**UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POST-CONSTRUCTION PERFORMANCE
EVALUATION REPORT - YEAR 3 (2001)
AND FLOOD DAMAGE ASSESSMENT (2001)**

PRINCETON REFUGE
HABITAT REHABILITATION AND ENHANCEMENT

NOVEMBER 2001

US Army Corps
of Engineers
Rock Island District

**POOL 14
MISSISSIPPI RIVER MILES 504.0-506.4R
SCOTT COUNTY, IOWA**

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

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US Army Corps
of Engineers
Rock Island District

EXECUTIVE SUMMARY

1. General. As stated in the Definite Project Report, the Princeton HREP project was initiated due to the inability to maintain desirable water levels as the result of a deteriorated levee system and limited water control. Improved water level control was necessary to maximize and sustain wetland habitat for migratory birds.

2. Purpose. The purpose of this report is to provide a summary of the monitoring data, field observations, and project operation and maintenance since project completion, as well as an assessment of the spring 2001 flood damages.

3. Project Goals, Objectives, and Features. The goal and associated objectives for the Princeton HREP project are as follows:

a. Enhance Wetland Habitat
   (1) Provide reliable food source for migratory birds through levee restoration and water control improvements
   (2) Increase overall vegetation diversity and availability of preferred wildlife foods through mast tree plantings

4. Observations and Conclusions. For the evaluation period of project completion to September 2001, the Princeton HREP project was performing as designed and had provided enhanced water control over the pre-construction conditions. Stage II construction was essentially complete in July 2000, providing additional water control of the wetland management units.

5. Flood Damage Assessment. The north perimeter levee from Station 0+00 to Station 40+00 received moderate to severe damage. There were several scour areas where the top portion of the levee had been lifted and deposited in the refuge. Near Station 34+00, a large breach (approximately 250 feet in length) occurred in the levee. On the refuge side of the breach is a scour hole. The depth of this scour hole was not determined, but thought to be between 30 and 40 feet. From Station 135+00 to Station 160+00 and throughout most of the overflow roadway (spillway), the granular surfacing was washed to the riverside of the levee and deposited on the downstream slope. In most places, the geotextile fabric beneath the granular surfacing on the overflow roadway had been shifted to the downstream shoulder of the road.

The following alternatives were evaluated for repair of the perimeter levee and overflow roadway:

a. Alternative 1 - No action - $0
b. Alternative 2 - Construct setback levee and repair scour areas through equipment rental - $115,000
c. Alternative 3 - Construct setback levee, repair scour areas and overflow roadway - $185,000
d. Alternative 4 - Construct setback levee, repair scour areas, lower overflow roadway - $200,000
e. Alternative 5 - Construct setback levee, repair scour areas and overflow roadway, raise north perimeter levee - $465,000
f. Alternative 6 - Reconstruct original levee, fill scour hole by dredge, repair scour areas and overflow roadway - $550,000
g. Alternative 7 - Reconstruct original levee, fill scour hole by truck, repair scour areas and overflow roadway - $1,110,000

The selected project is Alternative 2. The proposed schedule is to award the contract in October 2001, begin construction in November 2001, and complete construction in December 2001.

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1. INTRODUCTION

The Princeton Refuge Habitat Rehabilitation and Enhancement Project (HREP), hereafter referred to as "the Princeton HREP project," is a part of the Upper Mississippi River System (UMRS) Environmental Management Program (EMP). The Princeton HREP project is located in Pool 14 on the Iowa side of the Mississippi River navigation channel between River Miles (RM) 504.0 and 506.4. Approximately 418 acres of the refuge is owned by the State, with the remaining 711 acres being Federal lands. Plate 1 in Appendix L contains the location plan, vicinity map, and general notes for the Princeton HREP project.

a. Purpose. The purposes of this Performance Evaluation Report (PER) and Flood Damage Assessment (FDA) are as follows:

(1) Summarize the performance of the Princeton HREP project, based on the project goals and objectives;

(2) Review the monitoring plan for possible revision;

(3) Summarize project operation and maintenance efforts to date;

(4) Review engineering performance criteria to aid in the design of future projects; and

(5) Assess flood damage and evaluate alternatives for repair.

b. Scope. The PER summarizes available project monitoring data, inspection records, and field observations made by the United States Army Corps of Engineers (USACE), the United States Fish & Wildlife Service (USFWS), and the Iowa Department of Natural Resources (IADNR) for the period from project completion through September 30, 2001. The FDA summarizes the spring of 2001 flood damages and recommends alternatives for repair.

2. PROJECT BACKGROUND

a. General. As stated in the Definite Project Report (DPR), the Princeton HREP project was initiated due to the inability to maintain desirable water levels as the result of a deteriorated levee system and limited water control. The levee surrounding Princeton was originally constructed in the late 1920's and early 1930's. A small capacity pump and outlet structure, installed in 1957, allowed some manipulation of water levels, but management was often compromised by limited pumping capability and levee overtopping during high water events. Levee improvements in 1982, in combination with the installation of a higher capacity pump in 1983, helped to overcome some of these difficulties. However, improved water level control was necessary to maximize and sustain wetland habitat quality and quantity for migratory birds.

b. Goals and Objectives. Goals and objectives, formulated during the project design phase, are summarized in Table 2-1. During the development of enhancement features, consideration was given to satisfying project goals and objectives while maximizing utilization of resource opportunities. Each project feature was constructed to satisfy at least one objective, either singularly or in combination with other enhancement features.

TABLE 2-1
Project Goals and Objectives

Goals	Objectives	Project Features
Enhance Wetland Habitat	Provide reliable food source for migratory birds	Levee restoration Water control improvements
	Increase overall vegetation diversity and availability of preferred wildlife foods	Mast tree planting

c. Management Plan. As with more recently developed EMP projects, a formal Annual Management Plan has been developed for the Princeton HREP project. This plan was developed by the USACE, in coordination with the IADNR, as shown in Table 2-2. The Princeton HREP project is maintained and operated by the IADNR under the terms of a Cooperative Agreement with the USFWS.

TABLE 2-2
Annual Management Plan

Month	Action	Purpose
April - July	Dewater area by gravity flow or portable pump	Expose and maintain mudflats to allow revegetation
August - November	Gradually increase water levels to correspond with growth of marsh plant community	Provide access to food plants for migratory waterfowl
December - April	Maintain water levels to maximum extent possible and then release water late during early spring	Maintain winter furbearer habitat and then prepare for aquatic plant germination through gradual water release

3. PROJECT DESCRIPTION

a. Project Features. The Princeton HREP project consists of a 2-cell wetland management unit (WMU) to enhance wetland habitat. Plate 2 in Appendix L contains the site plan for the Princeton HREP project. The project features consist of the perimeter levee, cross dike, overflow roadway (spillway), pump station, water control structures (one reinforced stoplog structure and two CMP stoplog structures), a gatewell structure, mast tree plantings, site access, and three borrow areas.

TABLE 3-1
Summary of Project Features

Project Feature	Measurement or Quantity	Units of Measure
Perimeter Levee		
Length	16,400	Feet
Crown Width	10 - 12	Feet
Side Slopes	4:1	Horizontal:Vertical
Level of Protection	15	Year Event
Design Top Elevation	581.3 – 582.3	Feet NGVD 1912
Embankment Volume	100,000	Cubic Yards
Cross Dike		
Length	5,158	Feet
Crown Width	10	Feet
Side Slopes	4:1	Horizontal:Vertical
Level of Protection	<5	Year Event
Design Top Elevation	578	Feet NGVD 1912
Embankment Volume	18,500	Cubic Yards
Overflow Roadway		
Length	2,300	Feet
Crown Width	24	Feet
Side Slopes	4:1	Horizontal:Vertical
Level of Protection	10	Year Event
Design Top Elevation	580.3	Feet NGVD 1912
Embankment Volume	5,000	Cubic Yards
Intake Structure		
Concrete Top Elevation	578	Feet NGVD 1912
Concrete Sill Elevation	568	Feet NGVD 1912
Intake Pipe		
Diameter	24	Inches
Length (to centerline traverse)	27	Feet
Invert Elevation	570	Feet NGVD 1912
Riprap	182	Tons

TABLE 3-1 (Continued) Summary of Project Data		
Project Feature	**Measurement or Quantity**	**Units of Measure**
Pump Engine Building		
Length	28	Feet
Width	22	Feet
Concrete Floor Elevation	583.5 – 583.78	Feet NGVD 1912
Reinforced Stoplog Structure		
Concrete Top Elevation	578.5	Feet NGVD 1912
Concrete Sill Elevation	574	Feet NGVD 1912
Length	16	Feet
Width	5	Feet
Discharge Pipe		
Diameter	24	Inches
Length (to centerline traverse)	90.5	Feet
Invert Elevation	575	Feet NGVD 1912
Riprap	20	Tons
CMP Stoplog Structures (2)		
Diameter	24	Inches
Invert Elevation West Structure	571.50	Feet NGVD 1912
Invert Elevation East Structure	572.10	Feet NGVD 1912
Gatewell Structure		
Concrete Top Elevation	582	Feet NGVD 1912
Concrete Floor Elevation	573	Feet NGVD 1912
Slide Gate	1	Each
RCP		
Diameter	36	Inches
Length	64	Feet
Landside Invert Elevation	573.25	Feet NGVD 1912
Riverside Invert Elevation	572.75	Feet NGVD 1912
Riprap	22	Tons

(1) Water Control Plan. The basic operating plan for the Princeton HREP project is to maintain a lower water elevation in the spring and summer and a higher water elevation in the fall and winter, as illustrated in Table 2-2. To manage for specific vegetation needs, it is best to be able to control water levels independently within two WMUs, hereafter referred to as the North Wetland Management Unit (NWMU) and South Wetland Management Unit (SWMU). To accomplish independent filling of the WMUs, the pump station directly discharges into a reinforced concrete structure (located at the east end of the cross dike) where flow direction can then be controlled by placement or removal of stoplogs. To facilitate independent drainage of the WMUs, a new gatewell structure was constructed to gravity drain the NWMU. Two CMP stoplog structures were added to

the cross dike to increase capacity and facilitate drainage to a lower elevation. The existing gatewell structure at the downstream end of the project area is used to gravity drain the SWMU. A portable pump may also be used to dewater the WMUs.

During impoundment, the water surface elevation in the NWMU is 576 feet above mean sea level (MSL) and the water surface elevation in the SWMU is 575 feet MSL. Table 3.2 shows the surface 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 1 to 2 feet deep. Migratory waterfowl, in particular dabbling ducks, require water depths of 12 to 18 inches for access to food plants. The WMU water surface elevations represent those elevations that give the greatest areal average of 12- to 18-inch depth for both WMUs. The selected water surface elevations represent maximum levels for design purposes; actual operating levels may be lower if desired. Filling of the WMUs shall be accomplished through use of the pump station. The pump station is located at the convergence of the perimeter levee with the eastern end of the cross dike.

TABLE 3-2
Wetland Management Unit Water Control Plan

Water Elevation (Feet)	Area < 1' Deep (Acres)	Acres 1'-2' Deep (Acres)	Acres > 2' Deep (Acres)	Total Area Flooded (Acres)
SWMU				
574	167.1	9.8	0.0	177.0
575	167.0	167.1	9.9	344.0
576	98.0	167.0	177.0	442.0
577	33.0	98.0	344.0	475.0
NWMU				
574	36.0	0.0	0.0	36.0
575	181.0	36.0	0.0	217.0
576	140.0	181.0	36.0	357.0
577	97.0	140.0	217.0	454.0

(2) Water Source. The pump station intake is located in Grant Slough, which is a backwater of the Mississippi River. Water surface elevations in the slough fluctuate with those of the river. This is considered to be a reliable water source and will accommodate the annual management plan. A 16,000-gallon-per-minute hydraulic pump provides the necessary flow to flood the WMUs.

(3) Perimeter Levee, Overflow Roadway, and Cross Dike. The existing perimeter levee was restored to a 15-year level of protection. To minimize damage potential, the perimeter levee profile parallel to the Mississippi River is sloped upstream

(Station 56+00 to Station 164+00) to provide for gradual overtopping during flood events greater than 15 years. The maximum top elevation for the WMU perimeter levee is 582.3 feet MSL (Station 0+00 to Station 56+00). The levee top width is 12 feet in reaches having an access road and 10 feet in reaches without an access road. The levee side slopes are shaped to 4:1 horizontal on vertical. The plan, profile, and section drawings for the perimeter levee are located in Appendix L, plates 8 through 11 and plate 14.

To provide controlled overtopping of the levee system, a 2,300-foot overflow roadway (spillway) was constructed at elevation 580.3 feet MSL or approximately 2 feet lower than the north perimeter levee. This elevation provides for gradual overtopping during flood events greater than 10 years. The top width is 24 feet with side slopes of 4:1 minimum horizontal on vertical. The overflow roadway allows rapid filling of the WMU interior water surfaces prior to overtopping of the perimeter levee. An overtopping analysis is contained in Appendix H of the DPR.

To provide enhanced management capabilities, a 5,158-foot cross dike was constructed at elevation 578 feet MSL. The top width is 10 feet with side slopes of 4:1 horizontal on vertical. The plan, profile, and section drawings for the overflow roadway and cross dike are presented on plates 12, 13, and 15 in Appendix L.

(4) Pump Station. A pump station was constructed at the intersection of the perimeter levee and cross dike. The pump station is designed to fill the NWMU to elevation 576 feet MSL in 7 days and the SWMU to elevation 575 feet MSL in 5 days. Actual fill times are longer than the design intent. The pump station consists of a pump engine building and intake structure. The pump engine building was constructed of reinforced concrete and provides weather-tight housing for the pump engine, trailer, an additional fuel tank, diesel engine generator, and miscellaneous supplies. A site plan and section of the pump station are presented on plates 16, 17, and 19 in Appendix L.

(5) Water Control Structures. Operation of the WMUs requires the use of three water control structures. The reinforced concrete stoplog structure is located at the east end of the cross dike in conjunction with the pump station discharge pipe. The placement of stoplogs at either end of this structure directs the pumped water into the NWMU or SWMU as needed (see Appendix L, plate 18). Two CMP stoplog structures are located at the middle and west end of the cross dike. These structures provide water level control between the WMUs at lower elevations by gravity flow.

(6) Gatewell Structure. A gatewell structure with a 36-inch-diameter reinforced concrete pipe is located immediately upstream of the intake structure along the perimeter levee. Operation of this structure allows for filling or dewatering of the WMUs, whenever river levels will allow. Additional details are illustrated in Appendix L, plate 20.

(7) Mast Tree Plantings. In the NWMU, approximately 21 acres of mast trees were planted. Two sites were selected for plantings, one near the mid-point of the north perimeter levee and one in the eastern half just south of the power line. The species selected consist of swamp white oak, pin oak, bur oak, pecan, hickory, and cedar.

(8) Borrow Areas. Material for perimeter levee restoration came from the riverside slope and borrow areas located within the project boundaries. Material for cross dike construction came from the adjacent ditch excavation and was supplemented with the borrow areas. The excavated ditch along the south side of the cross dike serves as boat access from the west parking lot to the SWMU. These borrow areas and the associated soil borings are identified on plate 4 in Appendix L. The soil boring logs are presented in Appendix L, plates 5 through 7.

(9) Site Access. Access to the project is by county road from U.S. Highway 67. There are three access areas to the Princeton HREP project: south, middle, and north. Each area has a parking lot and security gate to control access. The IADNR operates these gates as necessary to prevent public vehicular access and minimize consequent disturbance. A crushed stone surface road, 10 feet in width, runs along the top of the perimeter levee from the south parking lot to the pump station. This road facilitates delivery of materials for the pump station. Plate 2 in Appendix L illustrates the site access areas, parking lots, and access road to the pump station.

b. Project Construction. There were two construction phases for the Princeton HREP project. The Stage I contract was awarded to Malco Steel Incorporated of Kansas City, Missouri, on September 13, 1996. This contract included the major project features. The existing access road was modified to work as a spillway. During high river levels, the overflow roadway (spillway) provides controlled filling, minimizing damage to the perimeter levee. The perimeter levee was reinforced and raised to provide reliable water control. The pump station was moved from the lower end of the WMU to the mid-point of the perimeter levee. This, along with the cross dike, provides independent water control to the two WMUs. Construction was essentially complete in November 1998, except for the mast tree plantings, which were conducted in the spring of 1999. A dedication ceremony was held in November 1999. The Stage II contract was awarded to Kemp & Son Incorporated of Letts, Iowa. This contract consisted of cross dike ditch excavation and water control structure installation. Construction was complete in July 2000.

c. Project Operation and Maintenance. Operation and maintenance (O&M) of the Princeton HREP project is the responsibility of the IADNR in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580. These functions are further defined in the O&M Manual. The project features were designed and constructed to minimize the operation and maintenance requirements. Project operation and maintenance generally consists of the following: mowing and burning the perimeter levee and cross dike to ensure serviceability year round; operating the pump station and water control structures to achieve desired water levels consistent with vegetative growth, and opening the gates to minimize overtopping erosion when the river reaches elevation 582 feet MSL with predicted stage to increase; maintaining the access roads and overflow roadway (spillway); and removing snags and other debris from the cross dike ditches.

4. PROJECT MONITORING

a. General. Appendix B presents the Post-Construction Evaluation Plan, along with the Transect Evaluation Summary. These references were developed during the design phase and serve as a guide for measuring and documenting project performance. The Post-Construction Evaluation Plan also outlines the monitoring responsibilities for each agency. Appendix C contains the Monitoring and Performance Evaluation Matrix and Monitoring and Data Collection Summary. The Monitoring and Performance Evaluation Matrix outlines the monitoring responsibilities for each agency. The Monitoring and Data Collection Summary presents the types and frequency of data needed to meet the requirements of the Post-Construction Evaluation Plan. Plate 3 in Appendix L contains the monitoring plan for the Princeton HREP project.

b. U.S. Army Corps of Engineers. The success of the project relative to original project objectives shall be measured by the USACE, USFWS, and IADNR through monitoring data, inspection records, and field observations. The USACE has overall responsibility to evaluate and document project performance. The USACE is also responsible for collecting field data as outlined in the Post-Construction Evaluation Plan at the specified time intervals. The USACE shall also perform joint inspections with the USFWS and IADNR in accordance with Engineer Regulation (ER) 1130-2-339. The purpose of these inspections is to assure that adequate maintenance is being performed as presented in the DPR and O&M Manual. Joint inspections should also occur after any event that causes damage in excess of annual operation and maintenance costs.

c. U.S. Fish and Wildlife Service. The USFWS does not have project-specific monitoring responsibilities. However, the USFWS Savanna District Manager should be present at the joint inspections with the USACE and IADNR as described in the previous paragraph.

d. Iowa Department of Natural Resources. The IADNR is responsible for O&M, as well as monitoring the project through field observations during inspections. Project inspections should be performed on an annual basis following the guidance presented in the O&M Manual. It is recommended that the inspections be conducted in May or June, which is representative of conditions after spring floods. Joint inspections with the USACE and USFWS shall also be conducted as described above. For each inspection, the IADNR should complete the checklist form as provided in the O&M Manual. This form should also include a brief summary of the overall condition of the project and any maintenance work completed since the last inspection. Once completed, a copy of the form shall be sent to the USACE.

5. OPERATION AND MAINTENANCE SUMMARY

a. Operation. Project operations are detailed in the O&M Manual and generally consist of the following: (1) mowing and burning the perimeter levee and cross dike to ensure serviceability year round; (2) operating the pump station and water control structures to achieve desired water levels consistent with vegetative growth, and opening the gates to minimize overtopping erosion when the river reaches elevation 582 feet MSL with predicted stage to increase; (3) maintaining the access roads and overflow roadway (spillway); and (4) removing snags and other debris from the cross dike ditches.

The project has been operated successfully in this manner since its completion. During a joint inspection with USACE in December 2000, Bob Sheets from the IADNR commented that there had not been any operational problems during the past year. As described in the Annual Management Plan presented in Table 2-2, the WMUs are dewatered in May or June to allow revegetation. The WMUs are raised in August to November to provide access to food plants for migratory waterfowl. The WMUs are maintained at this elevation until April to control excessive plant growth if necessary.

b. Maintenance.

(1) Inspections. The IADNR has visited the Princeton HREP project on various occasions since project completion. Inspections of the Princeton HREP project are to be made by the IADNR Site Manager at least annually and follow inspection guidance presented in the O&M Manual. A copy of the completed project inspection checklist should be furnished to USACE. Other project inspections should occur as necessary after high water events or as scheduled by the IADNR Site Manager. Joint inspections of the Princeton WMA project are to be conducted periodically by the IADNR, USFWS, and USACE. These inspections are necessary to determine maintenance needs.

On December 8, 2000, Gene Rand (ED-G) and Charlene Carmack (PM-AR) from USACE met with Bob Sheets (IADNR) to complete a joint inspection of the Princeton HREP project. The conclusions from the inspection are discussed below.

(a) Perimeter Levee and Cross Dike. The perimeter levee was in excellent condition. There were no visible signs of erosion or animal distress. The levee appeared to have a good vegetation growth and was in excellent condition. An inspection was made of the cross dike. The cross dike also appeared to have a good vegetation growth with some minimal distress from burrowing animals. The levee inspection report is illustrated in Appendix G.

(b) Pump Station. The pump station was inspected and found to be in excellent condition. There was no visible damage to the concrete or steel.

(c) Water Control Structure. The concrete water control structure at the eastern end of the cross dike was inspected and found to be in excellent condition. There was no visible damage to the concrete, and the riprap was in place and undamaged.

(d) Gatewell Structure. The north gatewell structure in the perimeter levee was inspected and found to be in excellent condition. There was no visible damage to the concrete, and the riprap was in place and undamaged.

(e) Mast Tree Plantings. According to Gary Swenson (OD-MN), the mast trees that USACE planted south of the power line appear to be doing well. Some trees are experiencing mortality and top dieback with basal sprouting, while the others are fine. Survival is estimated at roughly 70%.

The mast trees that IADNR planted adjacent to the perimeter levee appear to be doing all right. Many of the top dieback trees are sprouting. The northeastern portion of the planting site is the lowest in elevation and very wet. The mast trees planted at this site did not survive the soil conditions. It is recommended that this area not be replanted. Overall, survival is estimated at approximately 50%.

Weed competition is an issue at both planting sites. The USACE planting site has a fair amount of reed canary grass and rice cutgrass. The IADNR planting site has a large amount of reed canary grass and browse.

(2) Maintenance Based on Inspections. The IADNR had not observed any waste materials or unauthorized structures within the project area through calendar year 2000. During the joint inspection in December 2000, it was discussed that the perimeter levee and the area adjacent to the toe should be mowed or burned to prevent encroachment of woody vegetation and promote growth. In summary, prior to the Flood of 2001, the Princeton HREP project was performing as designed and had provided enhanced water control over the pre-construction conditions.

Based on the OD-MN inspection of the mast tree plantings, it is recommend that these sites be treated with herbicide. Also, it may be beneficial to place weed barrier mats at the IADNR planting site, which would require mowing or weed whipping.

6. FLOOD DAMAGE ASSESSMENT

a. Flood Statistics. A significant flood was observed in the spring of 2001. The flood duration was approximately 34 days, from April 17 to May 20. This range was determined based on hydraulic data from Lock and Dams 13 and 14. The reason for the flood was due to heavy amounts of snowfall combined with above normal temperatures in March, causing rapid snowmelt. The exact dates of flood damage at the Princeton HREP project are unknown. However, it is known that the height of the water over the perimeter levee at the crest was approximately 2 to 3 feet. This was only 1 to 1.5 feet lower than the flood of record, which occurred in 1965.

On June 27, 2001, USACE received a letter from Allen Farris, Administrator for the IADNR Fish and Wildlife Division, requesting the "District's review and assessment" of the Princeton HREP project as well as "assistance in repairing the damage" caused by the Flood of 2001. This letter in its entirety can be found in Appendix D.

b. Damage Description. On May 31, 2001, USACE and IADNR representatives met at the Princeton HREP project to conduct a preliminary assessment of the flood damage. A summary of each project feature is presented below. Photographs of the flood damage have been included in Appendix H.

(1) <u>Perimeter Levee</u>. The IADNR observed overtopping of the perimeter levee on April 20. Once this occurred, the refuge filled in approximately 1 day. After the interior was filled, the river began flowing through the refuge. The velocity across the overflow roadway appeared to be around 3 to 4 miles per hour.

The perimeter levee from Station 0+00 to Station 40+00 received moderate to severe damage. From Station 0+00 to Station 33+00, there were several scour areas where the top portion of the levee had been lifted and deposited in the refuge. The major scour areas are approximately 3 feet deep. In some areas, deposition occurred on the side slopes, while in other areas, deposition occurred beyond the toe. The approximate locations and profiles of the scour areas are illustrated in Appendix L, plate 32.

Near Station 34+00, a large breach (approximately 250 feet in length) occurred in the perimeter levee. On the refuge side of the breach is a scour hole. The depth of this scour hole was not determined, but thought to be between 30 and 40 feet deep. According to the IADNR, on April 23 (1 day before the crest), the north perimeter levee was surveyed from a boat. At that time, the refuge was completely under water and the floodwaters were approximately 2 feet over the top of the levee. While inspecting the north perimeter levee, a small riffle was observed, suggesting that the breach may not have occurred at that time.

Several factors have been identified as possible causes of the flood damage to the levee:

- <u>Rodent Holes</u>. Rodent holes were observed in the majority of the scour areas. These holes were not identified during the December 2000 inspection.

- Sand Lens. A sand lens was identified in most scour areas approximately 2 to 3 feet below the top of the levee.

- Woody Vegetation. There is not any woody vegetation on the refuge side near the breach, unlike the rest of the north perimeter levee, which may have caused a greater current through this area.

- Field Tile. A broken clay field tile (approximately 15 inches in diameter) was discovered to the west of the breach at the toe of the levee on the refuge side. Smaller pieces of this field tile were also observed in several locations around the breach. This may suggest that the field tile was located beneath the levee and was the initial route for the floodwaters.

- Tributary Surge. The overflow roadway began to overtop about the same time as the north perimeter levee, which was not anticipated. The overflow roadway was designed to be lower than the north perimeter levee. This may suggest that the Wapsipinicon River, adjacent to the north perimeter levee, experiences a surge at its confluence with the Mississippi River during flood conditions. A hydraulic study would need to be conducted to verify whether or not this is the case.

- Overflow Roadway Grade. The design for the overflow roadway was to be 2 feet lower than the north perimeter levee. The as-built construction drawings show the final grade of the north perimeter levee at elevation 582.3 and the overflow roadway at elevation 580.3 feet MSL, which provides the required 2-foot difference. However, 8 inches (minimum) of granular surfacing was then placed on the overflow roadway. This would place the top of the overflow roadway at approximately elevation 581 feet MSL. A land survey performed in September 2001 verified that this is indeed the case. The average top elevation of the north perimeter levee was found to be 582.45 feet MSL, while the overflow roadway shows an average top elevation of 581.05 feet MSL. The result is a 1.4-foot difference between the two ends rather than the required 2-foot difference.

- Uneven Levee Crown. Overland data has been collected for Pool 14 as part of the ongoing Mississippi River Basin Study. This topographic data is fairly accurate if the levee has been maintained (i.e., no tall grass and brush). Levee crown elevations were examined for the Princeton HREP project. It was discovered that some of the crown elevations for the perimeter levee were similar to those for the overflow roadway (spillway), which would result in overtopping at the north end before interior filling. In general, the north perimeter levee and overflow roadway show crown elevations lower than the design grade. If this were the case, overtopping would occur at local areas, causing distress to the perimeter levee. A land survey conducted in September 2001 verified that this is not the case. The overland data may have been taken prior to completion of the Stage I construction contract.

Based on previous observations by the IADNR, the perimeter levee from Station 40+00 to Station 100+00 was intact with very little or no damage. The IADNR did mention that a low area exists in the perimeter levee near Station 100+00, which required sandbagging during the flood to prevent premature overtopping adjacent to the pump station and gatewell structure.

The perimeter levee from Station 135+00 to Station 163+73 received little damage, which consists of minor scouring on the refuge side from wave action. In addition, the granular surfacing was washed to the riverside of the levee and deposited on the slope. The rest of the levee from Station 100+00 to Station 135+00 had similar damage (minor scouring and displaced granular surfacing) according to the IADNR. Throughout the perimeter levee, there was very little debris on the top or side slopes.

TABLE 6-1
Summary of Damage to Perimeter Levee

Approx Begin Station	Approx End Station	Damage Length (feet)	Damage Location	Damage Description	Scour Depth (feet)	Levee Height (feet)	Section Loss (%)
02+80	03+30	50	Top	Minor Scour	0.15	5	3
03+30	05+10	180	Top	Major Scour	3	5	60
6+80	8+25	145	Top	Minor Scour	0.4	6	7
11+35	13+95	260	Top	Major Scour	3	7	43
15+80	17+30	150	Top	Major Scour	3	7	43
20+95	22+05	110	Top	Minor Scour	0.3	6	5
27+35	29+35	200	Top	Minor Scour	0.3	6	5
30+75	32+75	200	Top	Minor Scour	0.3	5	6
33+50	36+00	250	All	Breach	30-40	5	100

(2) Cross Dike. A full assessment of the cross dike was not conducted. However, the portion observed did not appear to have any damage. Earlier observations by the IADNR did not discover major damage. If anything, there may be some minor scouring. The vegetation was in good condition. Debris was not observed on the top or side slopes.

(3) Overflow Roadway. Near the west end of the overflow roadway (spillway), there were some areas where the granular surfacing was moved to the upstream side of the road and had deposited on the slope. This may suggest that these were the locations where the floodwaters first started to overtop and enter the refuge.

Throughout most of the overflow roadway (spillway), the granular surfacing was washed to the downstream side of the access road and deposited on the slope. In most places, the geotextile fabric beneath the granular surfacing had been shifted to the downstream shoulder of the access road. Despite the disturbance to the granular surfacing and geotextile fabric, the overflow roadway slopes are still intact with most of the vegetation remaining.

The south parking lot remains intact, but had been disturbed by the granular surfacing from the access road, which was deposited at the upstream end. The south boat ramp, constructed of seal coat, remains intact. Throughout the overflow roadway, there was very little debris on the top or side slopes. At the west end of the overflow roadway on the downstream side (across from the southwest parking lot) is a high water mark that the IADNR spray-painted in white on a utility box. Another high water mark was spray-painted in orange on a tree just north of the overflow roadway on the east side of 285^{th} Avenue.

(4) Pump Station. The pump station remains in place with no damage observed. At the crest, the elevation of the river was approximately 6 to 12 inches higher than the floor of the pump station. However, the mechanical and electrical equipment inside the pump station is 18 inches above the floor. The pump station inspection report is presented in Appendix F.

(5) Water Control Structures. The interior water control structures were opened as soon as the NWS predicted a river stage higher than the top of the perimeter levee, which occurred at least one week in advance from the time it began to overtop. (This is in accordance with the guidance provided in the DPR.) An inspection of the CMP stoplog structure at the west end of the cross dike did not find any damage.

(6) Gatewell Structure. The gatewell structure remains in place with no damage observed. There was not any debris near the inlet or outlet of the structure.

(7) Mast Tree Planting. Approximately 70 percent of the mast trees planted south of the power line appear to have survived the flood. About half of the mast trees survived along the north perimeter levee.

7. EVALUATION OF ALTERNATIVES FOR REPAIR

a. Proposed Alternatives. Six alternatives were evaluated for repair of the perimeter levee and overflow roadway.

(1) No action

(2) Construct setback levee and repair scour areas through equipment rental

(3) Construct setback levee, repair scour areas and overflow roadway

(4) Construct setback levee, repair scour areas, lower overflow roadway

(5) Construct setback levee, repair scour areas and overflow roadway, raise perimeter levee

(6) Reconstruct original levee, fill scour hole by dredge, repair scour areas and overflow roadway

(7) Reconstruct original levee, fill scour hole by truck, repair scour areas and overflow roadway

b. Discussion of Alternatives.

(1) Alternative 1 - No action. The perimeter levee and overflow roadway would not be reconstructed and the scour hole would not be filled.

(2) Alternative 2 - Construct setback levee and repair scour areas through equipment rental. A setback levee would be constructed on the refuge side of the scour hole to a 15-year level of protection, or approximate elevation 582.3 feet MSL, and tie into the existing levee at either end as shown on plate 33 in Appendix L. Impervious material is recommended for construction of the levee. The levee top width would be 10 feet. Levee side slopes would be shaped to 4:1 horizontal on vertical. The perimeter levee from Station 0+00 to 30+00 would be restored to the design elevation of 582.3 feet MSL (see plate 32). All disturbed areas would be seeded, fertilized, and mulched for stabilization.

The scour hole would not be completely filled. However, the sand deposited on the adjacent agricultural field may be removed and placed in the scour hole. The sand would have to be selectively excavated since it would be difficult to completely separate the corn stalks from the sand. This process would require close attention during construction. Small amounts of corn stalks in the sand would not cause problems but it would be imperative to avoid clumps of corn stalks in the sand. The sand deposited on the adjacent agricultural field may also be used to flatten the side slopes on the setback levee beyond the design template of 4:1 horizontal on vertical.

The cost estimate for this alternative was prepared using hourly prices for equipment rental. The reason for selecting equipment rental was to expedite construction in order to provide flood protection during high river levels next spring. Equipment rental was evaluated for this alternative only due to time constraints. The other alternatives could not be constructed prior to high river levels next spring. The preliminary cost estimate for Alternative 2 is $115,000. A detailed breakdown can be seen in Appendix E, Table E-1.

(3) Alternative 3 - Construct setback levee, repair scour areas and overflow roadway. The existing overflow roadway would be repaired from Station 3+00 to Station 20+00 in addition to Alternative 2. The overflow roadway (spillway) would be restored through installation of new woven geotextile and granular surfacing as illustrated on plate 35 in Appendix L.

The preliminary cost estimate for this alternative is $185,000. A detailed breakdown can be seen in Appendix E, Table E-2.

(4) Alternative 4 - Construct setback levee, repair scour areas, lower overflow roadway. The existing overflow roadway would be lowered from Station 3+00 to Station 20+00 in addition to Alternative 2. According to the as-built drawings, the north perimeter levee was constructed to elevation 582.3 feet MSL while the overflow roadway (spillway) was constructed to elevation 580.3 feet MSL or approximately 2 feet lower than the north end. However, these drawings reflect the final grade of the overflow roadway at elevation 580.3 feet MSL prior to 8 inches of granular surfacing. Therefore, the top of the overflow roadway may actually be at elevation 581 feet MSL. This alternative would lower the overflow roadway in order to provide a top elevation of 580.3 feet MSL after placement of granular surfacing as recommended in Appendix H of the DPR (refer to plate 36 in Appendix L). The results of a land survey performed in September 2001 confirmed what was suspected. The average top elevation of the overflow spillway was found to be 581.05 feet MSL.

The preliminary cost estimate for this alternative is $200,000. A detailed breakdown can be viewed in Appendix E, Table E-3.

(5) Alternative 5 - Construct setback levee, repair scour areas and overflow roadway, raise perimeter levee. The existing perimeter levee would be raised from Station 0+00 to Station 60+00 in addition to Alternative 3. According to the as-built drawings, the north perimeter levee was constructed to elevation 582.3 feet MSL while the overflow roadway (spillway) was constructed to elevation 580.3 feet MSL. This design was selected to allow rapid filling of the refuge interior across the overflow roadway in order to minimize the head differential between the exterior and interior water surfaces when overtopping of the perimeter levee begins.

The IADNR discovered during the flood that when the overflow roadway (spillway) was just beginning to overtop, the north perimeter levee was also overtopping. It may be possible that the refuge experiences a surge from the Wapsipinicon River, located adjacent to the north perimeter levee, causing the elevation of the river at this location to be higher than that at the overflow roadway. If this is the case, it may be necessary to raise the north perimeter levee to maintain the function of the overflow roadway.

If this alternative is desired, a hydraulic analysis of the Wapsipinicon and Mississippi Rivers would be necessary to evaluate their combined effects to the north perimeter levee during various flood frequencies. The results of this analysis would determine how high the north perimeter levee would need to be raised to allow the overflow roadway (spillway) to function properly.

The IADNR proposed this alternative shortly after the preliminary flood damage assessment in May and was later supplemented by a letter. In the letter, dated July 17, 2001, the IADNR requested that USACE evaluate raising the north perimeter levee to its original elevation. During construction of the Princeton HREP project, the north perimeter levee was lowered approximately 18 inches. Appendix D displays this letter in its entirety.

The preliminary cost estimate for this alternative is $465,000. A detailed breakdown can be seen in Appendix E, Table E-4.

(6) Alternative 6 - Reconstruct original levee, fill scour hole by dredge, repair scour areas and overflow roadway. The existing perimeter levee would be restored to the 15-year level of protection along the original alignment, as shown on plate 34 in Appendix L. Impervious material is recommended for construction of the levee. The levee top width would be 10 feet. Levee side slopes would be shaped to 4:1 horizontal on vertical. The perimeter levee from Station 0+00 to 30+00 would be restored to the design elevation of 582.3 feet MSL (see plate 32). All disturbed areas would be seeded, fertilized, and mulched for stabilization.

The scour hole would be filled with clean sand. The clean sand would be hydraulically dredged from the main channel (Wapsipinicon River Dredge Cut at RM 505.6-506.0) and pumped to the scour hole. In addition, the overflow roadway (spillway) would be restored through installation of new woven geotextile and granular surfacing as presented on plate 35 in Appendix L.

The preliminary cost estimate for this alternative is $550,000. A detailed breakdown can be viewed in Appendix E, Table E-5.

(7) Alternative 7 - Reconstruct original levee, fill scour hole by truck, repair scour areas and overflow roadway. This alternative is the same as Alternative 6, except the clean sand would be hauled in by truck. The preliminary cost estimate for this alternative is $1,110,000. A detailed breakdown can be viewed in Appendix E, Table E-6.

(8) Summary. Table 7-1 presents a summary of the proposed alternatives and preliminary cost estimates to repair the flood damage at the Princeton HREP project.

TABLE 7-1 Summary of Proposed Alternatives	
Description	**Amount**
Alternative 1 – No Action	$0
Alternative 2 – Construct Setback Levee Repair Scour Areas (Equipment Rental)	$115,000
Alternative 3 – Construct Setback Levee Repair Scour Areas & Overflow Roadway	$185,000
Alternative 4 – Construct Setback Levee Repair Scour Areas Lower Overflow Roadway	$200,000
Alternative 5 – Construct Setback Levee Repair Scour Areas & Overflow Roadway Raise Perimeter Levee	$465,000
Alternative 6 – Reconstruct Original Levee Fill Scour Hole by Dredge Repair Scour Areas & Overflow Roadway	$550,000
Alternative 7 – Reconstruct Original Levee Fill Scour Hole by Truck Repair Scour Areas & Overflow Roadway	$1,110,000

c. Selected Alternative. The selected project is Alternative 2 – construct setback levee around scour hole through equipment rental. Besides construction of the setback levee, sufficient field data will be collected to determine the existing top elevations of the north perimeter levee and overflow roadway (spillway). Based on the results of this data in addition to an agreement with the IADNR, the overflow roadway will be lowered as necessary (but no lower than elevation 580.3 feet MSL) during flood events where overtopping is anticipated in order to provide a 2-foot differential between the north perimeter levee and overflow roadway as presented in Appendix H of the DPR. A hydraulic analysis is also recommended pending an agreement with the sponsor.

d. Construction Considerations. As-built drawings and cross sections of the perimeter levee from Phase I construction have been used to estimate embankment quantities for levee repairs. In addition, the as-built drawings and cross sections would be used for final design and provided as a reference to the contractor. The as-built drawings are illustrated on plates 1 through 20 in Appendix L, while the as-built cross sections are presented on plates 21 through 31. Mobilization of construction equipment would likely be accomplished by truck. Project access is variable and would likely be the contractor’s option with prior approval. Wherever project access is selected, improvements would be necessary at project completion.

The Princeton HREP project is located within the floodplain of the Mississippi River. Due to the pervious substrate on site, ground water elevations are highly influenced by river levels as well as rainfall. Flat pool elevation is 572 feet MSL. For Phase I construction, three borrow areas were identified within the Princeton HREP project, as shown on plate 4 in Appendix L. Two borrow areas were located in the NWMU and one in the SWMU. The land surface elevations of these areas range from elevation 575 to 577 feet MSL. It is anticipated that shallow borrow and subsequent embankment construction can be accomplished using traditional earth-moving equipment during flat pool conditions.

The borrow areas in the NWMU have material that is marginally suitable for levee construction (refer to Appendix L, plates 5 through 7 and plate 37). The majority of the material is a clayey sand or sandy clay. This material is similar to the material used in the existing levee. While the material is not ideal for levee construction, the borrow areas in the NWMU may be used to repair the dike. The disadvantage of this material is that it easily erodes. The erosion susceptibility of the soil will cause the levee to sustain some damage during an uncontrolled overtopping. The borrow area in the SWMU does have better material for levee construction. Soil borings indicate the presence of medium to fat clays in the SWMU. However, the material from the NWMU will adequately restore the levee to its pre-flood condition.

e. Implementation Schedule. It will be necessary to waive the normal exclusion period from September to December for waterfowl hunting in order to complete the project as scheduled in Table 7-2. The IADNR has previously agreed to this construction consideration.

TABLE 7-2
Implementation Schedule

Project Milestone	Scheduled Date
Approve Flood Damage Report	28 September 2001
Execute Project Cooperation Agreement	01 October 2001
Award Construction Contract	15 October 2001
Begin Construction	15 November 2001
Complete Construction	01 December 2001

APPENDIX A

ACRONYMS

ACRONYMS

CEMVR	Corps of Engineers, Mississippi Valley Division, Rock Island District
DPR	Definite Project Report
ED-G	Engineering Division - Geotechnical Branch
EMP	Environmental Management Program
ER	Engineer Regulation
FDA	Flood Damage Assessment
HREP	Habitat Rehabilitation and Enhancement Project
LTRMP	Long-Term Resource Monitoring Program
IADNR	Iowa Department of Natural Resources
MSL	Mean Sea Level
NWMU	North Wetland Management Unit
O&M	Operation and Maintenance
OD-MN	Operations Division - Mississippi River Project, Natural Resources Management Section
PER	Performance Evaluation Report
PM-AR	Planning, Programs, and Project Management Division – Economic and Environmental Analysis Branch, Environmental Analysis Section
RM	River Mile
SWMU	South Wetland Management Unit
UMESC	Upper Midwest Environmental Sciences Center
UMRS	Upper Mississippi River System
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMU	Wetland Management Unit

APPENDIX B

POST-CONSTRUCTION EVALUATION PLAN
AND
SEDIMENTATION TRANSECT PROJECT OBJECTIVES EVALUATION

TABLE B-1
Post-Construction Evaluation Plan

Goal	Objective	Enhancement Feature	Unit	Year 0 (1998) Without Project	Year 0 (1998) With Project	Year 2 (2000) With Project	Year 50 (2047) Target With Project	Feature Measurement	Annual Field Observations by IADNR Site Manager
Enhance Wetland Habitat	Provide reliable food source for migratory birds	Levee restoration	Lineal feet of eroded levee	16,400	0	--	0	Levee system transects and profiles	Describe any erosion/seepage effects
		Water control improvements	Acres of aquatic vegetation	213	--	--	300 [1/]	Vegetation transects	Estimate effective acreage and wildlife use
	Increase overall vegetation diversity and availability of preferred wildlife foods	Mast tree planting	Acres of mast trees	7-10	--	--	40	Vegetation transects	Estimate area of established/ regenerated vegetation

[1/] Includes areas of cropland or non-forested wetland conversion.

TABLE B-2 Transect Evaluation Summary		
Transect	**Project Objectives to Be Evaluated**	
	Provide Reliable Food Source for Migratory Birds	**Increase Overall Vegetation Diversity and Availability of Preferred Wildlife Foods**
Vegetation		
SWMU		
V-M503.1B to V-M503.4J	X	X
V-M504.6A to V-M504.7K	X	X
NWMU		
V-M506.0A to V-M505.9J	X	X
V-M506.2A to V-M506.1J	X	X
Levee System		
Perimeter Levee		
Sta. 0+00 to Sta. 164+00	X	
Overflow Roadway		
Sta. 0+00B to Sta. 23+50B	X	
Cross Dike		
Sta. 0+00C to Sta. 53+53C	X	

1/ Bathymetric mapping of the dike field as water levels permit

APPENDIX C

MONITORING AND PERFORMANCE EVALUATION MATRIX
AND
MONITORING AND DATA COLLECTION SUMMARY

TABLE C-1
Monitoring and Performance Evaluation Matrix

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementati Instructions
Pre-Project	Sedimentation Problem Analysis	System-wide problem definition; evaluate planning assumptions	USFWS	USGS (UMESC)	LTRMP	--
	Pre-Project Monitoring	Identify and define problems at HREP site; establish need of proposed project features	Sponsor	Sponsor	Sponsor	--
	Baseline Monitoring	Establishes baselines for performance evaluation	USACE	USACE / Sponsor	HREP	See Table C-
Design	Data Collection for Design	Include quantification of project objectives, design of project, and development of performance evaluation plan	USACE	USACE	HREP	See Table C-
Construction	Construction Monitoring	Assesses construction impacts; assure permit conditions are met	USACE	USACE	HREP	See State Sect 401 Stipulatio
Post-Construction	Performance Evaluation Monitoring	Determine success of project as related to objectives	USACE/ Sponsor	USACE/ Sponsor	HREP	See Table C-

TABLE C-2 Monitoring and Data Collection Summary [1/]								
	Engineering Data			**Natural Resource Data**				
Type Measurement	**Pre-Project Phase**	**Design Phase**	**Post-Const Phase**	**Pre-Project Phase**	**Design Phase**	**Post-Const Phase**	**Sampling Agency**	**Remarks**
POINT MEASUREMENTS								
Select Point Locations							USACE	
Soil Borings [2/]	1	1						
TRANSECT MEASUREMENTS								
Transects								
Vegetation [3/]						5Y	USFWS	
Levee System [4/]		1	5Y				USACE	
AREA MEASUREMENTS								
Mapping								
Vegetation Monitoring [5/]					1		USACE	
Aerial Photograph [6/]				1		5Y	USFWS	
Land Topographic [7/]		1					USACE	

Y = Yearly
nY = n-Yearly interval
1,2,3, --- = number of times data is collected within designated project phase

TABLE C-2 (Continued)
Monitoring and Data Collection Summary [1/]

[1/] Monitoring and Data Collection Summary - See plate 3 in Appendix L for Monitoring Plan

[2/] Soil Borings (Pre-Project Phase)

Boring Number	Date
PWA-90-1 to PWA-90-2	05-22-90
PWA-90-3 to PWA-90-6	05-23-90
PWA-90-7 to PWA-90-8	05-24-90
PWA-90-9 to PWA-90-11	05-15-90
PWA-90-12	05-24-90
PWA-90-13 to PWA-90-17	05-29-90
PWA-90-18 to PWA-90-19	05-30-90
PWA-90-20	05-31-90
PWA-90-21	05-05-90
PWA-90-21A	05-31-90
PWA-90-22 to PWA-90-24	06-01-90

Soil Borings (Design Phase)

Boring Number	Date
PWA-92-1 to PWA-92-4	01-29-92
PWA-92-5	02-10-92

[3/] Vegetation Transects (Post-Construction Phase)

V-M503.1B to V-M503.4J
V-M504.6A to V-M504.7K
V-M506.0A to V-M505.9J
V-M506.2A to V-M506.1J

[4/] Levee System Transects (Design Phase) – Cross sections at even 200-foot intervals, profile cross dike and perimeter levee

Levee System Transects (Post-Construction Phase) – Cross sections at even 500-foot intervals, profile cross dike and perimeter levee

[5/] Vegetation Monitoring (Design Phase) – September 1990 aerial photography

[6/] Aerial Photograph (Pre-Project and Post-Construction Phases) – 1':1250'

[7/] Land Topographic (Design Phase) – Contours at 1-foot intervals

APPENDIX D

COOPERATING AGENCY CORRESPONDENCE

Iowa
Fields of Opportunities

STATE OF IOWA

THOMAS J. VILSACK, GOVERNOR
SALLY J. PEDERSON, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
JEFFREY R. VONK, DIRECTOR

June 27, 2001

Colonel William J. Bayles
U.S. Army Corps of Engineers, Rock Island District
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel William J. Bayles:

Dear Colonel Bayles:

The Princeton Wildlife Management Area in Pool 14 of the Upper Mississippi River is the site of the Princeton Habitat Rehabilitation and Enhancement Project recently completed by the District. Situated on over 1,000 acres of Federal and State land managed by the Department of Natural Resources, project features enhance and will perpetuate wetland habitats for migratory birds and other wildlife.

Unfortunately, this year's high water has significantly damaged HREP features and future benefits are threatened. On a recent site visit District and DNR staff noted a 360 foot levee break, several hundred feet of shallow breaks, other erosion, water control structure siltation and tree planting damage. The extent of post HREP flood damage was not anticipated, particularly the levee breaks. Project design provided for floodwaters to inundate the area across two thousand feet of reinforced 'overflow' access road. Unfortunately, the perimeter levee was overtopped before water entered via this floodway.

WALLACE STATE OFFICE BUILDING / DES MOINES, IOWA 50319
515-281-5918 TDD 515-242-5967 FAX 515-281-6794 WWW.STATE.IA.US/DNR

FEMA representatives have visited the site to assess damage and potential assistance. If FEMA assistance is forthcoming it will be limited to Debris Removal and Emergency Protective Measures only. FEMA covered repairs will not be elgible for the structural damage to the levee. Considering the extent of damage and the need for timely repairs, we also need to investigate other potential assistance, especially HREP authority.

I am therefore requesting the District's review and assessment of Princeton's HREP levee design features as well as assistance in repairing the damage this year's floods have caused. It is my hope that timely review, repair and completion of any necessary modifications, will minimize or avoid future damage.

Wildlife Bureau staff is available to meet with your representatives at any time. Our Field personnel assigned to Princeton may be contacted directly for assistance. Wildlife Supervisor Art Roseland may be reached at 319 927-3276, or you may contact myself.

Your prompt attention to our request will be most appreciated.

Sincerely,

Allen L. Farris

Allen L. Farris, Administrator
Fish and Wildlife Division

Fields of Opportunities

STATE OF IOWA

THOMAS J. VILSACK, GOVERNOR
SALLY J. PEDERSON, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
JEFFREY R. VONK, DIRECTOR

19 July

Roger Perk- EMP coordination
U.S. Army Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61204-2004

Dear Roger,

We have hired a local contractor to do temporary repairs to the South access road at the Princeton state wildlife area. FEMA will assist. Total cost is $3000. IDNR picks up 15% of that amount. Work should begin next week.

I have a serious concern over the Wapsi river levee. Approximately 18 inches of levee elevation were removed during the HREP construction phase to obtain enough fill for added crown width and levee slopes. Hindsight is revealing that material should have been brought onto the levee as originally proposed. If the south access road is lowered , we are concerned that maintenance of the road and access to the boat ramp facilities will be jeopardized. The roadway began to function as a flood weir but the lowered Wapsi river levee did not allow it time to function. I would request that raising the Wapsi river levee to its original elevation be seriously investigated.

Sincerely,

Bob Sheets

BOB SHEETS WILDLIFE BIOLOGIST
Iowa Department of Natural Resources
CourtHouse - MAQUOKETA IA 52060
PH: (319) 652-3132

APPENDIX E

COST ESTIMATES FOR REPAIR OF FLOOD DAMAGE

TABLE E-1
Princeton Refuge HREP – Preliminary Cost Estimate
Alternative 2 - Construct Setback Levee and Repair Scour Areas through Equipment Rental

Project Management, Engineering, and Design				**$14,310.60**
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Amount*
Backhoe	50	HR	$245.00	$12,250.00
Truck	150	HR	$95.00	$14,250.00
Dozer	100	HR	$130.00	$13,000.00
Sheepsfoot	50	HR	$90.00	$4,500.00
Material Reclamation	150	HR	$130.00	$19,500.00
Seeding, Fertilizing, & Mulching	2	AC	$2,230.00	$4,460.00
Mobilization	1	LS	$3,000.00	$15,000.00
Subtotal				$82,960.00
Contingencies				$12,444.00
Construction Cost				$95,404.00
Engineering During Construction				$1,000.00
Construction Management/Inspection				$3,000.00
Total Construction				**$99,404.00**
TOTAL PROJECT COSTS				**$113,714.60**

TABLE E-2
Princeton Refuge HREP – Preliminary Cost Estimate
Alternative 3 - Construct Setback Levee,
Repair Scour Areas and Overflow Roadway

Project Management, Engineering, and Design				**$27,392.50**
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Amount*
Perimeter Levee Embankment	6,000	CY	$9.50	$57,000.00
Granular Surfacing	2,400	TN	$15.00	$36,000.00
Geotextile Fabric	5,400	SY	$2.10	$11,340.00
Seeding, Fertilizing, & Mulching	1	AC	$2,230.00	$2,230.00
Mobilization	1	LS	$3,000.00	$3,000.00
Subtotal				$109,570.00
Contingencies				$27,392.50
Construction Cost				$136,962.50
Engineering During Construction				$6,848.13
Construction Management/Inspection				$13,696.25
Total Construction				**$157,506.88**
TOTAL PROJECT COSTS				**$184,899.38**

TABLE E-3
Princeton Refuge HREP – Preliminary Cost Estimate
Alternative 4 – Construct Setback Levee, Repair Scour Areas, Lower Overflow Roadway

Project Management, Engineering, and Design				**$29,642.50**
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Amount*
Roadway Excavation	1,500	CY	$6.00	$9,000.00
Perimeter Levee Embankment	6,000	CY	$9.50	$57,000.00
Granular Surfacing	2,400	TN	$15.00	$36,000.00
Geotextile Fabric	5,400	SY	$2.10	$11,340.00
Seeding, Fertilizing, & Mulching	1	AC	$2,230.00	$2,230.00
Mobilization	1	LS	$3,000.00	$3,000.00
Subtotal				$118,570.00
Contingencies				$29,642.50
Construction Cost				$148,212.50
Engineering During Construction				$7,410.63
Construction Management/Inspection				$14,821.25
Total Construction				**$170,444.38**
TOTAL PROJECT COSTS				**$200,086.88**

TABLE E-4
Princeton Refuge HREP – Preliminary Cost Estimate
Alternative 5 – Construct Setback Levee, Repair Scour Areas and Overflow Roadway, Raise Perimeter Levee

Project Management, Engineering, and Design				**$70,142.50**
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Amount*
Perimeter Levee Embankment	24,000	CY	$9.50	$228,000.00
Granular Surfacing	2,400	TN	$15.00	$36,000.00
Geotextile Fabric	5,400	SY	$2.10	$11,340.00
Seeding, Fertilizing, & Mulching	1	AC	$2,230.00	$2,230.00
Mobilization	1	LS	$3,000.00	$3,000.00
Subtotal				$280,570.00
Contingencies				$70,142.50
Construction Cost				$350,712.50
Engineering During Construction				$10,000.00
Construction Management/Inspection				$35,071.25
Total Construction				**$395,783.75**
TOTAL PROJECT COSTS				**$465,926.25**

TABLE E-5
Princeton Refuge HREP – Preliminary Cost Estimate
Alternative 6 - Reconstruct Original Levee, Fill Scour Hole by Dredge, Repair Scour Areas and Overflow Roadway

Project Management, Engineering, and Design				**$82,767.50**
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Amount*
Perimeter Levee Embankment	3,000	CY	$9.50	$28,500.00
Fill Scour Hole (by dredge)	25,000	CY	$10.00	$250,000.00
Granular Surfacing	2,400	TN	$15.00	$36,000.00
Geotextile Fabric (120 mil)	5,400	SY	$2.10	$11,340.00
Seeding, Fertilizing, & Mulching	1	AC	$2,230.00	$2,230.00
Mobilization	1	LS	$3,000.00	$3,000.00
Subtotal				$331,070.00
Contingencies				$82,767.50
Construction Cost				$413,837.50
Engineering During Construction				$10,000.00
Construction Management/Inspection				$41,383.75
Total Construction				**$465,221.25**
TOTAL PROJECT COSTS				**$547,988.75**

TABLE E-6
Princeton Refuge HREP – Preliminary Cost Estimate
Alternative 7 - Reconstruct Original Levee, Fill Scour Hole by Truck, Repair Scour Areas and Overflow Roadway

Project Management, Engineering, and Design				**$169,330.00**
Item Description	*Quantity*	*Unit*	*Unit Cost*	*Amount*
Perimeter Levee Embankment	3,000	CY	$9.50	$28,500.00
Fill Scour Hole (by truck)	25,000	CY	$23.85	$596,250.00
Granular Surfacing	2,400	TN	$15.00	$36,000.00
Geotextile Fabric (120 mil)	5,400	SY	$2.10	$11,340.00
Seeding, Fertilizing, & Mulching	1	AC	$2,230.00	$2,230.00
Mobilization	1	LS	$3,000.00	$3,000.00
Subtotal				$677,320.00
Contingencies				$169,330.00
Construction Cost				$846,650.00
Engineering During Construction				$10,000.00
Construction Management/Inspection				$84,665.00
Total Construction				**$941,315.00**
TOTAL PROJECT COSTS				**$1,110,645.00**

APPENDIX F

PUMP STATION INSPECTION REPORT

PUMP STATION INSPECTION REPORT

Name of Project and Program (EMP, 1135, Etc.):
Princeton Wildlife Management Area, EMP
Pool 14, River Miles 504.0-506.5, Scott County, Iowa

Date/Hour Inspection Began/Ended:
Date: 5/31/01 Time: 1030

Inspectors:
Corps Representatives: Mark Clark, Rachel Fellman, John Behrens
Local Sponsor Officials: Bob Sheets, Randy Robinson, Mike Griffin, IADNR

River/Forebay Elevations:
River El.: _575.0___ Stage El.: ____N/A___ Zero Gage El.: __N/A___
North Management Unit El.: _576.25___ Stage El.: ____N/A___ Zero Gage El.: ___N/A__
South Management Unit El.: _576.25___ Stage El.: ____N/A___ Zero Gage El.: ___N/A__
Note: The North Management Unit was flowing into the South Management Unit and both cells were flowing into the river through the gravity outlets.

Project Data:
Pumping Arrangement and Configuration: One (1) hydraulic submersible M&W pump set up for one-way pumping with diversion to either management unit.

Size of Moist Cell Unit(s) (Acres): North Management Unit = 357 Acres at water surface elevation 576.0
South Management Unit = 344 Acres at water surface elevation 575.0

Fill Time (Days): Actual: North Management Unit = 45 days fill time to elevation 577.0. (1' above Corps design) It takes an additional 15 days of pumping to achieve the 1' increase.
South Management Unit = Approximately 30 days simultaneous with the filling of the North Management Unit.
Design: The design was to take 7 days for the North Unit and 5 days for the South Unit.

Empty Time (Days): Actual: Depends on the fluctuating river. IADNR tries to lower the management units as low as possible.
Design: Approximately elevation 574.0

General Comments:
1. The inspection was performed shortly after the 2001 Flood.
2. The river reached a level of 8" water depth within the pump station building above elevation 583.6.
3. A large amount of wood debris was on the levee around the pump station from the flood.
4. A low spot in the levee (approx. 100' long by 16"-24" deep) was observed in the vicinity of the gravity outlet gatewell. The area had been sandbagged during the flood fight to prevent overtopping near the pump station structure.
5. Overall the pump station appeared to be in good condition.

PUMP STATION MAINTENANCE INSPECTION GUIDE

RATED ITEM	A	M	U	EVALUATION	REMARKS
SECTION I				***FOR INTERNAL USE AND EVALUATION***	
1. Pump Station Size	A			Pump station has adequate capacity (considering pumping capacity, ponding areas, Compare Fill/Empty times with Design, etc.). (A or U.)	An 8" portable Godwin pump (2800 GPM @ 20' TDH) was provided to the IADNR in October 1999 to supplement pumping between the WMUs. The actual filling time for the WMUs is greater than the design filling times.
SECTION II				***FOR LOCAL SPONSOR USE***	
2. O&M Manual	A			O&M Manual is present and adequately covers all pertinent areas. (A or U.)	A draft Corps Operations and Maintenance Manual is dated April 1999 and was used internally to assist with this inspection. All equipment O&M manuals are kept at the Green Island project office. Recommendation: The O&M information should include a pump curve for the pump. The pump station operators and maintenance personnel should review the manuals biannually for routine maintenance to be identified and performed as recommended by the equipment manufacturers. Identify such review and maintenance in the operation logbook. Maintain good record keeping and perform the required maintenance as outlined in the operation and maintenance manuals.
3. Operating Log	A			Pump Station Operating Log is present and being used. (A or U.)	A daily log is maintained during pumping periods. The operating hours, filter/oil changes, problems, and quantity of fuel used is recorded. Recommendation: The logbook should be in a notebook, 3-ring binder or bound logbook and should be in neat tabular form. Entries in the logbook should indicate such items as date, water elevations, and periodic lubrication, pump hours or running time, maintenance/repairs, and special events that are significant in nature. The logbook should be stored and protected in the same location and manner as operation and maintenance manuals. Protection provided shall be moisture and rodent proof. The logbook should also include sections for pump performance testing, pump overhaul or service work performed, sump maintenance, pump discharge outlet work, and forebay cleaning (dredging), etc. Include in the logbook brief descriptions of any service work or maintenance. These descriptions could possibly be located in their own section that could be separate from the daily entries if space does not allow for it.

PUMP STATION MAINTENANCE INSPECTION GUIDE

RATED ITEM	A	M	U	EVALUATION	REMARKS
4. Annual Inspection	A			Annual inspection is being performed by the local sponsor. (A or U.)	The pump is removed annually to prevent winter ice damage and is stored in the pump station building. The pump is inspected at that time. Recommendation: The local sponsor should perform routine maintenance in accordance with the operation and maintenance manuals for the equipment. Annual inspection dates, discrepancies that are found and actions taken should be entered into the logbook. Recommend that a written checklist be developed for the annual inspection to ensure it is performed in accordance with manufacturer's recommendations as described in the operation and maintenance data.
5. Plant Building	A			A Plant building is in good structural condition. No apparent major cracks in concrete, no subsidence, roof is not leaking, etc. Intake louvers clean, clear of debris. Exhaust fans operational and maintained. Safe working environment. M Spalling and cracking are present, or minimal subsidence is evident, or roof leaks, or other conditions are present that need repair but do not threaten the structural integrity or stability of the building. U Any condition that does not meet at least Minimum Acceptable standard.	The electric generator for the pump station building electrical is stored off site at the Green Island project office. The building is made of concrete and is in good condition.
6. Pumps	A			A All pumps are operational. Preventive maintenance and lubrication are being performed. System is periodically subjected to performance testing. No evidence of unusual sounds, cavitation, or vibration. M All pumps are operational and deficiencies/minor discrepancies are such that pumps could be expected to perform through the next period of usage. U One or more primary pumps are not operational, or noted discrepancies have not been corrected.	The pump and impeller were visually inspected and appeared to be in good condition. The IADNR recently replaced a hydraulic seal on the pump. Recommendation: Continue annual maintenance and inspection of the pump.

PUMP STATION MAINTENANCE INSPECTION GUIDE

RATED ITEM	A	M	U	EVALUATION	REMARKS
7. Motors, Engines and Gear Reducers	A			A All items are operational. Preventive maintenance and lubrication being performed. Systems are periodically subjected to performance testing. Instrumentation, alarms, and auto shutdowns operational. M All systems are operational and deficiencies/minor discrepancies are such that pumps could be expected to perform through the next expected period of usage. U One or more primary motors are not operational, or noted discrepancies have period of usage.	A oil-sending unit was replaced on the engine driver in 2000. The engine coolant system has a coolant leak on the radiator that needs repaired. Recommendation: Repair the coolant leak to prevent accidental engine over heat. Perform operation and maintenance to the engine driver and hydraulic system in accordance with the operation and maintenance manuals. Replace engine lubricant, filters and hydraulic fluid as recommended by the engine maintenance schedule.
8. Sumps/Trash Racks		M		**SPECIAL INSTRUCTIONS:** *Measure silt accumulation in sumps and trash racks. Measure water depth at inlet and outlet.* A Sumps/Trash Racks are free of concrete deterioration, protected from Permanent damage by corrosion and free of floating and sunken debris. Sumps are clear of Accumulated silt. Passing debris is minimized by spacing of trash rack bars. Periodic maintenance performed on trash racks and removal of accumulated silt in sumps is performed. M Trash racks and sumps have some accumulated silt or debris but are not currently inhibiting the pump(s) performance. No periodic maintenance has been performed. Present condition could be expected to perform through the next expected period of usage provided removal of floating debris is accomplished. U Proper operation can not be ensured through the next period of usage. Possible damage could result to the pumping equipment with continued operation.	The IADNR installs the sump bulkheads when the pump is removed for winter storage. The trash rack is also removed to facilitate pump removal. A large submerged stone is currently lodged in the vicinity of the trash rack and is preventing the trash rack from being reinstalled. The sump was measured for silt accumulation. 8" of sand was measured outside the bulkhead and 1 1/2" of silt was measured inside the sump behind the bulkhead. Recommendation: Remove the large stone to reinstall the trash rack when the pump is reinstalled. Clean the sump of accumulated silt and sand prior to pumping operations to prevent wear to the pump and deposition within the WMUs. Dates of any maintenance or cleaning performed should be logged into the operation logbook.

PUMP STATION MAINTENANCE INSPECTION GUIDE

RATED ITEM	A	M	U	EVALUATION	REMARKS
9. Other Metallic Items	A			A All metal parts in plant/building are protected from permanent damage by corrosion. Equipment anchors and grout pads show no rust or deterioration. M Corrosion on metallic parts (except equipment anchors) and deterioration period of usage. U Any condition that does not meet at least Minimum Acceptable standards.	Engine ductwork and louvers were in good condition.
10. Ancillary Equipment i.e. Compressed Air Siphon Breakers Fuel Supply Vacuum Priming Pump Lubrication Heating/Ventilation Engine Cooling Engine Oil Filtering		M		A All equipment operational. Preventive and annual maintenance being performed. Equipment operation understood and followed by pump station operators. M Ancillary equipment is operational and deficiencies/minor discrepancies are such that equipment could be expected to perform through the next period of usage. U One or more of the equipment systems is inoperable. The present condition of the inoperable equipment could reduce the efficiency of the pump station or jeopardize the pump station's role in flood protection.	Bulk fuel tank and trailer-mounted day tank were in good condition. Engine cooling system has a small leak as previously noted. The pump station operators should be reminded to perform pumping with the valve, next to the door of the pump station building, open for increased pumping capacity. The battery box for the engine had rodents living in it. Recommendation: Repair coolant leak in radiator. Rodent proof the engine battery box.
11. Backup Ancillary Equipment	A			A Adequate, reliable, and enough capacity to meet demands. Backup units/equipment are properly sized, operational, periodically exercised, and in an overall well maintained condition. M Backup ancillary equipment is operational and deficiencies/minor discrepancies are such that equipment could be expected to perform through the next period of usage. U Backup ancillary equipment not considered reliable to sustain operations during flooding conditions.	Not Applicable
12. Pump Control System	A			A Operational and maintained free of damage, corrosion, or other debris. M Operational with minor discrepancies. U Not operational, or uncorrected discrepancies noted from previous inspections.	Pump station is operated manually.

PUMP STATION MAINTENANCE INSPECTION GUIDE

RATED ITEM	A	M	U	EVALUATION	REMARKS
13. Intake and Discharge Outlets	A			Functional. No damaging erosion evident. Opening/closing devices for vertical gates, flap gates, etc. are functional in a well-maintained condition. (A or U.)	Gaskets for the aluminum stoplogs were glued and screwed to the aluminum. The flap gate was in good condition. The gravity outlet gatewell appeared to be in good condition.
14. Insulation Megger Testing (For pump stations with Electric pumps only)				A Megger test has been performed within the last 36 months. Results of megger test show that insulation of primary conductors and electric motor meet manufacturer's or industry standard. M Results of megger test show that insulation resistance is lower than manufacturer's or industry's standard, but can be expected to perform satisfactorily until next testing or can be corrected. U Insulation resistance is low enough to cause the equipment to not be able to meet its design standard of operation.	Not Applicable.
15. Final Remarks					

GENERAL INSTRUCTIONS

1. All items on this guide must be addressed and a rating given.
2. The lowest single rating given will determine the overall rating for the pump station.
3. Additional areas for inspection will be incorporated by the inspector into this guide if the layout or physical characteristics of the pump station warrant this. Appropriate entries will be made in the REMARKS block.
4. Rating Codes:
   - A - Acceptable
   - M - Minimally Acceptable
   - U - Unacceptable

SPECIFIC INSTRUCTIONS

SECTION I. Actual fill and emptying times for the project shall be compared with design data and size of management unit to assess adequacy of design.

APPENDIX G

LEVEE INSPECTION REPORT

LEVEE INSPECTION REPORT

1. Name of Flood Control Works:
   Princeton Refuge Habitat Rehabilitation and Enhancement Project (HREP)

2. Date/Hour Inspection Began/Ended:
   08 December 2000

3. Inspectors (Including Sponsor Representatives):
   Corps Representative(s) – Eugene Rand (ED-G) and Charlene Carmack (PM-AR)
   Sponsor Representative(s) – Robert Sheets (IADNR Site Manager)

4. Inspection Procedures Followed:
   Drove the levee system

5. Evaluation of Flood Control Works:
   Acceptable

6. General Comments: Overall maintenance of levee system acceptable, however mowing or burning of perimeter levee recommended to prevent encroachment of woody vegetation and promote growth.

Inspector's observations and comments as follows:

RATING	ITEM	LOCATION Sta. to Sta.	REMARKS Note: R/S - Riverside L/S - Landside
	LEVEE SLOPES		
A	Depressions		
A	Erosion		
A	Slope Stability		
A	Cracking		
	Seepage Areas *(Do not rate. Note areas that are of concern during high water.)*		
A	Animal Burrows		
A	Unwanted Growth		
A	Grazing		
A	Sod		
MA	Encroachments	Sta. 0+00 to Sta. 100+00	L/S of levee – tree encroachment at toe of levee, suggest a 10 foot buffer between toe and trees

RATING	ITEM	LOCATION Sta. to Sta.	REMARKS Note: R/S - Riverside L/S - Landside
	LEVEE CROWN		
	Authorized Access Gates *(Do not rate. List gate locations.)*		Three security gates located at the north, west, and south access areas
A	Depressions		
A	Erosion		
A	Cracking		
MA	Animal Burrows	Cross Dike	Minimal burrowing observed resulting in small depressions
A	Unwanted Growth		
A	Grazing		
A	Sod		
A	Road Crossings *(other than those with closure structures)*		
A	Encroachments		

RATING	ITEM	LOCATION Sta. to Sta.	REMARKS Note: R/S - Riverside L/S - Landside
	REVETTED AREAS		
A	Riprap/Revetment		
A	Unwanted Growth		
A	Encroachments		
	DRAINAGE STRUCTURE(S)		
	Toe Drains *(Do not rate. List stationing and locations of drains.)*		
N/A	Relief Wells		
A	Culverts		
A	Riprap/Revetment		
A	Stability of Concrete Structures		
A	Concrete Surfaces		
A	Structural Foundations		
A	Gates		

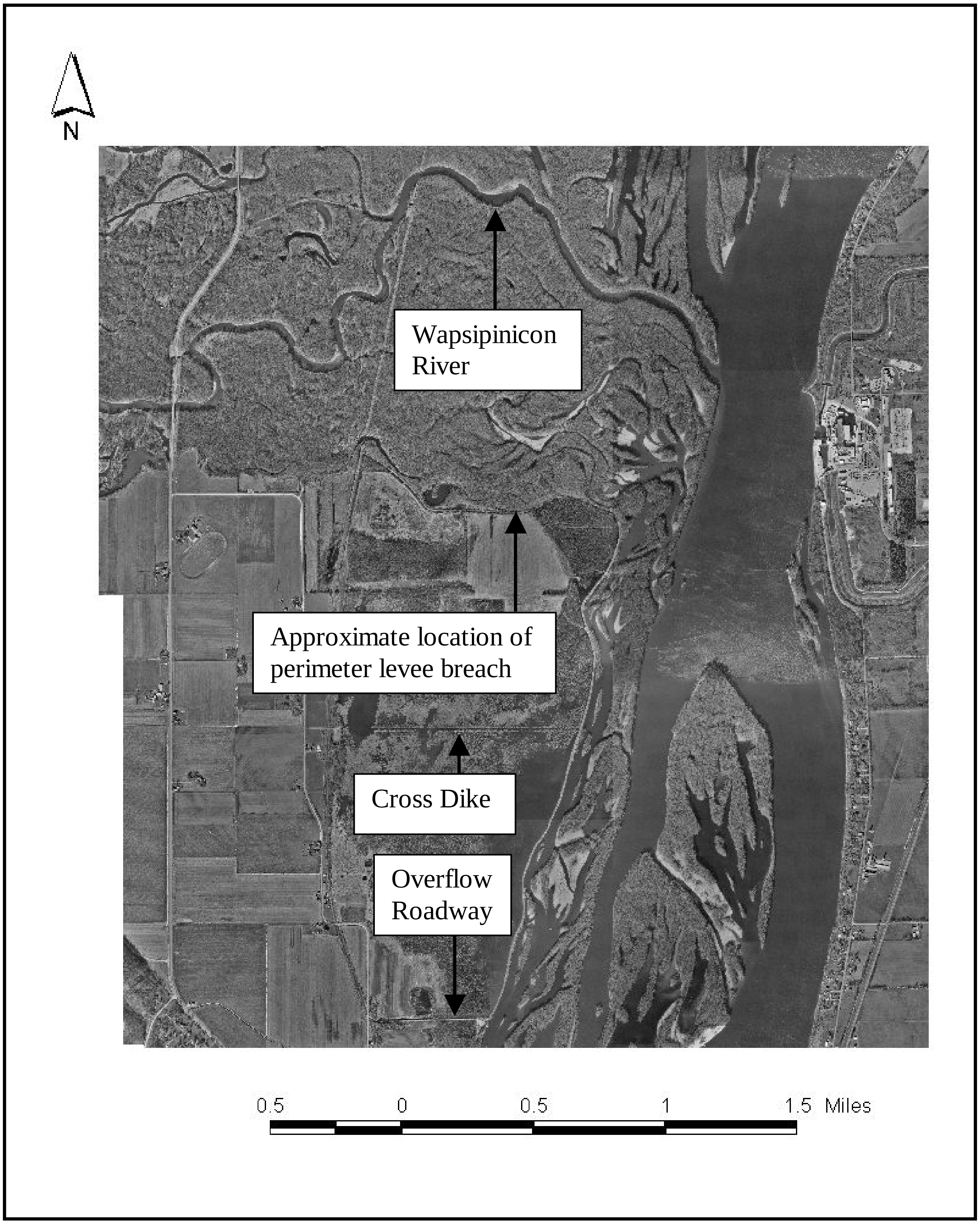
RATING	ITEM	LOCATION Sta. to Sta.	REMARKS Note: R/S - Riverside L/S - Landside
	CHANNELS		
A	Unwanted Growth		
A	Stability of Concrete Structures		
A	Concrete Surfaces		
A	Structural Foundations		
A	CLOSURE STRUCTURE(S)		
	PUMP STATION(S) *(See "Pump Station Inspection Report" in Appendix F.)*		

APPENDIX H

PHOTOGRAPHS OF FLOOD DAMAGE

Photo 1 – April 20, 2001 – Overflow Roadway

Photo 2 – April 20, 2001 – North Perimeter Levee


N
Wapsipinicon River
Approximate location of perimeter levee breach
Cross Dike
Overflow Roadway
0.5
0
0.5
1
1.5 Miles

APPENDIX I

PROJECT TEAM MEMBERS

TABLE I-1
Princeton HREP Project Team Members

OC	Position	Agency	Address	City	State	Zip Code	Telephone Number	FAX Number	Email Address
oger Perk eresa Kincaid	Program Manager	USACE	Clock Tower Building P.O. Box 2004	Rock Island	IL	61204	309-794-5475 309-794-5227	309-794-5710 309-794-5710	Roger.A.Perk@usace.army.mil Teresa.A.Kincaid@usace.army.mil
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ohn Behrens	Mechanical Engineer	USACE	Clock Tower Building P.O. Box 2004	Rock Island	IL	61204	309-794-5620	309-794-5698	John.T.Behrens@usace.army.mil
harlene armack	Biologist	USACE	Clock Tower Building P.O. Box 2004	Rock Island	IL	61204	309-794-5570	309-794-5157	Charlene.Carmack@usace.army.mil
on Cover	Engineering Technician	USACE	Clock Tower Building P.O. Box 2004	Rock Island	IL	61204	309-794-5481	309-794-5698	Ronald.L.Cover@usace.army.mil
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ary Swenson	Forester	USACE	Clock Tower Building P.O. Box 2004	Rock Island	IL	61204	309-794-4489	309-794-4347	Gary.V.Swenson@usace.army.mil
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om Boland	Fisheries Biologist	IADNR	24143 Highway 52 R.R. 3 Box 160	Bellevue	IA	52031	319-872-4976	319-872-4945	Tom.Boland@dnr.state.ia.us

APPENDIX J

REFERENCES

REFERENCES

Published reports relating to the Princeton HREP project or which were used as references in the production of this document are presented below.

(1) *Definite Project Report (R-10F) with Integrated Environmental Assessment, Princeton Wildlife Management Area, Upper Mississippi River System Environmental Management Program, Pool 14, Mississippi River Miles 504.0 – 506.5, Scott County, Iowa, February 1995*. The report marks the conclusion of the planning process and serves as a basis for approval of the preparation of final plans and specifications and subsequent project construction.

(2) Plans and Specifications, *Upper Mississippi River System, Environmental Management Program, Pool 14, River Miles 504.0 thru 506.4, Princeton Wildlife Management Area*, Solicitation No. DACW25-95-R-0024. These documents were prepared to provide sufficient detail for construction of the wetland management unit, which consisted of levee restoration, water control improvements, and mast tree planting.

(3) Plans and Specifications, *Upper Mississippi River System, Environmental Management Program, Pool 14, River Miles 504.0 thru 506.4, Princeton Wildlife Management Area, Stage II*, Solicitation No. DACW25-00-T-0003. These documents were prepared to provide sufficient detail for construction of the cross dike ditch and water control structures.

(4) *Draft Operation and Maintenance Manual, Princeton Wildlife Management Area, Upper Mississippi River Environmental Management Program, Pool 14, River Miles 504.0 - 506.4, Scott County, Iowa, March 2001*. This manual was prepared to serve as a guide for the operation and maintenance of the Princeton HREP project. Operation and maintenance instructions for major features of the project are presented.

APPENDIX K

DISTRIBUTION LIST

DISTRIBUTION LIST

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CEMVR-CD-C
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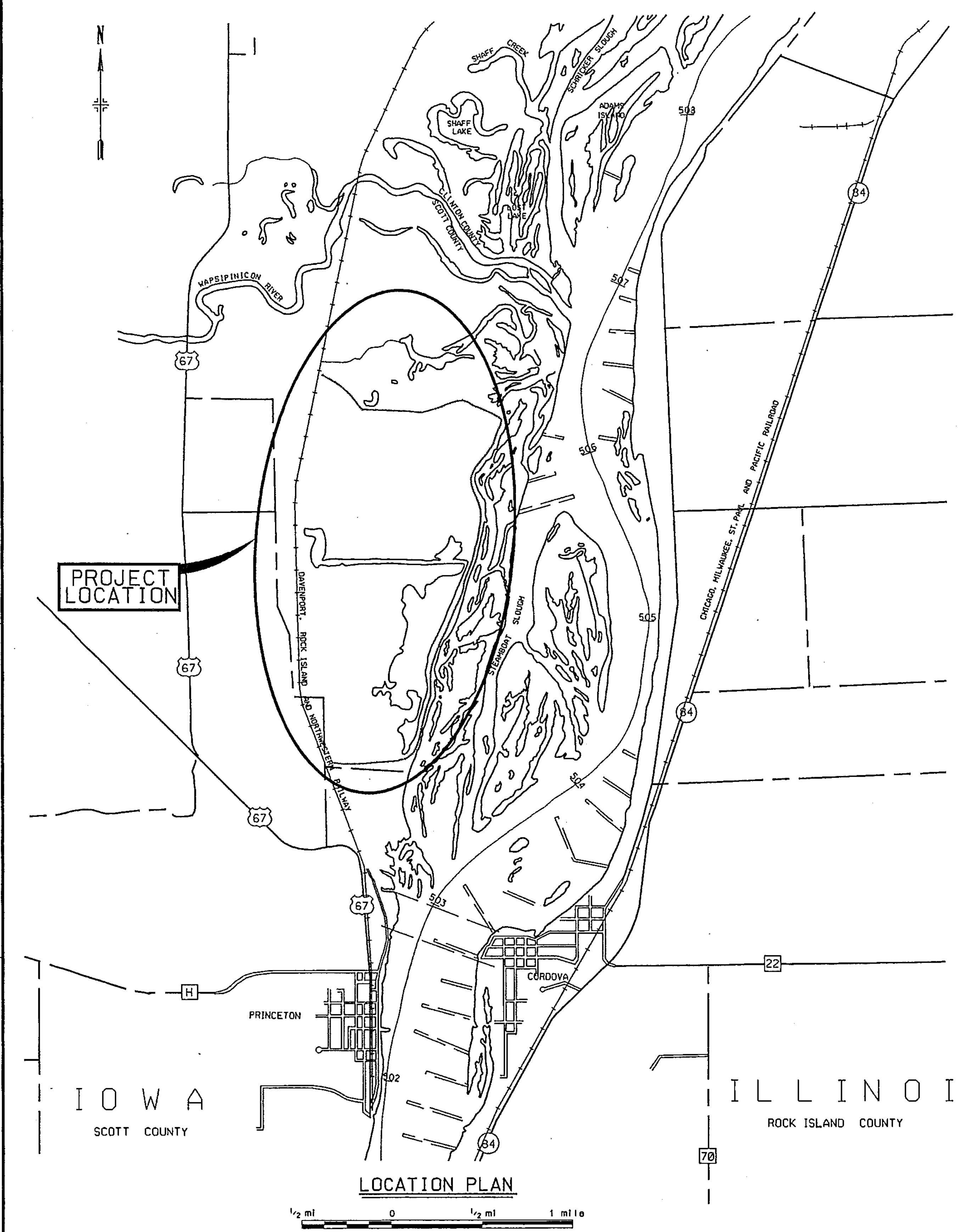
CEMVR-ED-DG (Fellman)
CEMVR-ED-H
CEMVR-ED-HQ
CEMVR-ED-HQ (Bierl)
CEMVR-ED-G
CEMVR-ED-S
CEMVR-OD-M
CEMVR-OD-MN
CEMVR-OD-MN (Swenson)

APPENDIX L

PLATES

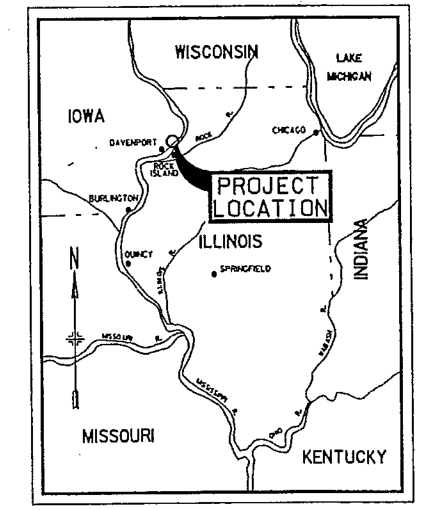


LOCATION PLAN

GENERAL NOTES:

1. THE SCOPE OF WORK GENERALLY CONSISTS OF, BUT IS NOT LIMITED TO:
   A. RESTORE AND CONSTRUCT LEVEES USING ONSITE BORROW.
   B. CONSTRUCT A PUMP STATION COMPLETE WITH GENERATOR ELECTRICAL POWER SUPPLY.
   C. CONSTRUCT A CAST-IN-PLACE CONCRETE INTAKE STRUCTURE.
   D. CONSTRUCT A STOPLOG WATER CONTROL STRUCTURE.
   E. CONSTRUCT A GRANULAR SURFACED ACCESS ROAD.
   F. PLACE RIPRAP EROSION PROTECTION.
   G. CONSTRUCT A PRECAST CONCRETE GATEWELL.
2. THE ENTIRE INTERIOR OF THE CONSTRUCTION SITE IS HIGHLY INFLUENCED BY VARYING RIVER STAGES. SEE SPECIFICATIONS FOR HYDRAULIC DATA.
3. APPROXIMATELY 1,100 FEET OF THE CROSS DIKE EMBANKMENT CONSTRUCTION WILL OCCUR UNDER WET CONDITIONS. BORROW EXCAVATION AND SUBSEQUENT EMBANKMENT PLACEMENT REQUIRES THE USE OF METHODS THAT LEAST DISTURB SOIL STRENGTH. SEE SPECIFICATIONS.
4. THE LAYOUT OF THE PROJECT FEATURES AND CONSTRUCTION WORK LIMITS AS SHOWN SHALL BE FIELD STAKED AND APPROVED BY THE CONTRACTING OFFICER PRIOR TO CONSTRUCTION.
5. THE MAJORITY OF THE TOPOGRAPHICAL CONTOURS SHOWN WHERE DEVELOPED FROM FIELD AND AERIAL SURVEYS TAKEN PRIOR TO THE FLOOD OF 1993. ACTUAL CONTOURS MAY VARY.

1



VICINITY MAP

25 0 25 50 75
SCALE IN MILES

LEGEND:

SECTION D/S103 — SECTION DESIGNATION; LOOK ON THIS SHEET FOR SECTION CUT LOCATION
3/8"-1'-0"

A/S103 — SECTION DESIGNATION; LOOK ON THIS SHEET FOR SECTION

Revisions			
Symbol	Description	Date	Approved
1	AMD. #1 - NOTE 6 DELETED	12/8/95	AWG/BLK

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

US Army Corps of Engineers
Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

LOCATION PLAN, VICINITY MAP, AND GENERAL NOTES

Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX, COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: X2
Solicitation Number: DACW25-95-R-0024
Sheet 2 of

05-NOV-2001 09:28
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PLATE 1

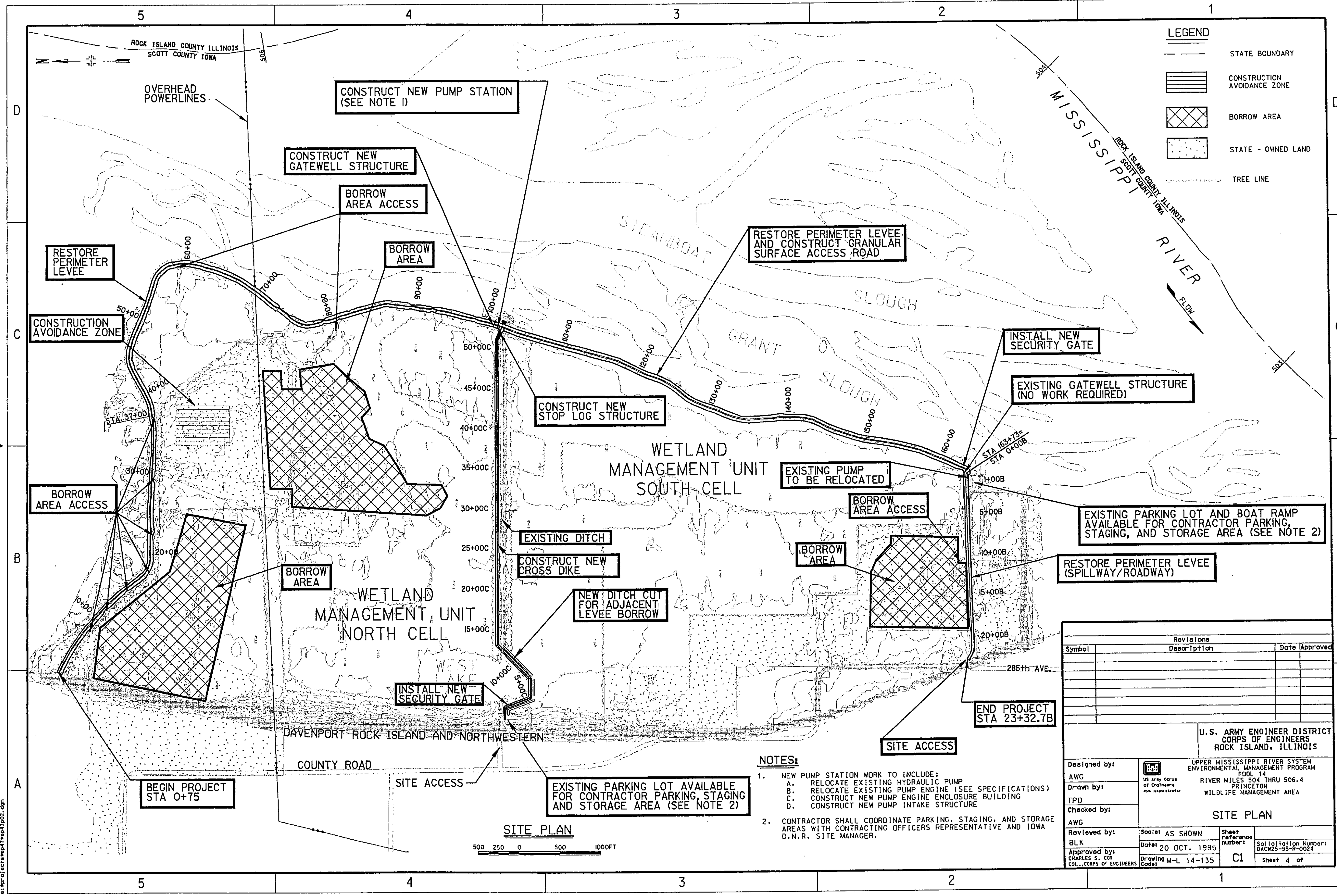

ROCK ISLAND COUNTY ILLINOIS
SCOTT COUNTY IOWA
OVERHEAD POWERLINES
CONSTRUCT NEW PUMP STATION (SEE NOTE 1)
CONSTRUCT NEW GATEWELL STRUCTURE
BORROW AREA ACCESS
BORROW AREA
RESTORE PERIMETER LEVEE
CONSTRUCTION AVOIDANCE ZONE
STA 37+00
BORROW AREA ACCESS
BORROW AREA
WETLAND MANAGEMENT UNIT NORTH CELL
WEST LAKE
INSTALL NEW SECURITY GATE
DAVENPORT ROCK ISLAND AND NORTHWESTERN
COUNTY ROAD
SITE ACCESS
BEGIN PROJECT STA 0+75
EXISTING PARKING LOT AVAILABLE FOR CONTRACTOR PARKING, STAGING AND STORAGE AREA (SEE NOTE 2)
CONSTRUCT NEW STOP LOG STRUCTURE
EXISTING DITCH
CONSTRUCT NEW CROSS DIKE
NEW DITCH CUT FOR ADJACENT LEVEE BORROW
STEAMBOAT SLOUGH
GRANT SLOUGH
RESTORE PERIMETER LEVEE AND CONSTRUCT GRANULAR SURFACE ACCESS ROAD
MISSISSIPPI RIVER
FLOW
WETLAND MANAGEMENT UNIT SOUTH CELL
INSTALL NEW SECURITY GATE
EXISTING GATEWELL STRUCTURE (NO WORK REQUIRED)
STA 163+73= STA 0+00B
EXISTING PUMP TO BE RELOCATED
BORROW AREA ACCESS
EXISTING PARKING LOT AND BOAT RAMP AVAILABLE FOR CONTRACTOR PARKING, STAGING, AND STORAGE AREA (SEE NOTE 2)
BORROW AREA
RESTORE PERIMETER LEVEE (SPILLWAY/ROADWAY)
285th AVE.
END PROJECT STA 23+32.7B
SITE ACCESS
LEGEND
STATE BOUNDARY
CONSTRUCTION AVOIDANCE ZONE
BORROW AREA
STATE - OWNED LAND
TREE LINE
NOTES:
1. NEW PUMP STATION WORK TO INCLUDE:
A. RELOCATE EXISTING HYDRAULIC PUMP
B. RELOCATE EXISTING PUMP ENGINE (SEE SPECIFICATIONS)
C. CONSTRUCT NEW PUMP ENGINE ENCLOSURE BUILDING
D. CONSTRUCT NEW PUMP INTAKE STRUCTURE
2. CONTRACTOR SHALL COORDINATE PARKING, STAGING, AND STORAGE AREAS WITH CONTRACTING OFFICERS REPRESENTATIVE AND IOWA D.N.R. SITE MANAGER.
SITE PLAN
500 250 0 500 1000FT
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 14 RIVER MILES 504 THRU 506.4 PRINCETON WILDLIFE MANAGEMENT AREA
SITE PLAN
Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C1
Solicitation Number: DACW25-95-R-0024
Sheet 4 of

PLATE 2

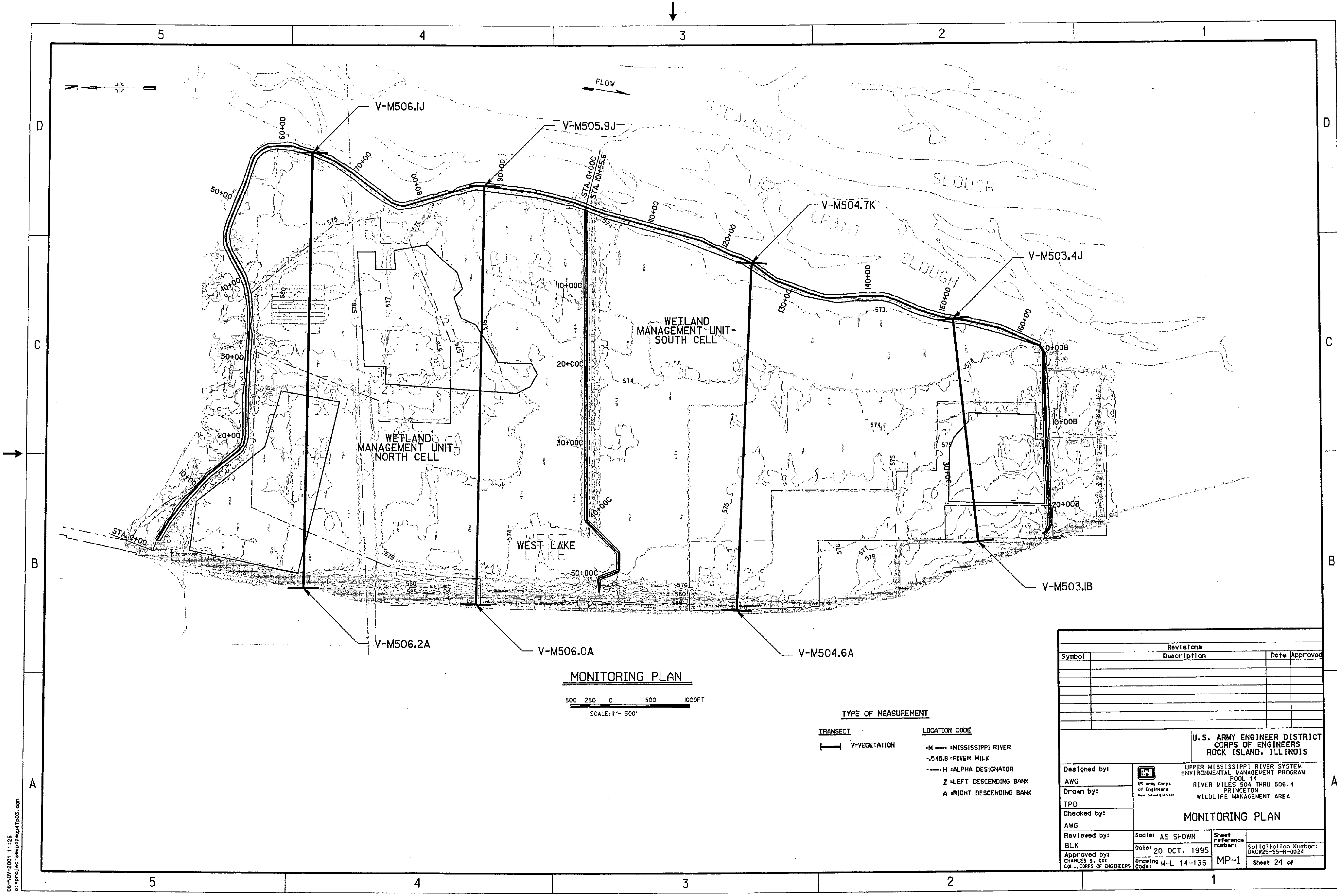
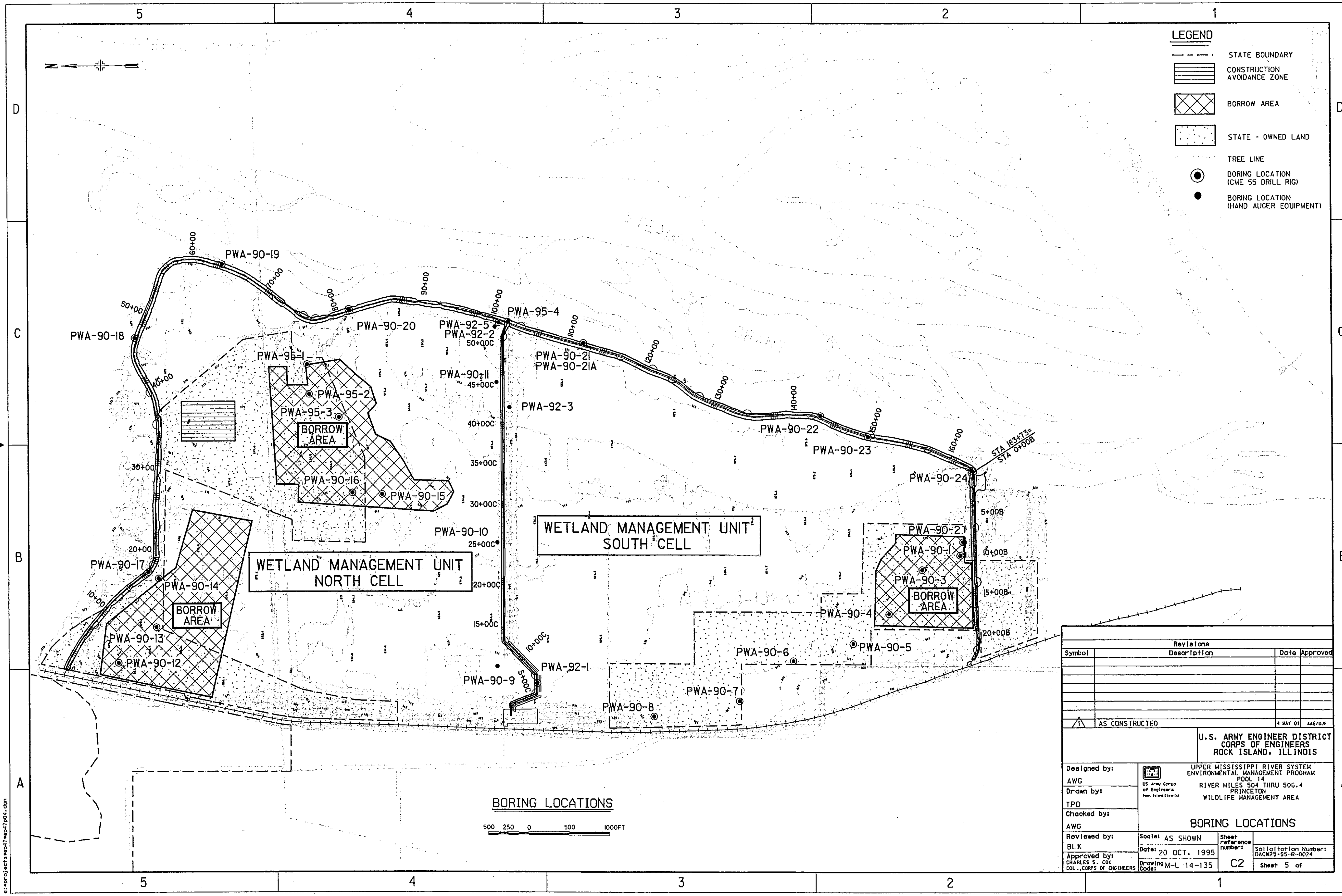
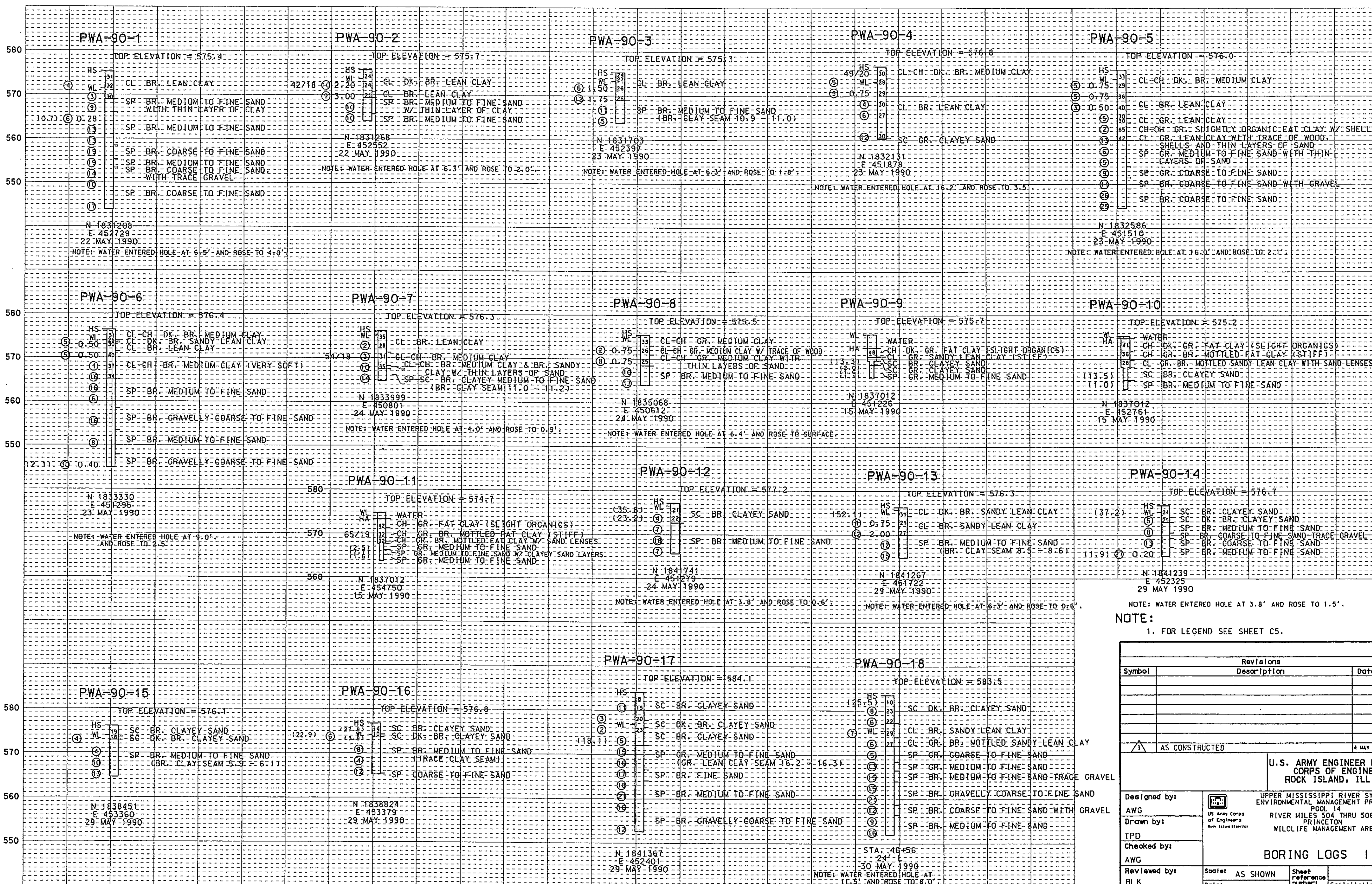

FLOW
STEAMBOAT SLOUGH
GRANT SLOUGH
V-M506.1J
V-M505.9J
V-M504.7K
V-M503.4J
V-M503.1B
V-M506.2A
V-M506.0A
V-M504.6A
WETLAND MANAGEMENT UNIT-NORTH CELL
WETLAND MANAGEMENT UNIT-SOUTH CELL
WEST LAKE
STA. 0+00
STA. 0+00C
STA. 101+55.6
0+00B
10+00B
20+00B
MONITORING PLAN
500 250 0 500 1000FT
SCALE: 1"= 500'
TYPE OF MEASUREMENT
TRANSECT
V=VEGETATION
LOCATION CODE
-M =MISSISSIPPI RIVER
-.545.8 =RIVER MILE
H =ALPHA DESIGNATOR
Z =LEFT DESCENDING BANK
A =RIGHT DESCENDING BANK
Revisions
Symbol
Description
Date
Approved
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
US Army Corps of Engineers Rock Island District
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA
MONITORING PLAN
Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: MP-1
Solicitation Number: DACW25-95-R-0024
Sheet 24 of
06-NOV-2001 11:26

PLATE 3



LEGEND
STATE BOUNDARY
CONSTRUCTION AVOIDANCE ZONE
BORROW AREA
STATE - OWNED LAND
TREE LINE
BORING LOCATION (CME 55 DRILL RIG)
BORING LOCATION (HAND AUGER EQUIPMENT)
WETLAND MANAGEMENT UNIT NORTH CELL
WETLAND MANAGEMENT UNIT SOUTH CELL
BORROW AREA
BORROW AREA
BORROW AREA
PWA-90-19
PWA-90-18
PWA-90-20
PWA-92-5
PWA-92-2
PWA-95-4
PWA-95-1
PWA-95-2
PWA-95-3
PWA-90-11
PWA-90-21
PWA-90-21A
PWA-92-3
PWA-90-16
PWA-90-15
PWA-90-10
PWA-90-22
PWA-90-23
PWA-90-24
PWA-90-2
PWA-90-1
PWA-90-3
PWA-90-4
PWA-90-5
PWA-90-6
PWA-90-7
PWA-90-8
PWA-90-9
PWA-92-1
PWA-90-17
PWA-90-14
PWA-90-13
PWA-90-12
STA 163+73= STA 0+00B
BORING LOCATIONS
500 250 0 500 1000FT
Revisions
Symbol
Description
Date
Approved
AS CONSTRUCTED
4 MAY 01
AAE/DJH
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
US Army Corps of Engineers
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA
BORING LOCATIONS
Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C2
Solicitation Number: DACW25-95-R-0024
Sheet 5 of

PLATE 4



NOTE:
1. FOR LEGEND SEE SHEET C5.

Revisions			
Symbol	Description	Date	Approved
	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

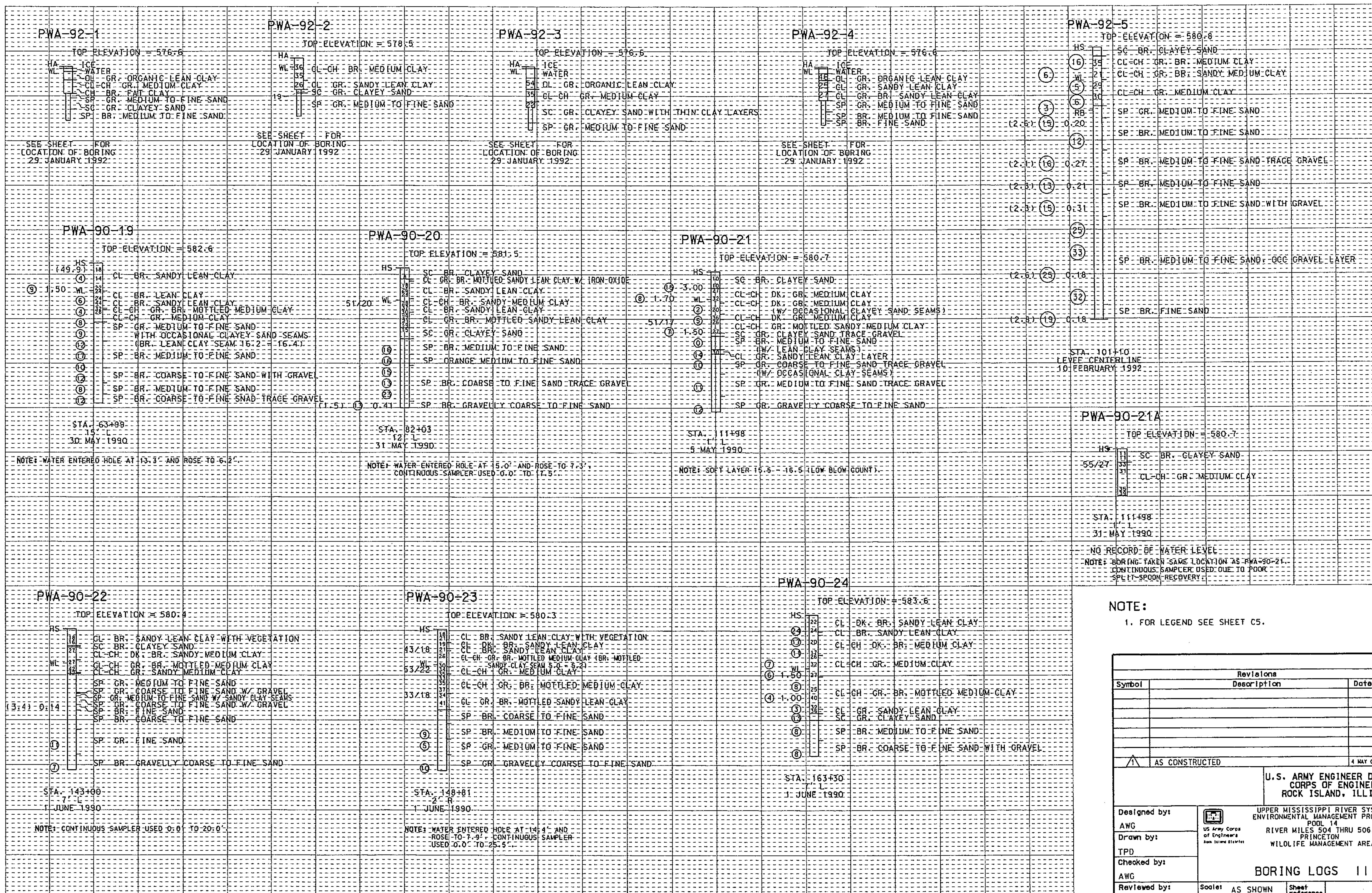
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

BORING LOGS I

Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C3
Solicitation Number: DACW25-95-R-0024
Sheet 6 of

PLATE 5



NOTE:

1. FOR LEGEND SEE SHEET C5.

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

US Army Corps of Engineers Rock Island District

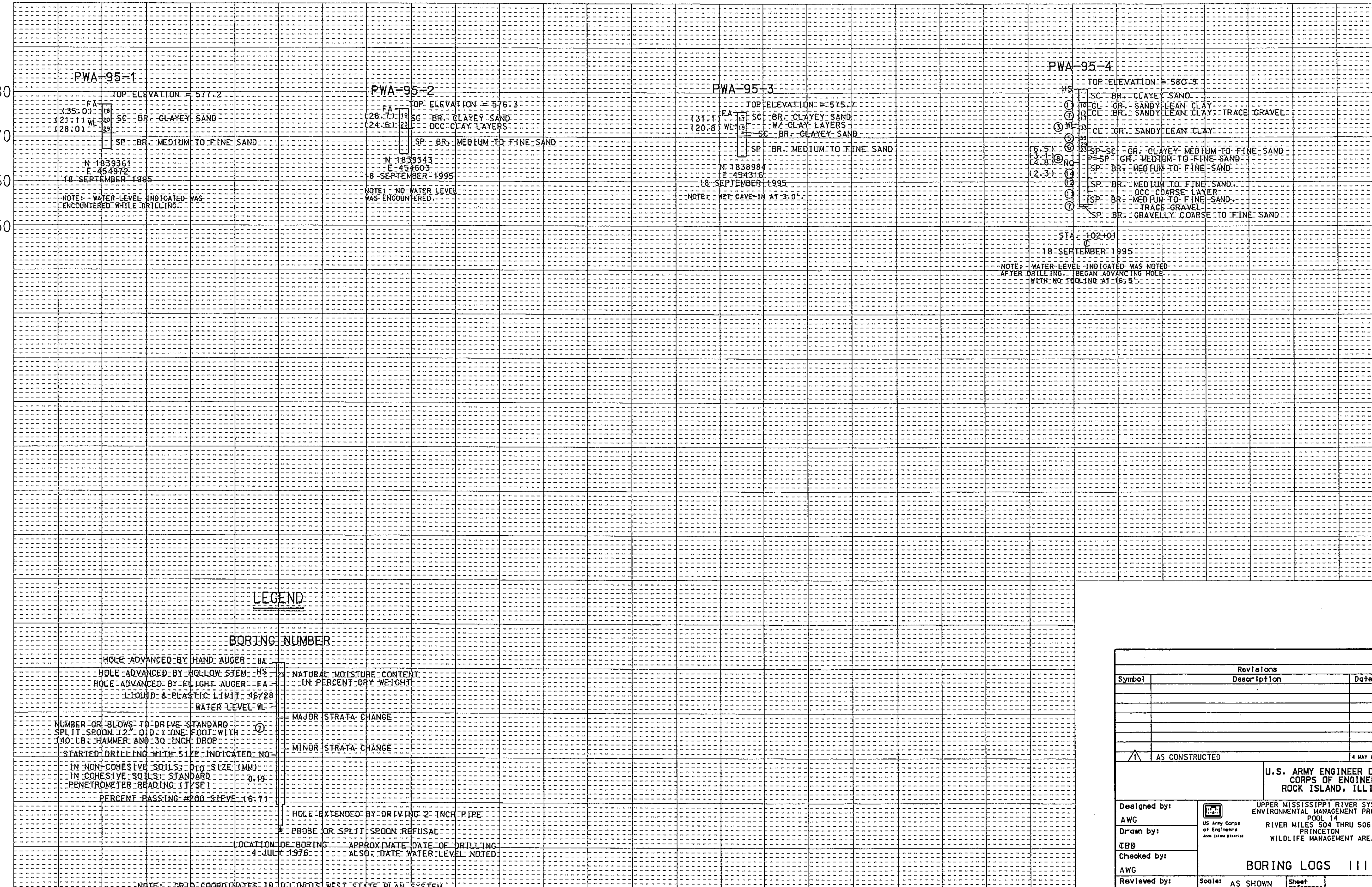
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

BORING LOGS II

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C4
Solicitation Number: DACW25-95-R-0024
Sheet 7 of

05-NOV-2001 10:08

PLATE 6



Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

US Army Corps of Engineers Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

BORING LOGS III

Designed by: AWG
Drawn by: CBB
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C5
Solicitation Number: DACW25-95-R-0024
Sheet 8 of

10 5 0 10 20FT

PLATE 7

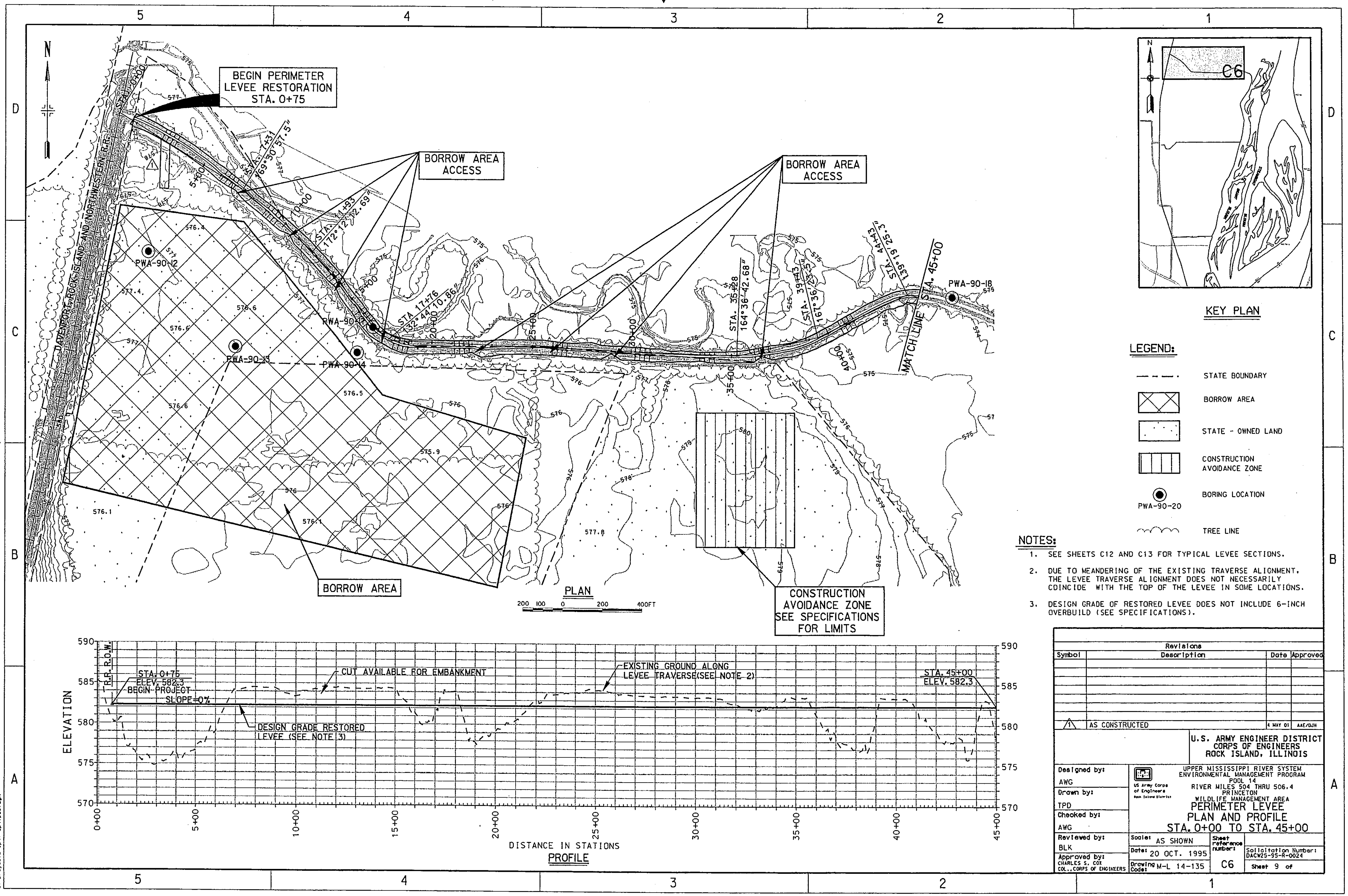
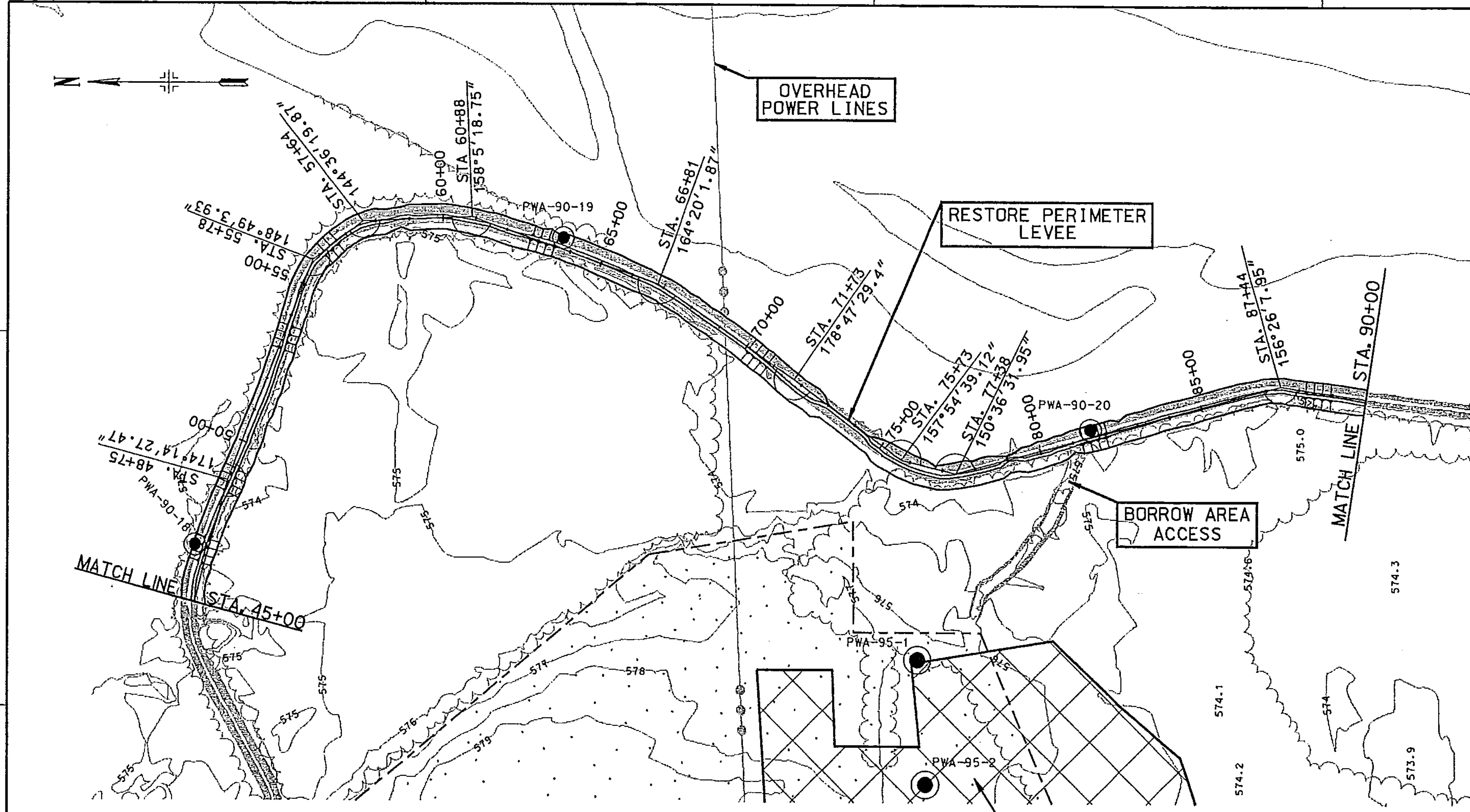
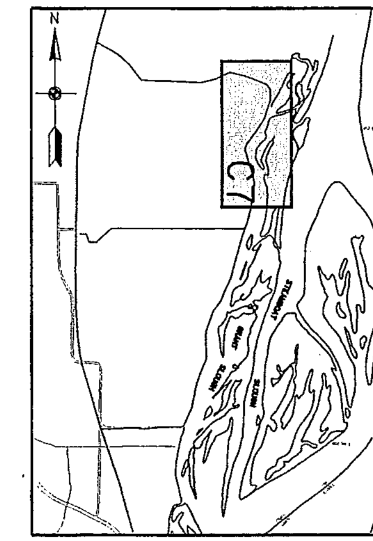

BEGIN PERIMETER LEVEE RESTORATION STA. 0+75
BORROW AREA ACCESS
BORROW AREA ACCESS
DAVENPORT, ROCK ISLAND AND NORTHWESTERN R.R.
PWA-90-12
PWA-90-13
PWA-90-14
PWA-90-18
STA. 17+76
STA. 35+28 164°36'42.68"
STA. 39+43
STA. 44+43
MATCH LINE STA. 45+00
BORROW AREA
CONSTRUCTION AVOIDANCE ZONE SEE SPECIFICATIONS FOR LIMITS
PLAN
200 100 0 200 400FT
KEY PLAN
C6
LEGEND:
STATE BOUNDARY
BORROW AREA
STATE - OWNED LAND
CONSTRUCTION AVOIDANCE ZONE
BORING LOCATION
PWA-90-20
TREE LINE
NOTES:
1. SEE SHEETS C12 AND C13 FOR TYPICAL LEVEE SECTIONS.
2. DUE TO MEANDERING OF THE EXISTING TRAVERSE ALIGNMENT, THE LEVEE TRAVERSE ALIGNMENT DOES NOT NECESSARILY COINCIDE WITH THE TOP OF THE LEVEE IN SOME LOCATIONS.
3. DESIGN GRADE OF RESTORED LEVEE DOES NOT INCLUDE 6-INCH OVERBUILD (SEE SPECIFICATIONS).
R.R. R.O.W.
STA. 0+75 ELEV. 582.3 BEGIN PROJECT
SLOPE=0%
CUT AVAILABLE FOR EMBANKMENT
EXISTING GROUND ALONG LEVEE TRAVERSE (SEE NOTE 2)
STA. 45+00 ELEV. 582.3
DESIGN GRADE RESTORED LEVEE (SEE NOTE 3)
ELEVATION
DISTANCE IN STATIONS
PROFILE
Revisions
Symbol
Description
Date
Approved
AS CONSTRUCTED
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS
Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 14 RIVER MILES 504 THRU 506.4 PRINCETON WILDLIFE MANAGEMENT AREA
PERIMETER LEVEE PLAN AND PROFILE STA. 0+00 TO STA. 45+00
Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C6
Solicitation Number: DACW25-95-R-0024
Sheet 9 of

PLATE 8



PLAN

200 100 0 200 400FT



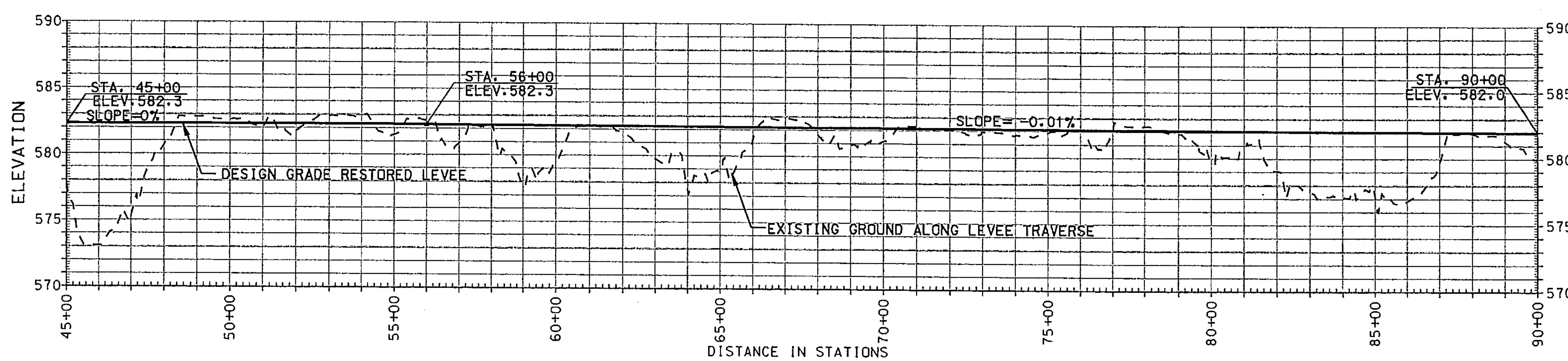
KEY PLAN

LEGEND:

- STATE BOUNDARY
- BORROW AREA
- STATE - OWNED LAND
- BORING LOCATION (PWA-90-20)
- TREE LINE

NOTE:

1. FOR NOTES SEE SHEET C6.



PROFILE

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

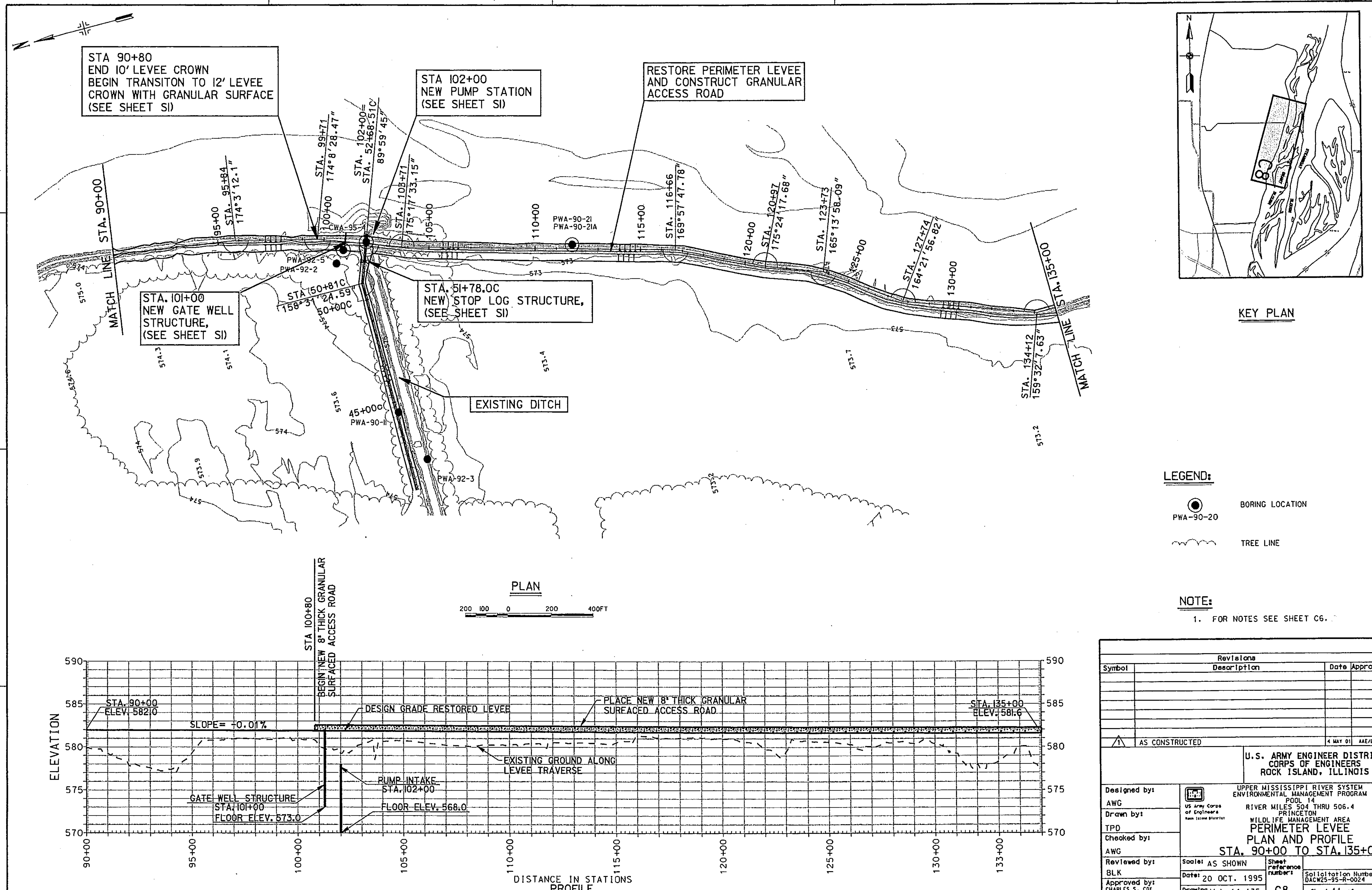
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA
PERIMETER LEVEE
PLAN AND PROFILE
STA. 45+00 TO STA. 90+00

Designed by:	AWG
Drawn by:	TPD
Checked by:	AWG
Reviewed by:	BLK
Approved by:	CHARLES S. COX COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C7
Solicitation Number: DACW25-95-R-0024
Sheet 10 of

05-NOV-2001 10:12

PLATE 9



NOTE:

1. FOR NOTES SEE SHEET C6.

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

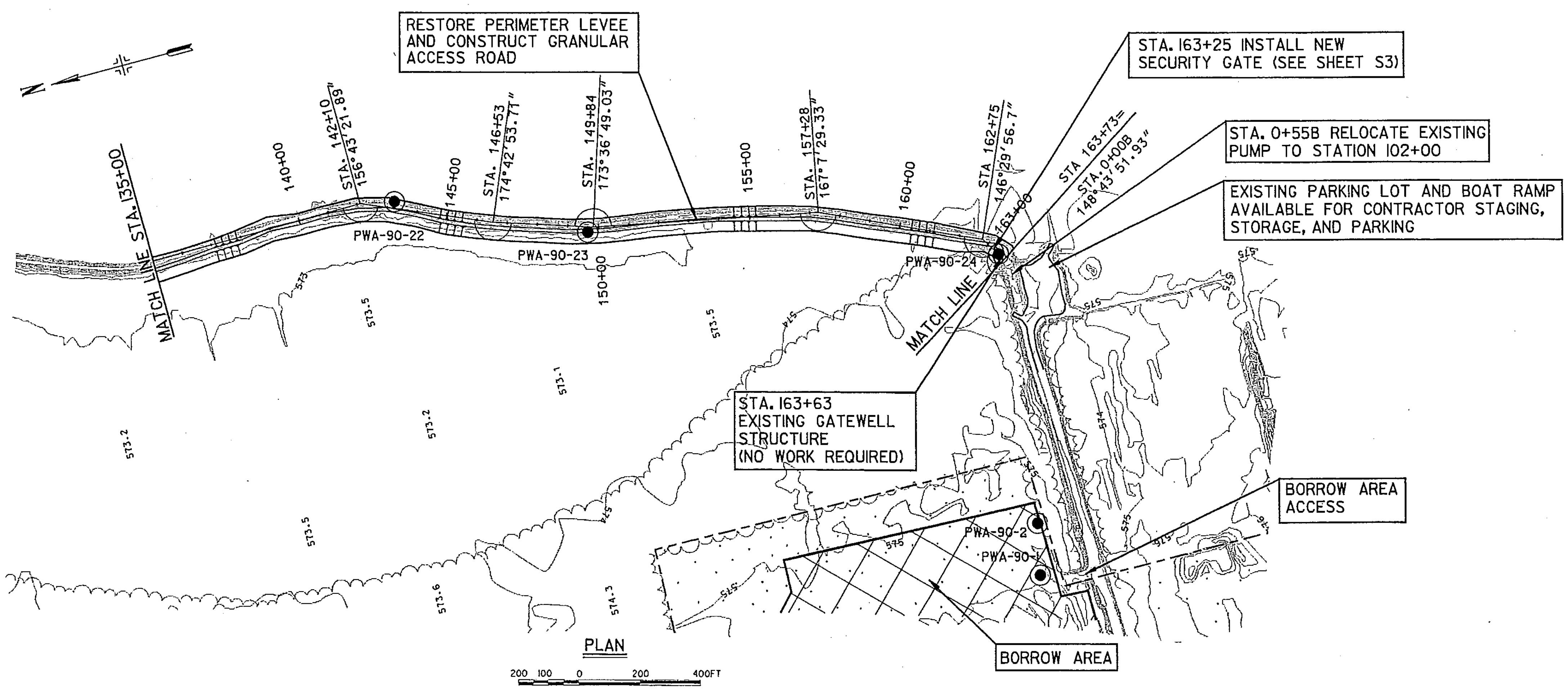
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA
PERIMETER LEVEE
PLAN AND PROFILE
STA. 90+00 TO STA. 135+00

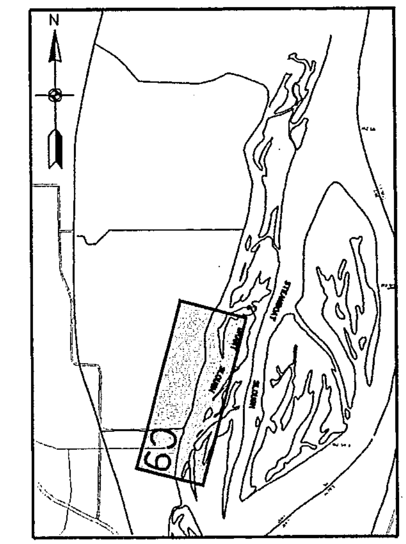
Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C8
Solicitation Number: DACW25-95-R-0024
Sheet 11 of

05-NOV-2001 10:03

PLATE 10





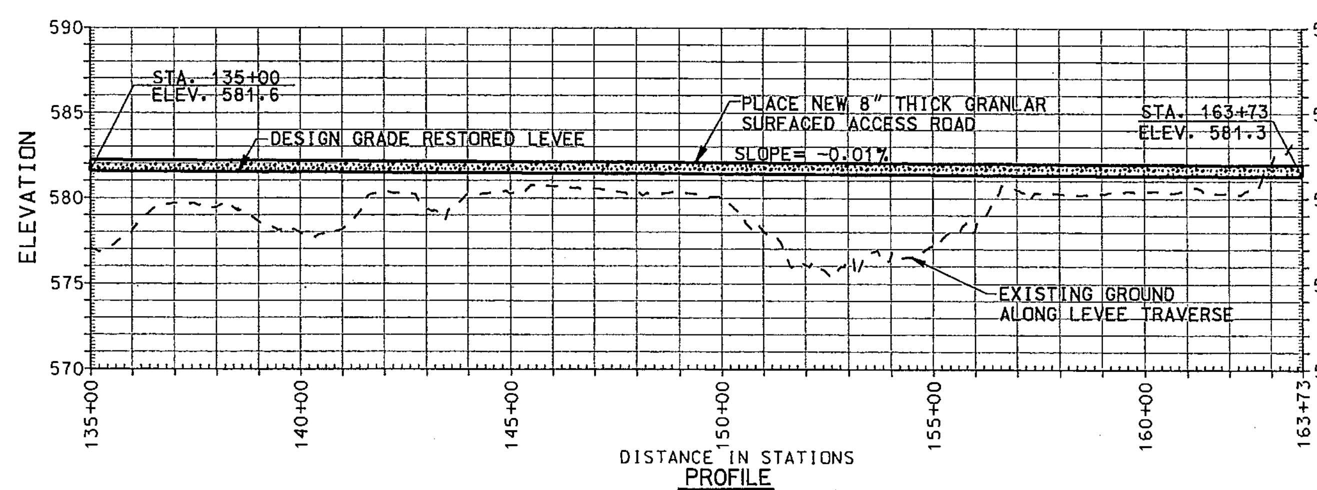
KEY PLAN

LEGEND:

- STATE BOUNDARY
- BORROW AREA
- STATE - OWNED LAND
- BORING LOCATION (PWA-90-20)
- TREE LINE

NOTE:

1. FOR NOTES SEE SHEET C6.



PROFILE

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

Designed by: AWG	US Army Corps of Engineers, Rock Island District — UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 14 RIVER MILES 504 THRU 506.4 PRINCETON WILDLIFE MANAGEMENT AREA
Drawn by: TPD	PERIMETER LEVEE PLAN AND PROFILE
Checked by: AWG	STA. 135+00 TO STA. 163+73
Reviewed by: BLK	Scale: AS SHOWN — Sheet reference number: C9
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS	Date: 20 OCT. 1995 — Drawing Code: M-L 14-135 — Solicitation Number: DACW25-95-R-0024 — Sheet 12 of

05-NOV-2001 10:25
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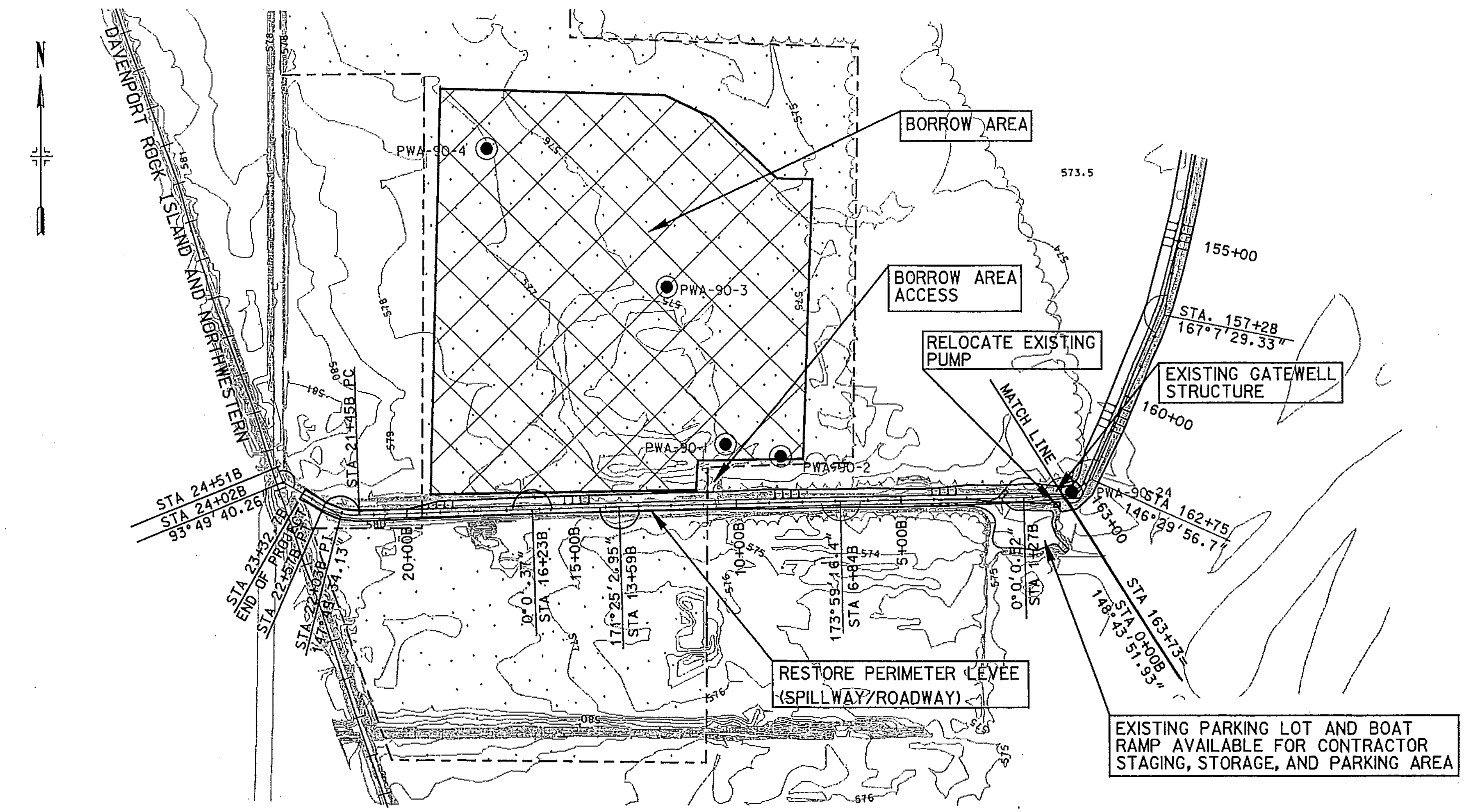
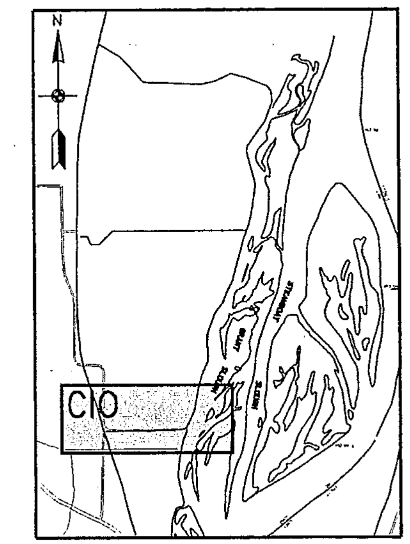
PLATE 11



PLAN

200 100 0 200 400FT



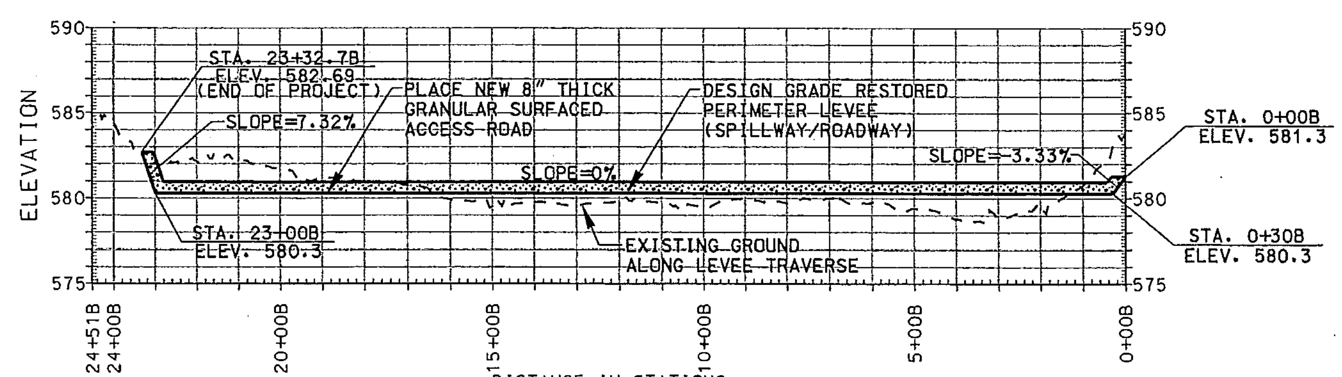
KEY PLAN

LEGEND:

- STATE BOUNDARY
- BORROW AREA
- STATE - OWNED LAND
- BORING LOCATION (PWA-90-20)
- TREE LINE

NOTE:

1. FOR NOTES SEE SHEET C6.



PROFILE

Symbol	Revisions Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

US Army Corps of Engineers Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

PERIMETER LEVEE SPILLWAY/ ROADWAY PLAN AND PROFILE STA. 0+00B TO STA. 24+51B

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C10
Solicitation Number: DACW25-95-R-0024
Sheet 13 of

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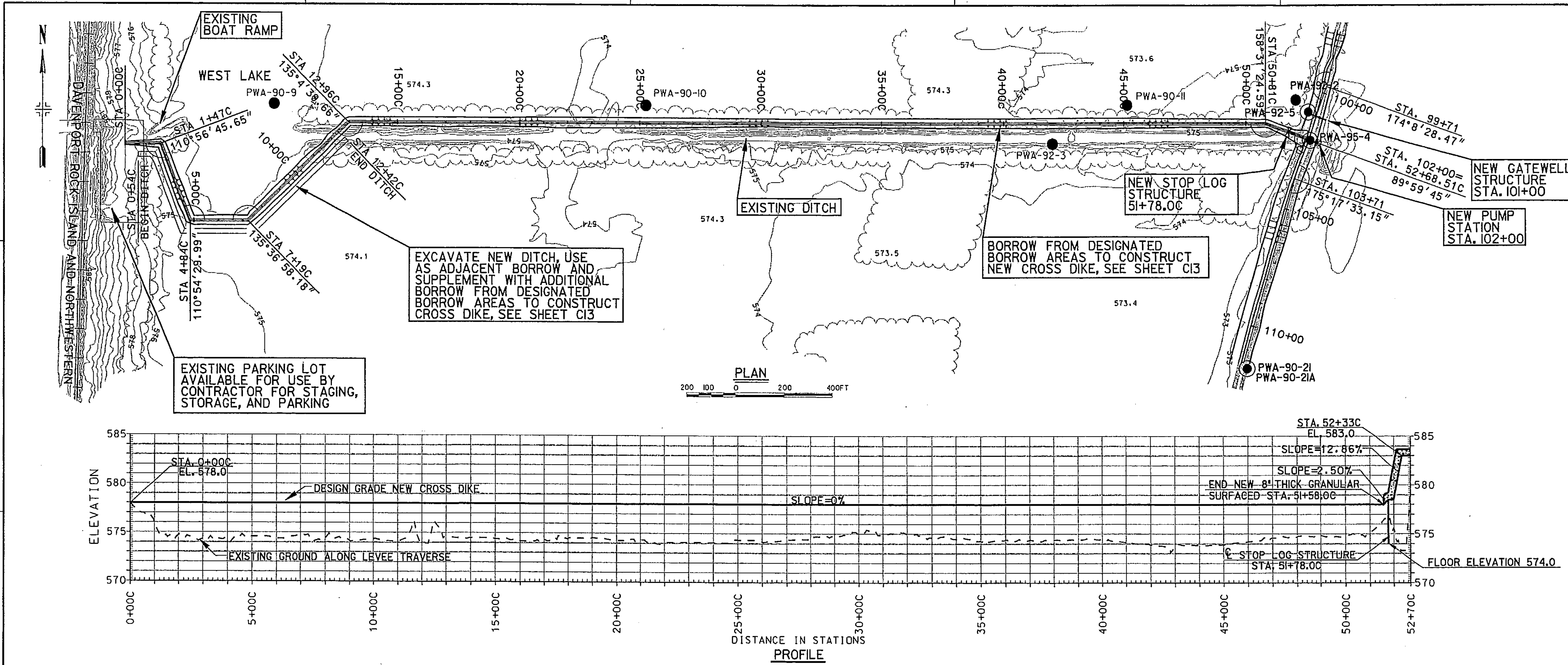
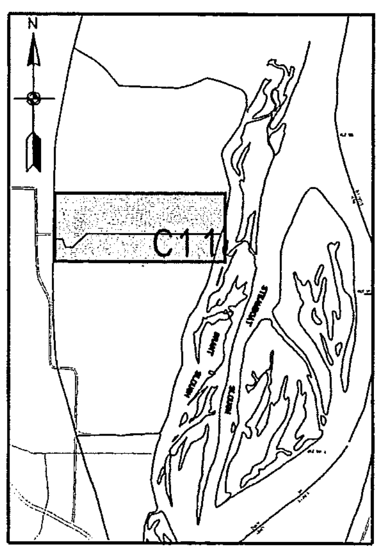
PLATE 12





KEY PLAN

LEGEND:

PWA-90-20 BORING LOCATION

TREE LINE

NOTE:

1. FOR NOTES SEE SHEET C6.

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

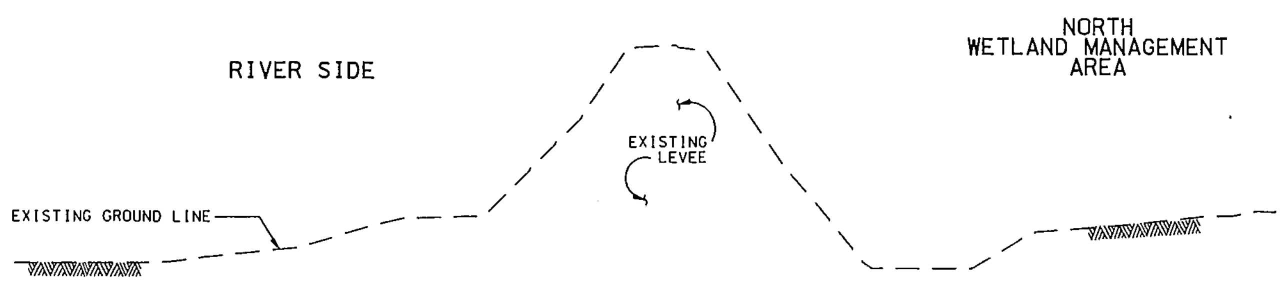
Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

CROSS DIKE PLAN AND PROFILE
STA. 0+00C TO STA. 52+68.51C

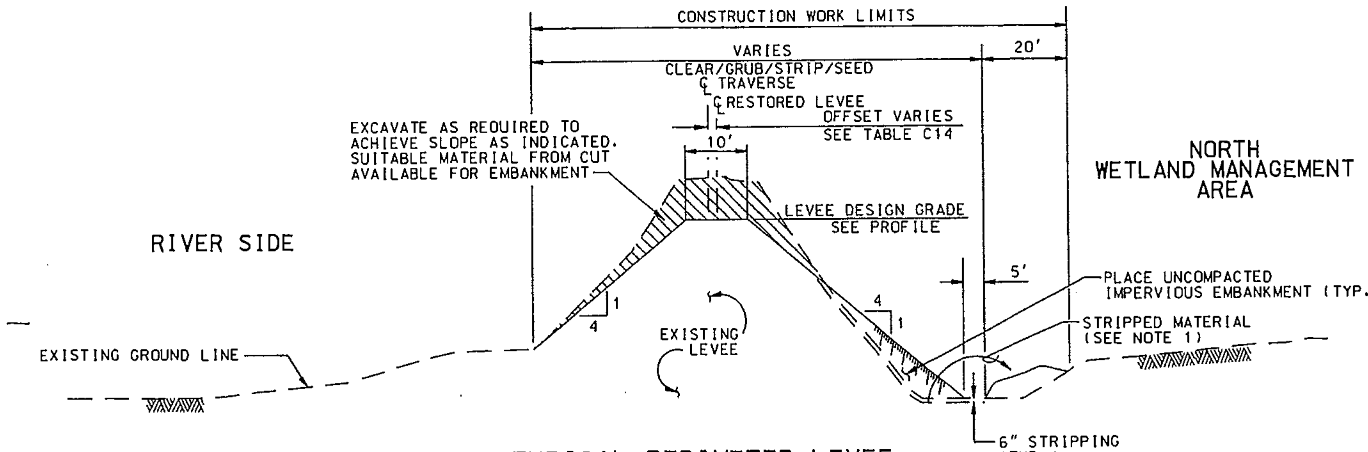
Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C11
Solicitation Number: DACW25-95-R-0024
Sheet 14 of

05-NOV-2001 10:33

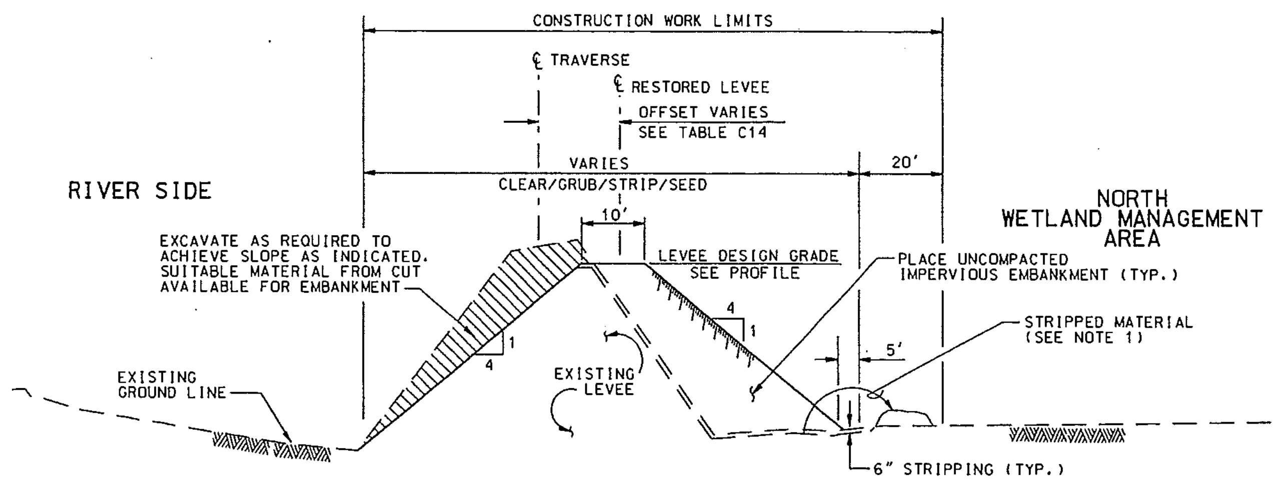
PLATE 13



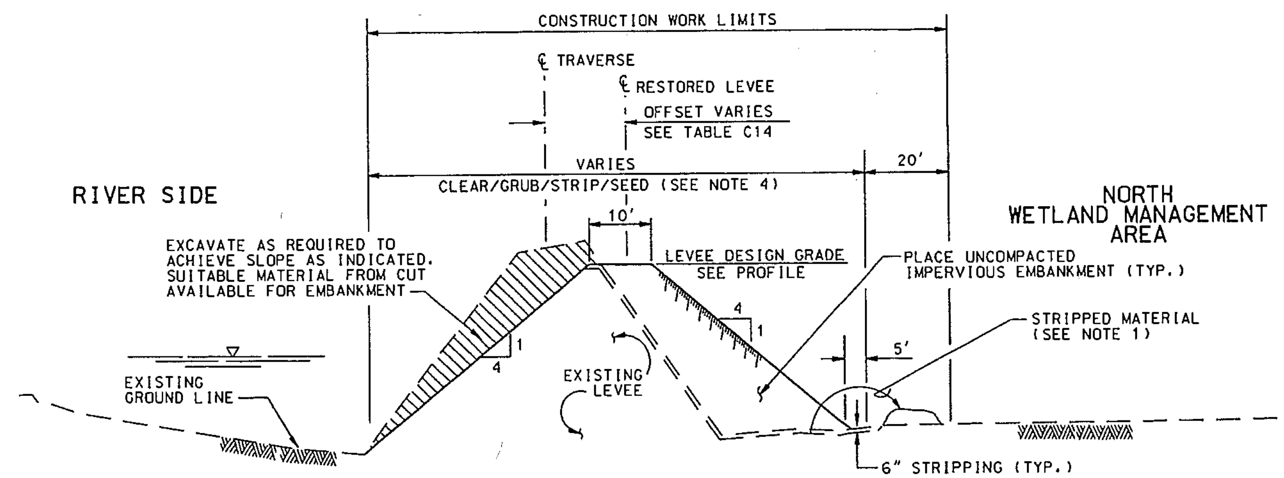
TYPICAL PERIMETER LEVEE
STA. 0+00 TO STA. 0+75
(NO WORK REQUIRED)



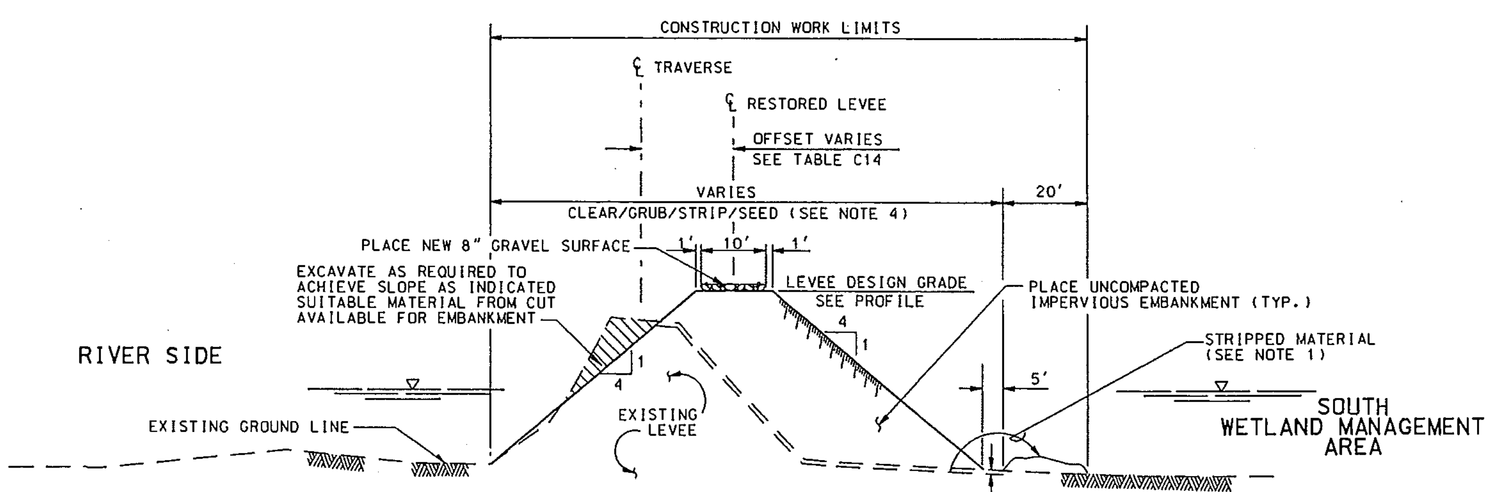
TYPICAL PERIMETER LEVEE
STA. 0+75 TO STA. 18+00



TYPICAL PERIMETER LEVEE
STA. 18+00 TO STA. 60+00



TYPICAL PERIMETER LEVEE
STA. 60+00 TO STA. 90+80
(SEE NOTE 5)



TYPICAL PERIMETER LEVEE
STA. 100+80 TO STA. 163+73
(SEE NOTE 5)

NOTES:

1. SEE SPECIFICATIONS FOR FINAL PLACEMENT OF STRIPPED MATERIAL.
2. LEVEE DESIGN GRADE DOES NOT INCLUDE 6" OVERBUILD. SEE SPECIFICATIONS.
3. WATER ELEVATION VARIES FOR HYDROGRAPHS AND DURATION CURVES. SEE SPECIFICATIONS.
4. AREAS BELOW FLAT POOL NEED NOT BE SEEDED.
5. CONSTRUCTION OF LEVEE FROM STATION 60+00 TO STATION 163+73 MAY ENCOUNTER WATER ON BOTH SIDES OF LEVEE.

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

US Army Corps of Engineers Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

TYPICAL LEVEE SECTIONS I

Designed by:	AWG
Drawn by:	TPD
Checked by:	AWG
Reviewed by:	BLK
Approved by:	CHARLES S. COX COL., CORPS OF ENGINEERS
Scale:	NO SCALE
Date:	20 OCT. 1995
Drawing Code:	M-L 14-135
Sheet reference number:	C12
Solicitation Number:	DACW25-95-R-0024
Sheet	15 of

05-NOV-2001 10:34
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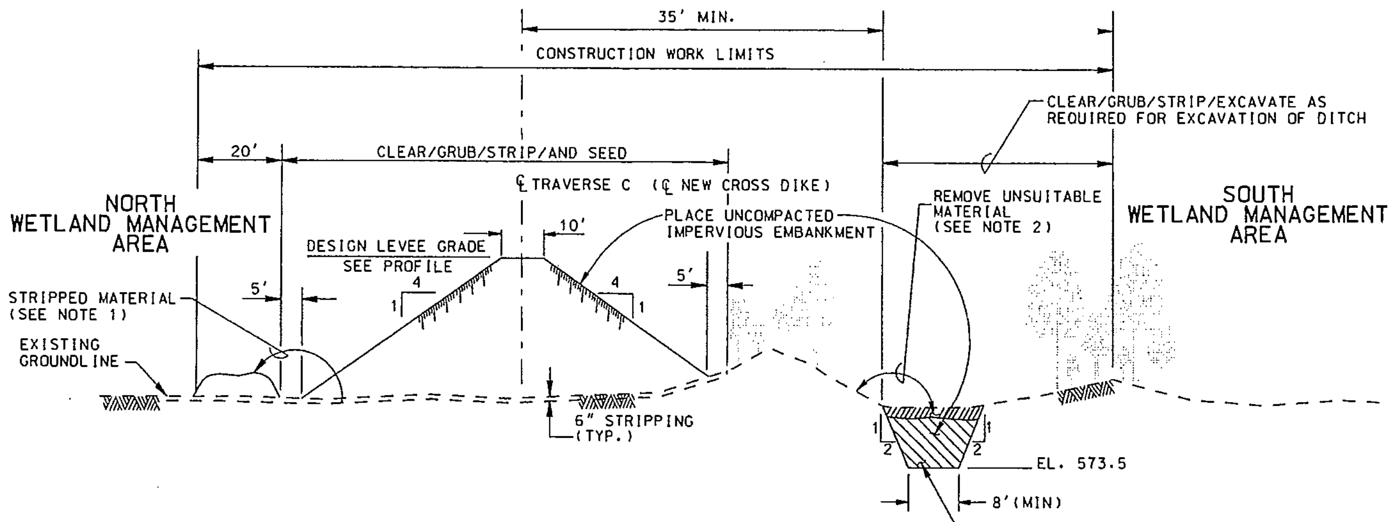
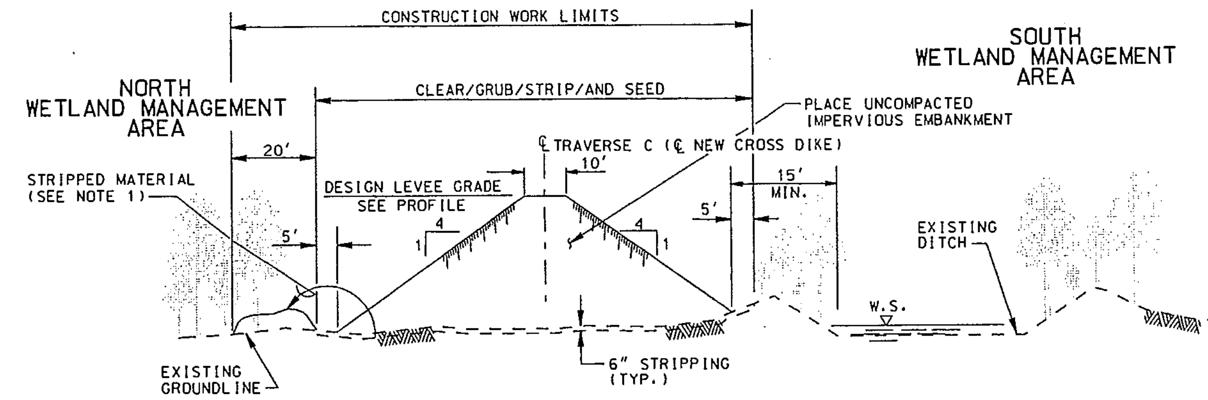
PLATE 14



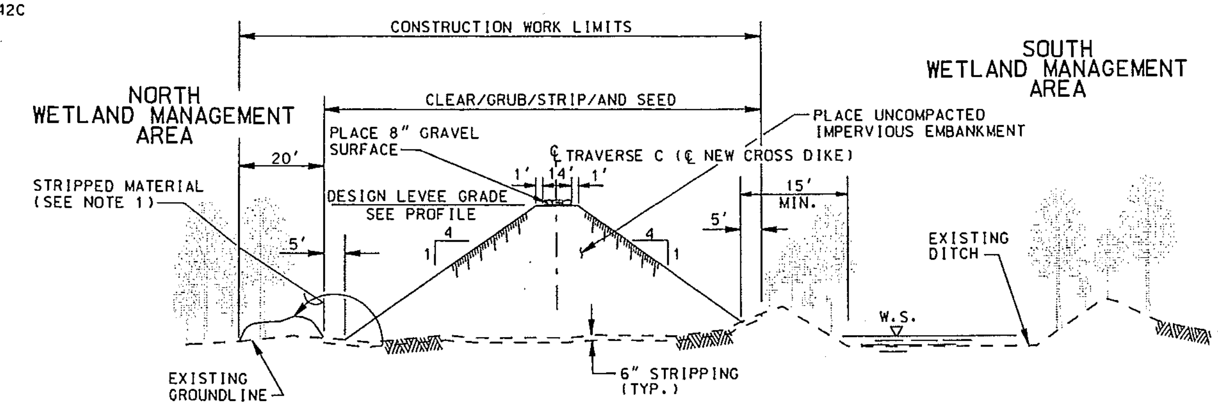
TYPICAL CROSS DIKE LEVEE SECTION

STA. 0+00C TO STA. 12+42C



TYPICAL CROSS DIKE LEVEE SECTION

STA. 12+42C TO STA. 51+58.01C

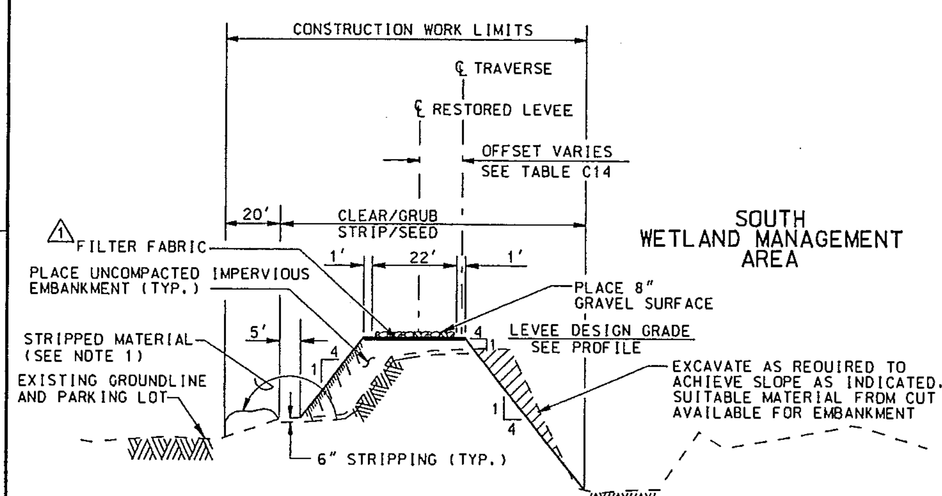


TYPICAL CROSS DIKE LEVEE SECTION

STA. 51+58.01C TO STA. 52+68.51C

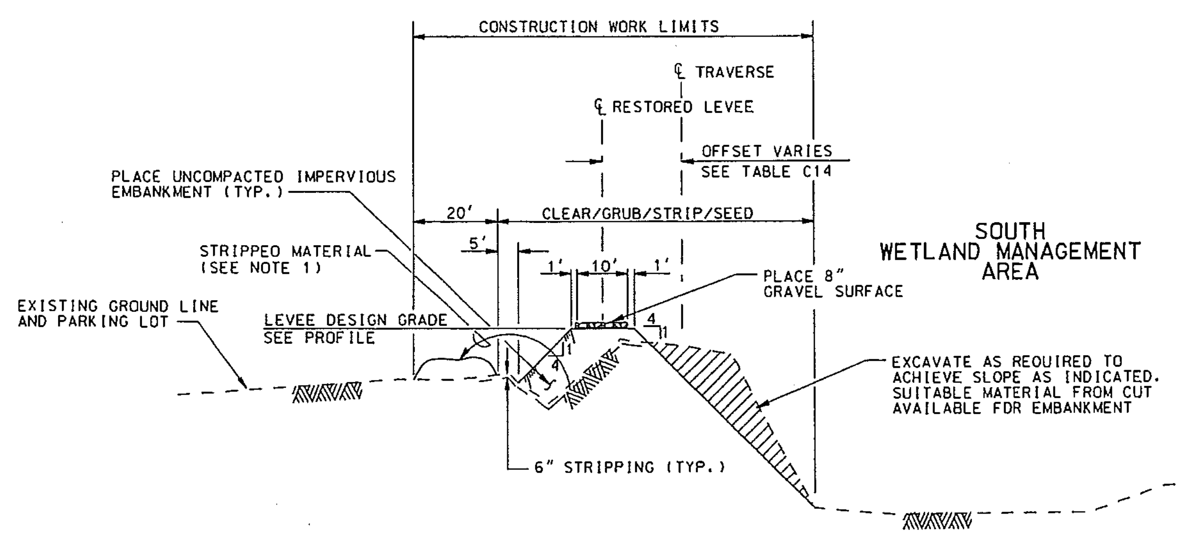
NOTES:

1. FOR NOTES, SEE SHEET C12.
2. FOR CROSS DIKE CONSTRUCTION BETWEEN STATIONS 0+54C TO 12+42C CONTRACTOR SHALL DETERMINE SUITABILITY OF EXCAVATED DITCH MATERIAL PRIOR TO USE IN CROSS DIKE EMBANKMENT. SUPPLEMENT EXCAVATED DITCH BORROW WITH BORROW FROM DESIGNATED AREAS TO COMPLETE CROSS DIKE EMBANKMENT.
3. BEGIN DITCH EXCAVATION AT STATION 0+54C.



TYPICAL PERIMETER LEVEE (SPILLWAY/ ROADWAY)

STA. 1+00B TO END OF PROJECT



TYPICAL PERIMETER LEVEE

STA. 0+00B TO STA. 1+00B

Revisions			
Symbol	Description	Date	Approved
1	REVISED AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

US Army Corps of Engineers Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

TYPICAL LEVEE SECTIONS II

Designed by: AWG
Drawn by: TPD
Checked by: AWG
Reviewed by: BLK
Approved by: CHARLES S. COE COL., CORPS OF ENGINEERS

Scale: NO SCALE
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: C13
Solicitation Number: DACW25-95-R-0024
Sheet 16 of

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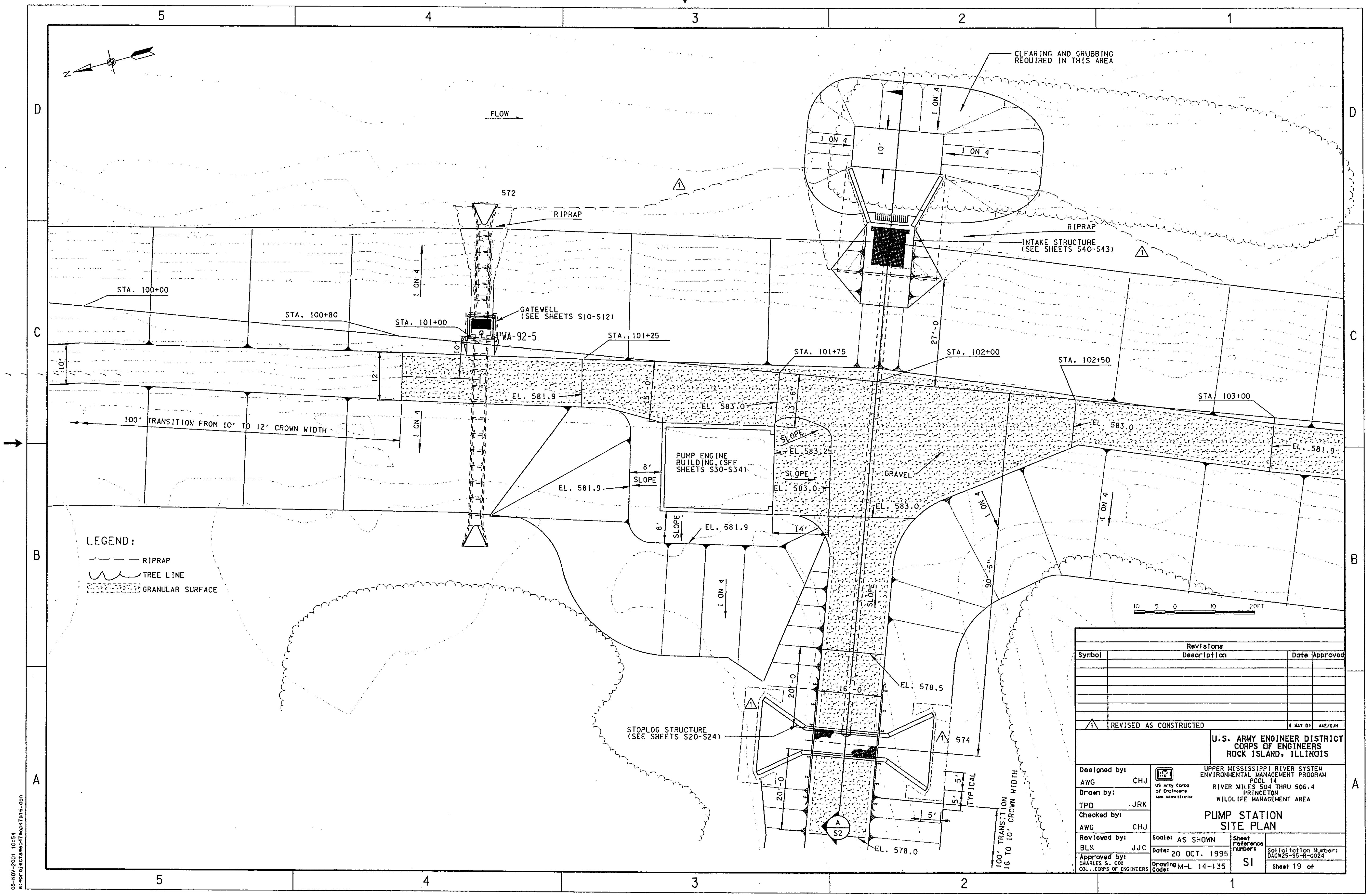
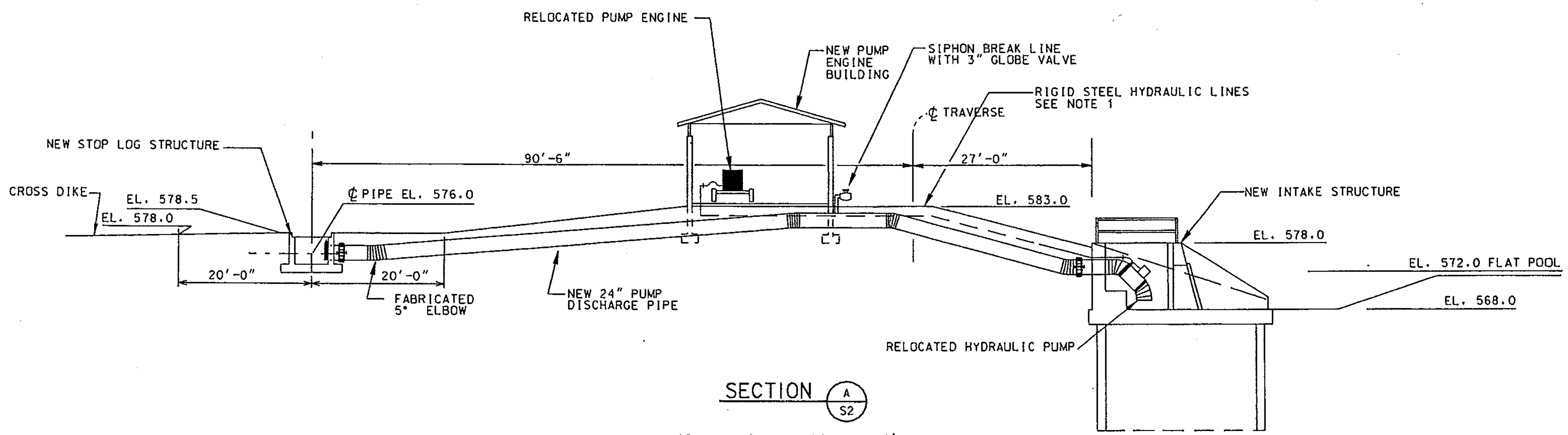


CLEARING AND GRUBBING REQUIRED IN THIS AREA
FLOW
572
RIPRAP
INTAKE STRUCTURE (SEE SHEETS S40-S43)
GATEWELL (SEE SHEETS S10-S12)
PWA-92-5
STA. 100+00
STA. 100+80
STA. 101+00
STA. 101+25
STA. 101+75
STA. 102+00
STA. 102+50
STA. 103+00
1 ON 4
27'-0
EL. 581.9
EL. 583.0
EL. 583.25
EL. 578.5
EL. 578.0
100' TRANSITION FROM 10' TO 12' CROWN WIDTH
PUMP ENGINE BUILDING, (SEE SHEETS S30-S34)
SLOPE
GRAVEL
1 ON A
90'-6"
14'
16'-0
20'-0
STOPLOG STRUCTURE (SEE SHEETS S20-S24)
574
5' TYPICAL
100' TRANSITION 16 TO 10' CROWN WIDTH
LEGEND:
RIPRAP
TREE LINE
GRANULAR SURFACE
Revisions
Symbol
Description
Date
Approved
REVISED AS CONSTRUCTED
4 MAY 01
AAE/DJH
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by: AWG CHJ
Drawn by: TPD JRK
Checked by: AWG CHJ
Reviewed by: BLK JJC
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS
UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA
PUMP STATION
SITE PLAN
Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: S1
Solicitation Number: DACW25-95-R-0024
Sheet 19 of
05-NOV-2001 10:54

PLATE 16



SECTION A/S2

10 0 10 20'

NOTE:
SEE MECHANICAL SHEETS FOR SPECIFICS ON HYDRAULIC PUMP, PUMP ENGINE, DISCHARGE PIPE, AND ASSOCIATED EQUIPMENT.

Revisions			
Symbol	Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

US Army Corps of Engineers Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

PUMP STATION AND INTAKE SECTION

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: S2
Solicitation Number: DACW25-95-R-0024
Sheet 20 of

05-NOV-2001 10:56
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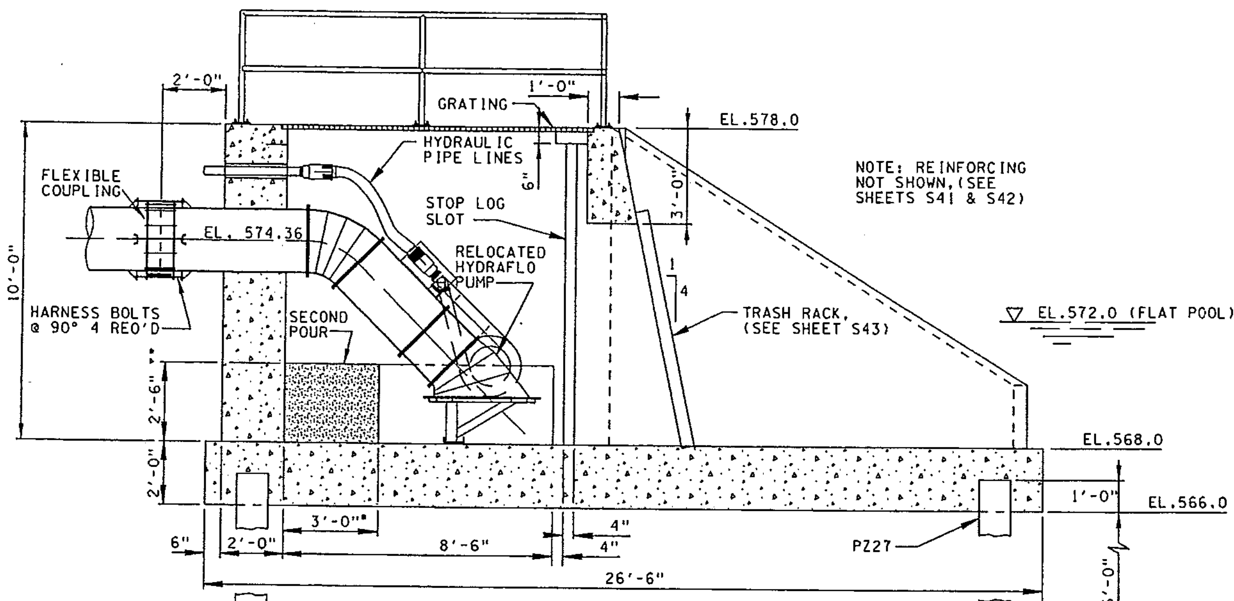
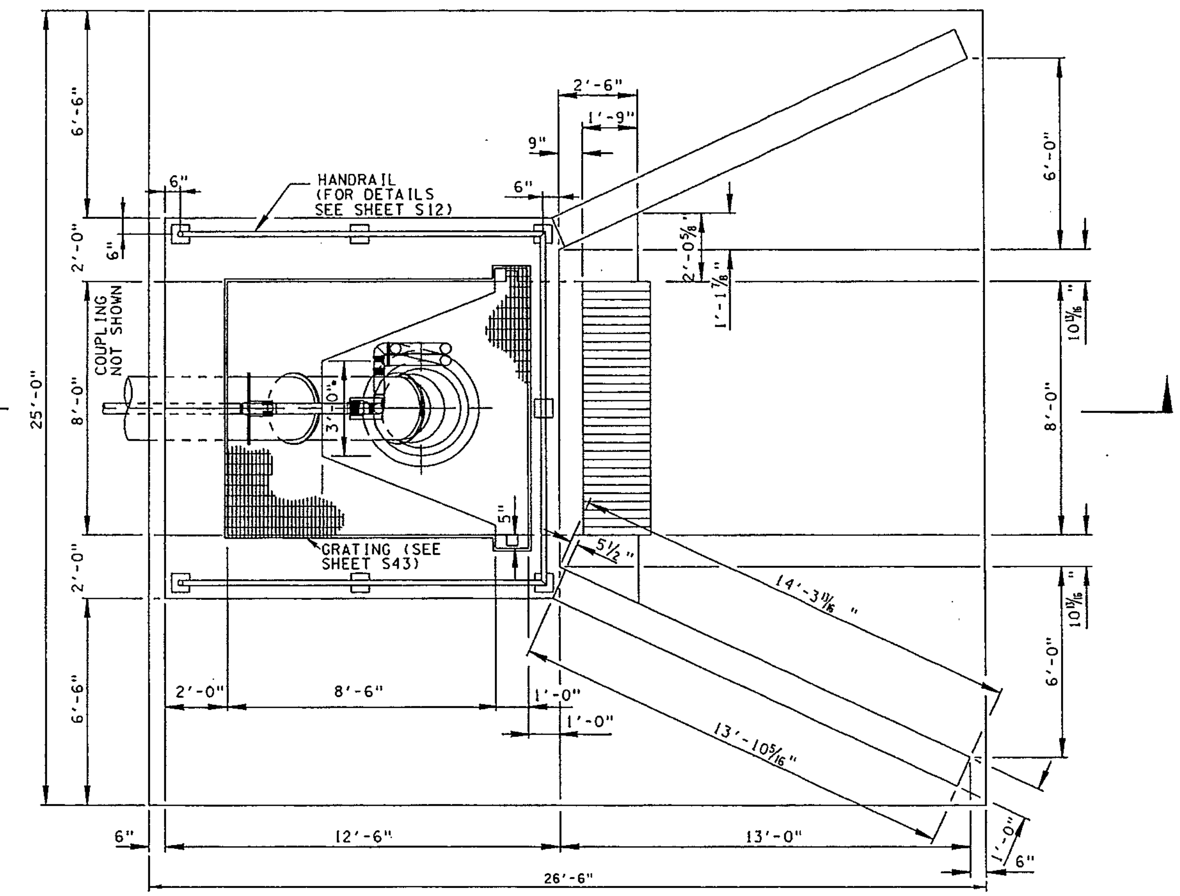
PLATE 17



NOTE: REINFORCING NOT SHOWN, (SEE SHEETS S41 & S42)

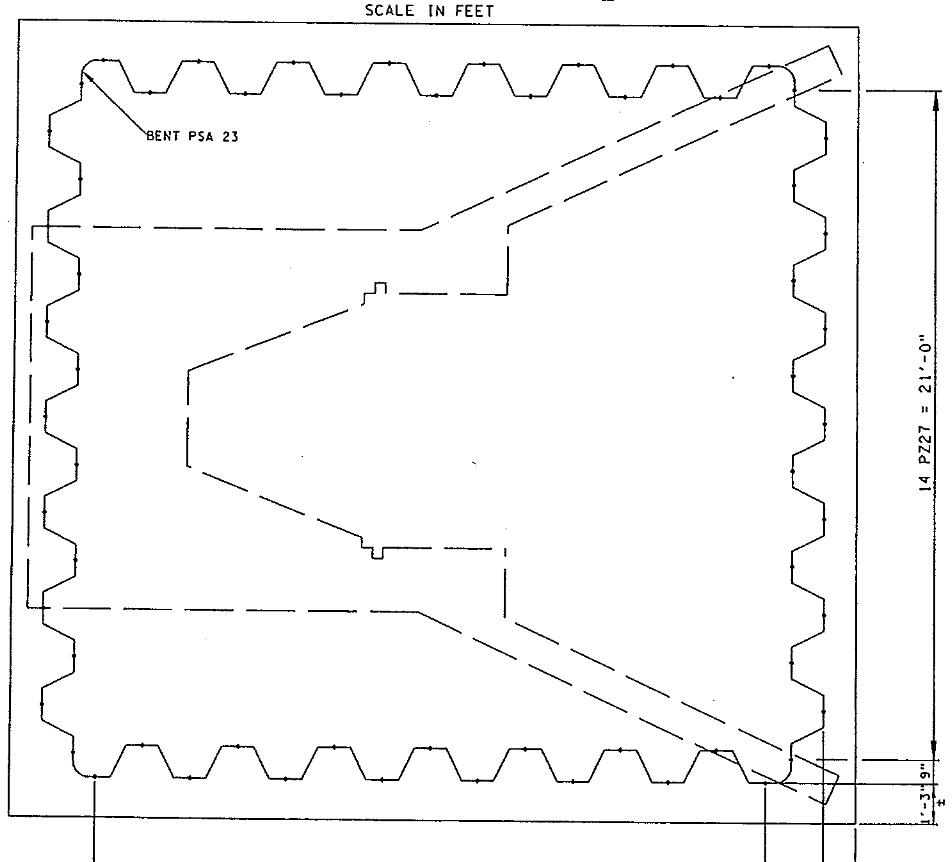
SECTION A/S40

4 0 4 8'
SCALE IN FEET



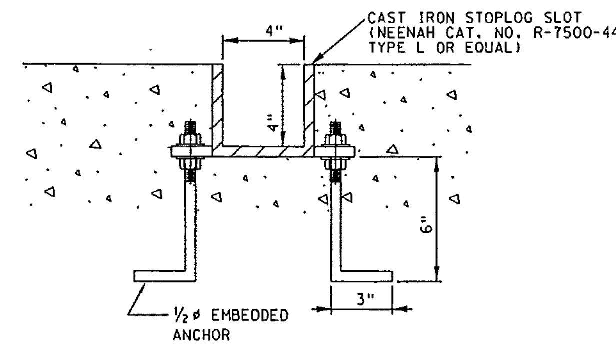
PLAN

4 0 4 8'
SCALE IN FEET



FOUNDATION PLAN

4 0 4 8'
SCALE IN FEET



STOPLOG DETAIL

NO SCALE

*THE ACTUAL SUMP DIEMENSIONS SHALL BE DETERMINED AFTER THE FIELD SUMP TEST HAS BEEN PERFORMED, SEE SPECIFICATIONS.

**MAKE THIS DIMENSION AS LARGE AS POSSIBLE.

REFERENCES:
1. FOR CONCRETE AND REINFORCING NOTES SEE S11

Symbol	Revisions Description	Date	Approved
1	AS CONSTRUCTED	4 MAY 01	AAE/DJH

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

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

INTAKE STRUCTURE
PLAN AND ELEVATION

Designed by:	
Drawn by:	
Checked by:	
Reviewed by:	Scale: AS SHOWN
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS	Date: 20 OCT. 1995
	Drawing Code: M-L 14-135

Sheet reference number: S40
Solicitation Number: DACW25-95-R-0024
Sheet 38 of

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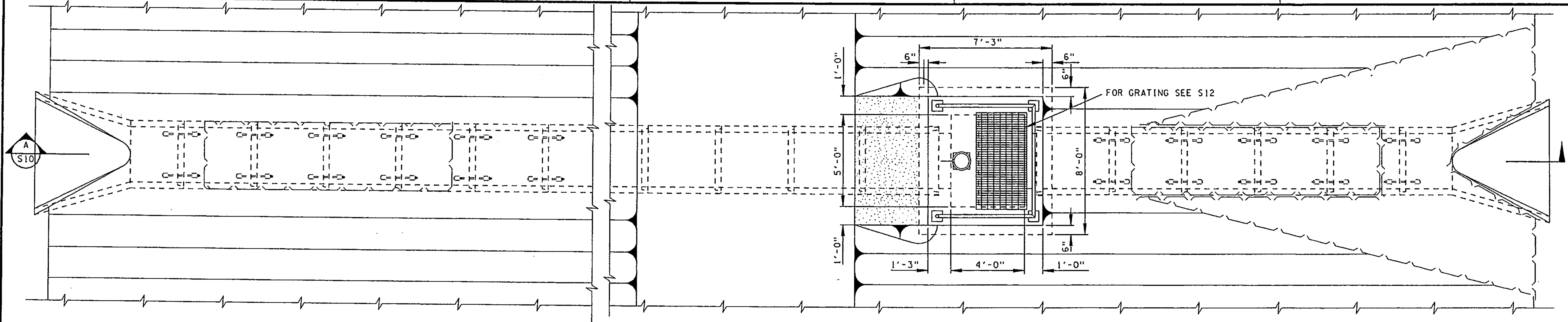
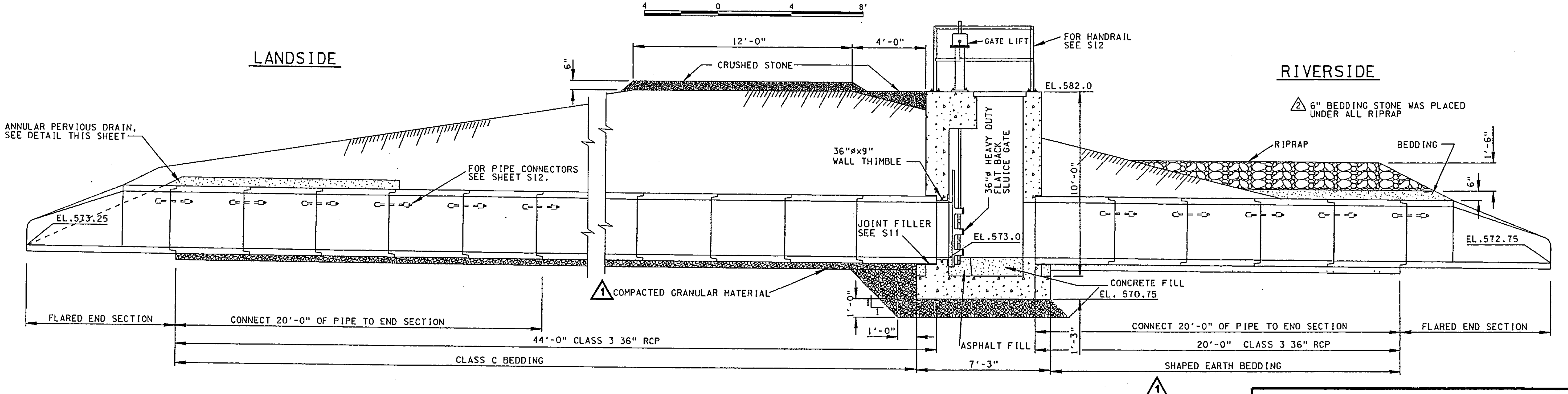
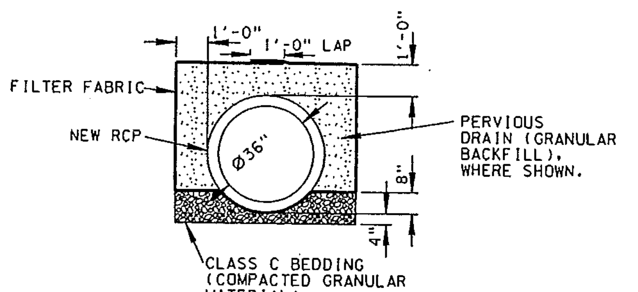
PLATE 19



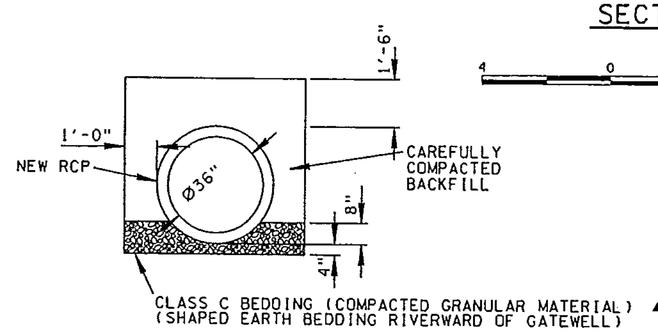
PLAN



SECTION A/S10



BEDDING AND DRAIN DETAIL



BEDDING DETAIL

GATE OPERATOR NOTES:

SEATING HEAD = 8.5'
UNSEATING HEAD = 8.5'
OPERATING HEAD = 8.5'

REFERENCES:

1. FOR LOCATION OF GATEWELL SEE SHEET S1.
2. FOR EXISTING GRADE SEE SHEET S1.

Revisions			
Symbol	Description	Date	Approved
2	REVISED AS CONSTRUCTED	4 MAY 01	AAE/DJH
1	AMD. #1 REMOVED COMPACTED GRAVEL BEDDING RIVERWARD OF GATEWELL.	8DEC95	

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

Designed by:
Drawn by:
Checked by:
Reviewed by:
Approved by: CHARLES S. COX COL., CORPS OF ENGINEERS

US Army Corps of Engineers Rock Island District

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT PROGRAM
POOL 14
RIVER MILES 504 THRU 506.4
PRINCETON
WILDLIFE MANAGEMENT AREA

GATEWELL
PLAN AND ELEVATION

Scale: AS SHOWN
Date: 20 OCT. 1995
Drawing Code: M-L 14-135
Sheet reference number: S10
Solicitation Number: DACW25-95-R-0024
Sheet 22 of

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PLATE 20

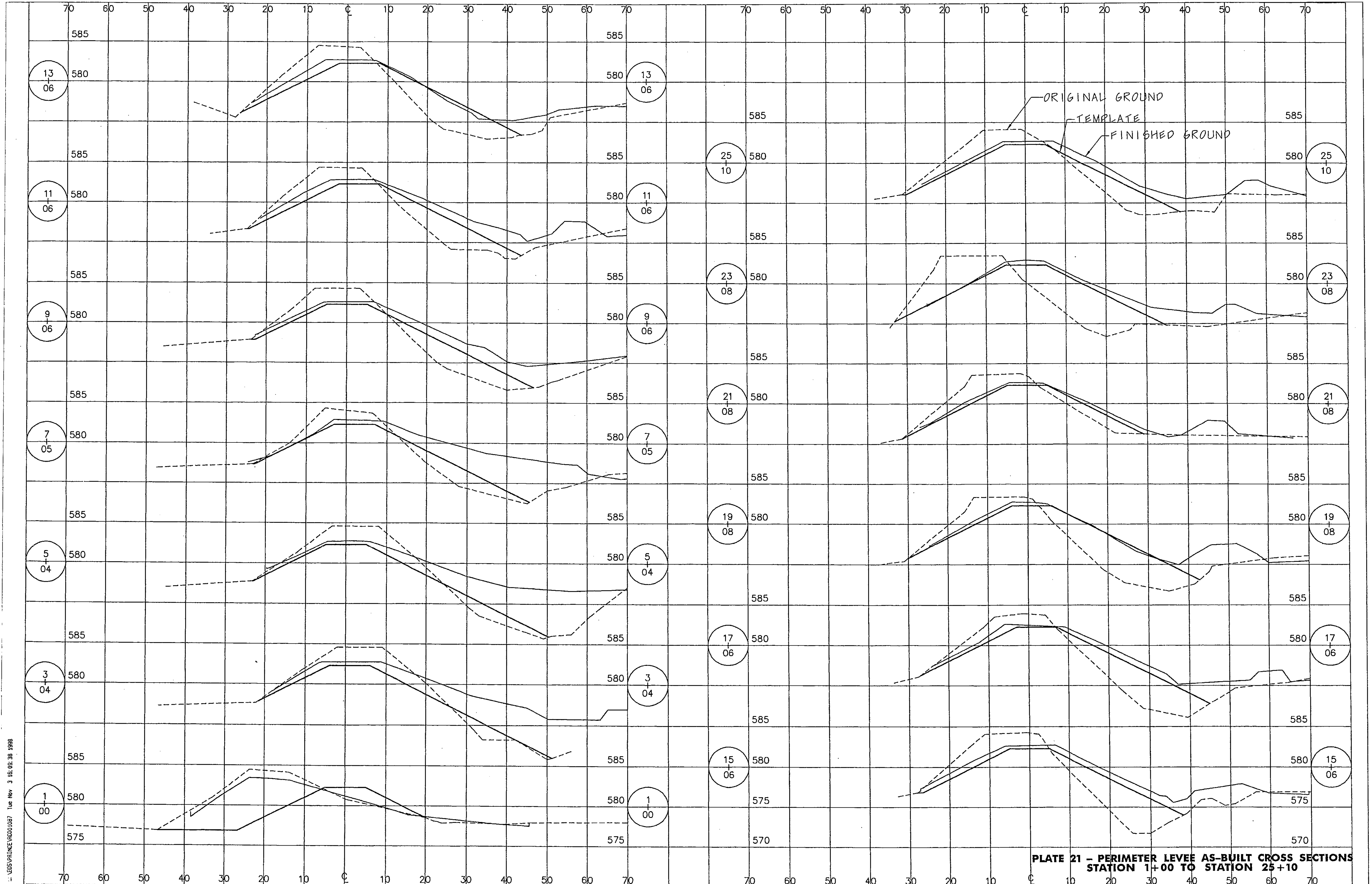


PLATE 21 – PERIMETER LEVEE AS-BUILT CROSS SECTIONS STATION 1+00 TO STATION 25+10

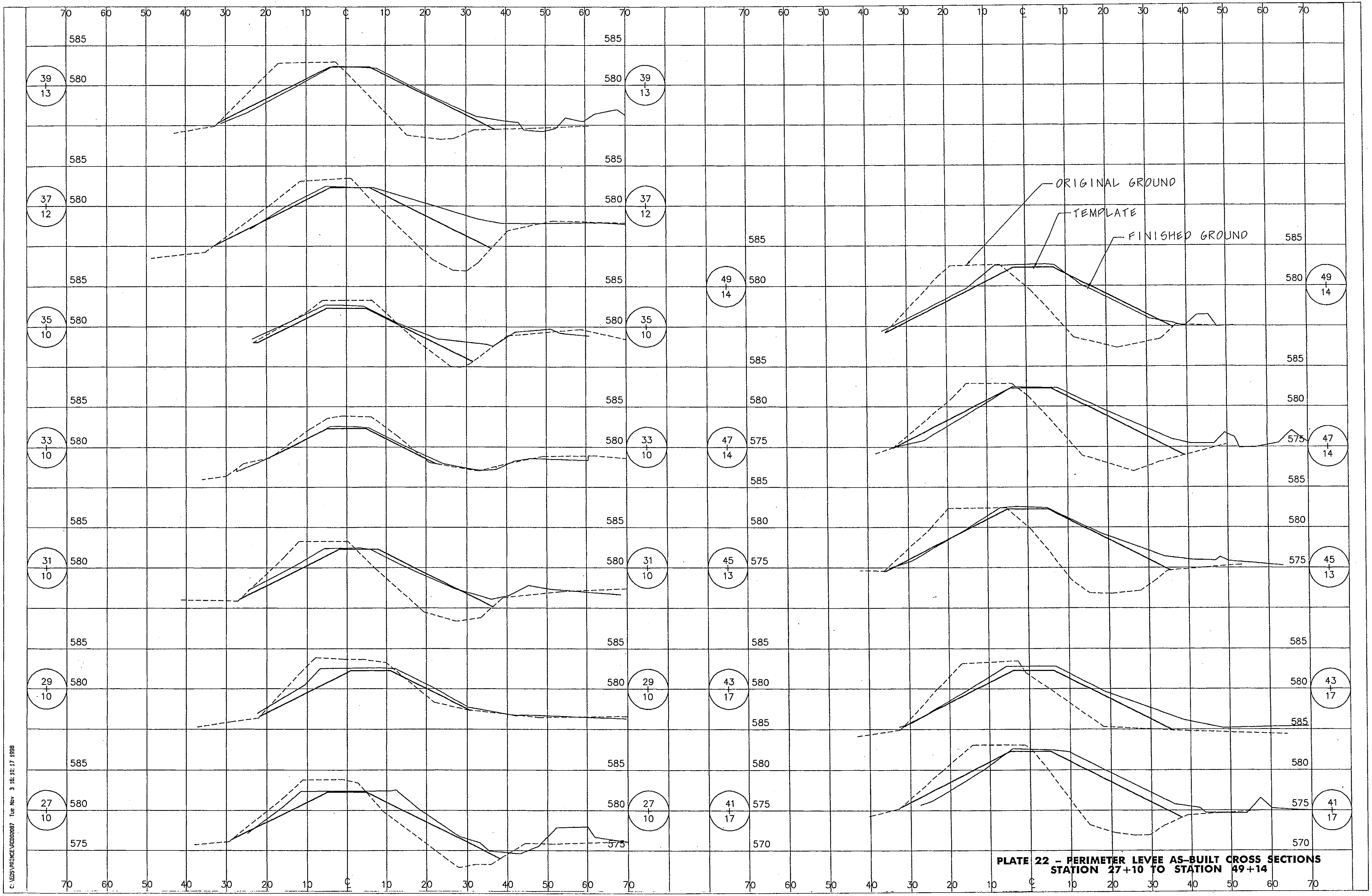


PLATE 22 - PERIMETER LEVEE AS-BUILT CROSS SECTIONS STATION 27+10 TO STATION 49+14

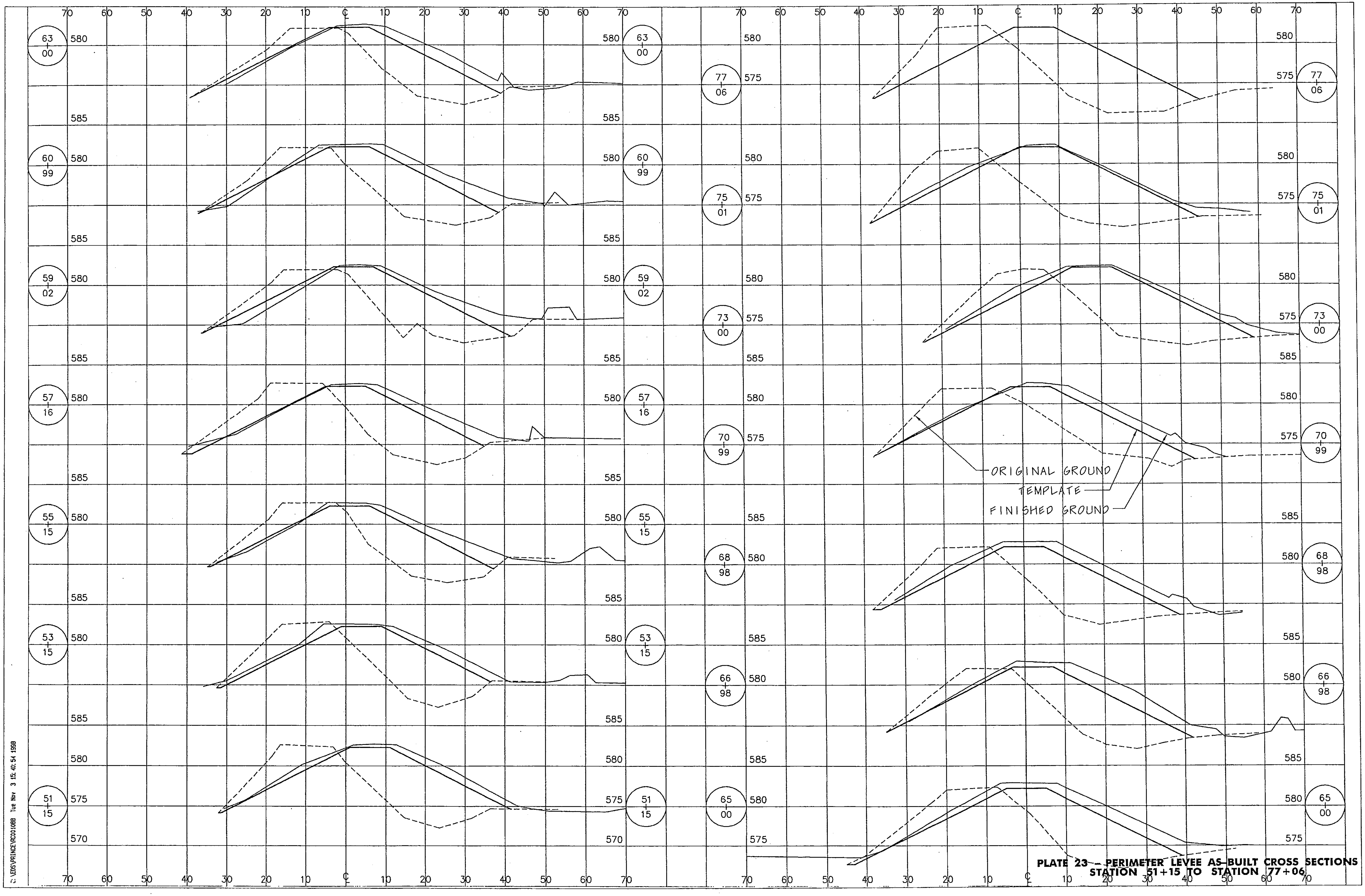


PLATE 23 – PERIMETER LEVEE AS-BUILT CROSS SECTIONS STATION 51+15 TO STATION 77+06

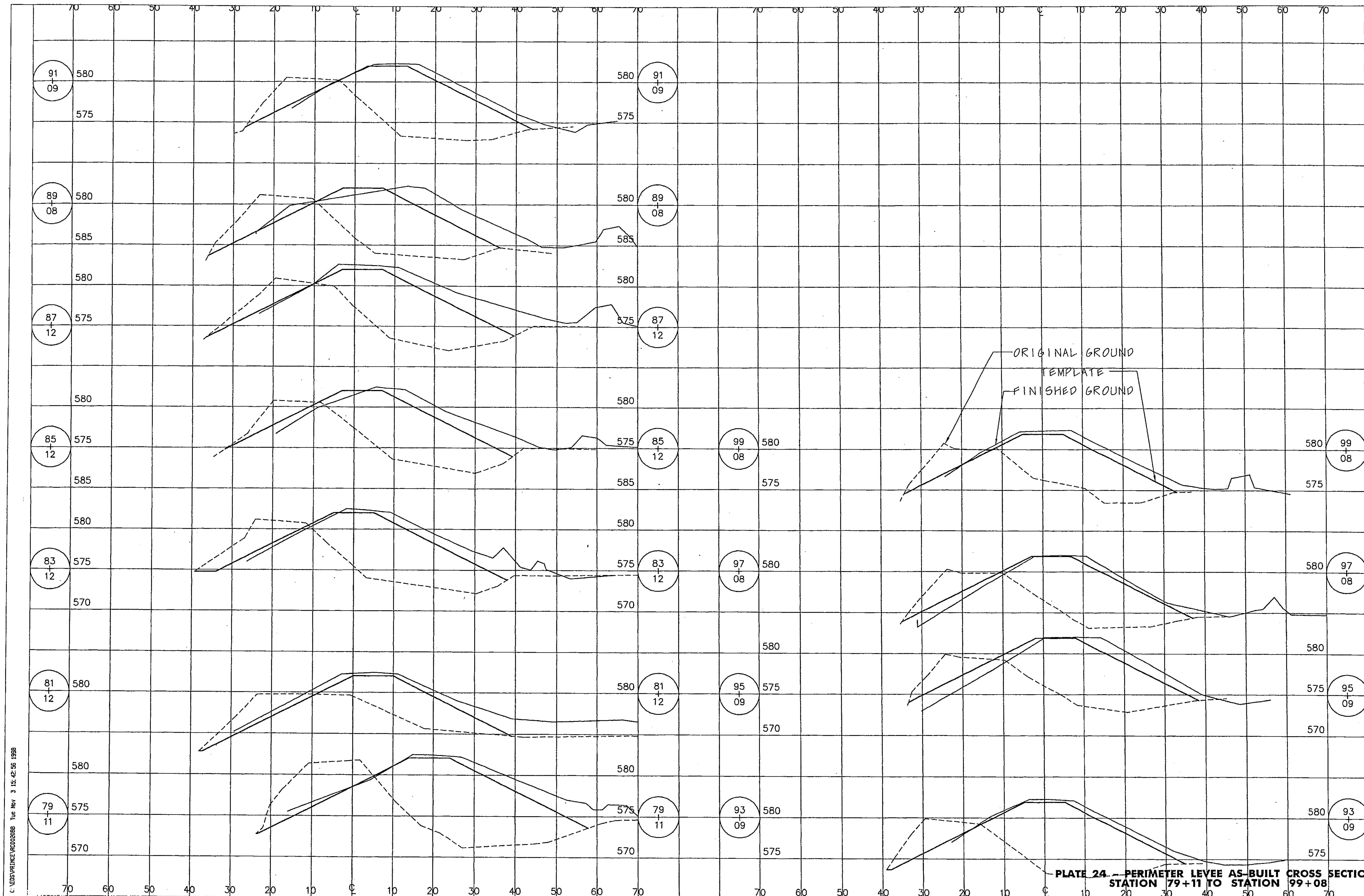


PLATE 24 – PERIMETER LEVEE AS-BUILT CROSS SECTIONS
STATION 79+11 TO STATION 99+08

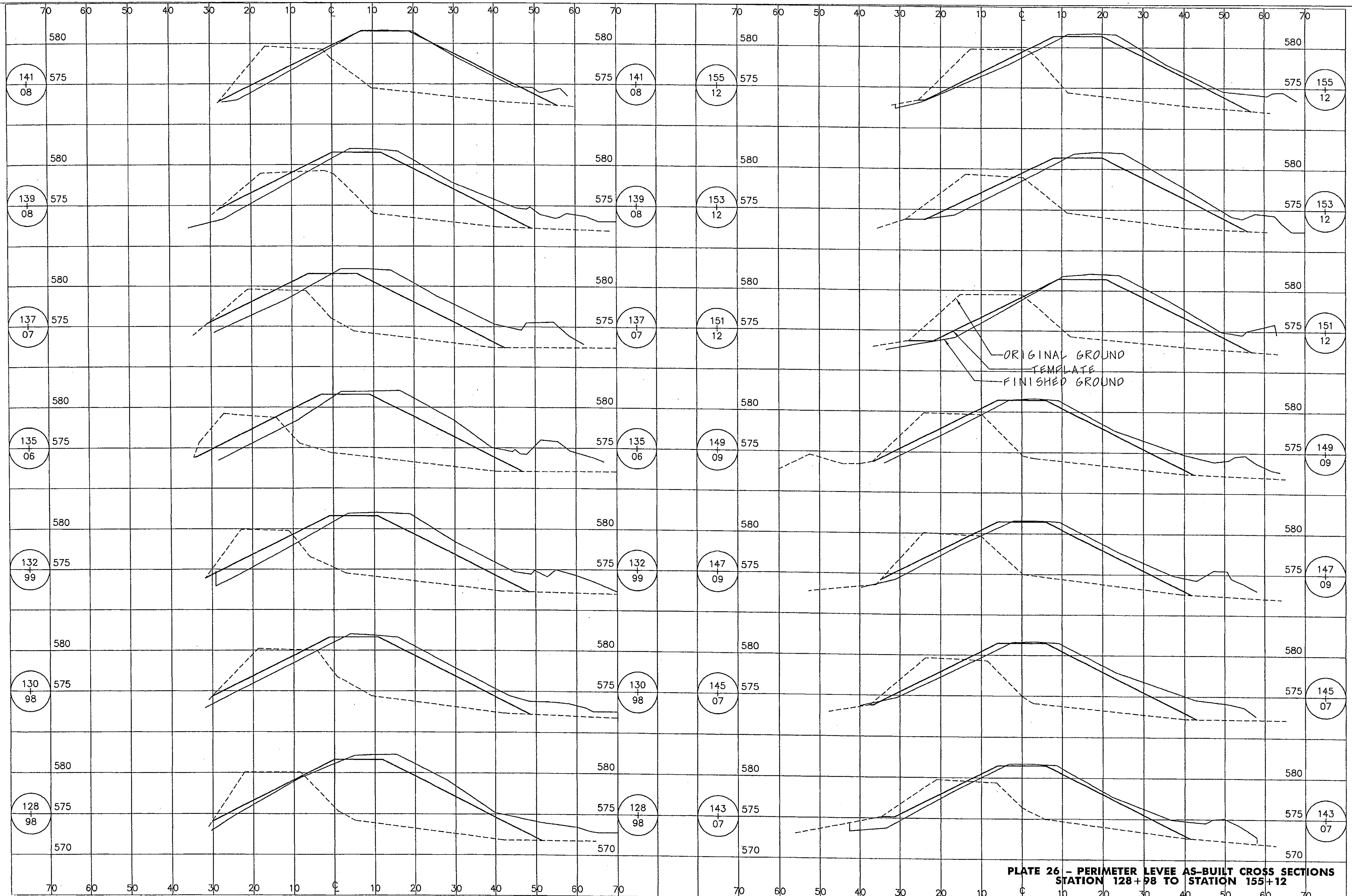


PLATE 26 – PERIMETER LEVEE AS-BUILT CROSS SECTIONS
STATION 128+98 TO STATION 155+12

C:\EDS\PRINCE\ED02085 Tue Nov 3 16:08:02 1998

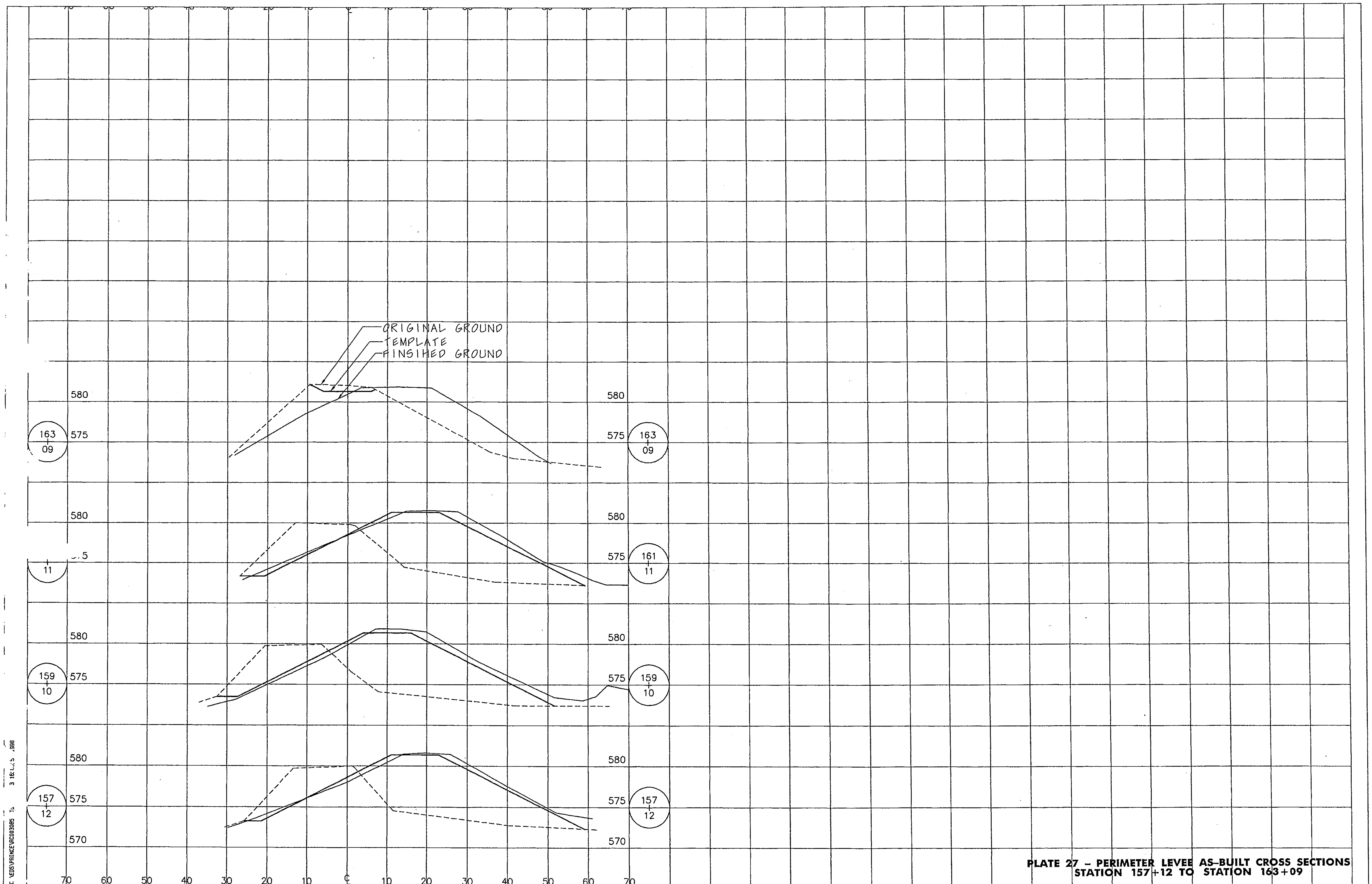


PLATE 27 – PERIMETER LEVEE AS–BUILT CROSS SECTIONS
STATION 157+12 TO STATION 163+09

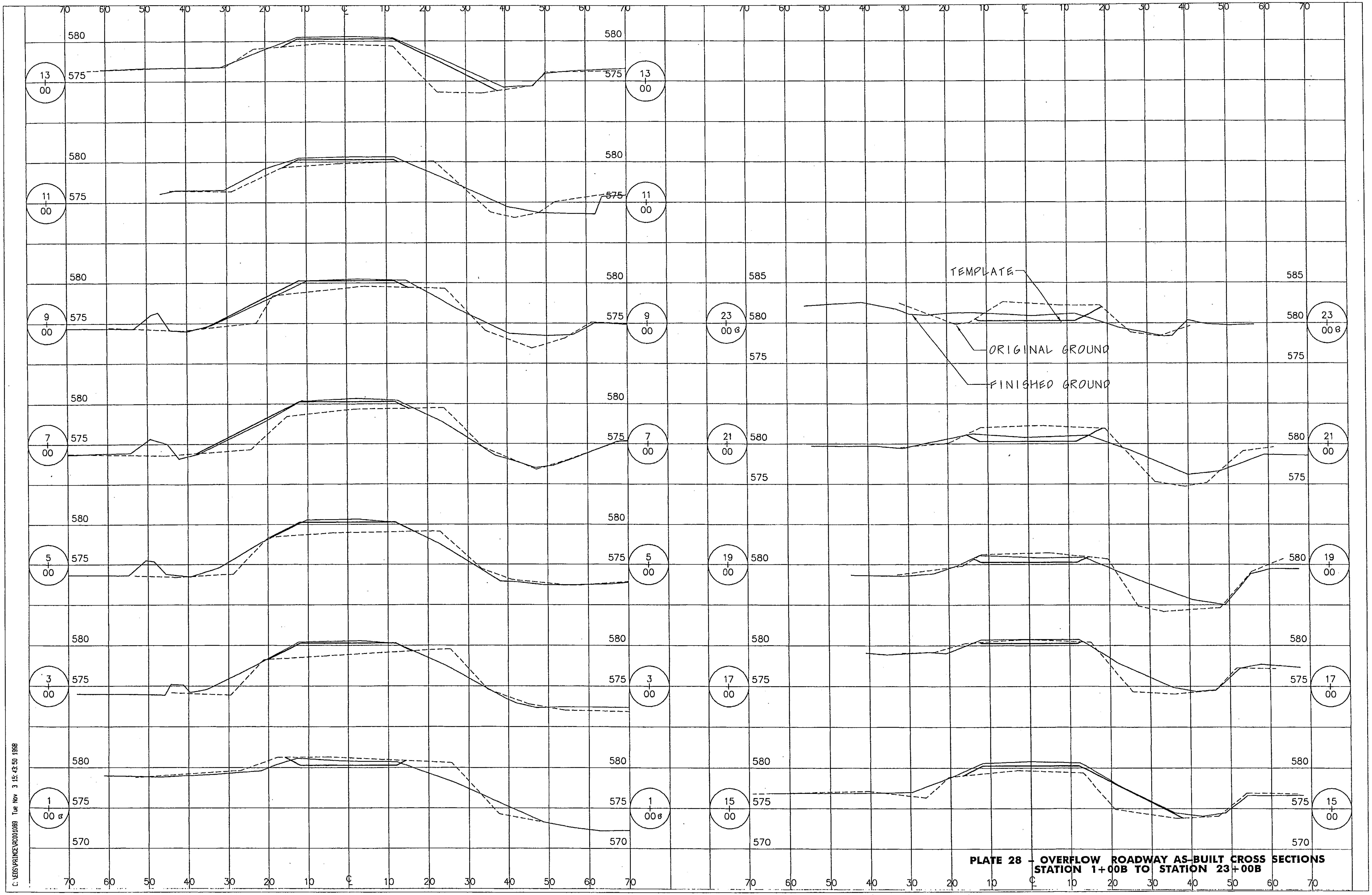


PLATE 28 – OVERFLOW ROADWAY AS-BUILT CROSS SECTIONS STATION 1+00B TO STATION 23+00B

C:\EDS\PRINCE\PC001089 Tue Nov 3 15:43:50 1998

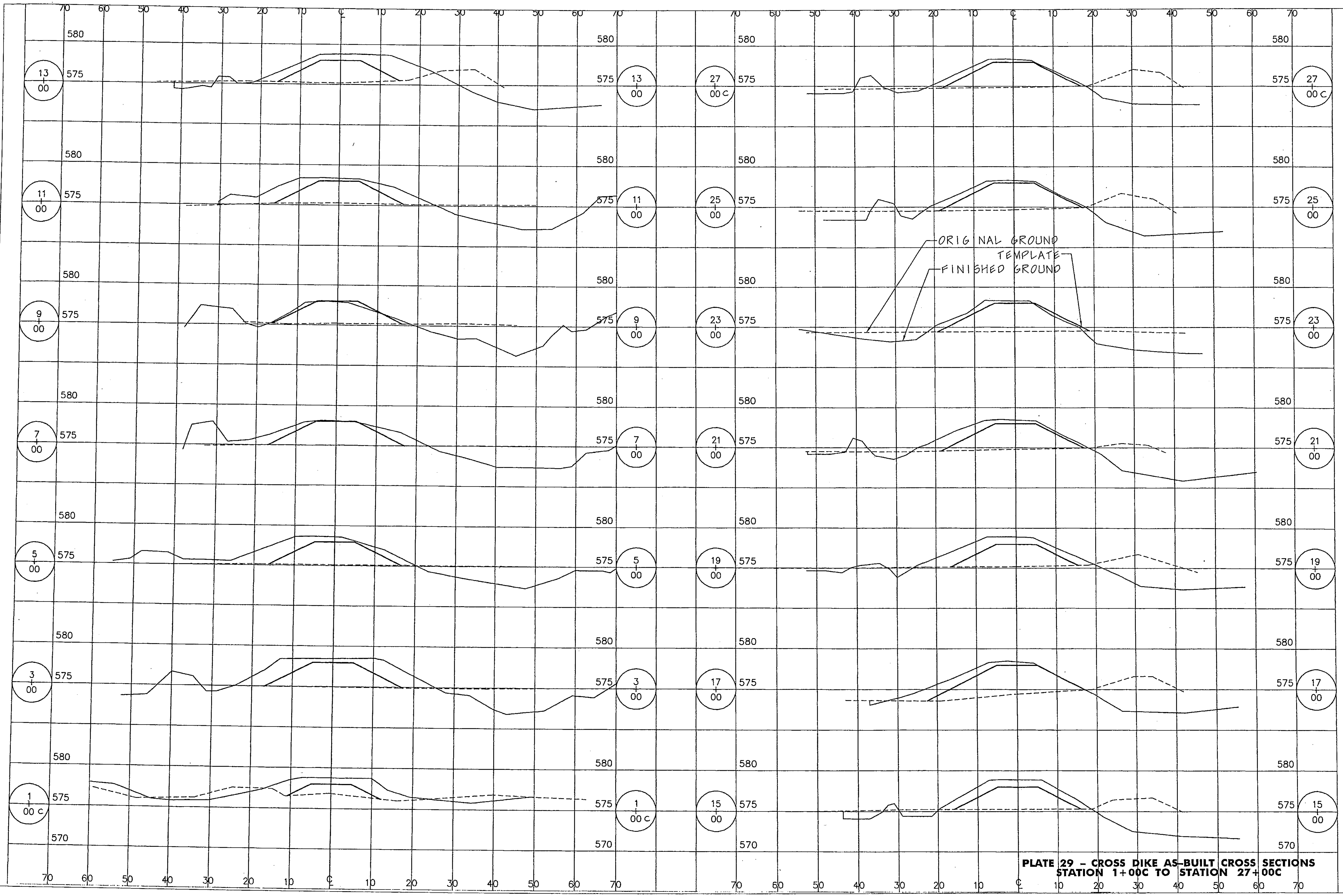


PLATE 29 - CROSS DIKE AS-BUILT CROSS SECTIONS
STATION 1+00C TO STATION 27+00C

C:\EDS\PRINCE\RC001086 Tue Nov 3 15:38:04 1998

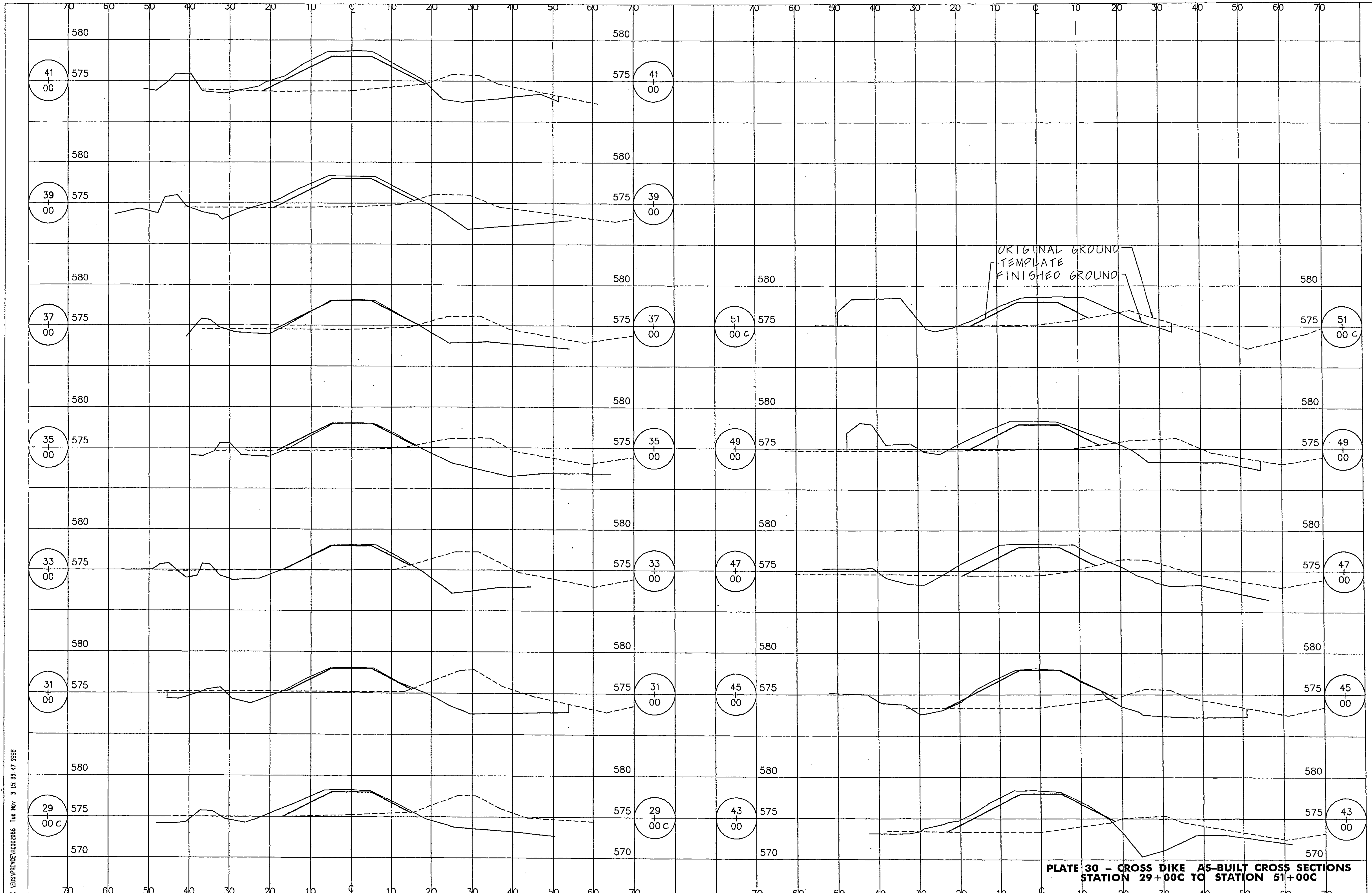


PLATE 30 – CROSS DIKE AS-BUILT CROSS SECTIONS STATION 29+00C TO STATION 51+00C

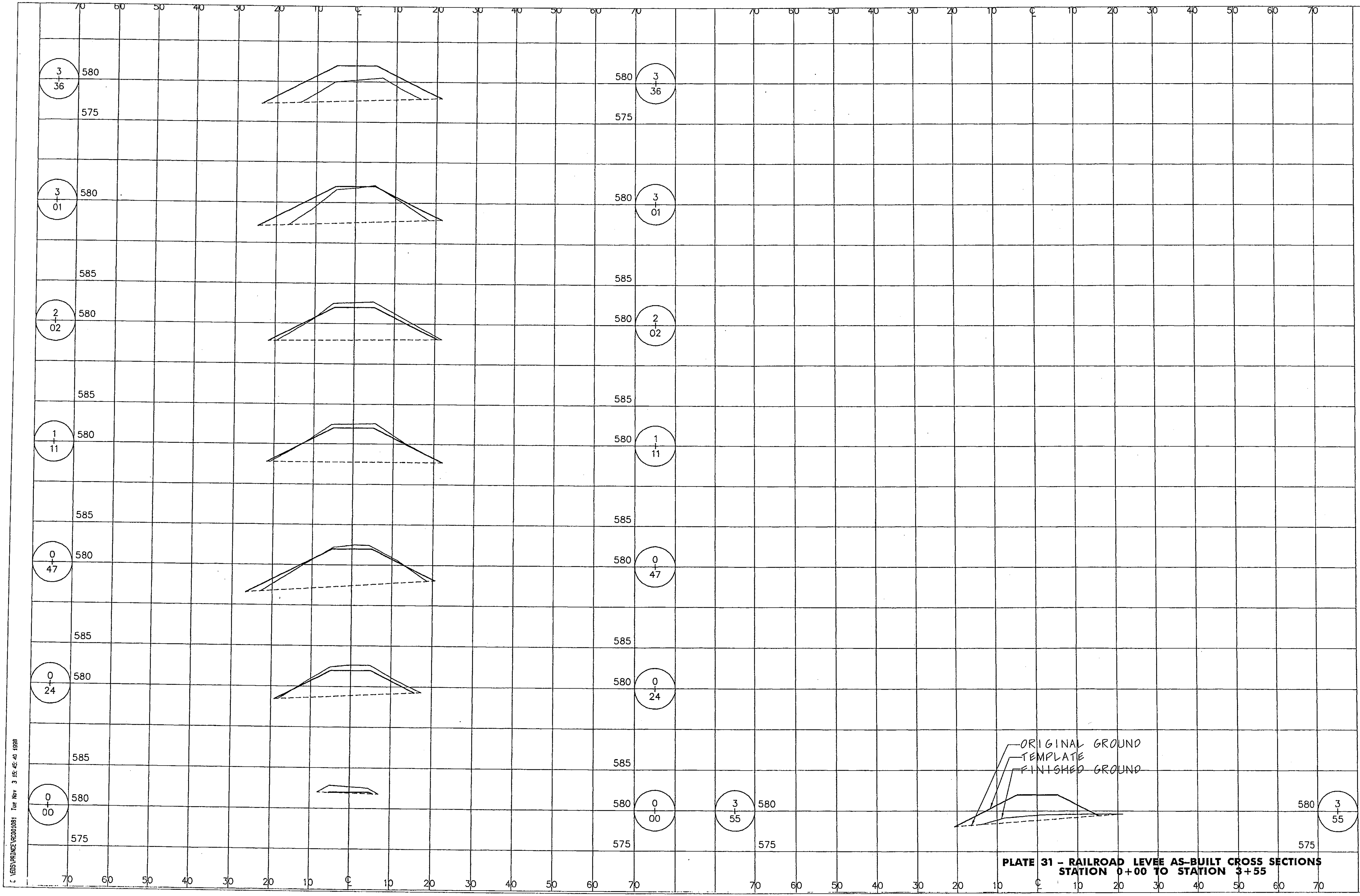
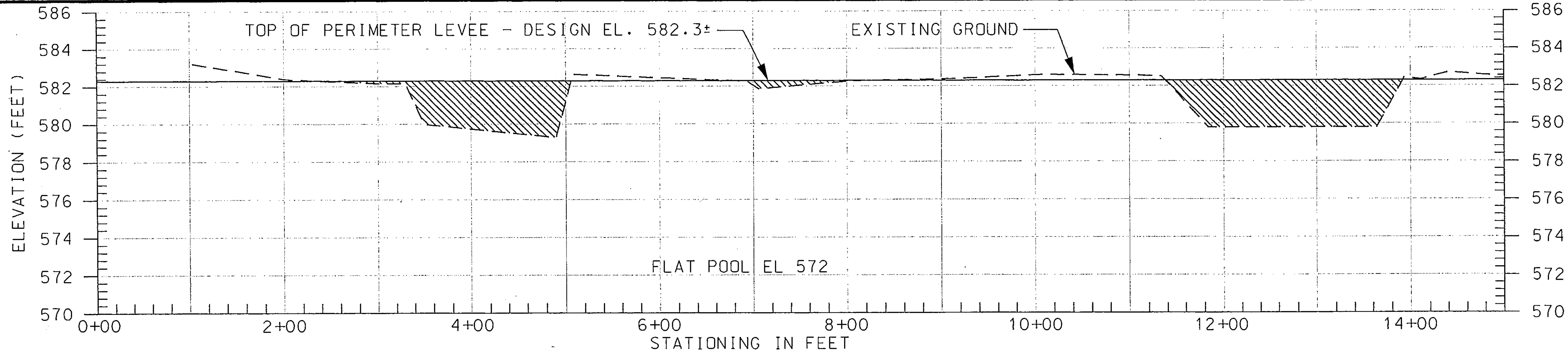
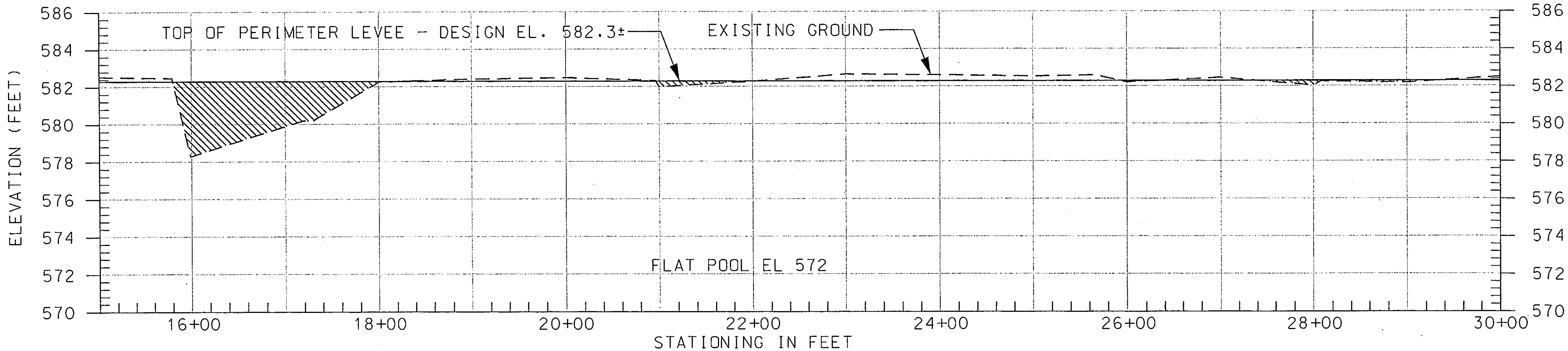
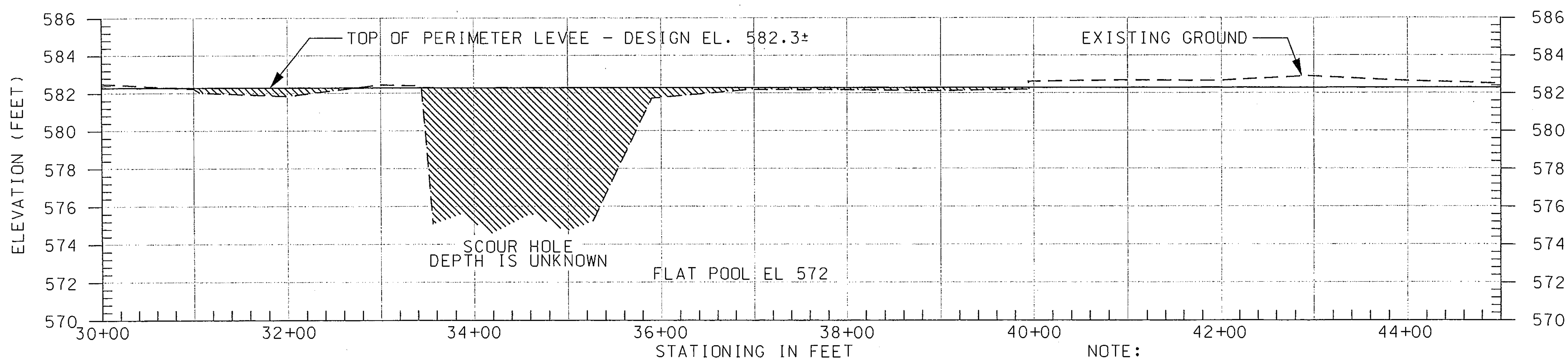


PLATE 31 – RAILROAD LEVEE AS-BUILT CROSS SECTIONS STATION 0+00 TO STATION 3+55







LEGEND:

SCOUR AREAS

NOTE:
REGRADE LEVEE AS A MINIMUM TO DESIGN EL. 582.3 OR TO MATCH EXISTING GROUND AT EITHER END OF SCOUR AREAS FROM STA. 0+00 TO NEW SETBACK LEVEE.

US Army Corps of Engineers Rock Island District

Symbol	Description	Date	Approved

Revisions

Designed By: RCF	Date: XX XXX XX
Drawn By: PDJ	Scale: AS SHOWN
Checked By: KJD	Project Code: XXXXX
Reviewed By: KJS	Solicitation Number: DACW25-XX-B-XXXX

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

LOWER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT
PROGRAM - POOL 14
PRINCETON WILDLIFE
MANAGEMENT AREA

SCOUR REPAIR
STATION 0+00 TO
STATION 40+00

Sheet Reference Number:
PLATE 32

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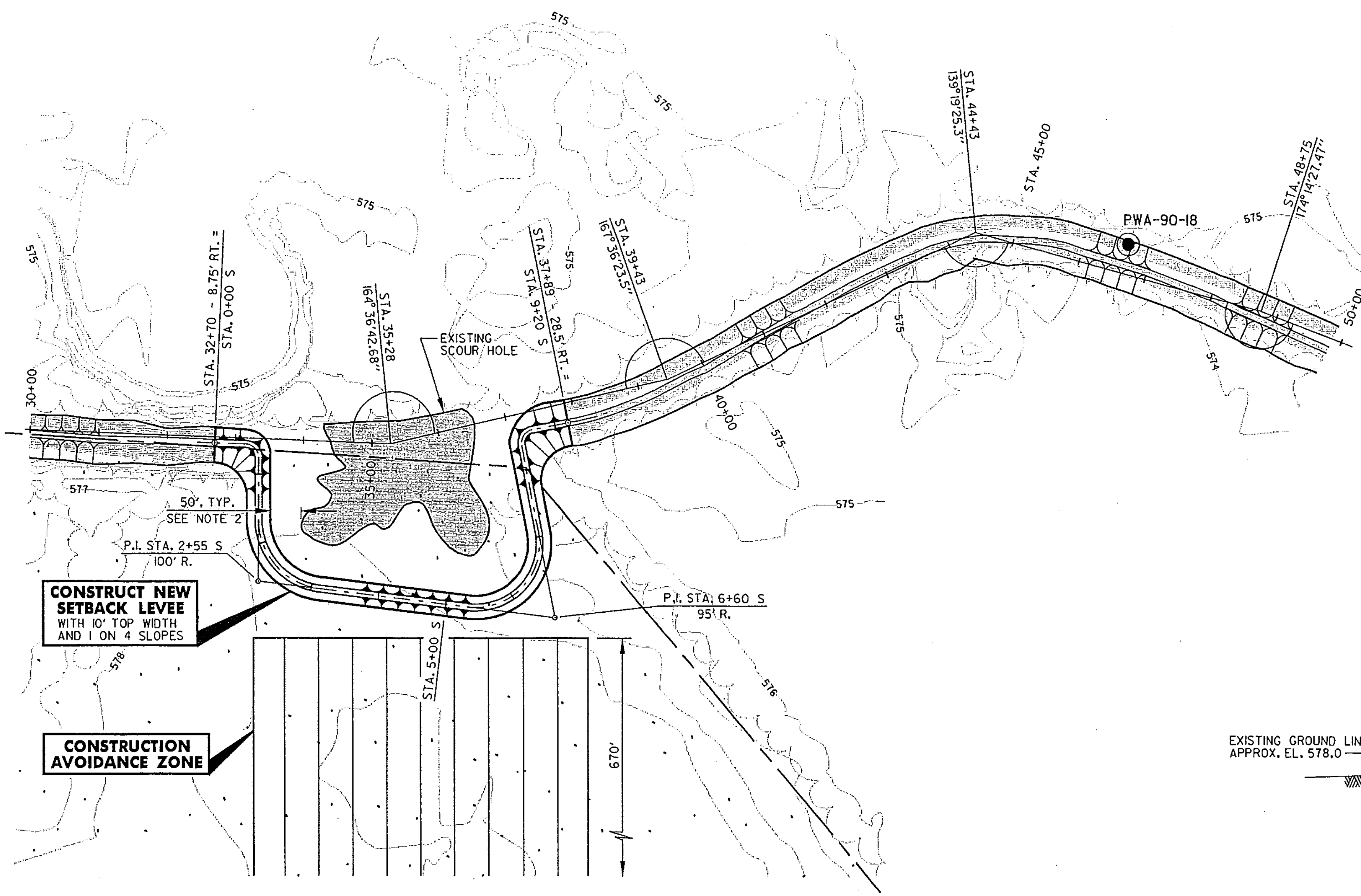
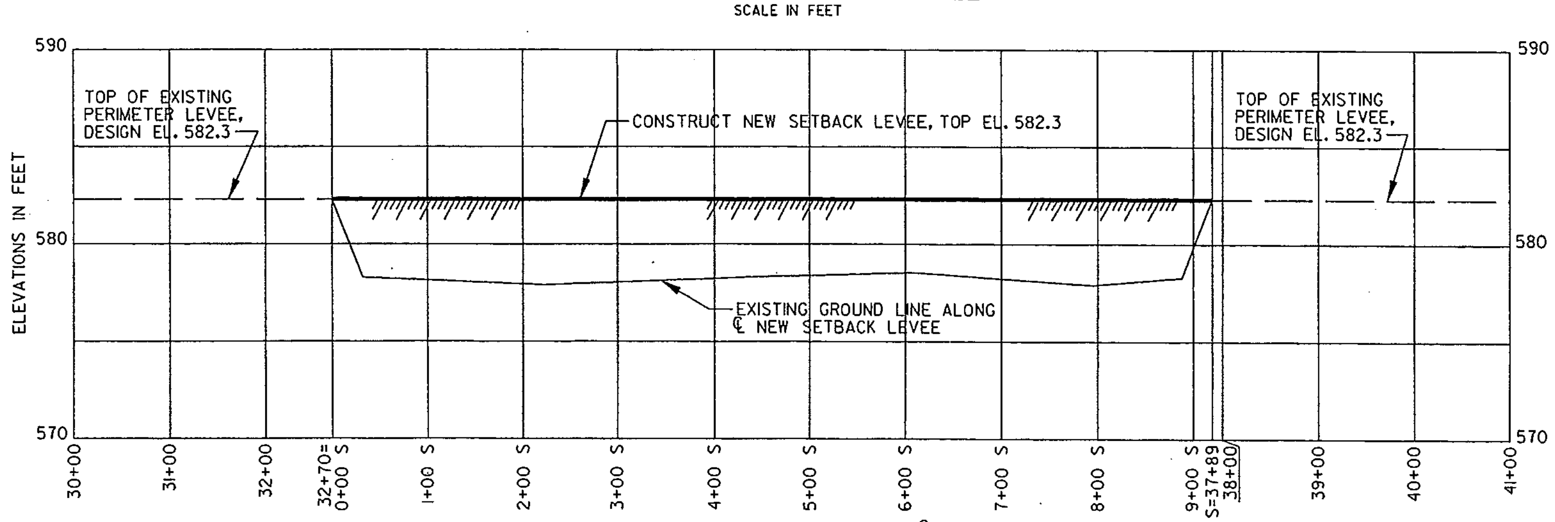


PLAN

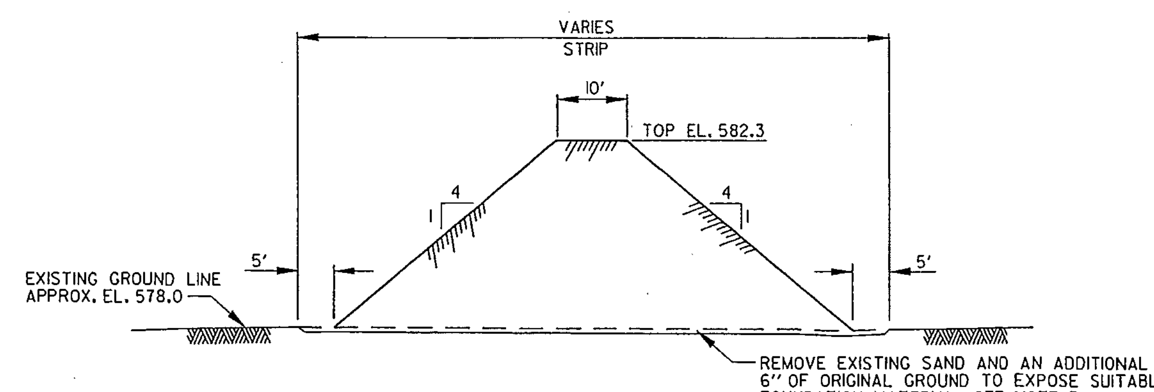
100 0 100 200 300
SCALE IN FEET

LEGEND:

- STATE BOUNDARY
- STATE - OWNED LAND
- SCOUR HOLE
- BORING LOCATION
- TREE LINE



PROFILE



TYPICAL SETBACK LEVEE SECTION

NO SCALE

NOTES:

1. LOCATION OF SCOUR HOLE IS APPROXIMATE.
2. MINIMUM DISTANCE ALLOWED BETWEEN TOE OF SETBACK LEVEE AND SCOUR HOLE IS 50 FEET.
3. EXTENT OF MATERIAL RECLAMATION FROM THE FIELD AND PLACEMENT SHALL BE DETERMINED BY THE CONTRACTING OFFICER.
4. CONSTRUCTION AVOIDANCE ZONE WILL BE STAKED BY THE CONTRACTING OFFICER PRIOR TO START OF CONSTRUCTION.
5. AFTER REMOVING EXISTING SAND DEPOSITED FROM THE SCOUR HOLE, STRIP EXISTING VEGETATION FROM THE ORIGINAL GROUND LINE (PRIOR TO BREACH) TO EXPOSE SUITABLE FOUNDATION MATERIAL. SUITABLE FOUNDATION MATERIAL SHALL CONSIST OF IMPERVIOUS CLAY MATERIAL THAT IS FREE OF VEGETATION AND ORGANIC MATERIAL.

US Army Corps of Engineers
Rock Island District

Symbol	Description	Date	Approved
	Revisions		

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

Designed By: RCF	Date: XX XXX XX
Drawn By: RLC	Scale: AS SHOWN
Checked By: KJD	Project Code: XXXXX
Reviewed By: KJS	Solicitation Number: DACW25-XX-B-XXXX

LOWER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT
PROGRAM - POOL 14
PRINCETON WILDLIFE
MANAGEMENT AREA

BREACH REPAIR
SETBACK LEVEE

Sheet Reference Number:
PLATE 33

05-NOV-2001 13:20
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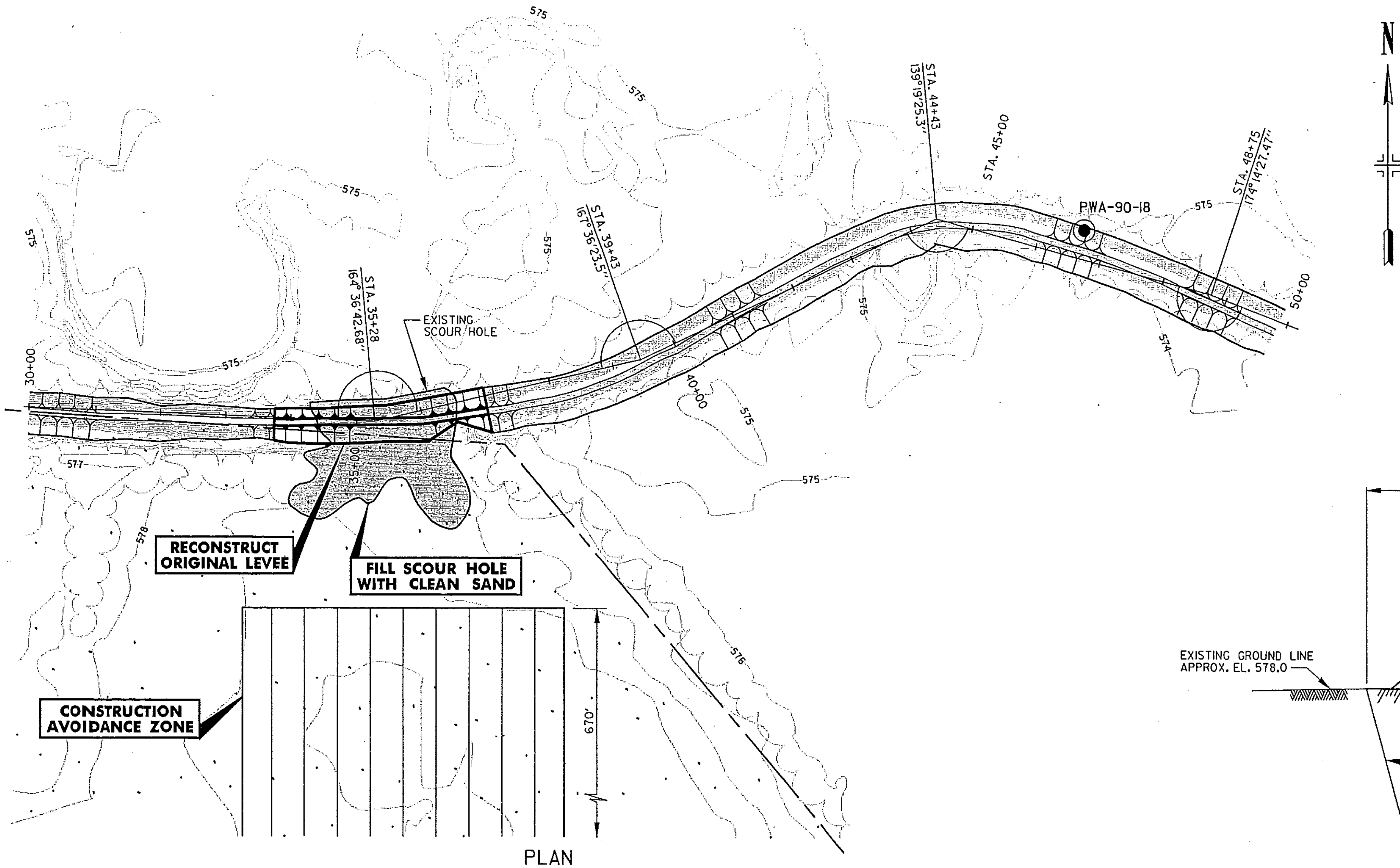
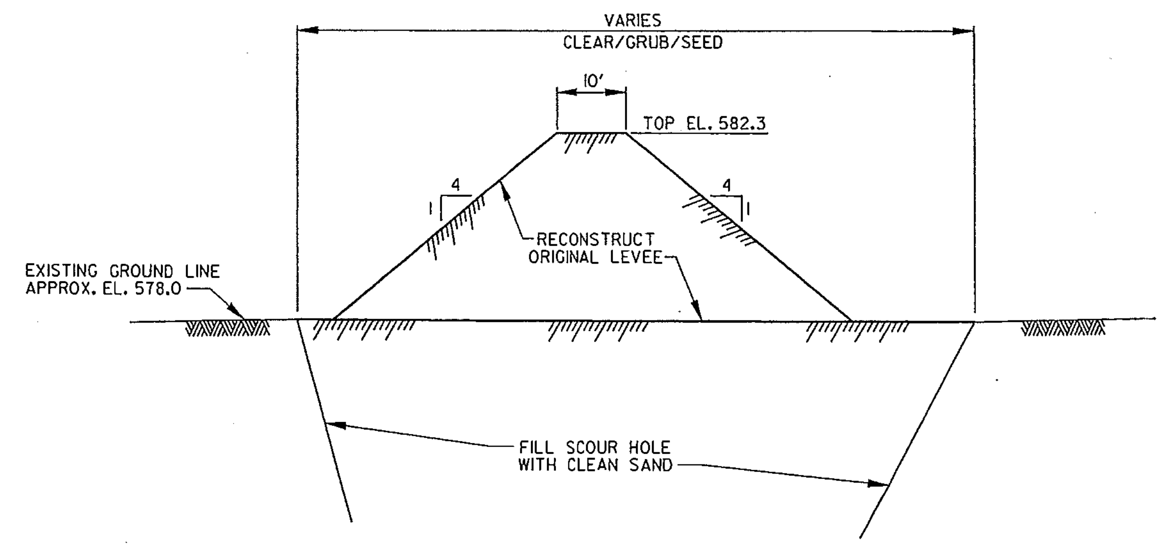


PLAN

100 0 100 200 300
SCALE IN FEET

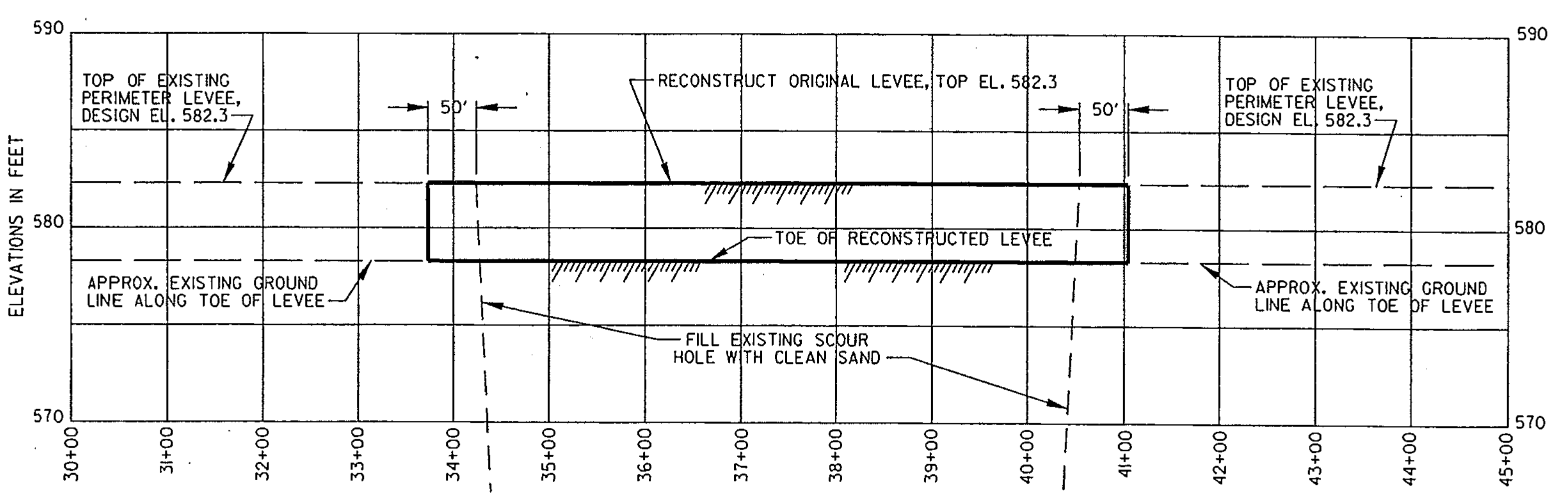
LEGEND:

- STATE BOUNDARY
- STATE - OWNED LAND
- SCOUR HOLE
- BORING LOCATION
- TREE LINE



TYPICAL LEVEE REPAIR SECTION

NO SCALE



STATIONING IN FEET ALONG EXISTING TRAVERSE

PROFILE

NOTES:

1. LOCATION OF SCOUR HOLE IS APPROXIMATE.
2. DUE TO MEANDERING OF THE EXISTING TRAVERSE ALIGNMENT, THE LEVEE TRAVERSE ALIGNMENT DOES NOT NECESSARILY COINCIDE WITH THE TOP OF THE LEVEE IN SOME LOCATIONS.
3. DESIGN GRADE OF PERIMETER LEVEE DOES NOT INCLUDE 6-INCH OVERBUILD (SEE SPECIFICATIONS).
4. DEPTH OF SCOUR HOLE IS UNKNOWN.

US Army Corps of Engineers Rock Island District

Symbol	Description	Date	Approved

Revisions

Designed By: RCF	Date: XX XXX XX
Drawn By: RLC	Scale: AS SHOWN
Checked By: KJD	Project Code: XXXXX
Reviewed By: KJS	Solicitation Number: DACW25-XX-B-XXXX

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

LOWER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT
PROGRAM - POOL 14
PRINCETON WILDLIFE
MANAGEMENT AREA

BREACH REPAIR
ORIGINAL LEVEE

Sheet Reference Number:
PLATE 34

05-NOV-2001 13:27
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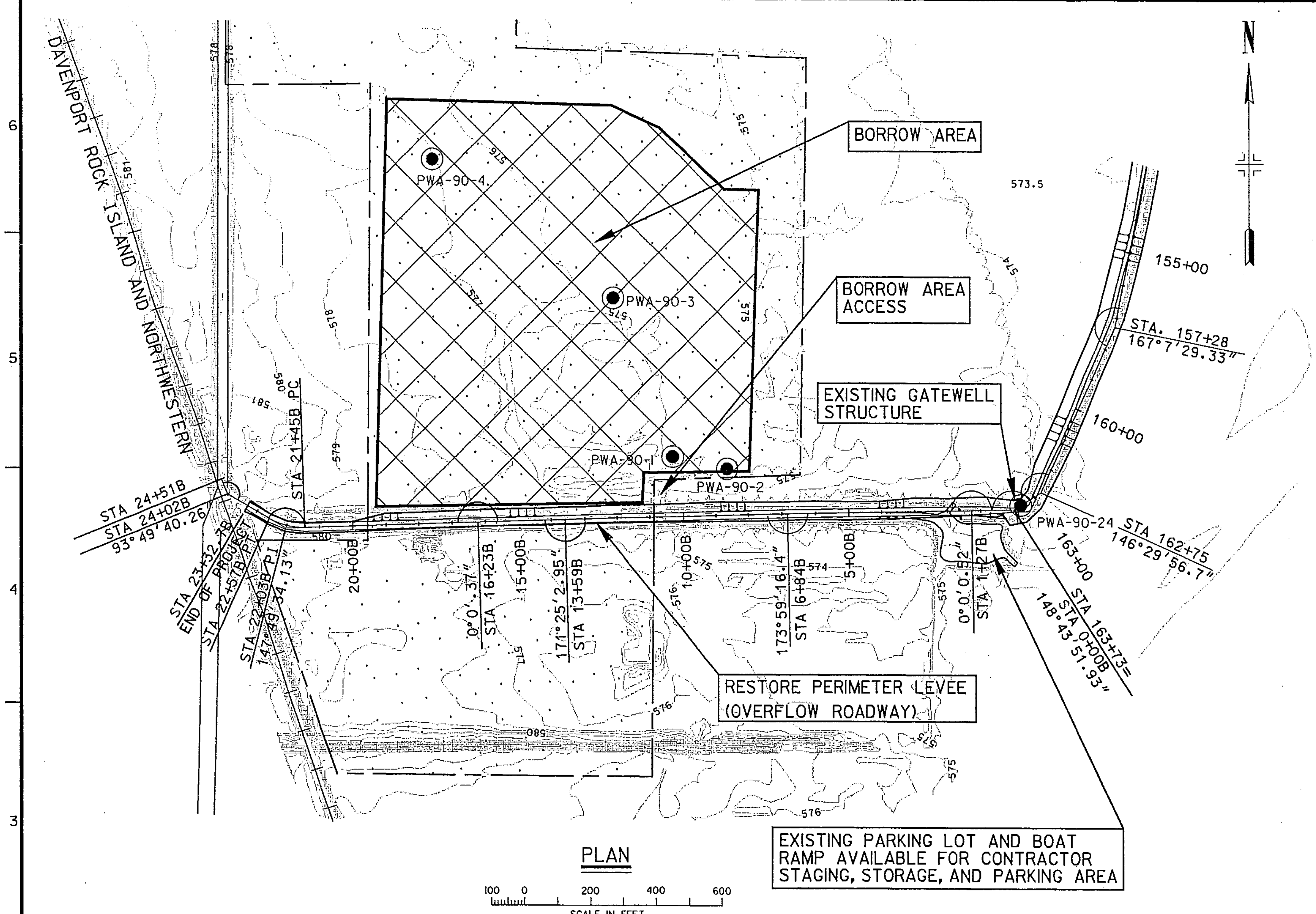
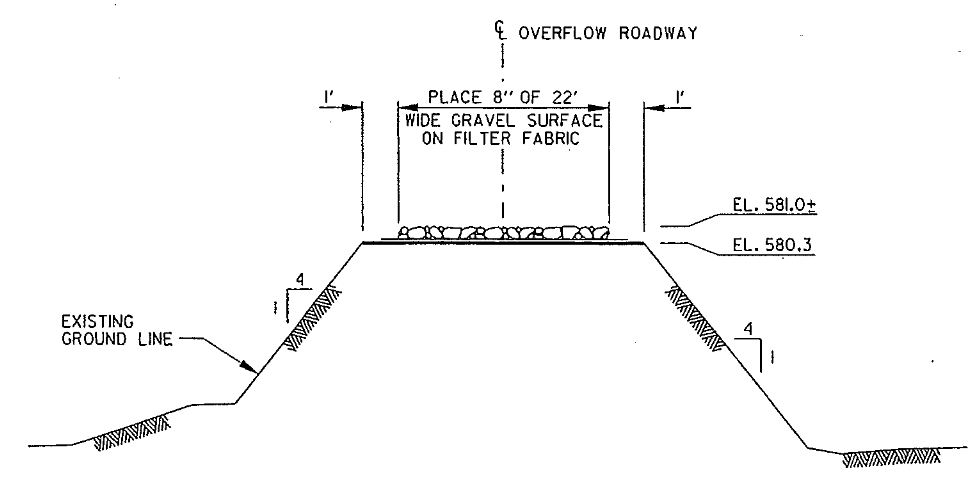


PLAN

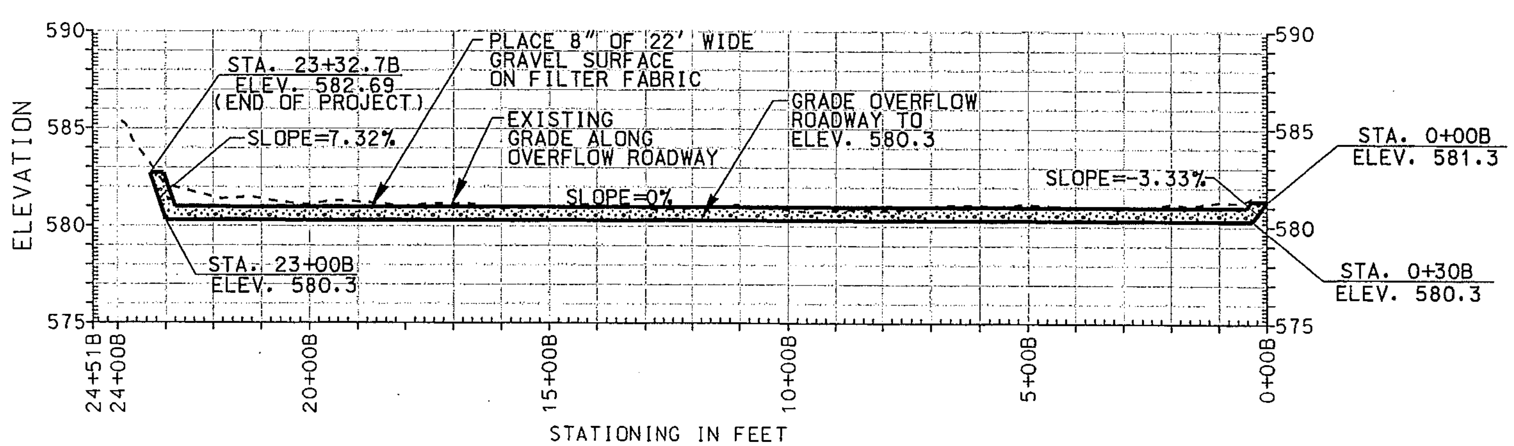
LEGEND:

- STATE BOUNDARY
- BORROW AREA
- STATE - OWNED LAND
- BORING LOCATION
- TREE LINE



TYPICAL OVERFLOW ROADWAY (SPILLWAY) SECTION

STA. 1+00B TO END OF PROJECT
NO SCALE



PROFILE

NOTES:

1. DUE TO MEANDERING OF THE EXISTING TRAVERSE ALIGNMENT, THE LEVEE TRAVERSE ALIGNMENT DOES NOT NECESSARILY COINCIDE WITH THE TOP OF THE LEVEE IN SOME LOCATIONS.
2. DESIGN GRADE OF PERIMETER LEVEE DOES NOT INCLUDE 6-INCH OVERBUILD (SEE SPECIFICATIONS).

US Army Corps of Engineers Rock Island District

Symbol | Description | Date | Approved
Revisions

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

Designed By: RCF	Date: XX XXX XX
Drawn By: RLC	Scale: AS SHOWN
Checked By: KJD	Project Code: XXXXX
Reviewed By: KJS	Solicitation Number: DACW25-XX-B-XXXX

LOWER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM - POOL 14 PRINCETON WILDLIFE MANAGEMENT AREA

REPAIR OVERFLOW ROADWAY

Sheet Reference Number: **PLATE 35**

05-NOV-2001 13:51
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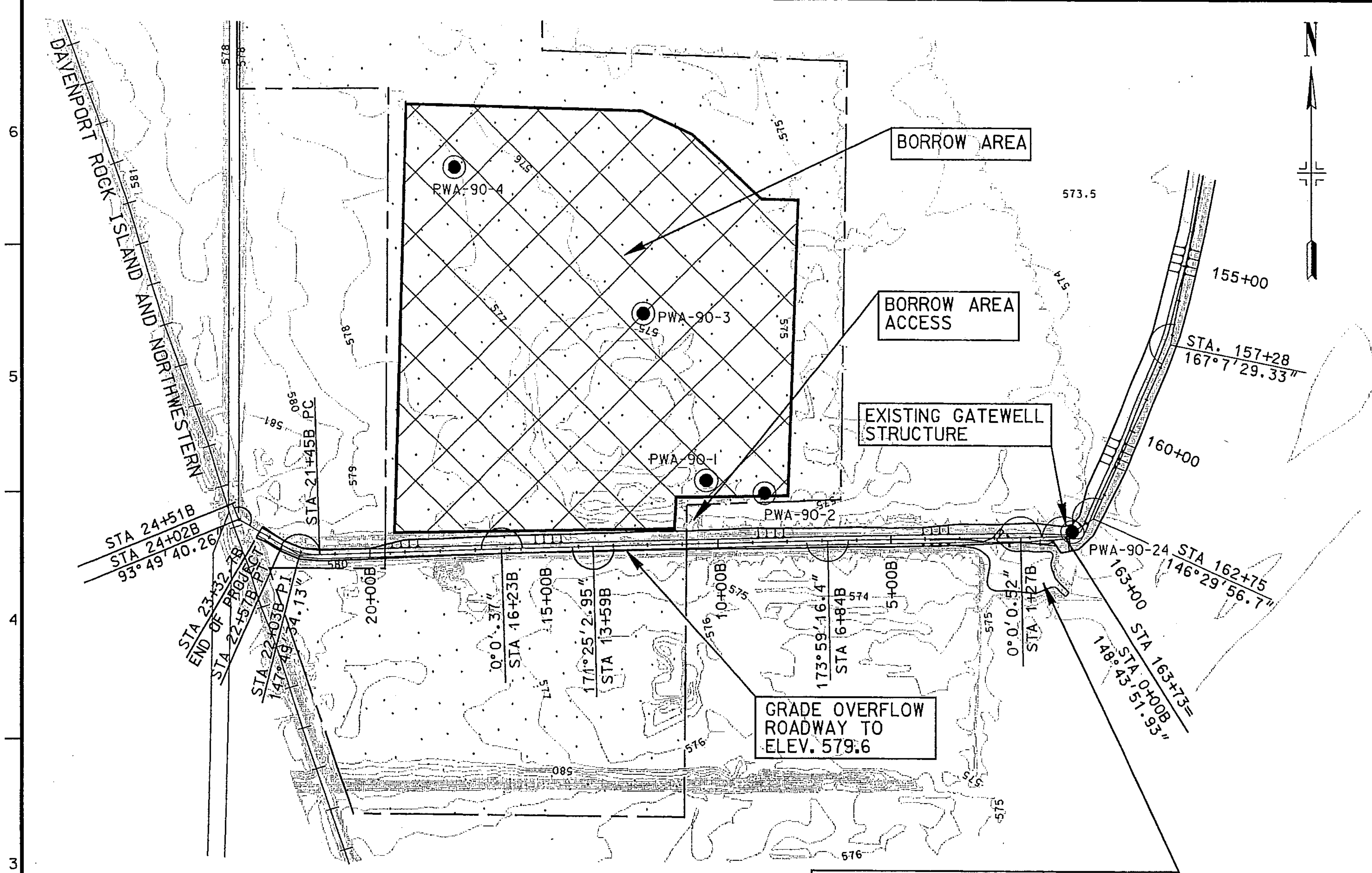
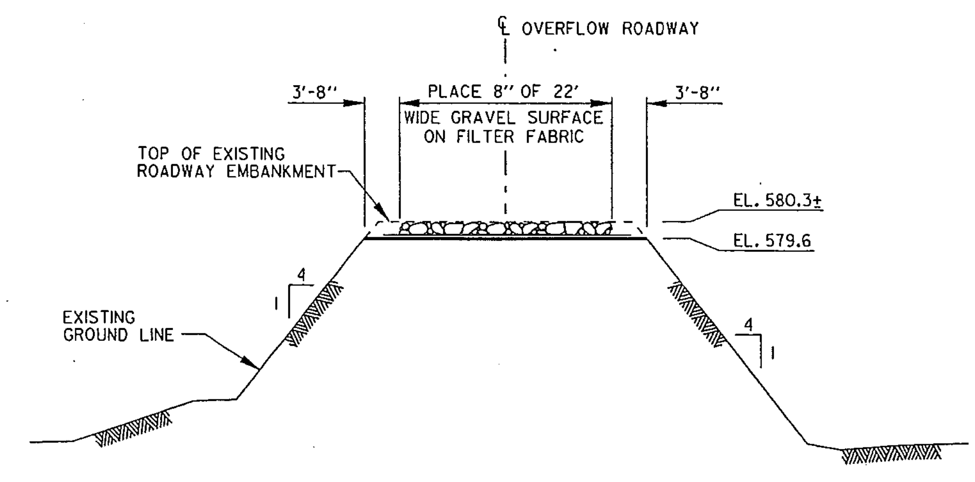


PLAN

100 0 200 400 600
SCALE IN FEET

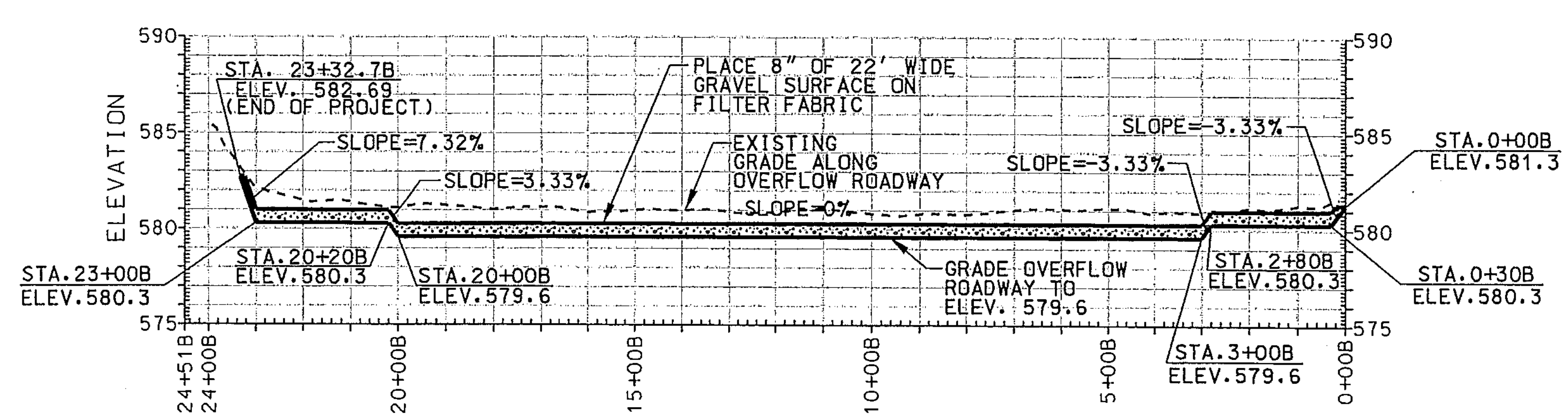
LEGEND:

- STATE BOUNDARY
- BORROW AREA
- STATE - OWNED LAND
- BORING LOCATION
- TREE LINE



TYPICAL OVERFLOW ROADWAY (SPILLWAY) SECTION

STA. 1+00B TO END OF PROJECT
NO SCALE



PROFILE

NOTES:

1. DUE TO MEANDERING OF THE EXISTING TRAVERSE ALIGNMENT, THE LEVEE TRAVERSE ALIGNMENT DOES NOT NECESSARILY COINCIDE WITH THE TOP OF THE LEVEE IN SOME LOCATIONS.
2. DESIGN GRADE OF PERIMETER LEVEE DOES NOT INCLUDE 6-INCH OVERBUILD (SEE SPECIFICATIONS).

US Army Corps of Engineers
Rock Island District

Symbol	Description	Date	Approved
	Revisions		

Designed By: RCF	Date: XX XXX XX	
Drawn By: TPD-RLC	Scale: AS SHOWN	
Checked By: KJO	Project Code: XXXXX	
Reviewed By: KJS	Solicitation Number: DACW25-XX-B-XXXX	

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

LOWER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMENT
PROGRAM - POOL 14
PRINCETON WILDLIFE
MANAGEMENT AREA

LOWER OVERFLOW ROADWAY

Sheet Reference Number:
PLATE 36

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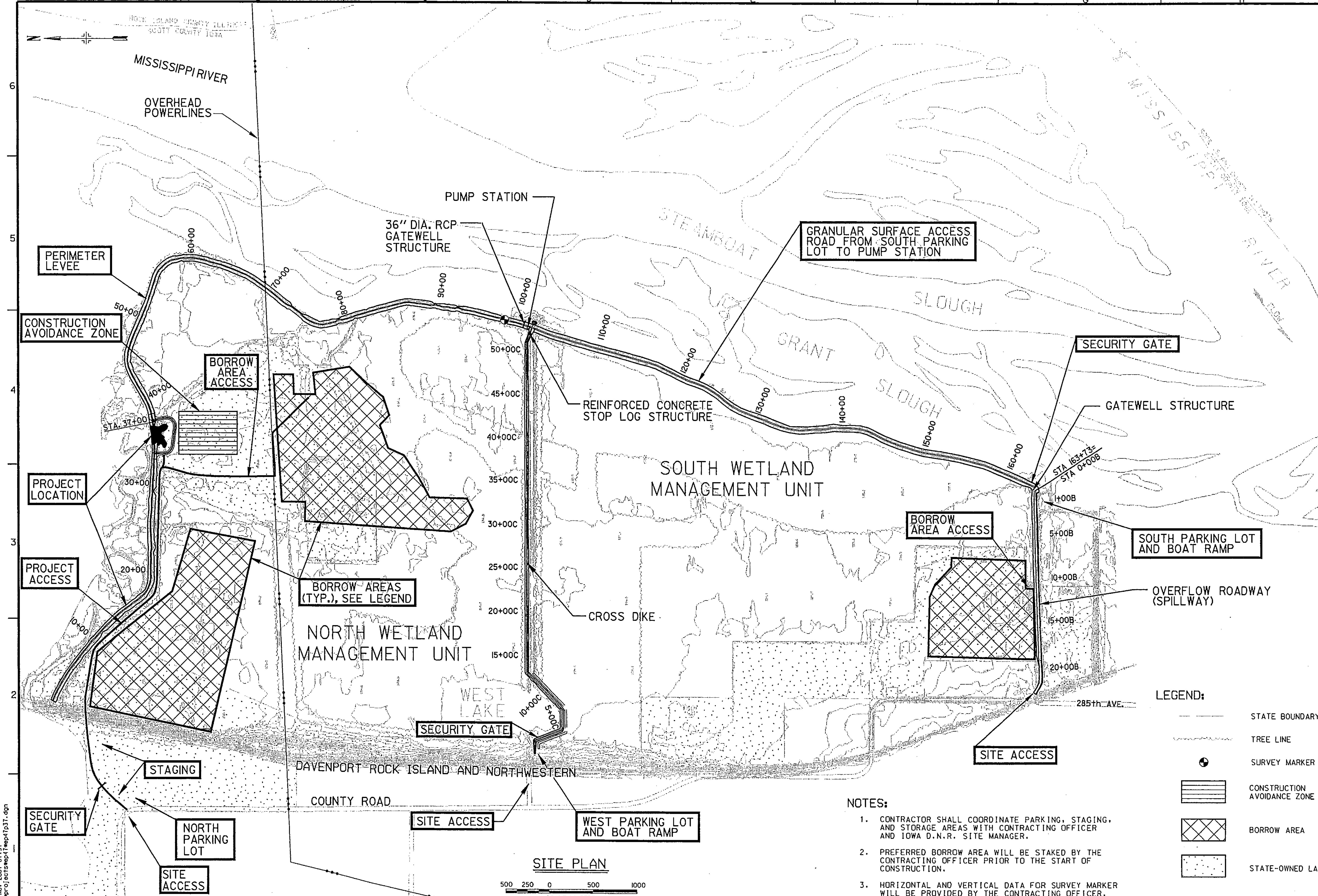

NOTES:

1. CONTRACTOR SHALL COORDINATE PARKING, STAGING, AND STORAGE AREAS WITH CONTRACTING OFFICER AND IOWA D.N.R. SITE MANAGER.
2. PREFERRED BORROW AREA WILL BE STAKED BY THE CONTRACTING OFFICER PRIOR TO THE START OF CONSTRUCTION.
3. HORIZONTAL AND VERTICAL DATA FOR SURVEY MARKER WILL BE PROVIDED BY THE CONTRACTING OFFICER.

US Army Corps of Engineers Rock Island District

Symbol	Description	Date	Approved

Revisions

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

Designed By: RCF	Date: XX XXX XX
Drawn By: TPD-RLC	Scale: AS SHOWN
Checked By: KJD	Project Code: XXXXX
Reviewed By: KJS	Solicitation Number: DACW25-XX-B-XXXX

LOWER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM - POOL 14 PRINCETON WILDLIFE MANAGEMENT AREA

BORROW AREAS FOR LEVEE REPAIR

Sheet Reference Number: **PLATE 37**

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