippi River System Environmental Management Program Pool 24, River Mile 219 Key Island, Missouri	
Drawn by HOS		TYPICAL SECTIONS I	
Checked by DSH		No Scale	
Reviewed by DSH		Date: 10 DEC 1970	
Approved by JAMES H. BRIDGES COL, Corps of Engineers		SOLICITATION NO. SACW28-81-1-0001	
		C-19	

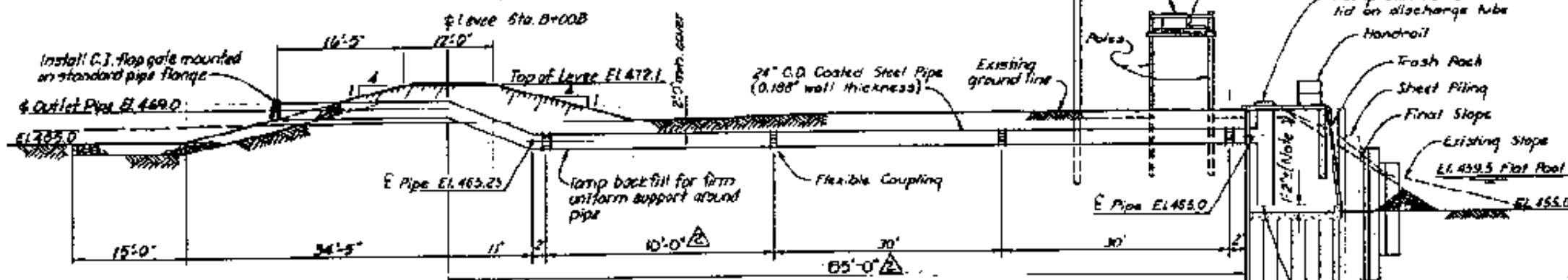


Proposed Construction		Date Approved
AS CONSTRUCTED MINOR REVISIONS		Date Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS		
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 23, RIVER MILE 511 BAY ISLAND, MISSOURI		
TYPICAL SECTIONS II		
Designed by BLK	Drawn by HOG	Checked by GJM
Reviewed by DJH	Approved by JOHN R. BROWN COL, Corps of Engineers	Scale No Scale Date 10 DEC 1990 Drawing Code M-112-BB
SOLICITATION NO. DACW28-91-M-0094		Sheet 21 of 40

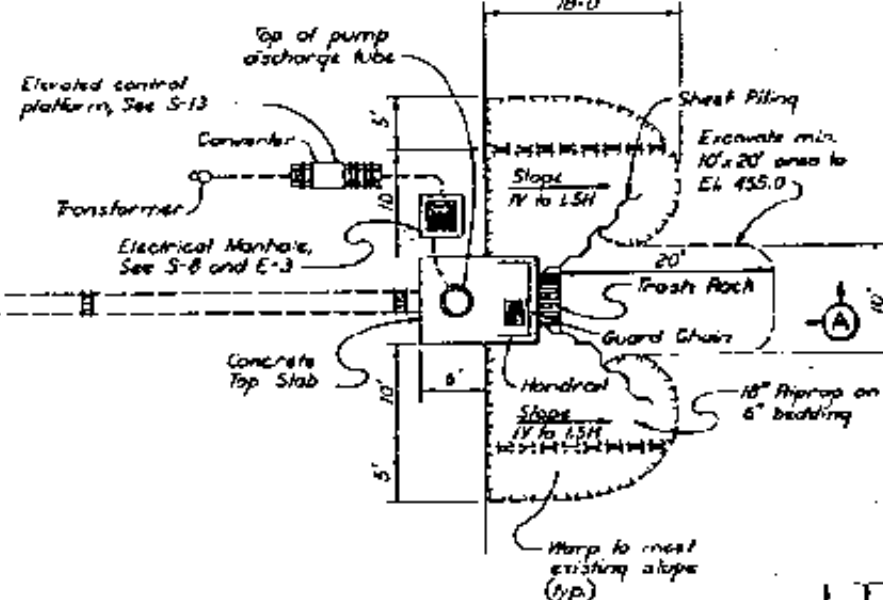




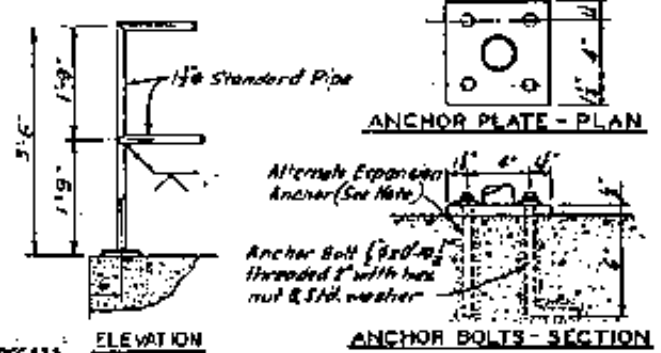
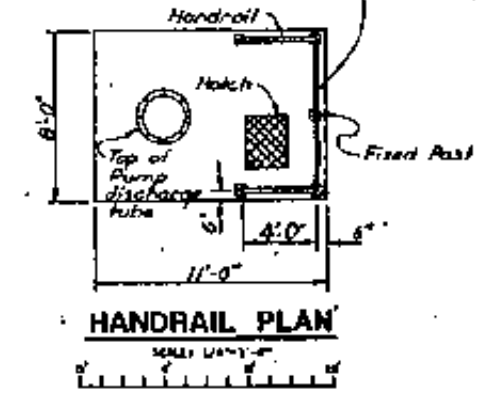
SITE PLAN
SCALE: 1/8"=1'-0"



SECTION A
SCALE: 1/8"=1'-0"



At top rail and mid-rail elevation install size 10 galvanized jack chain, each length removable at center post w/ galv utility snap.



HANDRAIL DETAILS
NO SCALE

- REVISIONS:**
1. ANCHOR BOLTS—EITHER EXPANDED BOLTS, OR BOLTS ON EXPANDED BOLTS MAY BE USED. EXPANDED BOLTS SHALL BE 1/2" INCH DIA. HAVE AT LEAST 5 INCH EXPANSION, 4000 LB. TENSILE YIELDING AND 8000 LB. TENSILE STRENGTH. ALL ANCHOR BOLTS AND NUTS SHALL BE GALVANIZED.
 2. WELD ALL PIPE JOINTS WITH SOUTHERN PIPING, 6120 SHALL BE WELD. WELDING SHALL BE DONE BY A WELDER WHO IS QUALIFIED TO WELD TO THE WELDING CODE FOR THE WELDING OF STEEL TO STEEL.
 3. HANDRAIL SHALL BE GALVANIZED AFTER INSTALLATION.

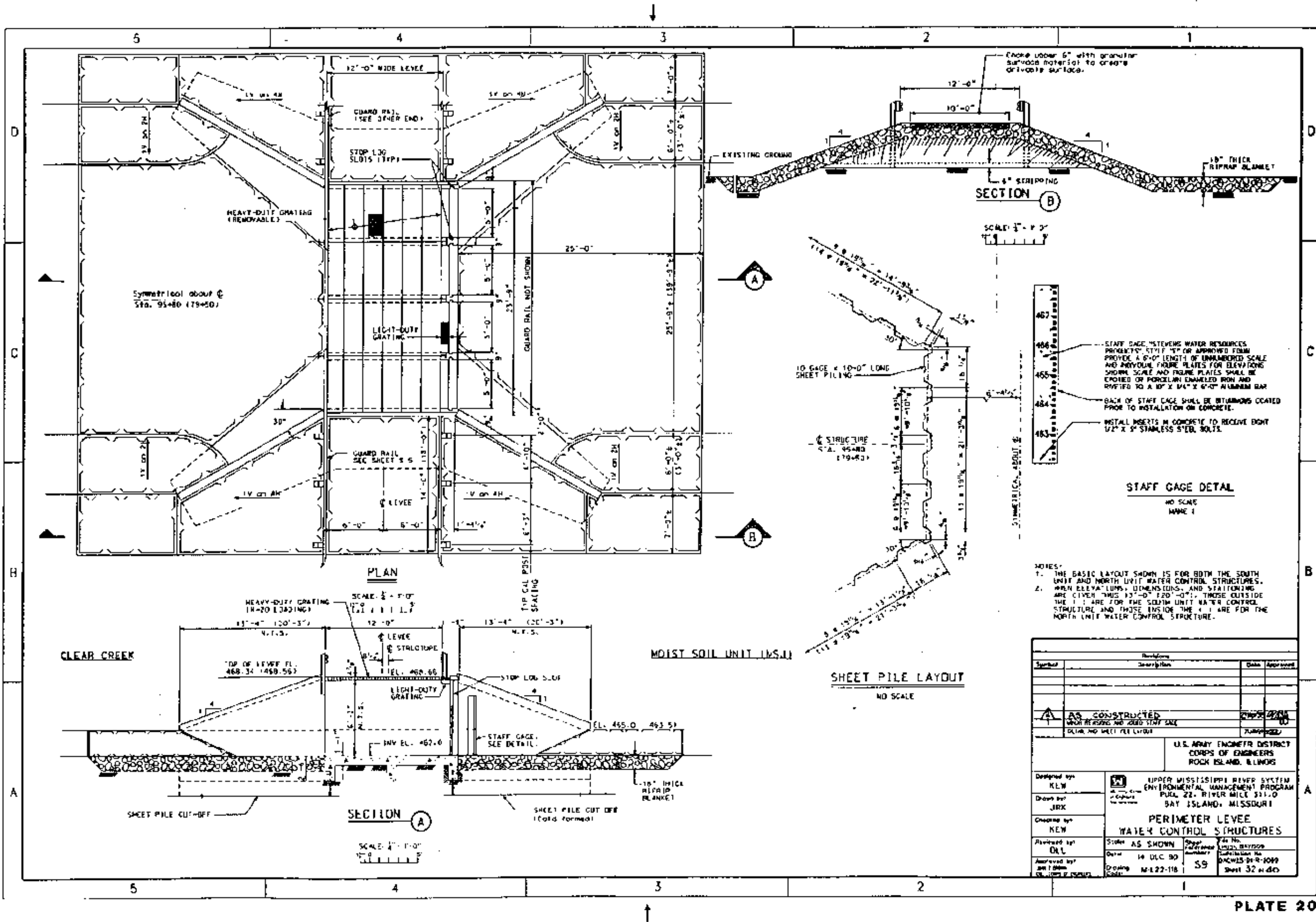
- NOTES:**
1. THE DISCHARGE TUBE, SUPPORTS, AND REDUCING FLANG OUT OF THE PUMP STATION SHALL BE FABRICATED AND INSTALLED AS RECOMMENDED BY THE PUMP MANUFACTURER.
 2. THE DISCHARGE TUBE SHALL BE PROVIDED WITH A REMOVABLE, FLANGE, AND WATERPROOF ACCESS COVER.
 3. ADJUST DISCHARGE TUBE / PUMP FLOOR CLEARANCE AS RECOMMENDED BY PUMP MANUFACTURER.
 4. GET ELECTRICAL PARTS LIST THROUGH 23 FOR TYPICAL ELECTRICAL DETAILS.

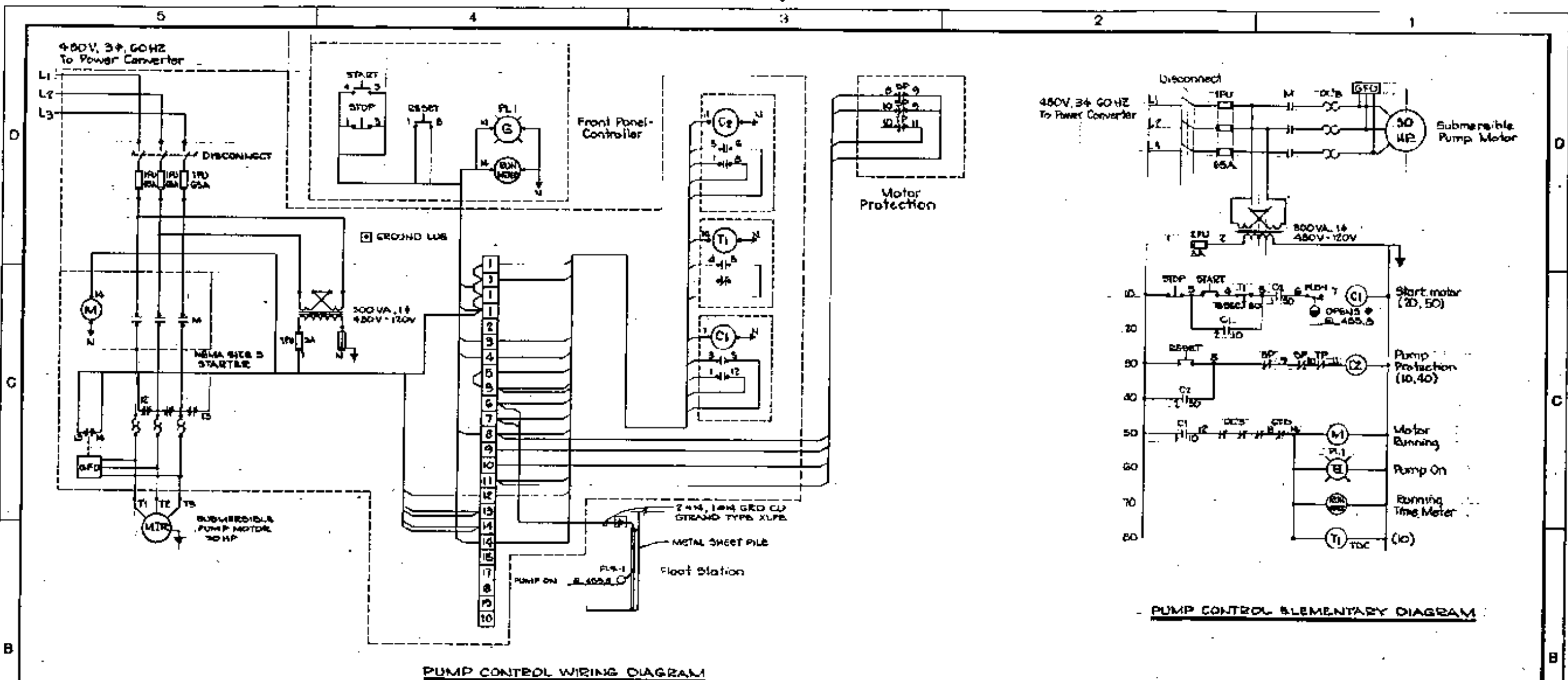
Revision	Description	Date	Approved
1	REVISION AS CONSTRUCTED	10/10/00	10/10/00

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS

Project: S.A.P.
Drawn by: D.G.P.
Checked by: D.J.H.
Reviewed by: D.J.H.
Approved by: D.J.H.

OFFICE: AD SHOWN
Date: 10/22/99
Drawing No: 10-12-118
Scale: S-6
SOLUTION NO. 10-12-118
Date: 10/22/99





PUMP CONTROL ELEMENTARY DIAGRAM

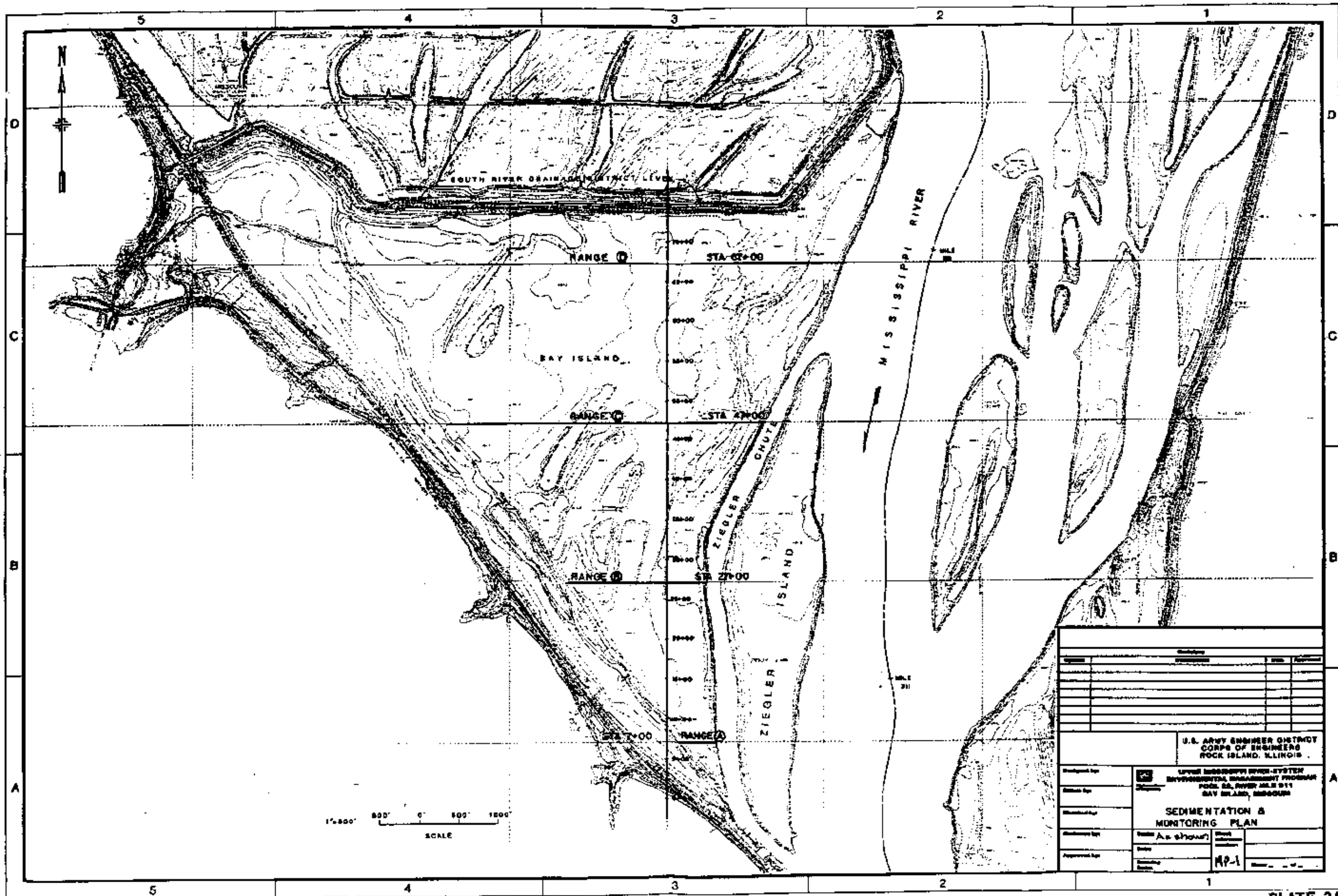
Revision		Date	Approved
1	AS CONSTRUCTED	10/1/70	
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by CJA	Drawn by HDS	Checked by CJA	Reviewed by DJA
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 22, RIVER MILE 311 BAT ISLAND, MISSOURI			
PUMP STATION ELEMENTARY AND WIRING DIAGRAMS			
Approved by JCS	Author None	Effect None	Revision None
Approved by JCS	Author None	Effect None	Revision None
E-2			
EDUCATION NO. E-2			

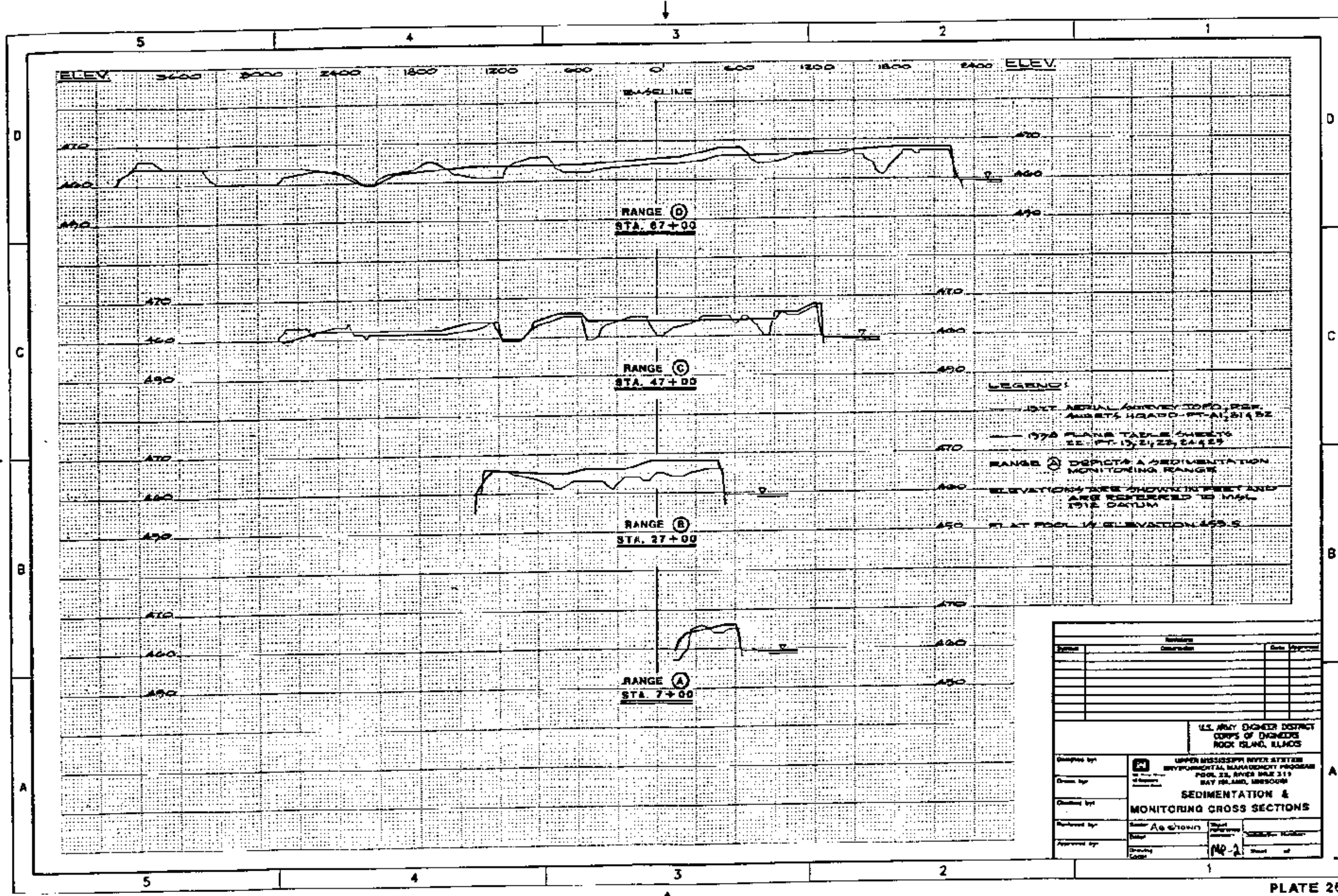


NOTES:

1. USE 1" AND 2" FIBER GLASS STEEL CONCRETE PIPES
2. CONTRACTOR AND POWER CABLES UNSPECIFIED
3. ALL CONCRETE ENTERING AND CABLES EXITING JUNCTION BOX SHALL BE WATER SEALED
4. PUMP MANUFACTURER TO FURNISH SUGGESTED PUMP CABLE AND CABLE GLANDS
5. SEE SHEET 3-B FOR MAINHOLE DETAIL
6. FOR ELECTRICAL LEGEND SEE SHEET 4-1
7. UNUSUAL TREATMENTS SHALL BE COPPER TYP.
8. RANGE 0-300 A.C.M.

Drawing Description Date Approvers	
AS CONSTRUCTED MOUNTAIN VIEW	
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	
Drawn by C.J.A. Checked by HOG Approved by D.J.H.	UPPER MISSOURI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 12, RIVER MILE 911 BAT ISLAND, MISSOURI PUMP CONTROLLER AND ELECTRICAL DETAILS
Drawn by D.J.H. Approved by JAMES R. BROWN CHIEF OF ENGINEERS	Title None Date 14DEC 1990 Drawing Code M-LT2-110
Revision E-3	SOLICITATION NO. D45899-AT-0000 Sheet 40 of 40





Revisions		Date		Approval	
By	Comment				

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 23, RIVER MILE 311 BAY ISLAND, MISSOURI	
SEDIMENTATION & MONITORING CROSS SECTIONS	
Designed by:	Senior AG Engineer
Drawn by:	
Checked by:	
Reviewed by:	
Approved by:	
	142-2