
**US Army Corps
of Engineers**
St. Paul District

UPPER MISSISSIPPI RIVER SYSTEM

ENVIRONMENTAL MANAGEMENT PROGRAM

OPERATION AND MAINTENANCE MANUAL

COLD SPRINGS BACKWATER

**HABITAT REHABILITATION
AND ENHANCEMENT PROJECT**

**POOL 9
UPPER MISSISSIPPI RIVER
CRAWFORD COUNTY, WISCONSIN**

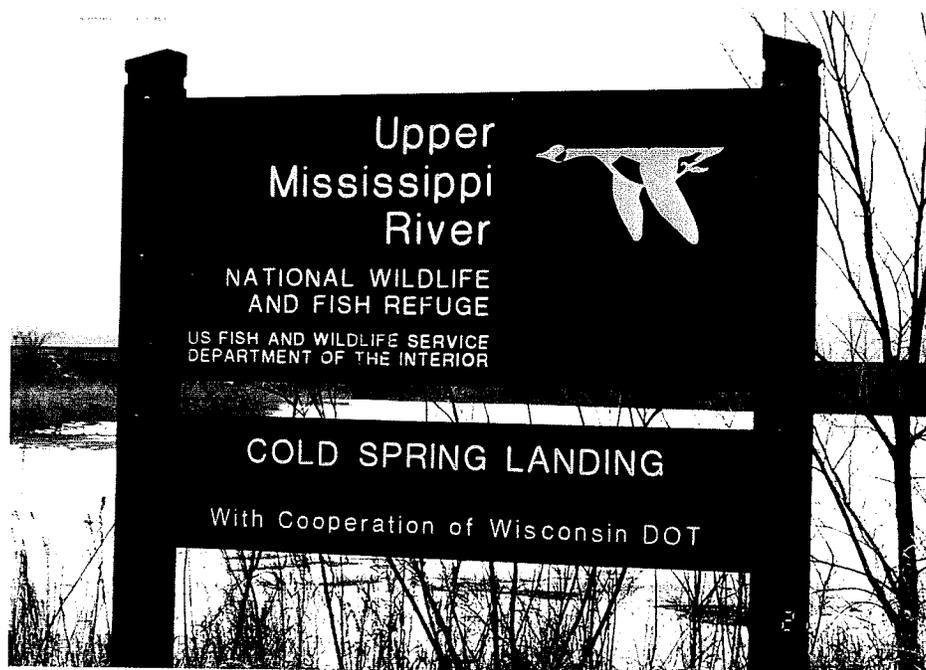
AUGUST 1995

PREFACE

The Cold Springs Backwater Habitat Rehabilitation and Enhancement Project, constructed by the Corps of Engineers, was completed in August 1994. In accordance with Section 906(e) of the Water Resources Development Act (WRDA) of 1986 and Section 107(b) of the WRDA of 1992, the U.S. Fish and Wildlife Service has the responsibility for operation and maintenance. The Corps of Engineers has prepared this manual to assist in fulfilling operation and maintenance tasks.

The manual includes a brief project summary and description of primary features and operation and maintenance activities. Appendix A contains the as-built project drawings; Appendix B presents the Memorandum of Agreement between the Corps of Engineers and U.S. Fish and Wildlife Service; Appendix C includes the Inspection Checklist Report; Appendix D contains supplemental maintenance-related information; and Appendix E describes the post-construction interagency monitoring plan to track project performance relative to project objectives.

The project as designed and constructed will improve fish and wildlife habitat in Pool 9. However, continued functioning of the project will depend upon the manner in which the project is managed. Proper operation, inspection, and maintenance can help accomplish this goal. The planning, design, and construction of the project was the result of extensive cooperation and coordination efforts on the part of Federal and State agencies and the public. Continuation of those efforts as part of the maintenance and monitoring of the project will be important to the success of the project and is strongly encouraged.



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CRAWFORD COUNTY, WISCONSIN

OPERATION AND MAINTENANCE MANUAL

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
190 Fifth Street East
St. Paul, Minnesota 55101-1638

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INTRODUCTION

This manual has been prepared to serve as a guide for the operation and maintenance of the Cold Springs Backwater Habitat Rehabilitation and Enhancement Project (hereinafter, the Cold Springs Backwater Project) in Crawford County, Wisconsin. Descriptions and operation and maintenance instructions for the major features of the project are presented. These instructions are consistent with the general procedures found in the Cold Springs Definite Project Report dated May 1991. This manual has been written for project and management personnel familiar with the project. It does not contain detailed information which is common knowledge to personnel or which is presented in other manuals or regulations.

The basic operating procedures are simple, consisting of inserting and removing sets of stoplogs twice per year. The intent of the maintenance instructions is to present preventive maintenance information consisting of systematic inspections and subsequent corrective actions which should ensure long-term use of project features. A timely maintenance program will prevent major damage to constructed features by early corrective action.

For ease in use, this manual is divided into two parts:

Part I describes project features and provides background information on the project.

Part II gives details on operation and maintenance of the project.

PART I - PROJECT FEATURES AND CONSTRUCTION HISTORY

AUTHORIZATION AND LOCATION

Authority for the Cold Springs Backwater Project is found in Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662), which provides for "a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement...."

The project area is on the left bank of the Upper Mississippi River in Pool 9, at approximately river mile 653, between the communities of Lynxville and Ferryville, Wisconsin.

The Cold Springs Backwater Project is located on Federal lands managed as part of the Upper Mississippi River National Wildlife and Fish Refuge. Therefore, operation and maintenance of the completed project are to be carried out in compliance with Section 107(b) of the 1992 Water Resources Development Act, which specifies

that the U.S. Fish and Wildlife Service is responsible for operation and maintenance of the completed project.

DESCRIPTION OF PROJECT

General

The 35-acre Cold Springs backwater is semi-isolated from the Mississippi River by a Burlington Northern Railroad causeway; the openings through a 3-pier railroad bridge connect the backwater and river. The State Highway 35 embankment curves around the landward perimeter of Cold Springs.

Spring-fed Kettle Creek enters the backwater from the east via a bridge opening through the highway embankment. The creek's watershed covers 5.4 square miles. Cold Springs is divided into two "lobes" by a peninsula which extends approximately 650 feet into the backwater along the north side of the creek outlet channel. The opening into the north lobe at the tip of this peninsula is about 75 feet wide. A public boat landing and parking lot is located on this peninsula, and the Kettle Creek channel has been dredged in the past to improve access to the river for fishing boats. A second, smaller peninsula is located on the south side of the creek/boat channel.

Cold Springs provides excellent habitat for a number of fish and wildlife species. The backwater provides spawning, rearing, and good overall habitat for bluegill, crappie, bass, and gizzard shad and is used by walleye, sauger, northern pike, and other species, especially for refuge during periods of high water.

Animals using the area include beaver, muskrat, raccoon, white-tailed deer, squirrels, and other small mammals. Wood ducks and mallards nest in the area, and the backwater is used by a variety of migrating waterfowl and shore bird species.

The primary habitat deficiency in the Cold Springs backwater area is low wintertime dissolved oxygen (DO) levels. The low DO stresses fish by forcing temporary migrations from the sheltered backwater and may contribute to fish kills. Suspected contributors to the low wintertime DO include the ice cover that prevents air/water oxygen transfer, the oxygen demand of bacteria and fungi decomposing dead vegetation and other organic matter, plant respiration, and a long-term decrease of water volume due to sedimentation. Monitoring by the Wisconsin Department of Natural Resources has shown that DO in the south lobe can fall below 5 milligrams per liter (mg/l), the minimum desirable concentration; DO in the north lobe may reach critical levels of less than 1 mg/l.

DO in the creek/boat channel remains relatively high because of the inflow of highly oxygenated water from Kettle Creek.

However, wintertime mixing of this oxygenated water with the DO-deficient waters of the north and south lobes is minimal because the relatively warm creek water tends to stratify and shunt directly out of the backwater via the creek/boat channel.

Sedimentation is a related problem in the Cold Springs backwater area. Construction of the railroad causeway in the late 1800s isolated Cold Springs from the Mississippi River main channel. Because the backwater now experiences little or no flow velocities, sediment in river or creek inflows tends to settle out, accumulating in the backwater and forming natural levees along the creek/boat channel. The problem was exacerbated in the first half of this century by poor farming, grazing, and logging practices in the Kettle Creek watershed, since largely corrected. Data collected in 1937 and 1987 show that over 5 feet of sediment had settled in some portions of the backwater over that 50-year period. Sedimentation is currently estimated to be between 0.15 and 0.30 inch per year.

The project is designed to redirect the warm, highly oxygenated Kettle Creek inflow into the south lobe during winter months. This would provide an immediate influx of additional DO to an area of preferred habitat and would relocate the area of open water (kept open by the relatively warm spring-fed creek water) from the creek/boat channel to the south lobe for improved air/water oxygen transfer. In addition, the project provides for improved fish movement between the north and south lobes so that fish throughout the backwater may access the elevated DO in the south lobe.

Appendix A contains a set of drawings showing details of the constructed project. Additional information on project objectives, alternative evaluations, planning and design considerations, and impact assessment may be found in the "Definite Project Report/Environmental Assessment (SP-11), Cold Springs, Habitat Rehabilitation and Enhancement Project," dated May 1991, with amendments prepared in March 1992, and the revised Environmental Assessment, Finding of No Significant Impact, and 404(b)(1) evaluation dated November 1992.

Design Considerations

The Cold Springs Backwater Project was designed to improve the habitat for centrarchid fish species, while maintaining habitat value for other indigenous species. This goal was to be accomplished by providing wintertime DO concentrations of at least 5 mg/l to a minimum of 25 percent of the 35-acre backwater area. A related goal was to ensure that fish throughout the backwater have access to the area of enhanced DO.

Deepening was not a primary feature of the project because: (1) the Cold Springs Definite Project Report concluded that deepening by itself would not correct wintertime DO deficiencies; (2)

the existing deep-water habitat (4 feet or more) is close to the percentage given a maximum rating in the winter habitat suitability model for bluegill; and (3) the character and potential volume of dredged material made disposal cost-prohibitive. Nonetheless, deepening incidental to constructing the creek diversion works and providing fish access has beneficially impacted localized portions of the backwater.

Kettle Creek Diversion Works (see Figures 1 and 2)

Weir The principal project feature is the 50-foot-long weir across Kettle Creek about 50 feet downstream (west) of the Highway 35 bridge. The weir is constructed of steel sheetpile, which serves as a 'membrane' to flows, ensuring that most creek flow is redirected as intended. The sheetpile was driven to elevation 585.0¹ to provide a stable foundation.

The sheetpile is protected by rock fill placed in a trapezoidal cross section with a minimum 10-foot top width and side slopes of 1-vertical on 2-horizontal on the upstream side and 1-vertical on 3-horizontal on the downstream side. The rock fill was placed on geotextile which, in turn, was laid on clean pervious fill which replaced excavated in situ bottom materials to a depth of approximately 5 feet.

The top elevation of the steel sheetpile, 619.43,² approximates the normal elevation of Pool 9. Therefore, the weir's steel sheetpile should be at or near the water surface under normal pool conditions, although some rock fill will generally protrude above the water surface.

The center of the weir has a "notch" 4 feet 9 $\frac{3}{4}$ inches wide, with a bottom (sill) elevation of 617.47.³ This notch is opened for non-winter operation to allow creek inflows to follow the usual creek/boat channel and to allow fish and small boat access into and out of Kettle Creek. Normal spring-fed creek inflows on the order of 2 cubic feet per second will produce velocities through the notch of less than $\frac{1}{2}$ foot per second. Greater inflows (for example, from a major thunderstorm event over the Kettle Creek watershed), could submerge the weir and produce short-term velocities in excess of 5 feet per second. The weir will also be submerged by higher than normal pool levels; velocities through the notch and

¹ All elevations in this manual are 1929 adj. N.G.V.D. Add 0.46 foot to convert to 1912 adj. M.S.L.

² The nominal pool elevation of 619.5 was the target design weir elevation.

³ The notch design called for a nominal width of 4 feet and depth of 2 feet (to a sill elevation of 617.5).

COLD SPRINGS BACKWATER (panorama from southwest to west to northwest
photographed from the Highway 35 bridge over Kettle Creek)

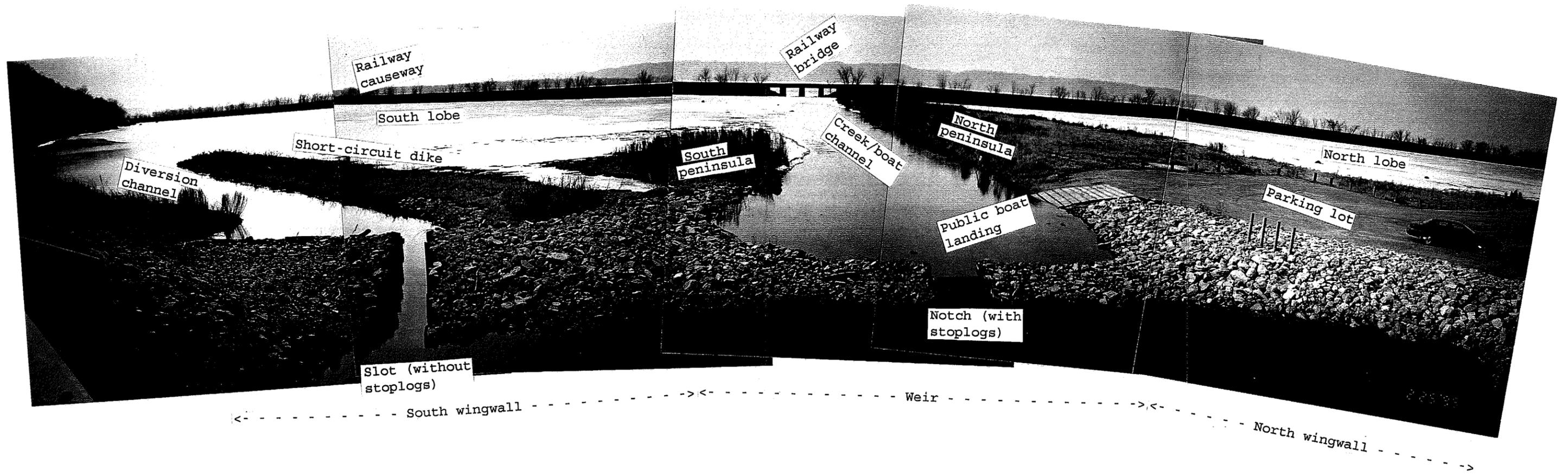


Figure 1

COLD SPRINGS BACKWATER (panorama from south to west
photographed from north wingwall)

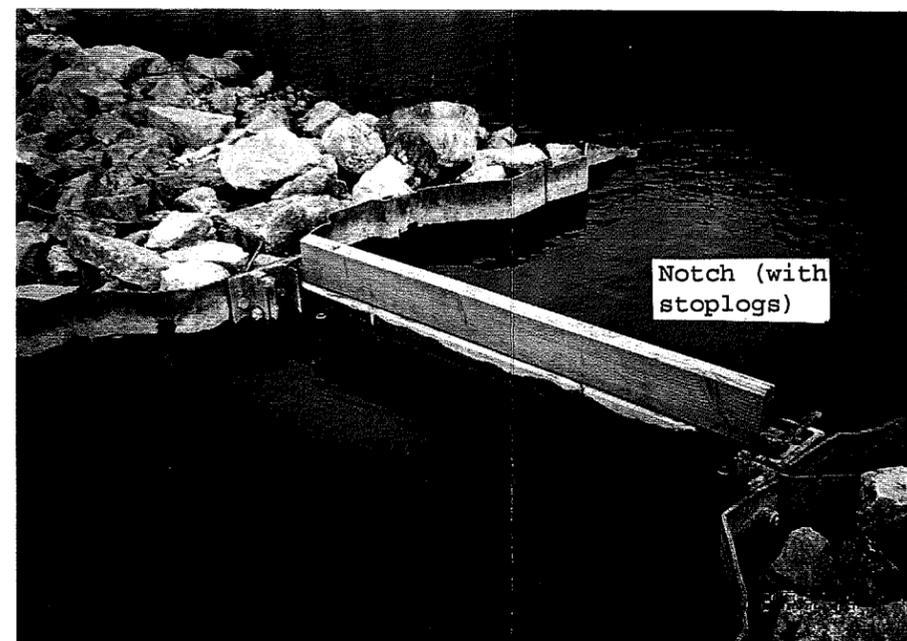
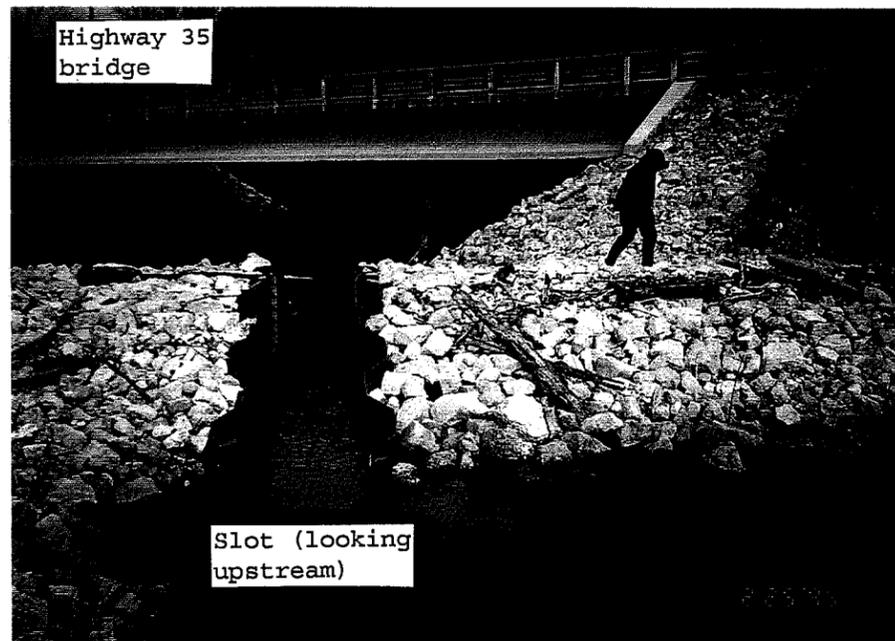
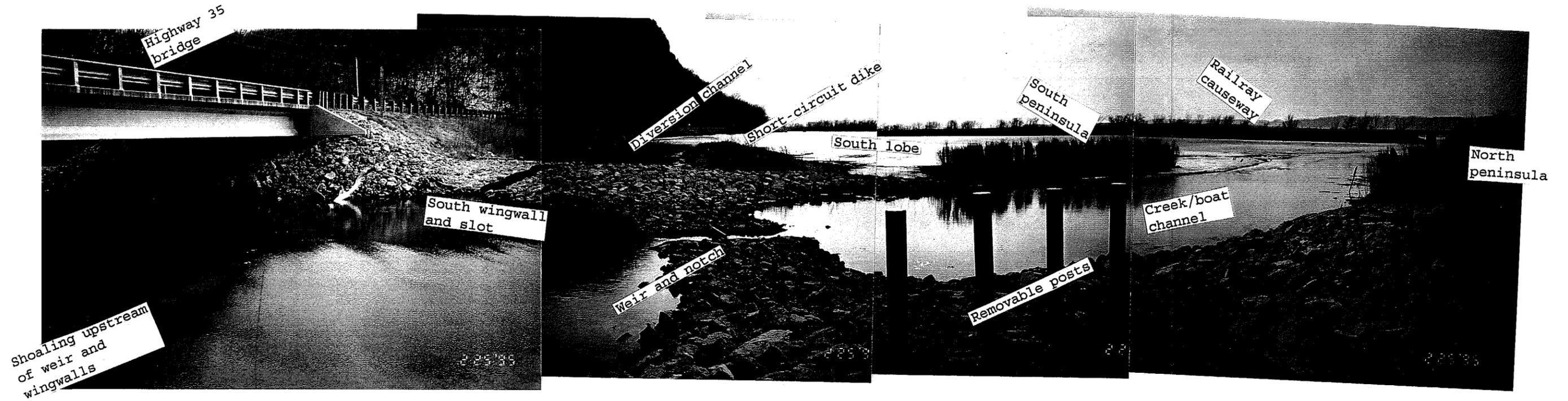


Figure 2

over the weir under high pool conditions will depend on creek inflow at the time.

During the winter, the notch is closed with wooden 2x6 stoplogs to divert creek inflows into the south lobe (see the Wingwalls description below).

Because turbulent flow over the weir may have the potential for scouring the creek/boat channel bed and banks downstream of the weir structure, rock fill was keyed into the channel bottom and sides and extended downstream.

Wingwalls Wingwalls tie the weir back into the Highway 35 embankment. During winter operation, the weir notch is stoplogged, and creek flows are shunted into the south lobe through a "slot" in the south wingwall 3 feet $\frac{3}{4}$ inch wide and 5 feet $7\frac{1}{2}$ inches high with a bottom (sill) elevation of 617.23.⁴ This slot also provides fish access into and out of Kettle Creek during the winter. During non-winter operation, stoplogs are installed in the slot and removed from the weir's notch to redirect Kettle Creek inflows down the creek/boat channel.

The basic construction of the wingwalls is similar to that of the weir -- steel sheetpile covered by rock fill. However, the sheetpile was driven to a depth of 605.0, except for the diversion slot where it was driven to 595.0. The south wingwall was constructed in a manner similar to the weir -- poor quality in situ materials were excavated, clean pervious fill was substituted, and rock fill was placed on geotextile laid on the clean fill. Because of the better in situ materials on the north peninsula, rock fill for the north wingwall was placed on geotextile laid directly on the ground.

The south wingwall sheetpile elevation of 622.86 (average) and the north wingwall rockfill elevation of approximately 624.0⁵ were designed to make overflow into the north and south lobes similar in frequency and severity to that at present. The transition slope between the weir sheetpile top elevation of 619.43 and the south and north wingwall top elevations is 1-vertical on 4-horizontal.

Diversion Channel A diversion channel extends into the south lobe from the south wingwall slot. This channel is trapezoidal in shape, with 1-vertical on 3-horizontal side slopes and a 3-foot bottom width at elevation 616.5.

⁴ The slot design called for a nominal width of 3 feet and depth of $5\frac{1}{4}$ feet (to a sill elevation of 617.5).

⁵ The project design called for nominal north and south wingwall top elevations of 624.0 and 623.0, respectively.

This channel conveys creek inflows during the winter when the south wingwall's slot is open and the weir's notch is stoplogged. Normal wintertime base (spring-fed) creek inflows are on the order of 2 cubic feet per second, which produce velocities in the diversion channel of less than ¼ foot per second.

Under higher than normal pool levels and/or greater than normal creek inflows, the weir will be submerged to some degree, and part of the creek inflow could overflow the weir and exit the backwater via the creek/boat channel, bypassing the slot and diversion channel.

During non-winter operation, the south wingwall's slot will be stoplogged, preventing creek flow from entering the diversion channel except when pool levels and/or unusually high creek inflows overtop the south wingwall's top elevation of 622.86.

Dike The diversion channel is bordered on the west by a dike to prevent diverted creek flows from 'short-circuiting' back into the creek/boat channel. The dike is approximately 300 feet long, with 1-vertical on 3-horizontal side slopes, a top width of 10 feet minimum, and a nominal top elevation of 621.5, 2 feet higher than the normal elevation of Pool 9. Diversion channel maintenance could be accomplished by positioning equipment (e.g., a backhoe) on the dike, gaining access from the north peninsula's parking lot by temporarily bridging the weir's notch.

Fish Access Channel

Through the years, natural levees formed along both sides of the creek/boat channel. Soundings made off the tips of the north and south peninsulas by the Wisconsin Department of Natural Resources in January 1987 showed many spots less than 2 feet deep. Under those circumstances, severe winter conditions could produce ice depths that essentially isolate the north and south lobes from the creek/boat channel and trap fish during low DO conditions.

The project includes a "fish access channel" excavated to a nominal depth of 615.5, 4 feet below the normal elevation of Pool 9, to prevent ice from blocking access to and from the north and south lobes. The fish access channel extends into both lobes until it 'daylights' to the 615.5 bathymetric contour. The fish access channel's design minimum bottom width is 12 feet; however, the as-built cross section provides a bottom width of approximately 20 feet as necessitated by the width of the barge carrying the backhoe excavating the channel. The channel's side slopes are at the bottom material's natural angle of repose.

North Peninsula

Approximately 1,000 cubic yards of material was dredged from the Cold Springs backwater during construction of the weir, wingwalls,

diversion channel, dike, and fish access channel. This material was placed on the north peninsula, which increased the north peninsula's top elevation above some flood events that would have inundated it in the past. The north peninsula was seeded with a mixture of annual ryegrass, alsike clover, timothy, Canada wild rye, and switchgrass, which replaced the predominant purple loosestrife with more desirable cover. In addition, the parking lot on the north peninsula, which was used as a staging area during construction, was regraded and topped with aggregate. Although these improvements to the north peninsula are not considered part of the habitat project per se and, therefore, have no maintenance requirements, they do provide increased benefits to users of the Cold Springs backwater area.

CONSTRUCTION HISTORY

The contract for construction of the Cold Springs Backwater Project was awarded to:

Lunda Construction Company
Box 669
Black River Falls, Wisconsin 54615

on July 12, 1993. The contract was considered substantially complete at the pre-final inspection held May 16, 1994. Minor rectifications were finished and the final inspection was held in August 1994.

PART II - OPERATION AND MAINTENANCE

GENERAL RESPONSIBILITIES AND PROCEDURES

Approved Responsibilities

Operation and maintenance responsibilities for the Cold Springs Backwater Project were originally outlined in the Definite Project Report and have since been clarified by Section 107(b) of the 1992 Water Resources Development Act. The acceptance of these responsibilities was formally recognized by an agreement signed by the U.S. Fish and Wildlife Service and the St. Paul District, Corps of Engineers. This agreement, executed April 26, 1993, is contained in Appendix B. The capability of the U.S. Fish and Wildlife Service to carry out operation and maintenance responsibilities described below will be contingent upon the passage of sufficient appropriations by Congress.

District Manager

Typically, the responsibility for operation and maintenance of habitat projects will be given to the District Manager in charge of

that portion of the appropriate National Wildlife Refuge. For the Cold Springs Backwater Project, the current address is:

District Manager
U.S. Fish and Wildlife Service
Upper Mississippi River National Wildlife and Fish Refuge
PO Box 460
McGregor, Iowa 52157

Hereafter, for the purposes of this manual, when describing responsibilities, etc., the term "District Manager" will be used.

Improvements or Alterations

It is understood that improvements and alterations to any portion of the habitat project that would affect the ability of that element to function as intended to meet the project's habitat goals and objectives would be coordinated with other involved agencies, specifically the St. Paul District, Corps of Engineers, and the Wisconsin Department of Natural Resources.

Procedure for Reviewing Maintenance Responsibilities

The District Engineer or his representative will be kept informed of maintenance activities for the Cold Springs Backwater Project through a periodic inspection of the project by the Corps of Engineers and by submittal of the annual Inspection Checklist Report by the U.S. Fish and Wildlife Service as described below. The Corps of Engineers will inspect the project with representatives of the U.S. Fish and Wildlife Service and Wisconsin Department of Natural Resources at least every other year and at other times as may be required. The Corps of Engineers will contact the District Manager and Wisconsin Department of Natural Resources to set up a mutually convenient date for the joint inspection.

The findings of these inspections will be transmitted to the U.S. Fish and Wildlife Service and could include recommendations for remedial work considered necessary to maintain the habitat project in a satisfactory condition. Any agreed upon remedial work should be completed as soon as possible by the U.S. Fish and Wildlife Service as provided in the letter of agreement between the U.S. Fish and Wildlife Service and the Corps of Engineers.

Annual Inspection Checklist Report

Each year, the District Manager should submit to the District Engineer, St. Paul District, Corps of Engineers a current Inspection Checklist Report covering inspection and maintenance of the Cold Springs Backwater Project during the preceding year. The Inspection Checklist Report should be accompanied by photocopies of the appropriate project drawings (from the as-built drawings in Appendix A) marking the sites being commented on. The U.S. Fish

and Wildlife Service may send the Cold Springs Inspection Checklist Report in conjunction with reports on other habitat projects for which it has responsibility. If so desired, these reports can be sent to the Corps of Engineers with the annual Cooperative Agreement Report which is done every April by the U.S. Fish and Wildlife Service. A blank Inspection Checklist Report for the Cold Springs Backwater Project can be found in Appendix C. The Inspection Checklist Report should summarize any maintenance work done during the past 1-year period and include pertinent photographs taken during inspections, maintenance, or corrective work.

OPERATION

Under winter operating conditions, the stoplogs shall be installed in the weir's notch, and the stoplogs shall be removed from the slot in the south wingwall. With this configuration, creek flow down the creek/boat channel is minimized, and a maximum amount is diverted into the south lobe.

Under non-winter operating conditions, the stoplogs shall be installed in the south wingwall's slot, and the stoplogs shall be removed from the weir's notch. With this configuration, normal creek inflow will be down the creek/boat channel, and no flow should enter the diversion channel.

No specific dates are prescribed for switching from winter setup to non-winter setup and vice versa; the transition date is at the discretion of the District Manager and will depend on weather conditions.

The above operating plan is designed to minimize the probability of major creek inflow events (e.g., in response to a thunderstorm) carrying sediment loads into the south lobe. These type of events are much more likely to happen when the non-winter operating setup is in place, and the sediment-laden inflow should exit the backwater via the creek/boat channel like under pre-project conditions. During the winter months, the chances of a major runoff event from the Kettle Creek watershed is very low; and the base flow from Kettle Creek is too low to carry sediment into the south lobe.

MAINTENANCE

General Inspection and Maintenance

The inspection requirements that follow were developed through coordination between the Corps of Engineers and the U.S. Fish and Wildlife Service. Five years after completion of the Cold Springs Backwater Project, the Corps of Engineers, U.S. Fish and Wildlife Service, and Wisconsin Department of Natural Resources will review

these inspection activities for adequacy in meeting project goals. If the design goals discussed under **DESCRIPTION OF PROJECT, Design Considerations**, have not been achieved in spite of proper maintenance, continued maintenance of this project may be discontinued by mutual written agreement of the two Federal agencies.

Inspections The District Manager should periodically perform the following visual inspections and report the findings on the Inspection Checklist Report:

(1) Weir/wingwall structure -- Note significant settlement or loss of rock fill material. Mark areas of geotextile damage that might accelerate displacement of rock fill material. Catalog shoreline washouts downstream of the weir, etc.

(2) Weir notch and diversion slot -- Examine stoplogs, stoplog locks, and stoplog guides for damages due to natural wear-and-tear (such as impacts from floating debris) or vandalism.

(3) Diversion channel -- Evaluate the blockage potential from any build-up of aquatic vegetation, debris, and sediment.

(4) Dike along the west side of the diversion channel -- Velocities in the diversion channel are not expected to cause erosion under normal circumstances; however, if a debris build-up concentrates flow on one spot, erosion might occur. Erosion is more likely to occur on the west side of the dike from wave action. This dike is expected to successfully perform its short-circuit prevention function for the duration of the project life; therefore, **no corrective action is required from the U.S. Fish and Wildlife Service**. However, erosion repair might be desirable if the dike is used for equipment access for maintenance on the diversion channel.

(5) Once per year for the first three years of project operation, monitor the weir's steel sheetpile for settlement by shooting its elevation from the benchmark on the southeast corner of the Highway 35 bridge. **No corrective action is required from the U.S. Fish and Wildlife Service.**

In addition to the above inspections, the U.S. Fish and Wildlife Service may check the following:

(1) Area upstream of the weir and wingwalls -- Shoaling and debris upstream of the weir are expected to flush out during major Kettle Creek runoff events. However, if there is a considerable period between such events (e.g., several years), the accumulation might build up to an undesirable extent. The situation could be exacerbated if vegetation "anchors" the sediment and debris, which will then not resuspend and flush out as readily (see Figure 3). Visual monitoring will help verify this anticipated performance; therefore, this **optional** inspection should address undesirable

COLD SPRINGS BACKWATER (area upstream of weir looking northwest to north photographed from Highway 35 bridge)

Highway 35
bridge railing

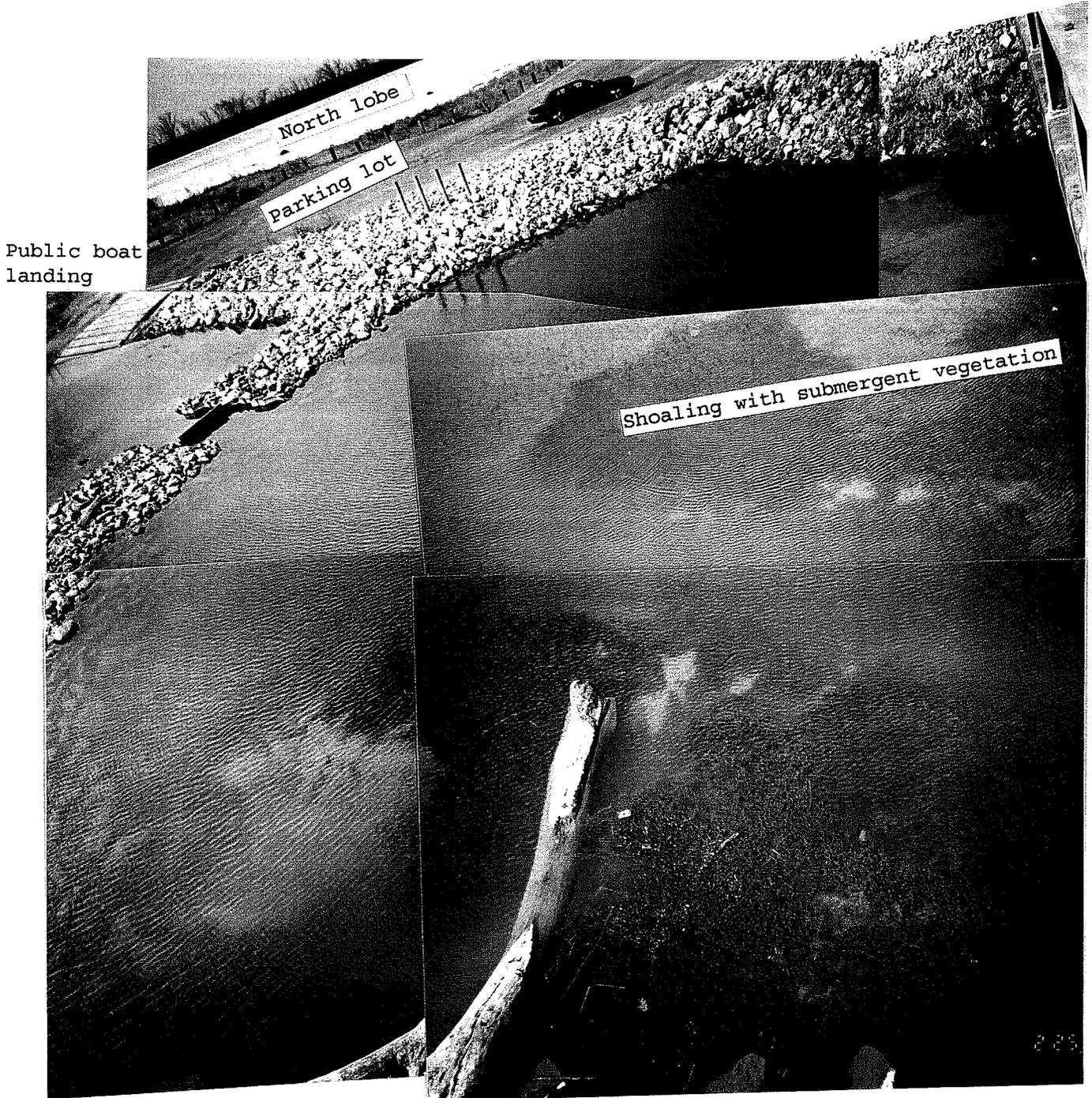


Figure 3

shoaling, vegetation build-up, and debris accumulation. **No corrective action is required from the U.S. Fish and Wildlife Service.**

(2) Fish access channel -- The fish access channel is expected to function for the duration of the project life; and the long-term monitoring and performance evaluation program (see Project Monitoring and Evaluation and Appendix E) provides for soundings of the fish access channel in 1994, 1999, and 2004 to monitor the impact of sedimentation on bottom width and depth. This information could be supplemented with **optional** spot-checks by U.S. Fish and Wildlife Service personnel in other years. **No corrective action is required from the U.S. Fish and Wildlife Service.**

Time of Year Visual inspections of the entire project should be made when the stoplogs in the weir notch and diversion slot are installed/removed for winter and non-winter operations.

Special visual inspections should be made following major Kettle Creek runoff events (which, generally, will be in response to serious thunderstorms). Because Kettle Creek has no automated stage recorder to access remotely to determine when such an event occurs, the District Manager will use judgment in deciding when major rainfall events in the Cold Springs area warrant special visual inspections. The inspection should focus on erosion and debris (discussed further in the following paragraphs).

Special visual inspections should also be made following Mississippi River flood events, i.e., following the spring snowmelt and major precipitation events in the watershed. Pool 9 flood stages will not have significant direct effects on the physical condition of the Cold Springs Backwater Project. However, river flooding could indirectly affect the project, for example, by depositing debris in sensitive areas. A tree trunk deposited on the weir, for instance, could divert creek flows against one of the creek/boat channel banks and cause erosion. Debris left in the diversion channel could block flows and reduce wintertime project effectiveness.

Generally, creek and river flooding will occur during non-winter operating conditions, when the weir notch is open and the diversion slot is stoplogged. With this setup, creek inflows will normally follow the pre-project path down the creek/boat channel. However, a major creek runoff event, particularly in conjunction with a high river stage, has the potential for overtopping the north and south wingwalls and having part of the creek inflow enter the backwater's north and south lobes. Following such an event, the visual inspection should cover possible erosion downstream of the weir and wingwalls. Any potentially serious erosion and debris problems should be recognized and corrected prior to setting up for winter operation, i.e., before stoplogs are installed in the weir notch and removed from the diversion slot.

The timing of these additional "drive-by" visual inspections is at the discretion of the District Manager.

Frequency Visual inspections should be made a minimum of twice a year when the stoplog switch is made. River flooding and creek runoff events will dictate the need for additional visual inspections. The sheetpile settlement check is to be done on an annual basis for the first three years of operation. The frequency for inspection will be subject to review by the U.S. Fish and Wildlife Service and Corps of Engineers and could change upon mutual agreement of both parties.

Corrective Actions Refer to Repair/Maintenance Materials and/or the as-built drawings (Appendix A) for information on acceptable types and sources of materials and installation/place-ment procedures. Corrective actions should be documented on the Inspection Checklist Report.

(1) Weir/wingwall structure -- If the weir/wingwall structure's rock fill has experienced significant settlement or loss of material, replacement material should be used to restore the nominal rock fill cross section. Trouble sites should be identified on the Inspection Checklist Report and monitored for repeated problems which might indicate a localized deficiency.

If turbulent flow over the weir/wingwall structure from high runoff events on Kettle Creek causes erosion to the north or south peninsulas, rock fill should be placed at the erosion site to prevent damage from reaching a stage where it affects project integrity or performance. If the erosion is extensive and/or the District Manager has questions about damage repair, it is suggested that the Corps of Engineers geotechnical/hydraulics staff be consulted prior to proceeding with repairs.

Lubricate access post padlocks as needed to prevent "freezing up"; replace damaged or "frozen" padlocks. See as-built drawings (Appendix A) for recommended padlock or equivalent.

If the geotextile fabric becomes torn and its function is threatened, overlying rock fill should be removed and a new piece of fabric laid over the tear such that the new fabric overlaps the old by 36 inches.

(2) Weir notch and diversion slot -- Remove debris (branches, rocks, etc.) and woody vegetation/saplings from weir notch or diversion slot to ensure the stoplogs will seat properly on the guide sill. Replace damaged stoplogs (pressure-treated 2 x 6s).

Lubricate stoplog padlocks as needed to prevent "freezing up"; replace damaged or "frozen" padlocks. See as-built drawings (Appendix A) for recommended padlock or equivalent.

Damaged stoplog guides may be repaired or replaced by removing the old hardware by unbolting or, if the bolts are "frozen," by torching the bolts off and replacing them. The dimensions of replacement hardware can be found on the as-built drawings (Appendix A).

(3) Diversion channel -- If a visual inspection suggests that vegetation, debris, or sedimentation is affecting flow in the diversion channel, a closer inspection should be made (including soundings if needed) to identify any portions of the channel that have become blocked or reduced significantly in depth. When the build-up of aquatic vegetation, debris, and/or sediment threatens to affect free flow, the channel should be restored to its nominal design cross section.

Repair/Maintenance Materials

Rock Fill Rock fill for the original construction was obtained from the Kings Bluff Quarry, T 18 N, R 8 W, NE 1/4, Sec 25, La Crosse County, WI. Other potential sources include the following approved quarries listed in the project plans and specifications:

Forde Quarry
T 10 N, R 6 W
SE 1/4, NE 1/4, Sec 5
Crawford County, WI

Operated by:
Edward Kraemer & Sons
1 Plainview Road
Plain, WI 53577
(Telephone: 608-546-2311)

Hanson Quarry
T 11 N, R 7 W, Sec 24
Crawford County, WI

Operated by:
Same as above

Wexford Quarry
T 98 N, R 3 W
NE 1/4, Sec 36
Allamakee County, IA

Operated by:
Bruening Rock Prod., Inc.
325 Washington Street
Box 127
Decorah, IA 52101
(Telephone: 319-382-2933)

To assist in proper procurement and placement of additional rock fill, the applicable section from the original specifications (including the acceptable gradation curves) is reproduced in Appendix D. Drawings in Appendix A should be consulted for placement and thickness of rock fill.

Geotextile Fabric To assist in proper procurement and installation of replacement geotextile fabric, the applicable section from the original specifications has been included in Appendix D.

Stoplogs and Hardware Stoplog dimensions and hardware specifications are shown on the as-built drawings in Appendix A.

INSPECTIONS AND PROJECT RE-ASSESSMENT FOLLOWING MAJOR FLOODS

General

As stated in the agreement between the U.S. Fish and Wildlife Service and the Corps of Engineers executed April 26, 1993 (Appendix B), the Corps will be responsible for any mutually agreed upon repair and rehabilitation of the Cold Springs Backwater Project that exceeds the annual maintenance requirements identified in the Definite Project Report⁶ and that is needed as a result of specific storm or flood events. The project will be inspected as previously described following significant Mississippi River floods or major Kettle Creek runoff events.

Project Rehabilitation/Abandonment

Should inspection of the project area following the flood events described above disclose substantial damage to the project that appears to exceed the annual operation and maintenance as specified in this manual and the Definite Project Report, the Corps of Engineers and U.S. Fish and Wildlife Service should meet to discuss the appropriate course of action in light of original project design. The inspections by the District Manager (summarized in the Inspection Checklist Report) and joint inspections with the Corps of Engineers will be the basis for determining maintenance by the U.S. Fish and Wildlife Service versus potential rehabilitation by the Corps of Engineers. With regard to the latter, the options of rehabilitation or abandonment of the project would be considered at that time in conjunction with the Wisconsin Department of Natural Resources. An abandonment decision would be carried out only upon written mutual agreement of the U.S. Fish and Wildlife Service and the Corps of Engineers after consultation with the Wisconsin Department of Natural Resources.

PROJECT MONITORING AND EVALUATION

Project evaluation is a Corps of Engineers responsibility. Appendix E contains the monitoring and performance evaluation plan established for the Cold Spring Backwater Project to help determine the extent to which the design meets the habitat improvement objectives. Information from this analysis will also be used, if required, when ascertaining whether rehabilitation or abandonment of this project would be the wisest choice.

Work for all habitat rehabilitation and enhancement projects is limited to measuring changes in physical, water quality, and vegetation habitat conditions. Monitoring beyond the scope of the Corps of Engineers project evaluation (e.g., to determine the response of fish and wildlife to habitat changes, monitoring for

⁶ Estimated at \$900.

longer duration or in a larger area, etc.) will be conducted at the discretion of the U.S. Fish and Wildlife Service and Wisconsin Department of Natural Resources. For the Cold Springs Backwater Project, Corps of Engineers-supported monitoring will consist of measuring wintertime DO concentrations in the backwater, estimating Kettle Creek's wintertime base flow and the amount of inflow diverted into the south lobe, and taking soundings in the fish access channel to determine its stability/longevity.

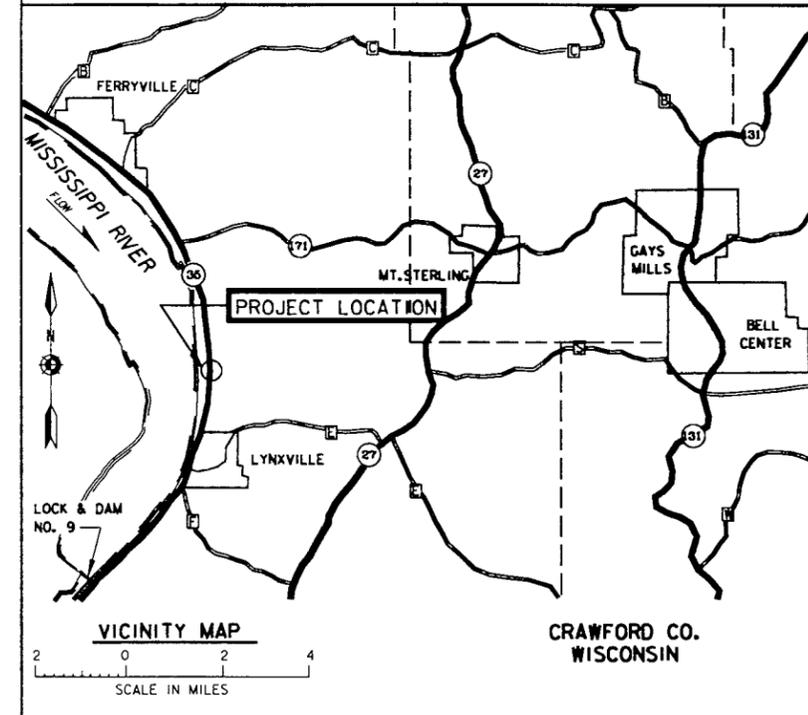
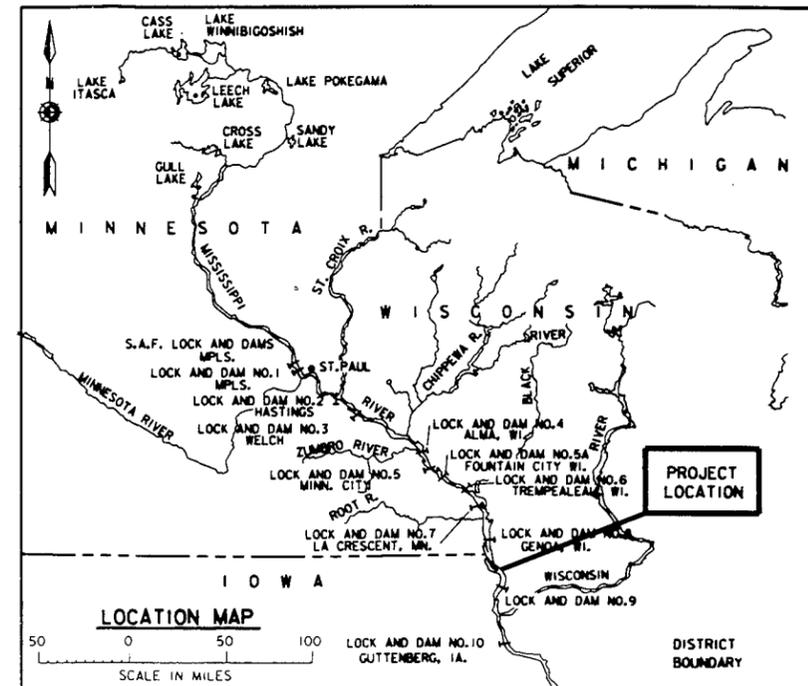
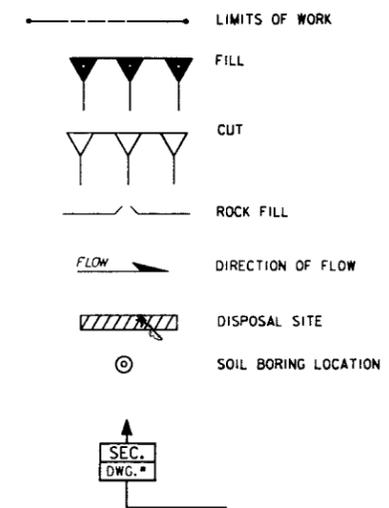
APPENDIX A

PROJECT DRAWINGS

| CONTRACT DRAWING INDEX | | | | |
|------------------------|------|--|--------------|----------------|
| DRAWING NO. | SHT. | DESCRIPTION | CAD FILE | VERTICAL DATUM |
| M-P9-10/9 | 1 | LOCATION, VICINITY, & DRAWING INDEX | mi04p000.dgn | 1929 ADJ |
| M-P9-10/10 | 2 | SITE MAP | mi04p001.dgn | 1929 ADJ |
| M-P9-64/4 | 3 | PLAN VIEW CLOSURE STRUCTURE | MYLAR | 1929 ADJ |
| M-P9-64/5 | 4 | CROSS SECTIONS - STATE HWY. 35, FISH CHANNEL, WEIR BANK PROTECTION | mi04p008.dgn | 1929 ADJ |
| M-P9-64/6 | 5 | OVERFLOW WEIR AND DIVERSION OUTLET - PLAN & SECTIONS | mi04rc01.dgn | 1929 ADJ |
| M-P9-64/7 | 6 | OVERFLOW WEIR AND DIVERSION OUTLET - SECTIONS | mi04rc04.dgn | 1929 ADJ |
| M-P9-64/8 | 7 | OVERFLOW WEIR AND DIVERSION OUTLET - SECTION & DETAILS | MYLAR | 1929 ADJ |
| M-P9-64/9 | 8 | OVERFLOW WEIR AND DIVERSION OUTLET - SECTIONS & DETAILS | MYLAR | 1929 ADJ |
| M-P9-64/10 | 9 | OVERFLOW WEIR AND DIVERSION OUTLET - SECTIONS & DETAILS | MYLAR | 1929 ADJ |
| M-P9-64/11 | 10 | OVERFLOW WEIR AND DIVERSION OUTLET - SECTIONS & DETAILS | MYLAR | 1929 ADJ |
| M-P9-64/12 | 11 | OVERFLOW WEIR AND DIVERSION OUTLET - SECTIONS & DETAILS | MYLAR | 1929 ADJ |

| REFERENCES | | | | |
|-------------|--|------|--------------|----------|
| DRAWING NO. | DESCRIPTION | DATE | CAD FILE | DATE |
| M-P9-14/14 | ELEVATION AND DURATION CURVES L/D 9 POOL | 1912 | D1_DAM9P.DGN | 1912 ADJ |
| M-P9-14/15 | ELEVATION AND DURATION CURVES L/D 9 POOL | 1912 | D2_DAM9P.DGN | 1912 ADJ |
| M-P9-14/16 | HYDROGRAPHS L/D 9 POOL | 1912 | POOL9A.DGN | 1912 ADJ |
| M-P9-14/17 | HYDROGRAPHS L/D 9 POOL | 1912 | POOL9B.DGN | 1912 ADJ |
| M-P9-10/11 | BORING LOGS | 1929 | COLDSHT1.DGN | 1929 ADJ |
| M-P9-10/12 | BORING LOGS | 1929 | COLDSHT2.DGN | 1929 ADJ |

LEGEND FOR DRAWINGS

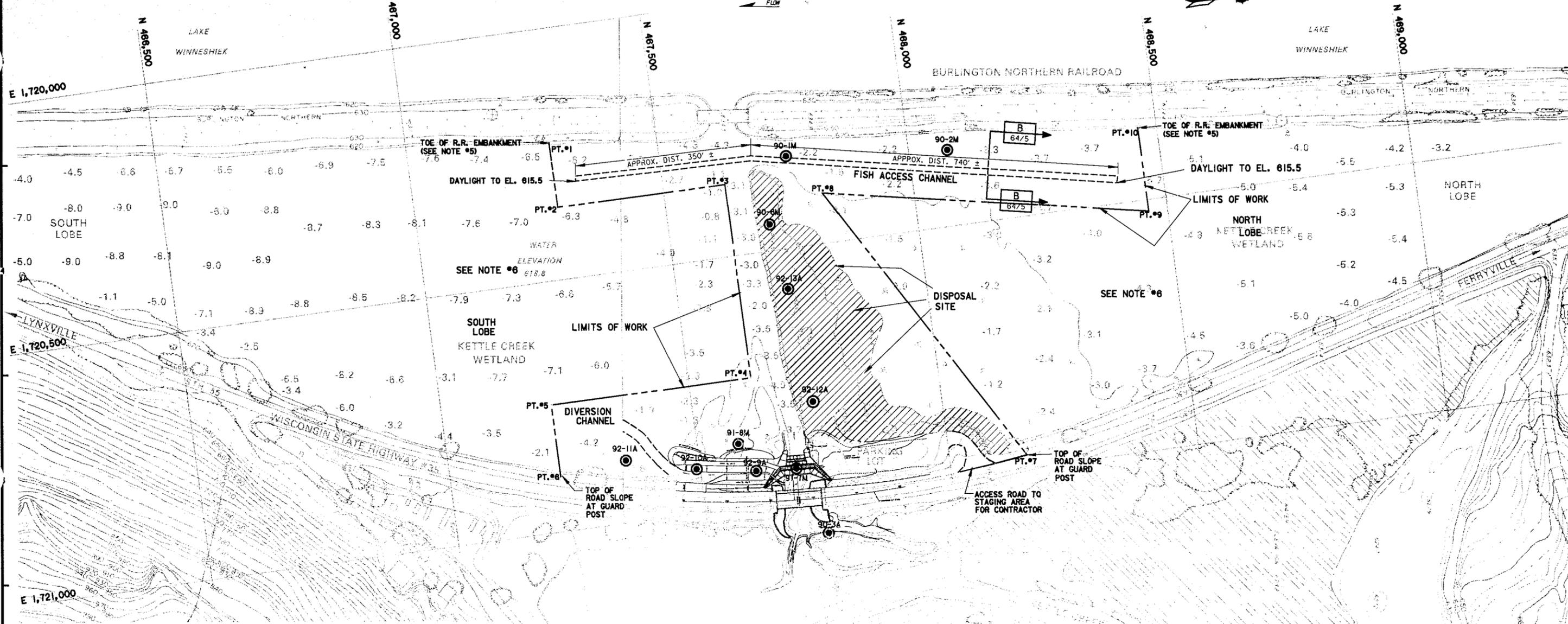


● GEN ENG
○ HYD
○ HYDR
○ GEOTECH
○ STR ENG
MLA



| | | | | | |
|---|--|---|--|--|-----|
| SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET, AS INDEXED ON THIS SHEET. | | AS-BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| APPROVAL RECOMMENDED BY: | | SYMBOL | | DESCRIPTION | |
| [Signature] CHIEF ED-D BRANCH [Signature] CHIEF ED-GH BRANCH [Signature] CHIEF ENGINEERING DIVISION | | [Signature] ENGINEER MANAGER [Signature] CHIEF SPECS. & TECH. SUPPORT SECTION [Signature] CHIEF GENERAL ENGINEERING SECTION [Signature] CHIEF STRUCTURAL SECTION [Signature] CHIEF MECH/ELEC/ARCH SECTION [Signature] CHIEF HYDRAULICS SECTION [Signature] CHIEF HYDROLOGY SECTION [Signature] CHIEF GEOTECHNICAL DESIGN SECTION | | DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | |
| APPROVED BY: | | AE APPROVING OFFICIAL: | | AS - BUILT | |
| [Signature] COL., CORPS OF ENGINEERS | | [Signature] | | COLD SPRINGS | |
| | | DESIGNED: W.P.R. | | ENVIRONMENTAL MGMT. PROGRAM - MISSISSIPPI RIVER | |
| | | CHECKED: W.P.R. | | CRAWFORD CO., WISCONSIN | |
| | | DRAWN: F.J.B. | | COLD SPRINGS | |
| | | DESIGNED: | | LOCATION AND VICINITY MAP | |
| | | CHECKED: | | DRAWING INDEX | |
| | | DATE: 12-09-92 | | CAD FILE NAME: mi044000.dgn | |
| | | | | DRAWING NUMBER: M-P9-10/9 | |
| | | | | SHT 1 OF 11 | |

MISSISSIPPI RIVER



| LIMITS OF WORK - PT. POINTS | | | | | |
|-----------------------------|-------------|------------|--------------|----------|-----------------|
| PT. POINTS | NORTH CORD. | EAST CORD. | BEARING | DISTANCE | COMMENTS |
| 1. | 467,285± | 1,720,230± | EAST | 130 | TOE OF RR SLOPE |
| 2. | 467,285 | 1,720,360 | NORTH | 340 | |
| 3. | 467,625 | 1,720,360 | EAST | 390 | |
| 4. | 467,625 | 1,720,750 | SOUTH | 405 | |
| 5. | 467,220± | 1,720,750 | EAST | 145 | |
| 6. | 467,220± | 1,720,895± | | | TOP OF RD SLOPE |
| 7. | 468,185± | 1,721,027± | | | TOP OF RD SLOPE |
| 8. | 467,817 | 1,720,403 | S 59 28 13W | 724 | |
| 9. | 468,463 | 1,720,525 | N10 41 40.6E | 657 | |
| 10. | 468,463± | 1,720,357± | WEST | 168 | TOE OF RR SLOPE |

REFERENCES

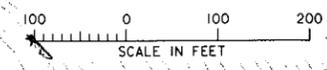
1. PLAN VIEW CLOSURE STRUCTURE
2. CROSS SECTIONS

NOTES:

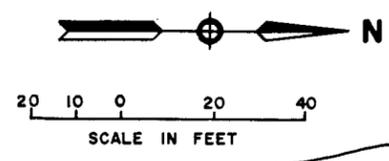
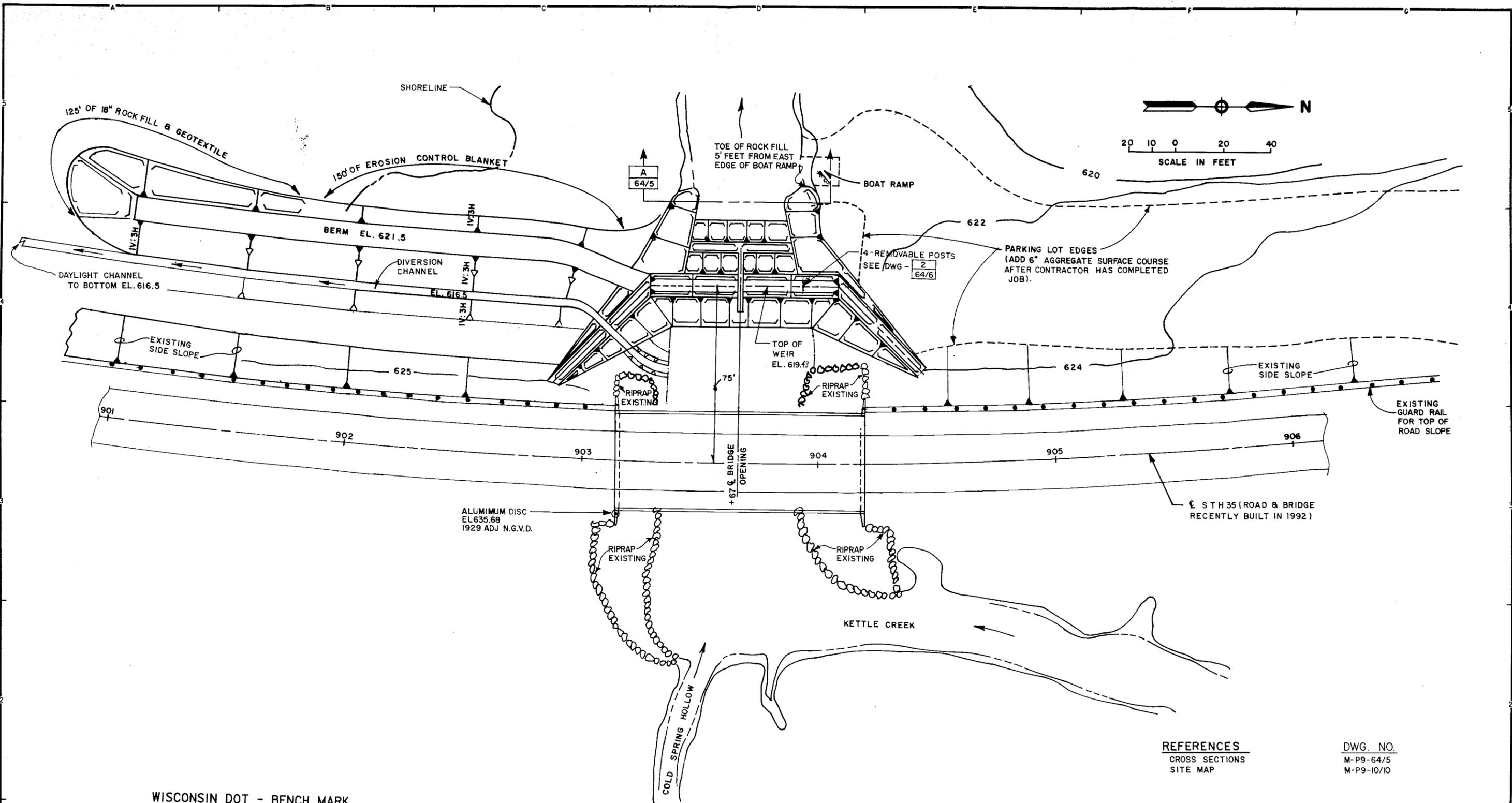
1. BORING 90-5TP LOCATED 700' UPSTREAM OF BORING 90-4TP AT N 65° E BEARING.
2. VERTICAL DATUM PLANE FOR THIS DRAWING IS 1929 ADJ. N.C.V.D. (ADD 0.46 TO 1929 DATA TO GET 1912 M.S.L. DATA.)
3. WIS DOT - TOPO - NOV. 1973
4. BATHYMETRY - JAN. 1987, W.S.E.L. IS REPRESENTATIVE OF SURVEY DATE ONLY.
5. TOE OF R.R. EMBANKMENT WILL BE 12' FROM LIMITS OF WORK.
6. SOUTH LOBE AREA FORMED BY PT 2, 3, 4 & 5. NORTH LOBE AREA FORMED BY 7, 8, & 9.
 - A. MOVEMENT OF CONSTRUCTION EQUIPMENT ONLY.
 - B. NO EXCAVATION OR DISPOSAL OF MATERAIL ALLOWED.

DWG. NO.
M-P9-34/4
M-P9-64/5

SITE MAP



| | | | |
|---|---|---|----------------|
| AS - BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AS - BUILT: COLD SPRINGS ENVIRONMENTAL MGMT PROGRAM - MISSISSIPPI RIVER POOL 9 | | CRAWFORD CO., WISCONSIN. COLD SPRINGS SITE MAP CLOSURE STRUCTURE | |
| AE APPROVING OFFICIAL: | | | |
| DESIGNED: W.P.R. | | | |
| CHECKED: W.P.R. | | | |
| DRAWN: G.P./F.J.B. | | | |
| DESIGNED: | | | |
| CHECKED: | | | |
| DATE: 12-15-92 | CAD FILE NAME: SPEC NO: DACW37-93-B-0026 | DRAWING NUMBER: M-P9-10/10 | SHT 2 OF 11 |



WISCONSIN DOT - BENCH MARK

| NO. | STA. | DESCRIPTION | ELEV. |
|-----|--------------------|--|--------|
| 5 | 921 + 65 58' RT | U.S.G.S. DISK/CONC. POST 1929 ADJ. N.G.V.D. | 639.42 |
| | 903 + 15 | ALUMINUM DISC. | 635.68 |

VERTICAL DATUM PLANE FOR THIS DRAWING IS 1929 ADJ. N.G.V.D.
(ADD 0.46 TO 1929 DATA TO GET 1912 ADJ. M.S.L.)

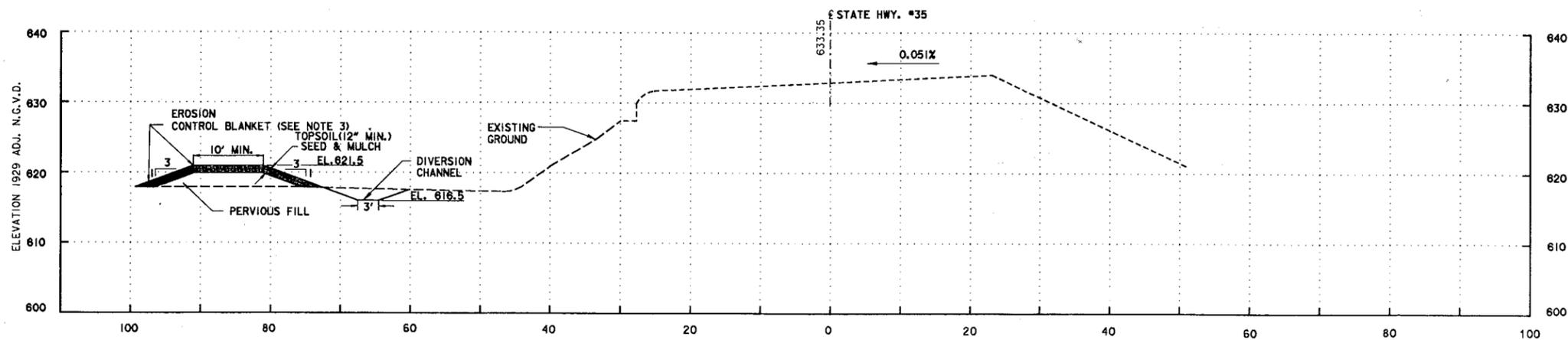
PLAN VIEW
(FOR CLOSURE STRUCTURE & DIVERSION CHANNEL)

REFERENCES
CROSS SECTIONS
SITE MAP

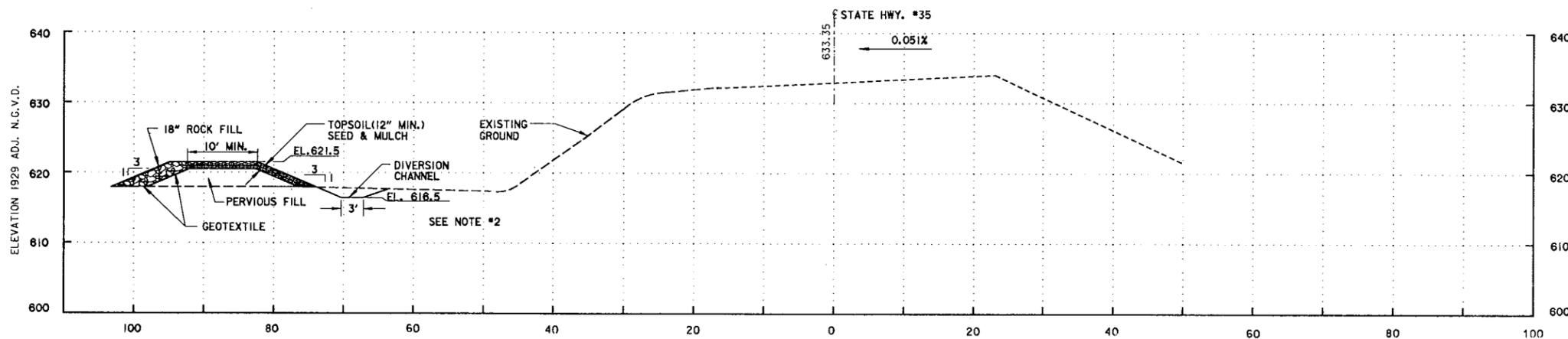
DWG. NO.
M-P9-64/5
M-P9-10/10

| | | | |
|---|---------------------------|--|-------------|
| AS-BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AE APPROVING OFFICIAL: | | AS-BUILT COLD SPRINGS ENVIRONMENTAL MGMT PROGRAM - MISSISSIPPI RIVER POOL 9 CRAWFORD CO., WISCONSIN. COLD SPRINGS PLAN VIEW CLOSURE STRUCTURE | |
| DESIGNED: W.P.R. | CHECKED: W.P.R. | DESIGNED: CHECKED: | |
| DRAWN: G.P./F.J.B. | | | |
| DATE: 10-30-92 | CAD FILE NAME: | DRAWING NUMBER: | SHT 3 OF 11 |
| | SPEC NO: DACW37-93-B-0026 | M-P9-64/4 | |

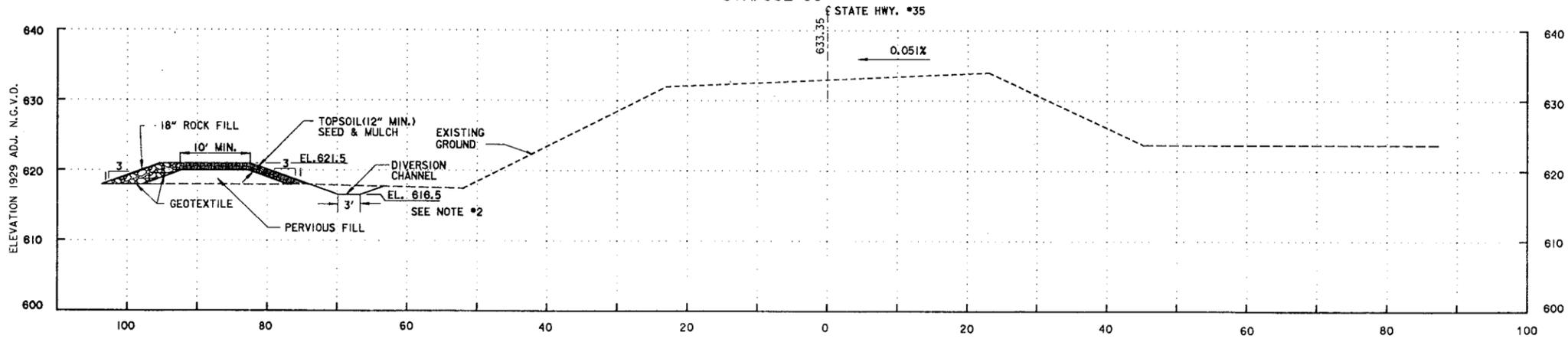
- GEN ENG
- HYD
- HYDR
- GEOTECH
- S1
- MEA



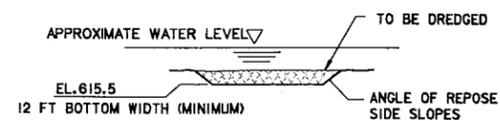
SECTION
STA. 902+80



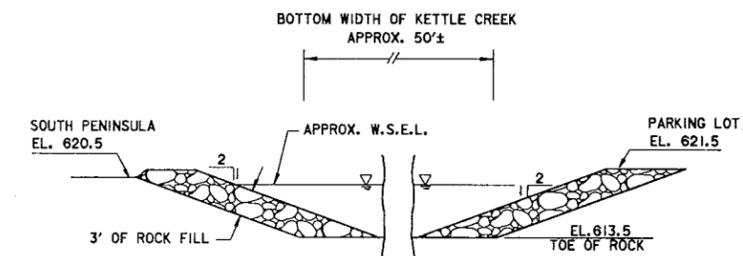
SECTION
STA. 902+00



SECTION
STA. 901+00
STATE HWY. #35 CROSS SECTIONS
(LOOKING NORTH)



TYPICAL SECTION
FISH ACCESS CHANNEL
(APPROX. 1100 FEET LONG)



TYPICAL SECTION
BANK PROTECTION
DOWNSTREAM OF WEIR (LOOKING WEST)



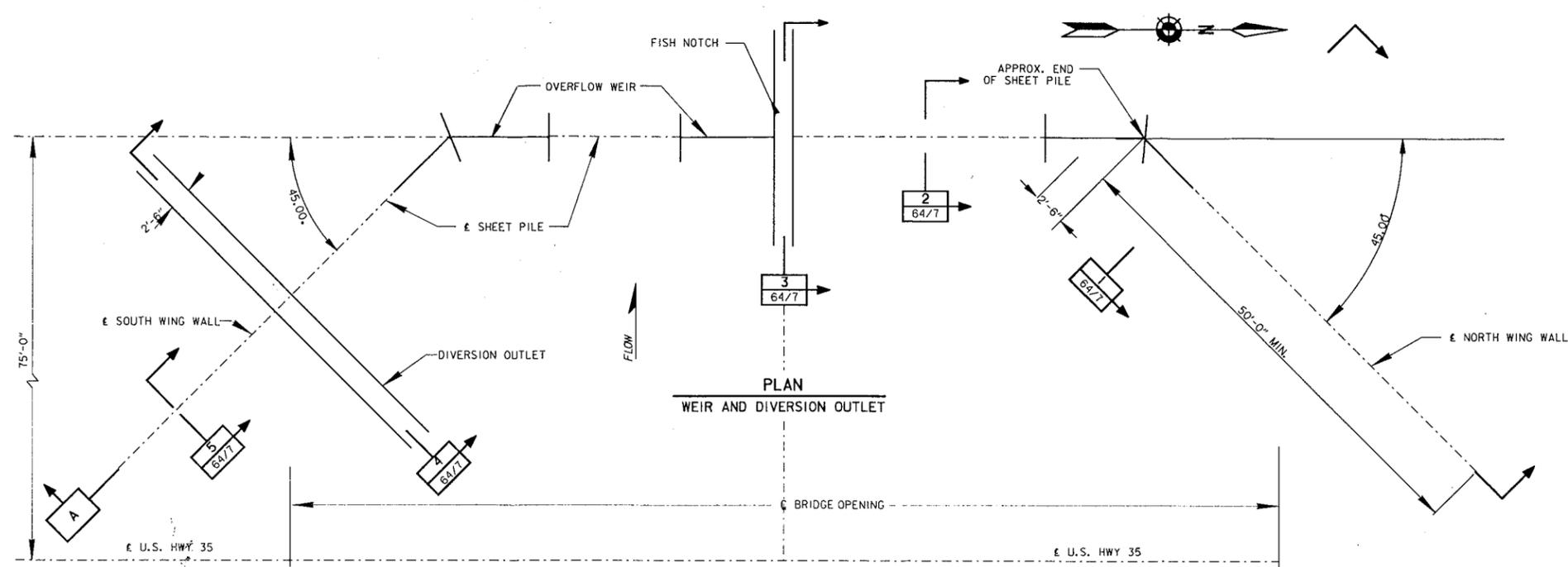
NOTES:

- VERTICAL DATUM PLANE FOR THIS DRAWING IS 1929 ADJ. N.G.V.D. (ADD 0.46 TO 1929 DATA TO GET 1912 M.S.L. DATA.)
- DIVERSION CHANNEL SIDE SLOPES CAN BE IV TO 3H OR FLATTER.
- AS-BUILT PROJECT WAS "CURLX EXCELSIOR BLANKET" FROM AMERICAN EXCELSIOR COMPANY) MEETING WISCONSIN D.O.T.' SPECIFICATION 628.2.2.

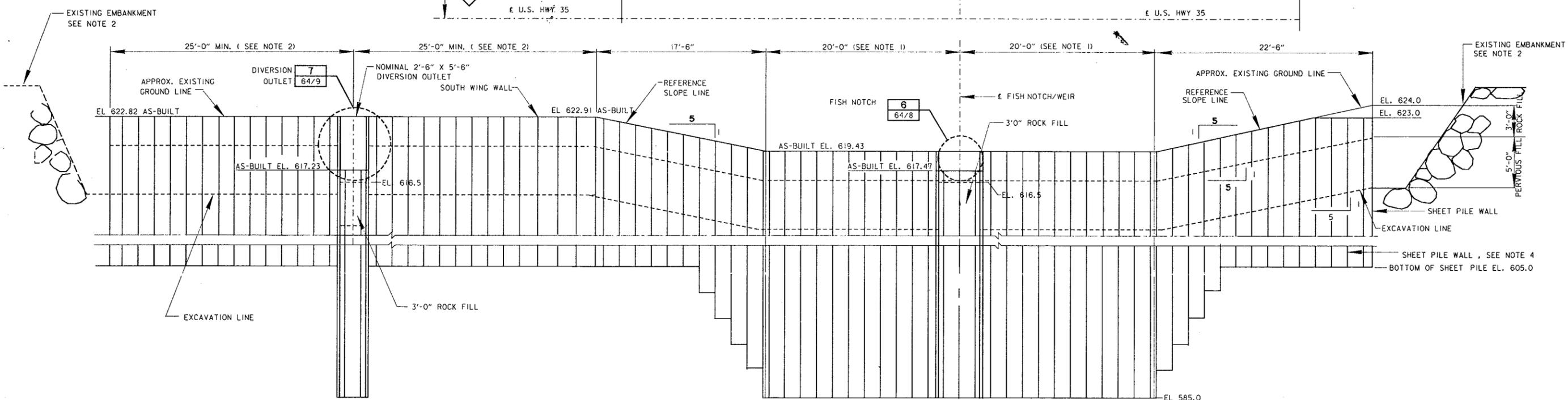
| REFERENCES: | DWG. NO. |
|-----------------------------|------------|
| SITE MAP | M-P9-10/10 |
| PLAN VIEW CLOSURE STRUCTURE | M-P9-64/4 |

| | | | |
|---|-----------------------------|--|----------|
| AS-BUILT AS OF COMPLETION DATE | | 8/94 | EGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AE APPROVING OFFICIAL: | | AS-BUILT | |
| DESIGNED: WINSTON | | COLD SPRINGS | |
| CHECKED: WINSTON | | ENVIRONMENTAL MGMT PROGRAM -- MISSISSIPPI RIVER | |
| DRAWN: GRS/SKM | | POOL 9 CRAWFORD CO., WISCONSIN | |
| DESIGNED: | | COLD SPRINGS | |
| CHECKED: | | CROSS SECTIONS - STATE HWY. #35, FISH CHANNEL, & WEIR BANK PROTECTION | |
| DATE: 12-09-92 | CAD FILE NAME: m104c008.dgn | DRAWING NUMBER: | SHT 4 |
| | SPEC NO: DACW37-93-B-0026 | M-P9-64/5 | OF 11 |

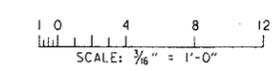
- GEN ENG
- HYD
- HYDR
- GEOTECH
- STR ENG



PLAN
WEIR AND DIVERSION OUTLET



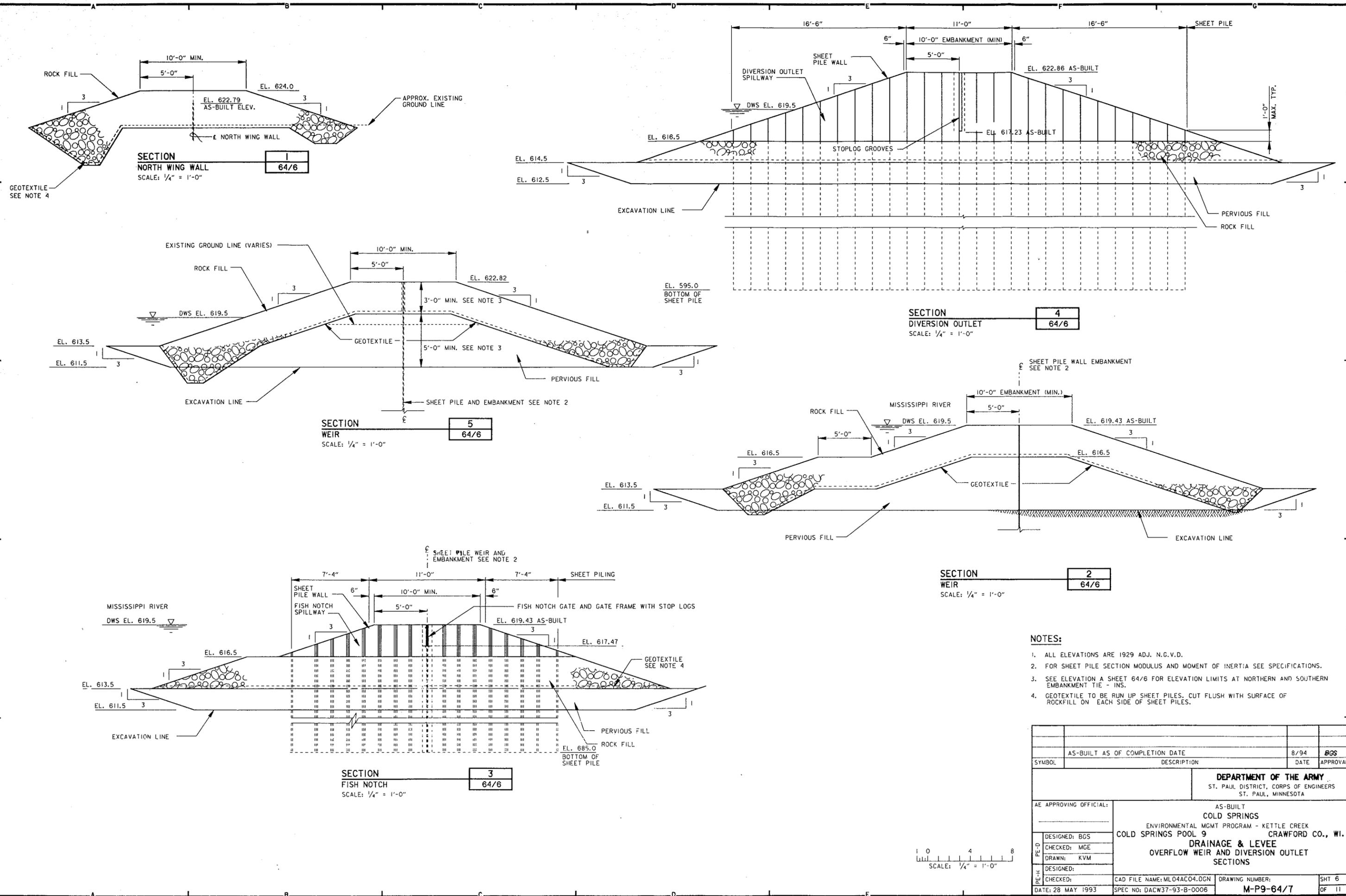
SECTION
WEIR AND DIVERSION OUTLET



- NOTES:**
1. ALIGN ϵ OF OVERFLOW WEIR ϵ WITH OF CHANNEL.
 2. WING WALL LENGTH SHALL BE ADJUSTED IN THE FIELD TO TIE INTO THE EMBANKMENT AT THE ELEVATIONS SHOWN SUBJECT TO THE CONTRACTING OFFICER REPRESENTATIVE'S APPROVAL.
 3. ALL ELEVATIONS ARE 1929 ADJ. N.G.V.D.
 4. FOR SHEETPILE SECTION MODULUS AND INERTIA MOMENT SEE SPECIFICATIONS.

| | | | |
|---|-------------------|---|----------|
| AS-BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AE APPROVING OFFICIAL: | | AS-BUILT | |
| | | COLD SPRINGS | |
| | | ENVIRONMENTAL MGMT PROGRAM - MISSISSIPPI RIVER | |
| | | COLD SPRINGS POOL 9 CRAWFORD CO., WI. | |
| | | DRAINAGE & LEVEE | |
| | | OVERFLOW WEIR AND DIVERSION OUTLET | |
| | | PLAN AND SECTION | |
| DESIGNED: PWS | CHECKED: MGE | CAD FILE NAME: MLO4ACO1.DGN DRAWING NUMBER: M-P9-64/6 DATE: 11-07-94 SPEC NO: DACW37-93-B-0026 | |
| DRAWN: HPA / KM | DESIGNED: XXX/XXX | | |
| CHECKED: XXX/XXX | | | |
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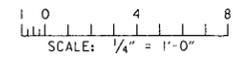
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- HYD
- HYDR
- GEOTECH
- STR FNG
- MEA

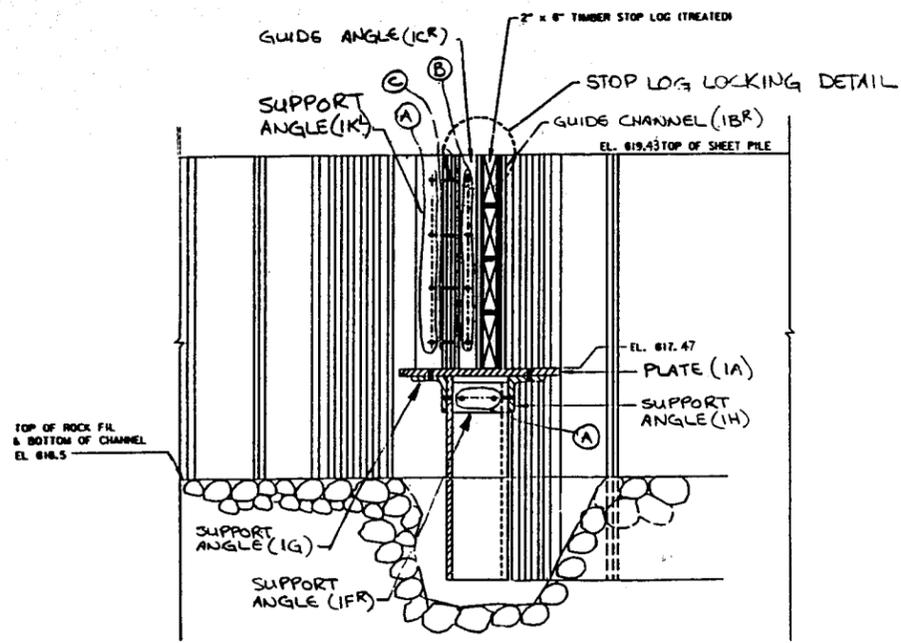


- GEN ENG
- HYD
- HYDR
- GEOTECH
- STR ENG
- MEA

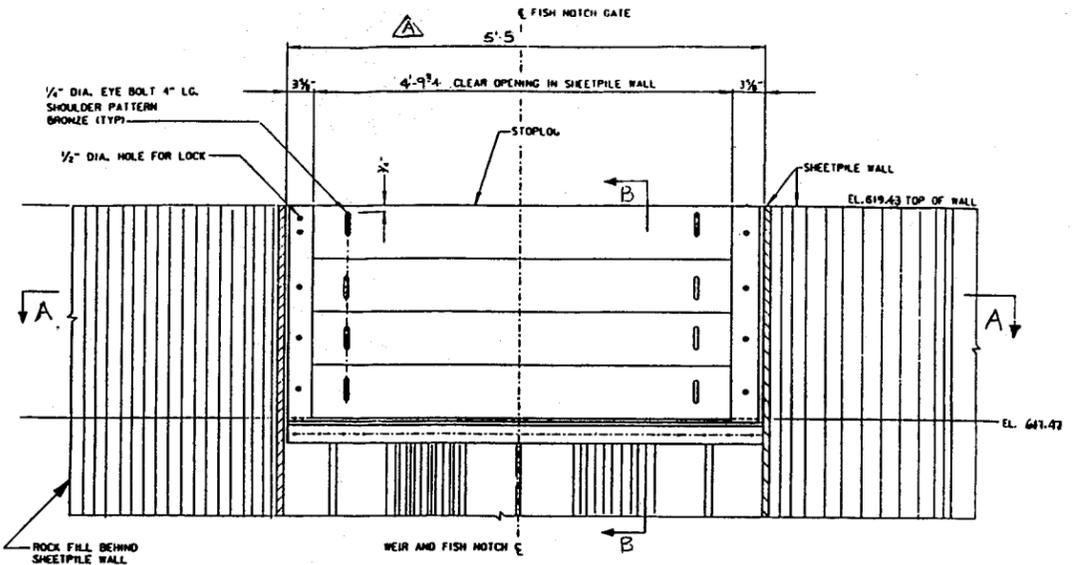
- NOTES:**
1. ALL ELEVATIONS ARE 1929 ADJ. N.G.V.D.
 2. FOR SHEET PILE SECTION MODULUS AND MOMENT OF INERTIA SEE SPECIFICATIONS.
 3. SEE ELEVATION A SHEET 64/6 FOR ELEVATION LIMITS AT NORTHERN AND SOUTHERN EMBANKMENT TIE - INS.
 4. GEOTEXTILE TO BE RUN UP SHEET PILES. CUT FLUSH WITH SURFACE OF ROCKFILL ON EACH SIDE OF SHEET PILES.

| | | | |
|---|--|--|----------|
| AS-BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AE APPROVING OFFICIAL: | | AS-BUILT COLD SPRINGS ENVIRONMENTAL MGMT PROGRAM - KETTLE CREEK COLD SPRINGS POOL 9 CRAWFORD CO., WI. | |
| DESIGNED: BGS | DRAINAGE & LEVEE OVERFLOW WEIR AND DIVERSION OUTLET SECTIONS | | |
| CHECKED: MGE | DRAWING NUMBER: | | |
| DRAWN: KVM | SHT 6 | | |
| DESIGNED: | CAD FILE NAME: ML04AC04.DGN | DRAWING NUMBER: | OF 11 |
| CHECKED: | SPEC NO: DACW37-93-B-0006 | M-P9-64/7 | |
| DATE: 28 MAY 1993 | | | |

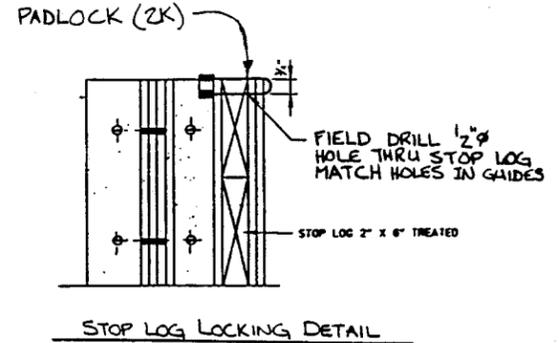




SECT. "B-B"



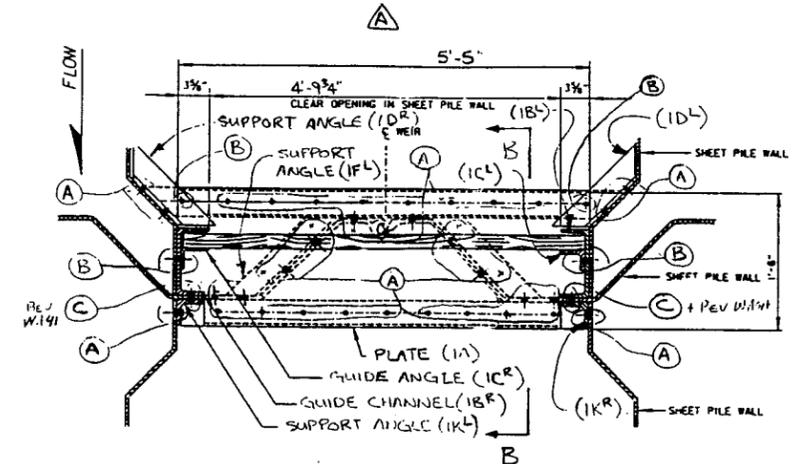
ELEVATION AT FISH NOTCH



STOP LOG LOCKING DETAIL

ERECTION NOTE:
 PIECE MARKS FOR VERTICAL MEMBERS (IK^E, IC^E & IB^E) TO BE LOCATED AT TOP OF OPENING

FIELD CLIP SUPPORT L^S ID^E, IF^E & IH AS REQ'D. TO CLEAR.



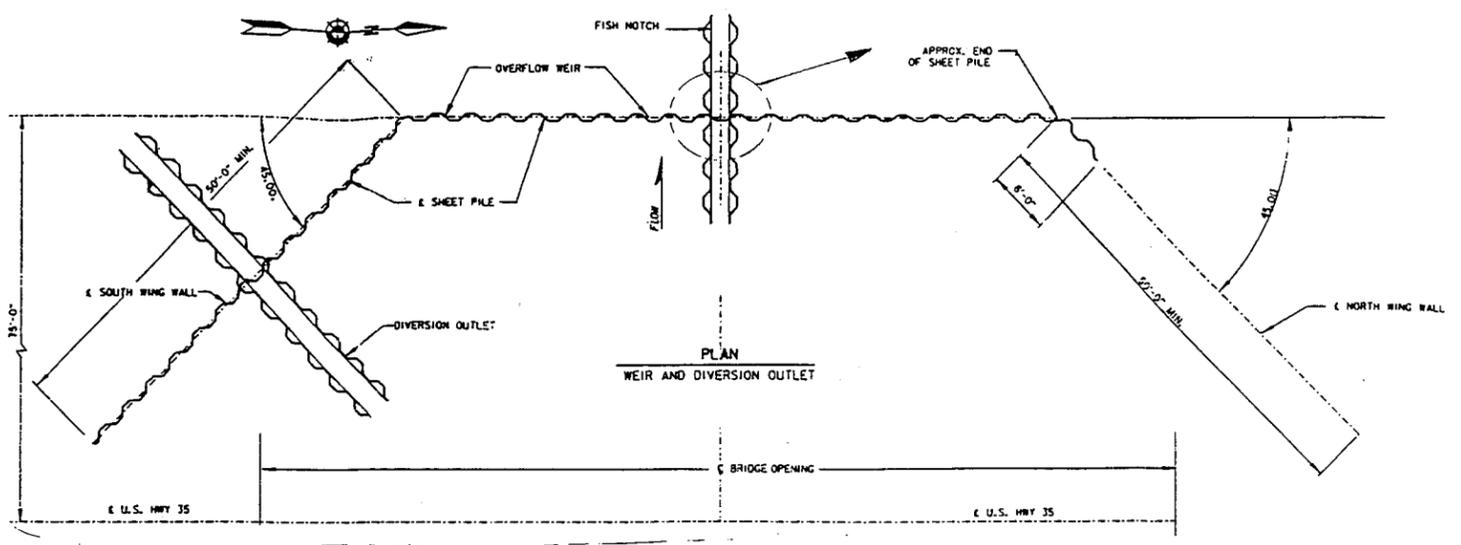
SECT. "A-A"

○ - INDICATES FASTENER TYPE SEE SCHEDULE FOR SIZE AND MARKS USE 2 WASHERS EA. BOLT

| BOLT SCHEDULE | | | | | |
|---------------|----------------|----|----|----|----|
| TYPE | SIZE | BW | HB | HN | FW |
| | | IK | MK | MK | MK |
| A | HB 3/4 x 2 | - | 2M | 2R | 2S |
| B | HB 3/4 x 2 1/2 | - | 2N | 2R | 2S |
| C | HB 3/4 x 2 3/4 | 2T | 2P | 2R | 2S |

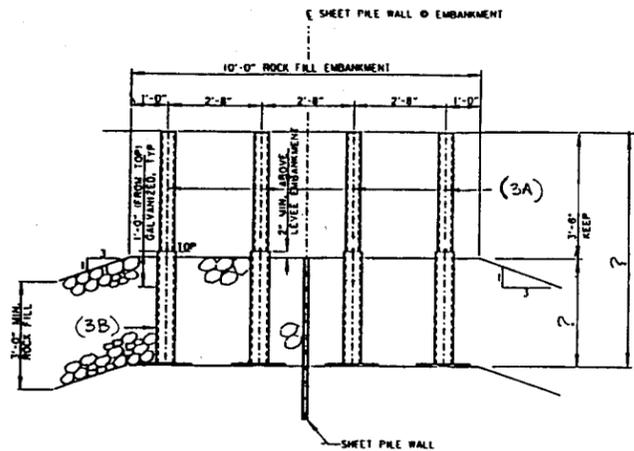
NOTES:

- APPROXIMATE WEIGHT OF ONE STOP LOG IS 12 LBS. STOP LOGS ARE TREATED TIMBER.
- ALL ELEVATIONS ARE 1929 ADJ. N.G.V.D.
- ALL FASTENERS FOR SHEET PILE SHALL BE 3/4" HIGH STRENGTH ASTM A 328 BOLTS SPACED AT 6" CENTERS OR 3" CTRS.
- STOP LOGS SHALL BE INSTALLED LEVEL. GROOVES SHALL BE INSTALLED PLUMB FINAL INSTALLATION OF GATE FRAME AND STOP LOGS SHALL BE LEAK PROOF.
- SEE SPECIFICATIONS FOR SHEET PILE SECTION MODULUS AND MOMENT OF INERTIA.
- NO GALVANIZING REQUIRED.

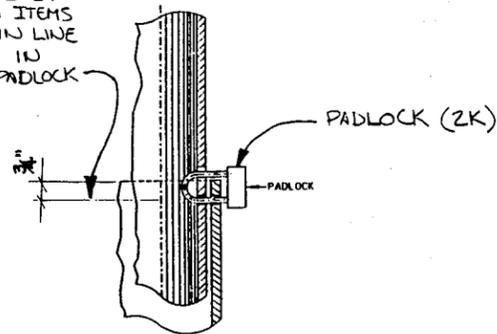


PLAN WEIR AND DIVERSION OUTLET

| | | | |
|---|-------------|---|-----------------|
| AS-BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AE APPROVING OFFICIAL: | | AS-BUILT COLD SPRINGS | |
| DESIGNED: BGS | | ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER COLD SPRINGS POOL 9 CRAWFORD CO., WISCONSIN | |
| CHECKED: | | DRAINAGE & LEVEE | |
| DRAWN: | | OVERFLOW WEIR AND DIVERSION OUTLET | |
| DESIGNED: | | SECTION & DETAILS | |
| CHECKED: | | CAD FILE NAME: | DRAWING NUMBER: |
| DATE: 05-12-93 | | SPEC NO: DACW37-93-B-0026 | M-P9-64/8 |
| | | SHT 7 | OF 11 |

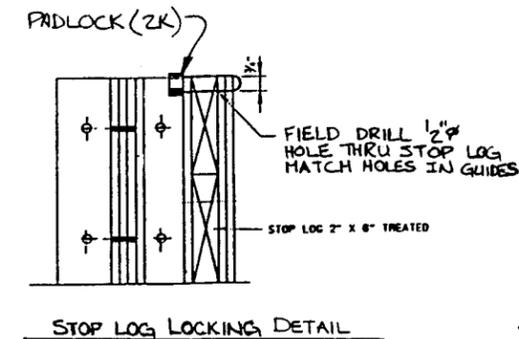


FIELD DRILL 1/2\"/>

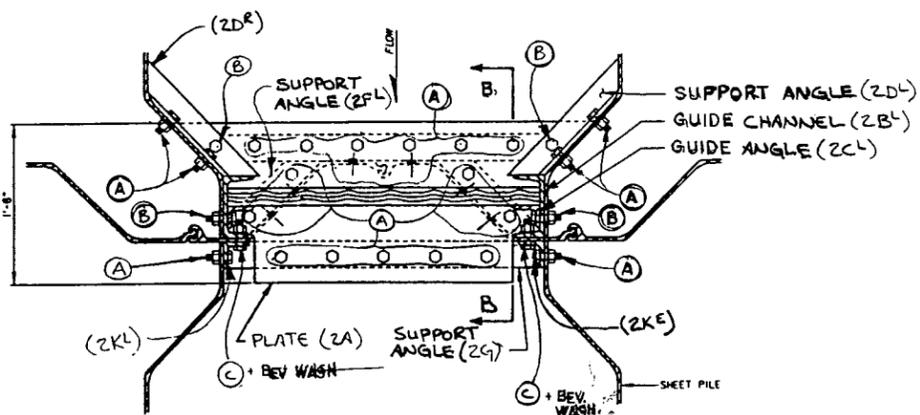


ERECTION NOTE:

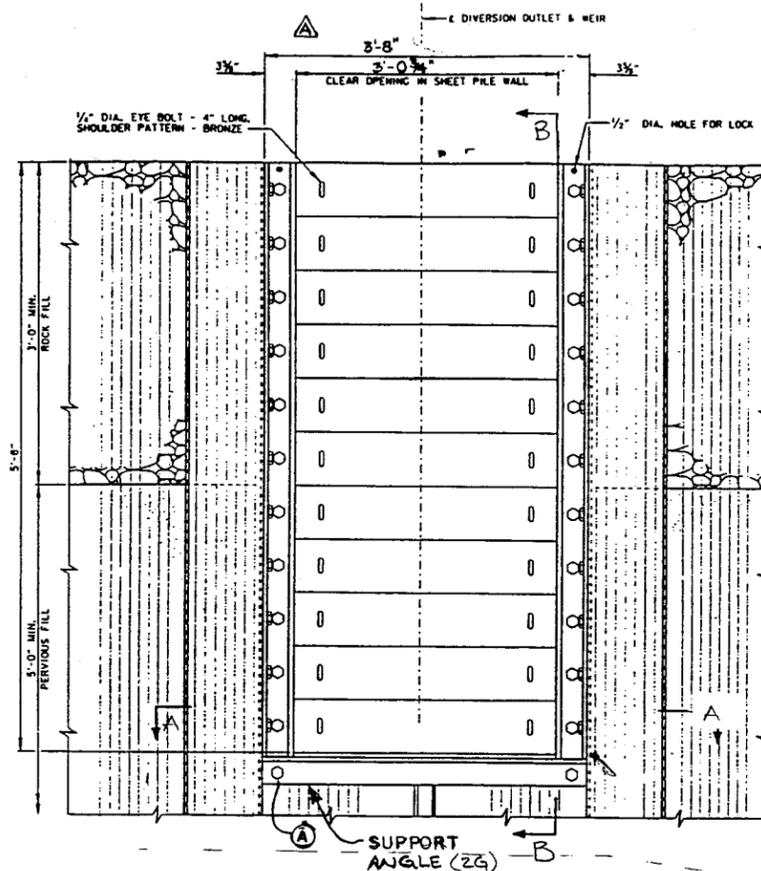
PIECE MARKS FOR VERTICAL MEMBERS (ZK^E, ZC^E & ZB^E) TO BE LOCATED AT TOP OF OPENING



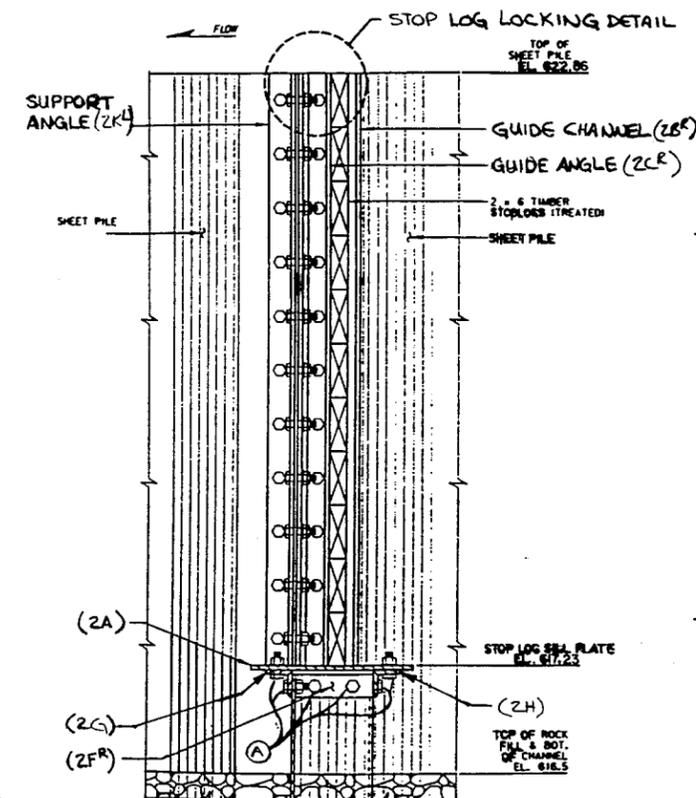
FIELD CUT SUPPORT L3 ZD^E, ZF^E & ZH AS REQ'D. TO CLEAR.



SECT. "A-A"



ELEVATION AT DIVERSION OUTLET



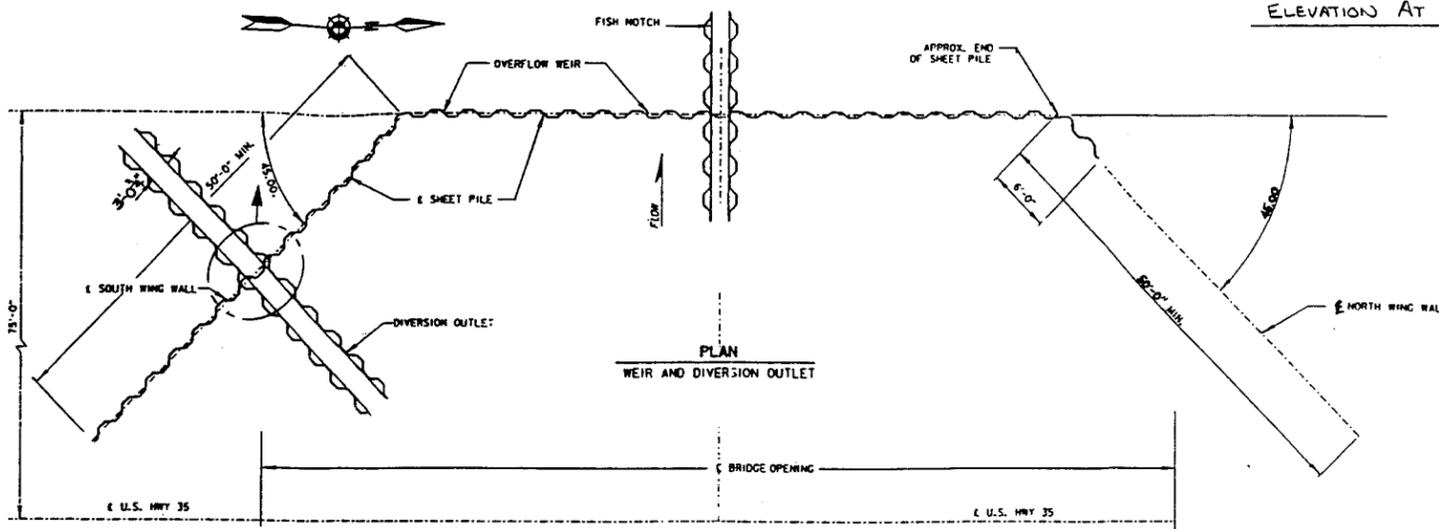
SECT. "B-B"

NOTES:

- APPROXIMATE WEIGHT OF ONE STOPLOG IS 8 LBS.
- ALL ELEVATIONS ARE 1929 ADJ. N.G.V.D.
- ALL FASTENERS FOR SHEET PILE SHALL BE 3/4" HIGH STRENGTH ASTM A325 BOLTS SPACED AT 6" CENTERS OR 3" CENTERS.
- FOR SHEET PILE SECTION MODULUS AND MOMENT OF INERTIA, SEE SPECIFICATION.
- NO GALVANIZING REQUIRED.

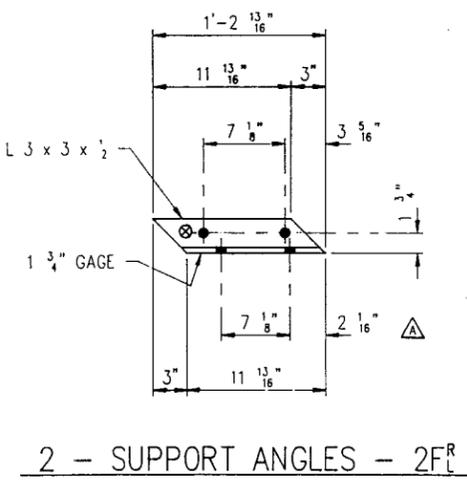
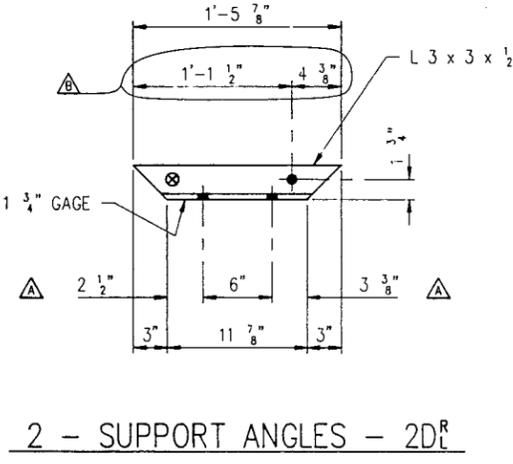
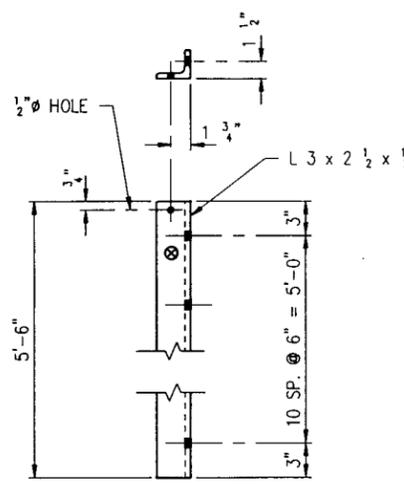
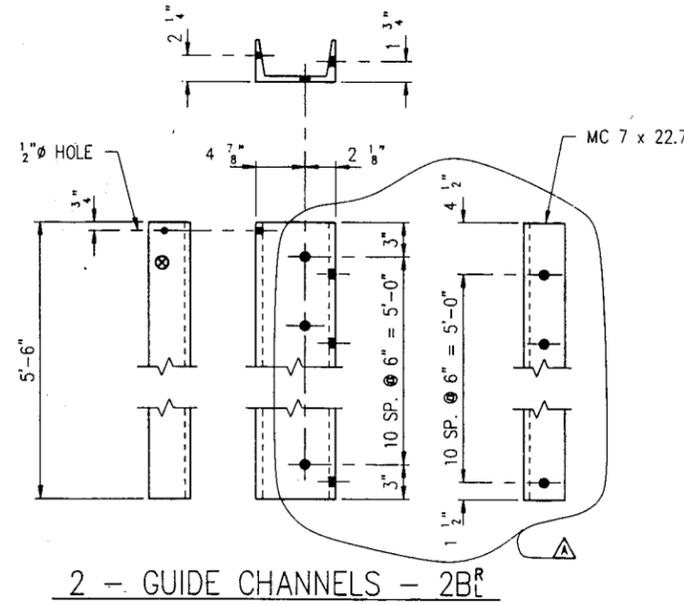
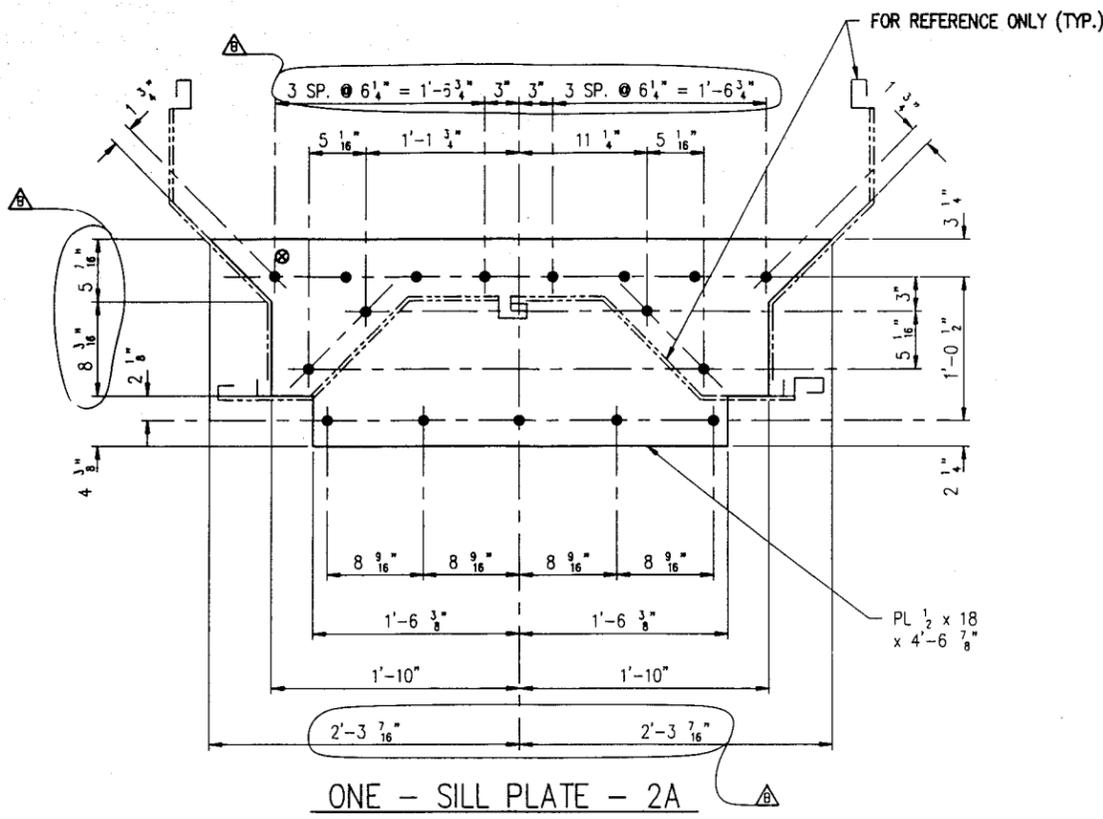
○ - INDICATES FASTENER TYPE SEE SCHEDULE FOR SIZE AND MARKS USE 2 WASHERS EA. BOLT

| BOLT SCHEDULE | | | | | |
|---------------|----------------|----------|----------|----------|----------|
| TYPE | SIZE | BW TK | HB TK | HN TK | FW TK |
| A | HB 3/4 x 2 | - | ZM | ZR | ZS |
| B | HB 3/4 x 2 1/2 | - | ZN | ZR | ZS |
| C | HB 3/4 x 2 3/4 | ZT | ZP | ZR | ZS |

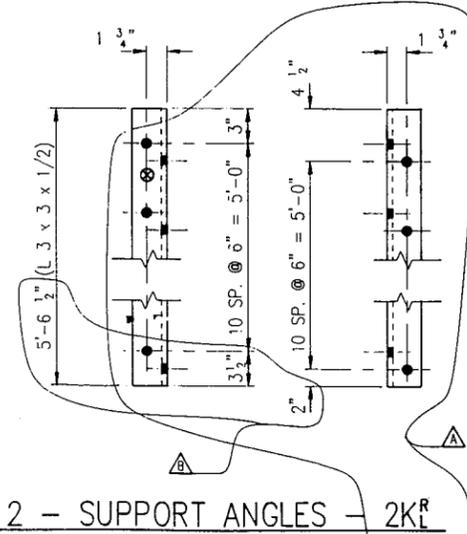
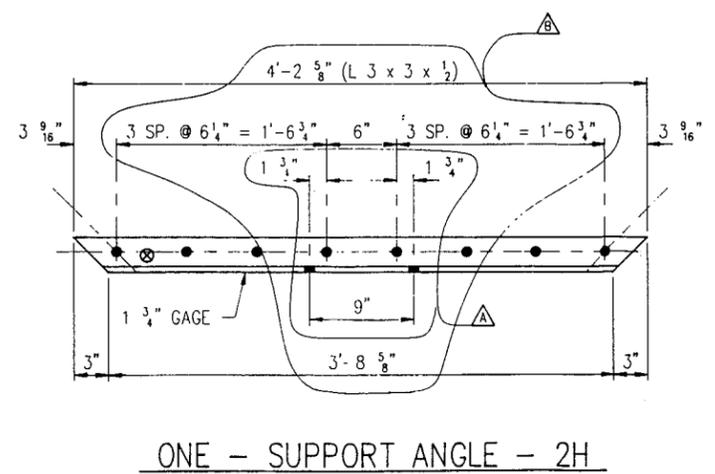
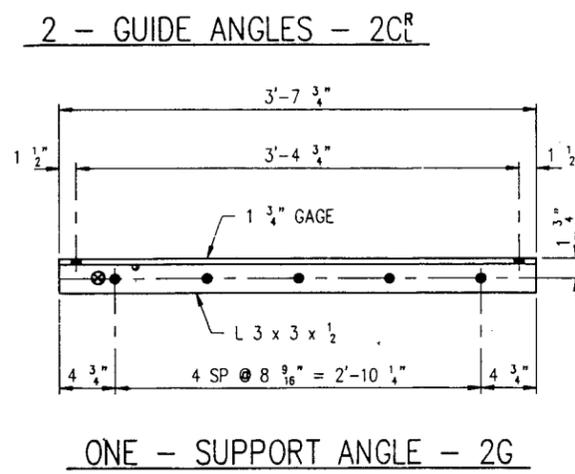


- GEN ENG
- HYD
- HYDR
- GEOTECH
- STR ENG

| | | | |
|--|-------------|--|-----------------|
| AS-BUILT AS OF COMPLETION DATE | | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE | APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | | |
| AE APPROVING OFFICIAL: | | AS-BUILT | |
| DESIGNED: BGS | | COLD SPRINGS | |
| CHECKED: | | ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER | |
| DRAWN: | | COLD SPRINGS POOL 9 CRAWFORD CO., WISCONSIN | |
| DESIGNED: | | DRAINAGE & LEVEE | |
| CHECKED: | | OVERFLOW WEIR AND DIVERSION OUTLET | |
| DATE: 05-12-93 | | SECTION & DETAILS | |
| SPEC NO: DACW37-93-B-0026 | | CAD FILE NAME: | DRAWING NUMBER: |
| | | M-P9-64/9 | SHT 8 |
| | | | OF 11 |



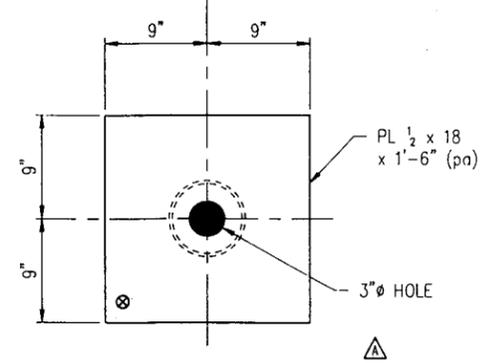
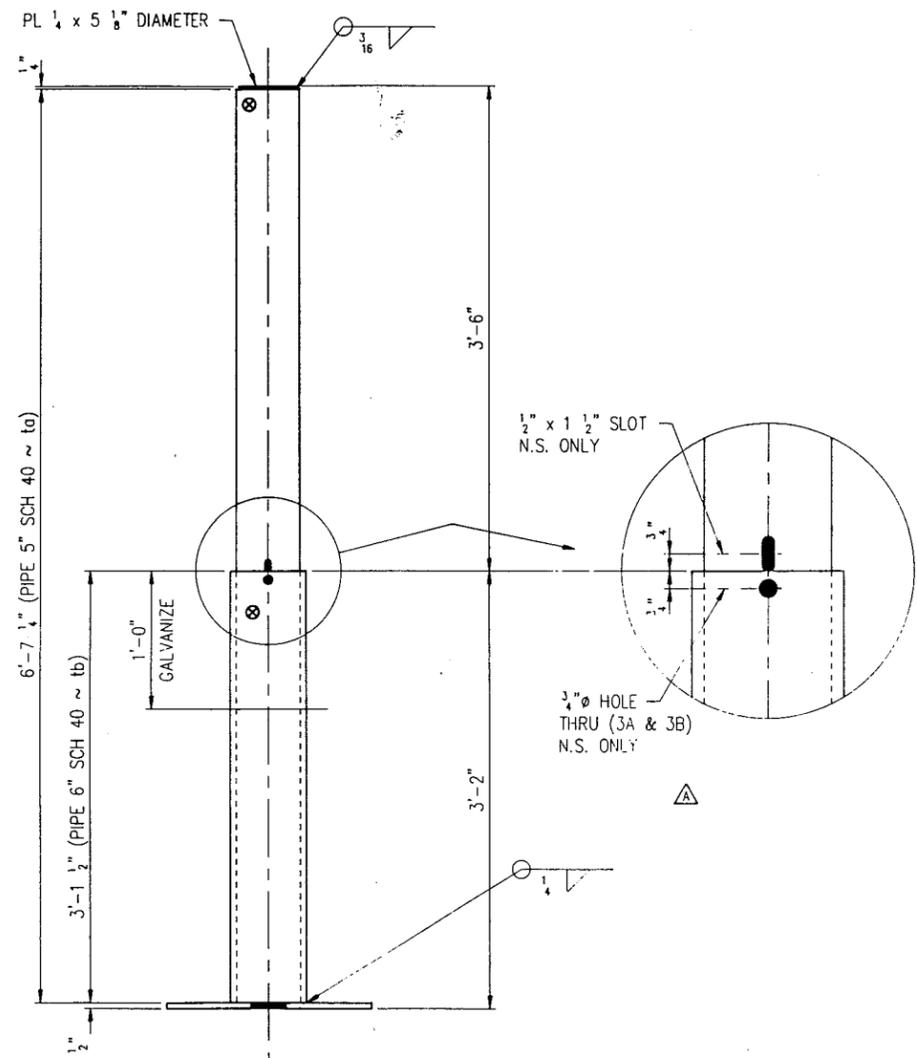
SHOP NOTE:
 ⊗ - INDICATES LOCATION OF SHIPPING PIECE MARK
 ALL HOLES TO BE 1/8" Ø UNLESS NOTED OTHERWISE.



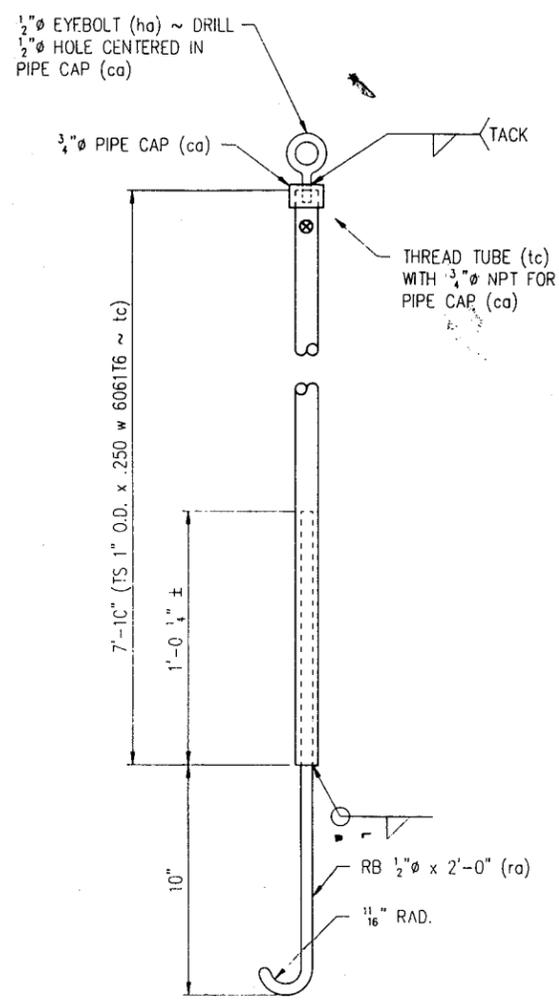
| LINE NO. | DESCRIPTION | LENGTH | MK | REMARKS | WGHT. |
|----------|--|-------------|-----------------|----------------|--------------|
| 1 | SILL PLATE | | 2A | HDG | |
| 2 | PL 1/2 x 18 | 4'-6 7/8" | 2A | SHAPE CUT | |
| 3 | | | | | |
| 4 | GUIDE CHANNELS | | 2B ^R | HDG | |
| 5 | MC 7 x 22.7 | 5'-6" | 2B ^R | | |
| 6 | | | | | |
| 7 | GUIDE ANGLES | | 2C ^R | HDG | |
| 8 | L 3 x 2 1/2 x 1/2 | 5'-6" | 2C ^R | | |
| 9 | | | | | |
| 10 | SUPPORT ANGLES | | 2D ^R | HDG | |
| 11 | L 3 x 3 x 1/2 | 1'-5 7/8" | 2D ^R | | |
| 12 | | | | | |
| 13 | SUPPORT ANGLES | | 2F ^R | HDG | |
| 14 | L 3 x 3 x 1/2 | 1'-2 13/16" | 2F ^R | | |
| 15 | | | | | |
| 16 | SUPPORT ANGLE | | 2G | HDG | |
| 17 | L 3 x 3 x 1/2 | 3'-7 3/4" | 2G | | |
| 18 | | | | | |
| 19 | SUPPORT ANGLE | | 2H | HDG | |
| 20 | L 3 x 3 x 1/2 | 4'-2 5/8" | 2H | | |
| 21 | | | | | |
| 22 | SUPPORT ANGLE | | 2K ^R | HDG | |
| 23 | L 3 x 3 x 1/2 | 5'-6 1/2" | 2K ^R | | |
| 24 | | | | | |
| 25 | | | | | |
| 26 | | | | | |
| 27 | FIELD BOLTS: | | | | |
| 28 | 8 MI BRASS PADLOCK 4" SHACKLE | | 2K | SEE NOTE NO. 3 | |
| 29 | 94 HB 3/4 x 2 A325 HDG | | 2M | | |
| 30 | 35 HB 3/4 x 2 1/2 A325 HDG | | 2N | | |
| 31 | 31 HB 3/4 x 2 3/4 A325 HDG | | 2P | | |
| 32 | 159 HN 1/2 A563DH HDG | | 2R | | |
| 33 | 318 FW 1/2 F436 HDG | | 2S | | |
| 34 | 31 BW 3/4 F844 HDG | | 2T | | |
| 35 | | | | | |
| 36 | | | | | |
| 37 | | | | | |
| 38 | | | | | |
| 39 | GENERAL NOTES: | | | | |
| 40 | 1. MATERIAL SHALL CONFORM TO ASTM A36, UNLESS NOTED OTHERWISE. | | | | |
| 41 | 2. GALVANIZE SHAPES AND PLATES PER ASTM A123. | | | | |
| 42 | 3. PADLOCKS SHALL BE McMASTER NO. 1557A62 OR EQ. AND THEY SHALL BE KEYED THE SAME. | | | | |
| 43 | | | | | |
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| 58 | | | | | |
| 59 | GENERAL REVISION PER APPROVAL | | | | 12/30/93 JDV |
| 60 | REVISED HOLE SPACINGS FOR ITEMS (2B ^R , 2C ^R , 2F ^R & 2K ^R) | | | | 10/14/93 JDV |
| REV. | DESCRIPTION | | | | DATE INT. |

| | | |
|--|--|---------------|
| AS-BUILT AS OF COMPLETION DATE | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE APPROVAL |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | |
| AE APPROVING OFFICIAL: | AS-BUILT COLD SPRINGS ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER COLD SPRINGS POOL 9 CRAWFORD CO., WISCONSIN DRAINAGE & LEVEE OVERFLOW WEIR AND DIVERSION OUTLET SECTION & DETAILS | |
| DESIGNED: BGS | DATE: 05-12-93 | |
| CHECKED: | SPEC NO: DACW37-93 8-0026 | |
| DRAWN: | DRAWING NUMBER: M-P9-64/10 | |
| DESIGNED: | SHT 9 | |
| CHECKED: | OF 11 | |

- GEN ENG
- HYD
- HYDR
- GEOTECH
- STR ENG
- MEA



4 - ACCESS POSTS - 3A
 4 - POST BASES - 3B



2 - LOG HOOKS - 3C

SHOP NOTE:
 ⊗ - INDICATES LOCATION OF SHIPPING PIECE MARK

| LINE NO. | NO. REQ'D. | DESCRIPTION | LENGTH | MK | REMARKS | WGHT. |
|----------|------------|---------------------------|-----------|----|-----------------------------|-------|
| 1 | 4 | ACCESS POSTS | | 3A | | |
| 2 | 4 | PI 5 SCH 40 A53F | 6'-7 1/4" | ta | HDG | |
| 3 | 4 | PL 1/2 x 18 | 0'-5 1/8" | pa | SHAPE CUT | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | 4 | POST BASES | | 3B | | |
| 7 | 4 | PI 6 SCH 40 A53F | 3'-1 1/2" | tb | HDG AS NOTED | |
| 8 | 4 | PL 1/2 x 18 | 1'-6" | pb | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | 2 | LOG HOOKS | | 3C | B | |
| 12 | 2 | TS 1 O.D. x .250 AL6061T6 | 7'-10" | tc | | |
| 13 | 2 | RB 1/2 AL6063T52 | 2'-0" | ra | ADD TO LENGTH FOR FINISHING | |
| 14 | 2 | MI 3/4 x 1 1/2 EYEBOLT | | ha | McMASTER 3014T491 or EQ. | |
| 15 | 2 | MI 3/4 PIPE CAP | | ca | McMASTER 4429K144 or EQ. | |
| 16 | | | | | | |
| 17 | | | | | | |
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| REV. | DESCRIPTION | DATE | INT. |
|------|---|----------|------|
| 39 | GENERAL NOTES: | | |
| 40 | 1. MATERIAL SHALL CONFORM TO ASTM A36, UNLESS NOTED OTHERWISE. | | |
| 41 | 2. GALVANIZE SHAPES AND PLATES PER ASTM A123, UNLESS NOTED OTHERWISE. | | |
| 42 | | | |
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| 60 | GENERAL REVISION PER APPROVAL. | 12/30/93 | JUV |

| | | |
|--|---|-----------------|
| AS-BUILT AS OF COMPLETION DATE | 8/94 | BGS |
| SYMBOL | DESCRIPTION | DATE |
| DEPARTMENT OF THE ARMY ST. PAUL DISTRICT, CORPS OF ENGINEERS ST. PAUL, MINNESOTA | | |
| APPROVING OFFICIAL: | AS-BUILT COLD SPRINGS | |
| DESIGNED: BGS | ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER COLD SPRINGS POOL 9 CRAWFORD CO., WISCONSIN | |
| CHECKED: | DRAINAGE & LEVEE | |
| DRAWN: | OVERFLOW WEIR AND DIVERSION OUTLET | |
| DESIGNED: | SECTION & DETAILS | |
| CHECKED: | CAD FILE NAME: | DRAWING NUMBER: |
| DATE: 05-12-93 | SPEC NO: DACW37-93-B-0026 | M-P9-64/12 |
| | | SHT 11 OF 11 |

- GEN ENG
- HYD
- HYDR
- GEOTECH
- STR ENG
- MEA

APPENDIX B

MEMORANDUM OF AGREEMENT

MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES FISH AND WILDLIFE SERVICE
AND
THE DEPARTMENT OF THE ARMY
FOR ENHANCING FISH AND WILDLIFE RESOURCES
OF THE
UPPER MISSISSIPPI RIVER SYSTEM
AT
COLD SPRINGS
CRAWFORD COUNTY, WISCONSIN

I. PURPOSE

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

II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. The project area is managed by the USFWS and is on lands managed as a national wildlife refuge. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features for the Cold Springs project are 100 percent Federal, and pursuant to Section 107(b) of the Water Resources

Development Act of 1992, Public Law 102-580, all costs of operation and maintenance for the Cold Springs project are 100-percent Federal.

III. GENERAL SCOPE

The Cold Springs project provides for: (1) constructing a diversion weir and channel to direct Kettle Creek flows into the south lobe of the backwater during the winter to correct a dissolved oxygen deficiency and (2) dredging a fish access channel between the north and south lobes to allow fish to travel from an area of potentially inadequate dissolved oxygen to areas with sufficient dissolved oxygen.

IV. RESPONSIBILITIES

A. The DOA is responsible for:

1. Construction: Construction of the project consists of (a) constructing a diversion weir at the mouth of Kettle Creek and a channel from the weir into the south lobe of the backwater and (b) dredging a fish access channel connecting deep areas of the north and south lobes.

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

3. Construction management: Subject to and using funds appropriated by the Congress of the United States, and in accordance with Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, the DOA will construct the Cold Springs project as described in the Definite Project Report/Environmental Assessment, Cold Springs, Habitat Rehabilitation and Enhancement Project, dated May 1991, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed.

If the DOA encounters potential delays related to construction of the project, the DOA will promptly notify the USFWS of such delays.

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

B. The USFWS is responsible for operation, maintenance, and repair: Upon completion of construction as determined by the District Engineer, St. Paul, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report/Environmental Assessment, Cold Springs, Habitat Rehabilitation and Enhancement Project, dated May 1991, in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580.

V. MODIFICATION AND TERMINATION

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

VI. REPRESENTATIVES

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

USFWS: Regional Director

U.S. Fish and Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, Minnesota 55111-4056

DOA: District Engineer

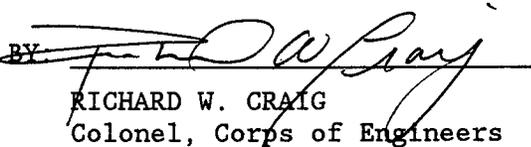
Department of the Army
Corps of Engineers, St. Paul District
180 Kellogg Boulevard East, Room 1421
St. Paul, Minnesota 55101-1479

VII. EFFECTIVE DATE OF MOA

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

THE DEPARTMENT OF THE ARMY

THE U.S. FISH AND WILDLIFE SERVICE

BY: 

RICHARD W. CRAIG
Colonel, Corps of Engineers
St. Paul District

BY: 

SAM MARLER
Regional Director
U.S. Fish and Wildlife Service

DATE: 26 Apr 93

APR 19 1993
DATE: _____

APPENDIX C

INSPECTION CHECKLIST REPORT

INSPECTION CHECKLIST REPORT

COLD SPRINGS BACKWATER
HABITAT REHABILITATION AND ENHANCEMENT PROJECT
Pool 9 - Upper Mississippi River

TO: U.S. Army Corps of Engineers
ATTN: CENCS-CO-NR
Army Corps of Engineers Centre
190 Fifth Street East
St. Paul, Minnesota 55101-1638

Inspected by: _____ Date: _____
Type of Inspection: () Annual () Special Post-Flood
() Other _____

NOTE: Attach photocopies of appropriate as-built drawings identifying project sites being commented on.

WEIR/WINGWALL STRUCTURE

- ROCK FILL
 - () Settlement or loss of material -- note problem site(s)

 - () Rock fill needed -- estimated quantity _____ CY
- EROSION DOWNSTREAM OF STRUCTURE
 - () North peninsula -- note problem site(s) _____
 - () South peninsula -- note problem site(s) _____
 - () Rock fill needed -- estimated quantity _____ CY
- ACCESS POST PADLOCKS
 - () Lubricate padlocks
 - () Damaged or "frozen" padlocks -- identify which _____
 - () Padlock replacements needed -- number _____
- GEOTEXTILE FABRIC
 - () Torn/damaged geotextile fabric -- note problem site(s)
 - () Geotextile needed -- estimated quantity _____ SY
- STEEL SHEETPILE (annual settlement check for first three years): **No corrective action is required from the U.S. Fish and Wildlife Service**
 - () Settlement -- record elevations at selected points

WEIR NOTCH AND DIVERSION SLOT

- DEBRIS AND WOODY VEGETATION/SAPLINGS
 - () Debris and vegetation/sapling removal needed -- note problem site(s) _____
 - () Identify equipment needed (if any) _____

- STOPLOGS
 - () Damaged stoplogs
 - () Stoplogs needed
 - number for weir notch _____
 - number for diversion slot _____

- STOPLOG PADLOCKS
 - () Lubricate padlocks
 - () Damaged or "frozen" padlocks
 - () Padlock replacements -- number _____

- STOPLOG GUIDES
 - () Damaged stoplog guides -- identify damaged items _____

DIVERSION CHANNEL

- VEGETATION, DEBRIS, OR SEDIMENTATION
 - () Build-up -- note potential problem site(s) needing soundings _____
 - () Removal needed -- note site(s) _____
 - () Identify equipment needed _____

DIVERSION CHANNEL DIKE

- EROSION: No corrective action is required from the U.S. Fish and Wildlife Service
 - () Diversion channel side -- note problem site(s) _____
 - () West side of dike -- note problem site(s) _____
 - () Rock fill needed for optional repairs -- estimated quantity _____ CY

UPSTREAM OF WEIR/WINGWALL STRUCTURE (Optional monitoring)

- **SHOALING, DEBRIS, AND VEGETATION: No corrective action is required from the U.S. Fish and Wildlife Service**

() Note degree of sediment and debris build-up and establishment of vegetation and describe potential effect on project performance _____

() Note degree of flushing of sediment, debris, and vegetation from major runoff event(s) _____

FISH ACCESS CHANNEL (Optional monitoring)

- **SEDIMENTATION, DEBRIS, AND VEGETATION: No corrective action is required from the U.S. Fish and Wildlife Service**

() Note site(s) where bottom elevation is significantly higher than nominal 615.5 _____

() Note vegetation and debris build-up potentially interfering with fish movement _____

OTHER ITEMS

- MAINTENANCE PERFORMED DURING PAST YEAR (include cost)

- MAINTENANCE REQUIRED (include itemized cost estimate)

- OTHER COMMENTS

APPENDIX D

SUPPLEMENTAL MAINTENANCE INFORMATION

PART I
SECTION C - SPECIFICATIONS
DIVISION 2
SECTION 2S

STONE PROTECTION

INDEX

| <u>Par. No.</u> | <u>Description</u> | <u>Page No.</u> |
|-----------------|--------------------------------|-----------------|
| 1 | SCOPE | 2S-1 |
| 2 | RELATED WORK OF OTHER SECTIONS | 2S-1 |
| 3 | APPLICABLE PUBLICATIONS | 2S-1 |
| 4 | GENERAL | 2S-1 |
| 5 | SUBMITTALS | 2S-1 |
| 6 | MATERIALS | 2S-1 |
| 7 | SOURCES AND EVALUATION | 2S-2 |
| 8 | TESTS FOR GRADATION AND SHAPE | 2S-2 |
| 9 | FOUNDATION PREPARATION | 2S-3 |
| 10 | PLACEMENT | 2S-3 |
| 11 | QUALITY CONTROL | 2S-4 |
| 12 | MEASUREMENT AND PAYMENT | 2S-4 |
| 13 | BIDDING SCHEDULE ITEMS | 2S-4 |

ATTACHMENTS:

ROCKFILL GRADATION CURVE
ENG FORM 4055
GRADATION ANALYSIS WORKSHEET

SECTION 2S - STONE PROTECTION

1. SCOPE. This section covers rockfill stone protection.
2. RELATED WORK OF OTHER SECTIONS. The following items of related work are covered under other sections:
 - 2.1 Geotextiles: SECTION 2T: GEOTEXTILE USED AS FILTER.
3. APPLICABLE PUBLICATIONS. The current issues of the publications listed below, but referenced to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:
 - 3.1 U. S. Army Corps of Engineers, Engineer Manual (EM).

EM 1110-2-1906 Laboratory Soils Testing (Nov 70) change 1
(May 80) and change 2 (Aug 86).
4. GENERAL.
 - 4.1 Tolerances. Where tolerances are shown or specified, plus shall be above lines and grades, and minus shall be below lines and grades.
5. SUBMITTALS:
 - 5.1 Gradation and testing procedures as specified in PARAGRAPH: TESTS FOR GRADATION AND SHAPE.
 - 5.2 Material Sources as specified in PARAGRAPH: SOURCES AND EVALUATION.
 - 5.3 Test Results as specified in PARAGRAPH: TESTS FOR GRADATION AND SHAPE.
 - 5.4 Methods of Processing and Handling Samples as specified in PARAGRAPH: TESTS FOR GRADATION AND SHAPE.
6. MATERIALS.
 - 6.1 Rockfill shall be a durable, quarried stone of a quality suitable to ensure permanence of the structure in the climate in which it is used. The stone shall be well graded within the gradation curve attached at the end of this section and shall be free from cracks, seams, and other defects that would unduly increase its deterioration from natural causes. Neither the breadth nor thickness of any piece of stone shall be less than one-third of its length. Occasional pieces of stone slightly larger than the maximum weight will be permitted, provided the gradation and voids are not unduly affected and that surface tolerances are met. In order to meet the structural design requirements for weight, gradation, and layer thickness, stone for rockfill shall have a specific gravity between 2.60 and 2.70.

7. SOURCES AND EVALUATION. Stone materials shall be produced from the sources listed in the SECTION H. If the Contractor proposes to furnish materials from a source not listed, the Government Geologist will make such investigations and evaluations as necessary to determine whether or not materials meeting the requirements of this project can be produced from the proposed source. Sources from which the Contractor proposes to obtain the materials shall be selected and submitted for approval at least 30 days in advance of the time when the material will be required in the work.

8. TESTS FOR GRADATION AND SHAPE.

8.1 Rockfill. Tests shall be performed by and at the expense of the Contractor. Testing shall be under the direction of the Contracting Officer, unless waived. Gradation test results shall be submitted on ENG Form 4055 provided at the end of this section and on the Gradation Analysis Worksheet provided at the end of this section. One sample for each type of material shall be taken from stockpiled materials and the remaining samples shall be taken from loads prior to dumping or from in-place material, when and where directed. Prior to placing materials, the Contractor shall submit proposed testing and procedures for approval. The Contractor shall state, in writing, methods of processing and handling samples and shall notify the Contracting Officer immediately when production methods are changed. A minimum of 5 weight classes shall be used in the gradation testing. The Contractor shall select weight classes to yield approximately 75, 50 and 30 percent finer by weight gradation points. The Contractor shall weigh that portion smaller than 4 inches in each sample of rockfill and indicate that weight in the total weight of the gradation test sample. Determination of the gradation of rockfill material smaller than 4 inches is not required.

8.2 Testing results shall be submitted to the Contracting Officer immediately after testing completion. The minimum sample size for tests shall be as follows:

| <u>Material</u> | <u>Minimum Sample Size</u> |
|-----------------|----------------------------|
| Rockfill | 4 cubic yards |

8.3 Frequency. The minimum gradation tests shall be performed as follows. The Contractor shall take as many additional tests under the Contractor's quality control program as is needed to ensure that the gradation is being met. Tests performed on materials that do not meet requirements will not be counted as part of the minimum required.

| <u>Material</u> | <u>Minimum Number of Tests</u> |
|-----------------|--------------------------------|
| Rockfill | 1 test |

8.4 Corrective Action. If materials fail to meet gradation or shape requirements, the Contractor shall adjust his operations and verify with necessary tests that acceptable materials are being produced, or

he shall propose another source and verify, with necessary tests, that acceptable material can be produced from that source. Failure to meet requirements may result in removal of material already in place that the failed test represents.

9. FOUNDATION PREPARATION. Foundation areas shall be excavated or filled to the lines and grades shown, or otherwise established, within a tolerance of plus or minus 2 inches for areas above and 3 inches plus or minus for areas below the water line. Filling shall be with earth similar to the adjacent material or with bedding material each well compacted. When overexcavation occurs the filling shall be at no additional expense to the Government. Immediately prior to placing bedding or rockfill, the prepared subgrade will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

10. PLACEMENT

10.1 Rockfill.

10.1.1 Rockfill thicknesses shall be measured perpendicular to the slope.

10.1.2 Rockfill shall be constructed to the lines, grades and elevations shown or established within a tolerance of 6 inches above and 3 inches below the prescribed grade, except either extreme shall not be continuous over an area greater than 200 square feet. Rockfill shall be placed to the full surface course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing rockfill in layers shall not be permitted. All rockfill shall be placed in such a manner as to produce a mass of unsegregated stone with maximum interlocking and stone to stone contact and a minimum of voids. The finished mass shall be free from pockets of small stones, clusters of larger stones and excessive voids. Placing rockfill by dumping into chutes or by similar methods likely to cause segregation shall not be permitted. Distribution of various sizes of stones shall be obtained during final placing, or by other methods which will produce the specified results. Rearranging of individual rockfill stones by mechanical equipment or by hand may be required to obtain a reasonably well graded distribution of stone sizes. The Contractor shall maintain the rockfill protection until accepted, and displaced material must be replaced by the Contractor at no additional cost to the Government.

10.1.2 Rockfill to be placed under water shall meet gradation requirements in the bucket or container used for placing, and shall be placed in a systematic manner directly on the bedding so as to ensure a continuous uniform layer of well-graded stone of the required thickness. Stone to be placed under water shall not be cast across the surface of the water.

10.1.3 Placement of rockfill on geotextile. In areas where geotextile is shown to be placed, the geotextile shall be in place prior to placement of rockfill thereon. Placement of the geotextile shall be as specified in SECTION 2T: GEOTEXTILE USED AS FILTER. The stone shall be

placed on the geotextile with care so as not to rupture the geotextile and shall not be dropped from a height greater than one (1) foot. During placement of stone, any damage to the geotextile shall be repaired by the Contractor at no additional cost to the Government.

11. QUALITY CONTROL. The Contractor shall establish and maintain quality control for work under this section to ensure compliance with contract requirements and maintain records of his quality control for all construction including, but not limited to, the following:

- (1) Gradation.
- (2) Uniformity of in place materials.
- (3) Elevations of all underlying materials.
- (4) Finished elevations of all materials.

A copy of the records of inspections and tests, as well as corrective actions taken, shall be furnished to the Government.

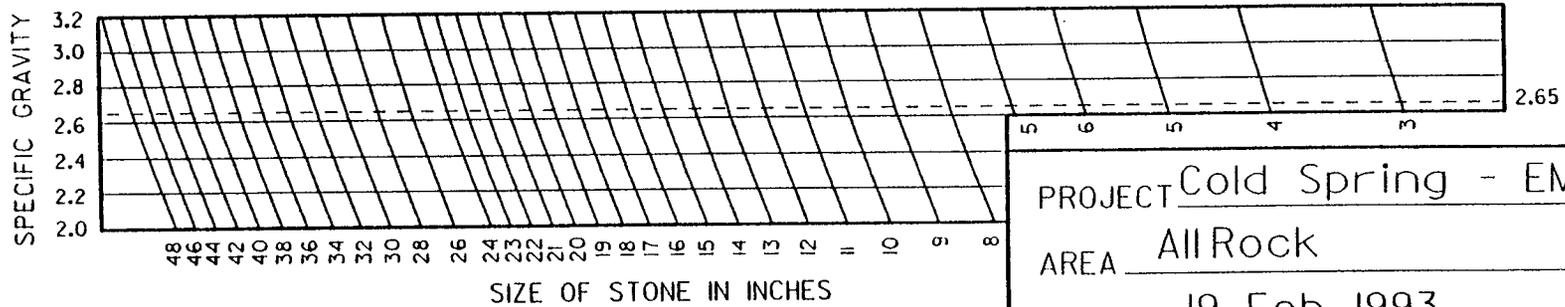
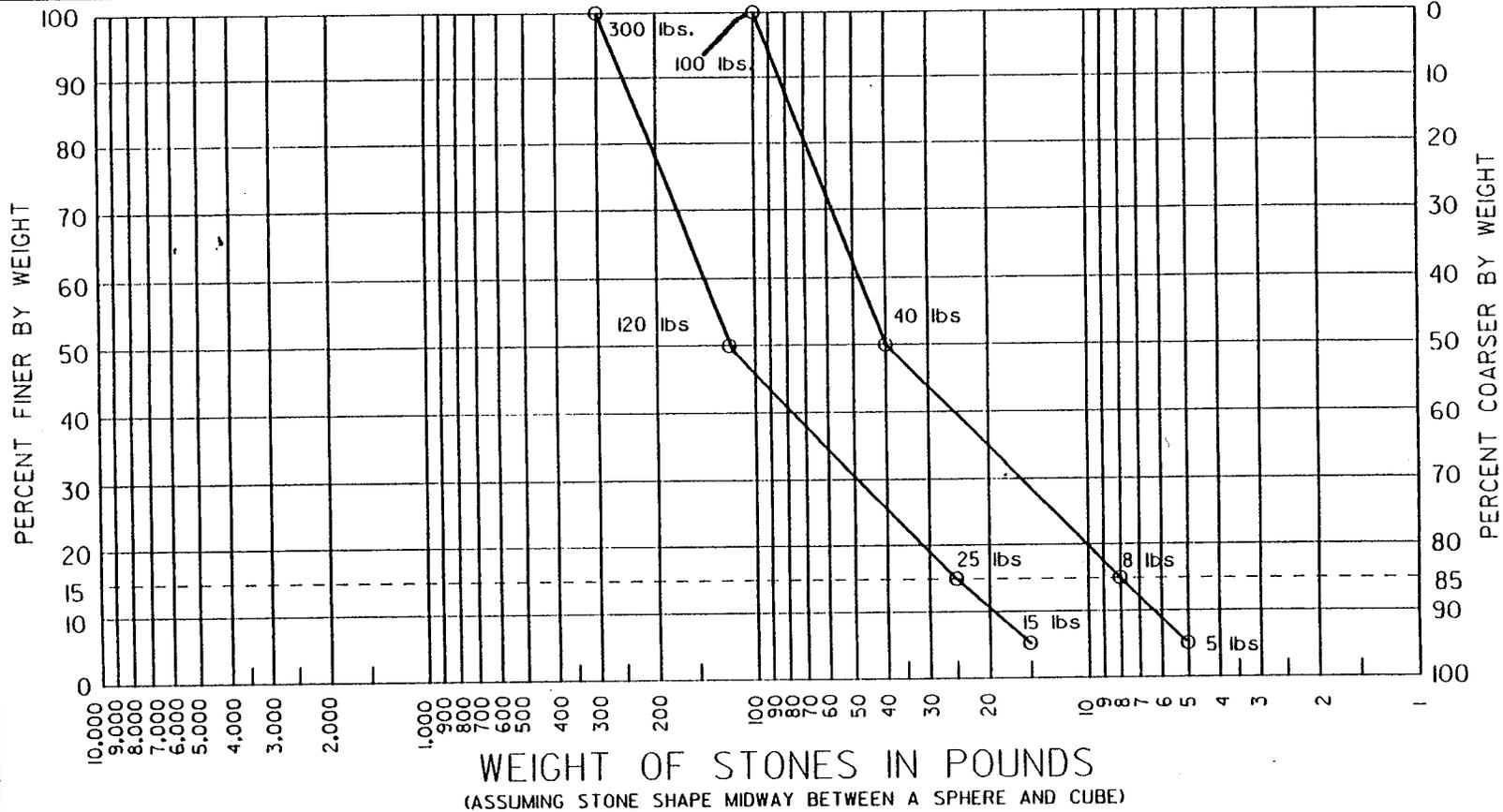
12. MEASUREMENT AND PAYMENT.

12.1 Rockfill will be measured for payment by the cubic yard, in place, to the neat lines, depths and elevations shown. Tolerances are allowed only for the convenience of the Contractor, and material placed outside of the lines or in excess of the depths shown will not be measured for payment.

13. BIDDING SCHEDULE ITEMS applicable to the work of this section are as follows:

| <u>Item</u> | <u>Unit</u> |
|-------------|-------------|
| Rockfill | CY |

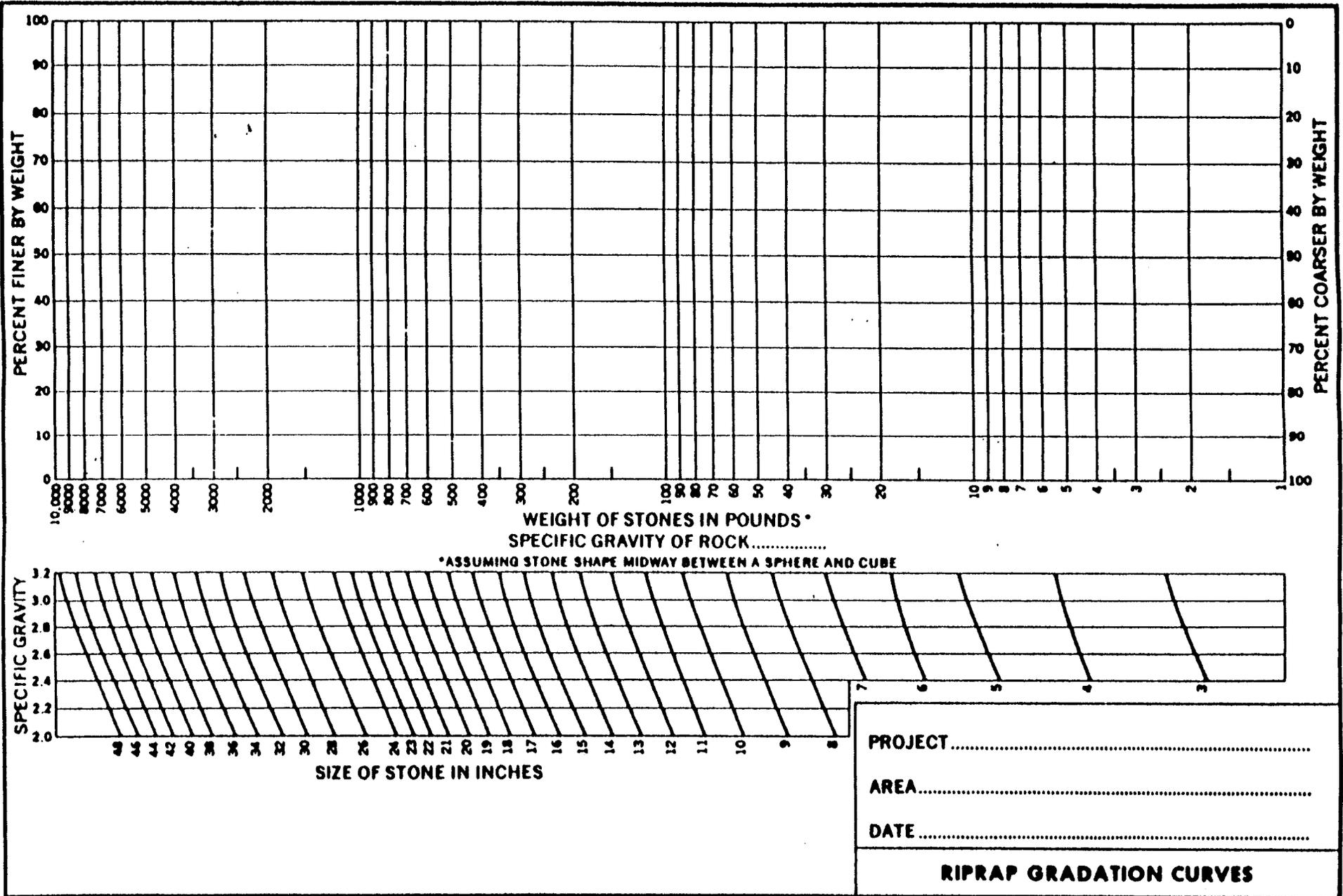
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SPECIFIC GRAVITY OF STONE = 2.65

PROJECT Cold Spring - EMP
 AREA All Rock
 DATE 19 Feb. 1993

RIPRAP GRADATION CURVES



PART I
SECTION C - SPECIFICATIONS
DIVISION 2
SECTION 2T

GEOTEXTILE USED AS FILTER

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ATTACHMENT
Table No. 1

SECTION 2T - GEOTEXTILE USED AS FILTER

1. SCOPE: The work provided for herein consists of furnishing all plant, labor, material, and equipment and performing all operations required for furnishing, hauling, and placing the geotextile, complete, as specified and shown, and maintaining the geotextile until placement of the stone protection cover is completed and accepted.

2. NOT USED.

3. APPLICABLE PUBLICATIONS: The current issues of the publications listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

3.1 American Society for Testing and Materials (ASTM):

D 123-89C. Standard Terminology Relating to Textiles.

D 1683-81. Failure in Sewn Seams of Woven Fabrics.

D 3787-80A. Bursting Strength of Knitted Goods: Constant-Rate-of-Traverse (CRT), Ball Burst Test.

D 3884-80. Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method).

D 4533-85. Trapezoid Tearing Strength of Geotextiles.

D 4632-86. Breaking Load and Elongation of Geotextiles (Grab Method).

D 4751-87. Determining Apparent Opening Size of a Geotextile.

4. NOT USED.

5. SUBMITTALS:

5.1 Certificates of compliance as specified in PARAGRAPH: MATERIALS.

5.2 Samples as specified in PARAGRAPH: MATERIALS.

6. MATERIALS:

6.1 Geotextile: The geotextile shall be a woven or non-woven pervious sheet of plastic yarn as defined by ASTM D-123. The geotextile shall meet the physical requirements specified in Table No. 1. The geotextile fiber shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, ester, amide, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic if necessary to make the filaments resistant to deterioration due to ultra-violet and heat exposure. The edges of the geotextile shall be finished to prevent the outer fibers from pulling away from the geotextile.

6.2 Seams: The seams of the geotextile shall be sewn with thread of a material meeting the chemical requirements given above for geotextile yarn or shall be bonded by cementing or by heat. The sheets of geotextile shall be attached at the factory or another approved location, if necessary, to form sections not less than 36 feet wide. Seams shall be tested in accordance with method ASTM D 1683, using 1-inch square jaws and 12 inches per minute constant rate of traverse. The strengths shall be not less than 90 percent of the required tensile strength (Table No. 1) of the unaged geotextile in all principal directions.

6.3 Acceptance Requirements: All geotextile to be used shall be accepted on the following basis. The Contractor shall furnish the Contracting Officer a certificate of compliance (mill certificate or affidavit) signed by a legally authorized official from the company manufacturing the geotextile. The certificate of compliance shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification. If requested by the Contracting Officer, the Contractor shall provide to the Contracting Officer geotextile samples for testing to determine compliance with any or all of the requirements in this specification. When samples are to be provided, they shall be submitted a minimum of 60 calendar days prior to the beginning of installation of the same geotextile. All samples provided shall be from the same production lot as will be supplied for the contract, and shall be the full manufactured width of the geotextile by at least 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturers lot designation.

7. SHIPMENT AND STORAGE: During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultra-violet rays, temperatures greater than 140 degrees Fahrenheit, mud, dirt, dust and debris. To the extent possible, the fabric shall be maintained wrapped in a heavy duty protective covering.

8. INSTALLATION: The geotextile shall be placed in the manner and at the locations shown. At the time of installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation, or storage. The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, debris and soft or low density pockets of material. Erosion features such as rills, gullies, etc. must be graded out of the surface before geotextile placement. If erosion features should develop after placement of the geotextile and prior to placement of stone protection, the geotextile shall be removed, the surface regraded and the geotextile replaced by the Contractor at no additional cost to the Government. The geotextile shall be laid smooth and free of folds, wrinkles, or creases, but also free of tensile stress. Sections of geotextile shall be placed to provide a minimum width of 36 inches of overlap for each joint. The placement procedure below water shall avoid water entrapment under the geotextile during the stone placement and subsequent reduction of overlap at geotextile joints. For joints that run parallel to the shoreline, the upslope strips shall overlap the downslope strips. Temporary pinning of the textile to help hold it in place until

the stone is placed will be allowed. The temporary pins shall be removed as stone protection is placed to relieve high tensile stress which may occur during placement of stone protection on the geotextile. The placement procedure requires that the length of the geotextile be approximately 15 percent greater than the slope length. The Contractor shall adjust the actual length of the geotextile used based on initial installation experience. The geotextile shall be protected at all times during construction from contamination by surface run-off and any geotextile so contaminated shall be washed clean with water or replaced with uncontaminated geotextile. Geotextile damaged during its installation or during placement of stone protection shall be replaced by the Contractor at no cost to the Government. The work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile: failure to comply with this requirement will require replacement of geotextile. The geotextile shall be protected from damage during the placement of stone protection. This may be accomplished by limiting the height of drop to less than 1 foot, by placing a cushioning layer of sand or gravel on top of the geotextile before placing the stone protection, or other methods approved by the Contracting Officer. Before placing the stone protection or other materials, the Contractor shall demonstrate that the placement technique will prevent damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile. Piling shall not be driven through geotextile.

9. QUALITY CONTROL: The Contractor shall establish and maintain quality control for all operations to assure compliance with the contract requirements and maintain records of his quality control for all construction operations, including but not limited to, the following:

- (1) Materials. Suitability, type and strength.
- (2) Construction. Layout, materials, handling, maintaining drainage, line and grade, installation, fabrication.
- (3) Testing for connection strength and long term allowable design load.
- (4) Certificate of Compliance.
- (5) Storing and Handling.

A copy of the records of inspections and tests, as well as corrective actions taken, shall be furnished to the Government.

10. MEASUREMENT AND PAYMENT: For purposes of payment, the installed geotextile will be measured in place to the nearest square yard of protected area as delineated on the drawings. Payment will be made at the contract unit price and will constitute full compensation to the Contractor for providing all plant, labor, material, and equipment and performing all operations necessary for the complete and satisfactory installation of the geotextile. Payment for the following items shall be included in the contract unit price for geotextile and shall not be counted a second time in the process of determining the extent of geotextile placed:

- a. Material and associated equipment and operation used in laps, seams, or extra length;
- b. Securing pins and associated material, equipment, and operations;
- c. Material and associated equipment and operations used to provide cushioning layer of sand or gravel or both to permit increase in allowable drop height of stone materials.

No payment shall be made for geotextiles replaced because of contamination or damage due to Contractor fault or negligence.

11. BIDDING SCHEDULE ITEMS applicable to the work of this section are as follows:

| <u>Item</u> | <u>Unit</u> |
|-------------|-------------|
| Geotextile | SY |

* * * *

TABLE NO. 1 - PHYSICAL REQUIREMENTS

| <u>Physical Property</u> | <u>Test Procedure</u> | <u>Acceptable Values</u> |
|---|---|---|
| Tensile Strength (unaged geotextile) ⁺ | ASTM D 4632 grab method using 1 inch by 2 inch jaws and a 12 inches per minute constant rate of traverse. | 200 pound minimum in all principal directions. |
| Breaking Elongation (unaged geotextile) ⁺ | ASTM D 4632 determine apparent breaking elongation. | 15 percent minimum in all principal directions. |
| Puncture Strength (unaged geotextile) ⁺ | ASTM D 3787 except polished steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp. | 80 pound minimum. |
| Abrasion Resistance | ASTM D 3884 Rubber-base abrasive wheels equal to CS-17 "Calibrase" by Taber Instrument Co; 1 kilogram load per wheel; 1000 revolutions, determine residual breaking load. | 55 pound minimum residual breaking load in all principal directions. |
| Apparent Opening Size (AOS) | ASTM D-4751 determine apparent opening size. | No finer than U.S. Standard Sieve No. 120 and no coarser than U.S. Standard Sieve No. 30. |
| Tear Strength | ASTM D 4533 trapezoid tearing strength. | 30 pounds minimum in all principal directions. |

+Unaged geotextile is defined as geotextile in the condition received from the manufacturer or distributor.

++All numerical values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the minimum in the table).

APPENDIX E

PROJECT OBJECTIVES AND MONITORING PLAN

**COLD SPRINGS BACKWATER
HABITAT REHABILITATION AND ENHANCEMENT PROJECT**

MONITORING AND PERFORMANCE EVALUATION

A monitoring plan for the project has been developed to directly measure the degree of attainment of project objectives. Monitoring activities will be closely coordinated with similar efforts by the Long-Term Resource Monitoring (LTRM) Program. The evaluation items are described below and a schedule presented in the following table.

1. PROJECT OBJECTIVE: To provide wintertime dissolved oxygen (DO) concentrations of at least 5 milligrams per liter (mg/l) to a minimum of 25 percent of the Cold Springs backwater area.

Evaluation Objective A: Determine wintertime DO concentrations at selected sites in the Cold Springs backwater.

Evaluation: Utilizing the same sites and methods presented in the pre-project summary report, "Winter water quality and discharge measurements collected at Cold Springs, pool 9, January - February 1993," prepared by Sullivan, McLimans, and Clemment, monitor DO concentrations from ice-up to ice-out the first, third and fifth years after project completion. Data should be collected approximately once every two weeks between December 15 and March 15 or as ice conditions permit.

Compare post-project data to pre-project data to determine the success of the project in meeting objective 1.

Evaluation Objective B: Determine wintertime (base) Kettle Creek flows entering the Cold Springs backwater.

Evaluation: Measure wintertime discharges through the diversion channel to assess the effectiveness of this diversion weir and channel, and estimate winter base flows of Kettle Creek. This information could be collected in conjunction with the DO and temperature data measurements.

2. PROJECT OBJECTIVE: To ensure fish throughout the Cold Springs backwater have access to area(s) with adequate DO.

Evaluation Objective: Determine stability/longevity of the fish access channel in the Cold Springs backwater.

Evaluation: Complete bathymetric surveys of the Cold Springs backwater after completion of the project (1994), five years after completion (1999), and ten years after completion (2004). Utilizing Geographical Information System (GIS) compare pre- and post-project surveys to determine changes in bottom elevations over time throughout Cold Springs, with emphasis placed on changes in the fish access channel connecting the north and south lobes.

COLD SPRINGS BACKWATER PROJECT - POOL 9
EVALUATION AND MONITORING SCHEDULE

| Project Objectives | Pre-Project Condition Surveys | Post-Project Monitoring | Schedule |
|--------------------|-------------------------------|-------------------------|----------|
|--------------------|-------------------------------|-------------------------|----------|

1. PROVIDE AT LEAST 5 MG/L DISSOLVED OXYGEN TO OVER 25 PERCENT OF BACKWATER

| | | | |
|--|---|------------------------------------|-------------------------------|
| A. Monitor wintertime DO concentrations at specified locations | Winter DO monitoring (78, 79, 87, 88, 93) | Winter DO & temperature monitoring | 1994-95 1996-97 1998-99 |
| B. Determine wintertime Kettle Creek base flow | None | Discharge measurements | 1994-95 |

2. PROVIDE FISH ACCESS TO AREAS WITH ADEQUATE DISSOLVED OXYGEN

| | | | |
|--|---------------------------|------------|-----------------------------------|
| Monitor stability/longevity of fish access channel | Bed elevation survey (87) | Bathymetry | 1994 1999 2004 ¹ |
|--|---------------------------|------------|-----------------------------------|

¹ Contingent on availability of funds for monitoring purposes.

