US Army Corps
of Engineers
St. Paul District

OPERATION AND MAINTENANCE MANUAL

ENVIRONMENTAL MANAGEMENT PROGRAM (HREP)

INDIAN SLOUGH

BUFFALO COUNTY, WISCONSIN

OCTOBER 1994

PREFACE

The Indian Slough Habitat Rehabilitation and Enhancement Project, constructed by the Corps of Engineers, was completed in June, 1994. In accordance with Section 906(e) of the Water Resources Development Act of 1986 and the policies set forth in the Fourth and Fifth Annual Addendums, the U.S. Fish and Wildlife Service has the responsibility for operation and maintenance of the project. The Corps of Engineers has prepared this manual to assist in fulfilling the operation and maintenance tasks.

The manual and appendices contain the latest approved agreements, maps, drawings, tables, and references pertinent to operation and maintenance of this project. Project evaluation features, a Corps responsibility, have also been included in order to provide a full perspective of post-construction project activities. Suggested monitoring that could be performed by others is also included.

The project as designed and constructed will improve fish and wildlife habitat in selected side channel and backwater areas of lower pool 4. However, continued successful functioning of the project will depend upon the manner in which the project is maintaned. Careful inspection and proper maintenance can help accomplish that goal.

The planning, design, and construction of the project was the result of an extensive cooperative effort on the part of the involved Federal and State agencies and the public. The continuation of this cooperation and coordination as part of the operation and maintenance of the project will be important to the success of the project and is strongly encouraged.

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

UPPER MISSISSIPPI RIVER SYSTEM
ENVIRONMENTAL MANAGEMEMENT PROGRAM

INDIAN SLOUGH
POOL 4, UPPER MISSISSIPPI RIVER
BUFFALO COUNTY, WISCONSIN

OPERATION AND MAINTENANCE MANUAL

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INTRODUCTION

This manual has been prepared to serve as a guide for the operation and maintenance of the Indian Slough Habitat Rehabilitation and Enhancement Project in Buffalo County, Wisconsin. Operation and maintenance instructions for the major features of the project are presented. These instructions are consistent with the general procedures found in the Indian Slough Definite Project Report dated September 1990. 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 existing manuals or regulations.

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 prevents major damage to constructed features by early corrective action.

For ease in use, this manual is divided into two sections.

Part I. This section describes the project features and provides historical information on the project.

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

PART I - PROJECT FEATURES AND CONSTRUCTION HISTORY

AUTHORIZATION AND LOCATION

The Indian Slough project was authorized under the provisions of the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99- 662). The Indian Slough project area is located in pool 4 of the Upper Mississippi River, across the river from the city of Wabasha, Minnesota. It is in the lower end of the pool on the left descending side of the navigation channel at approximately river mile 759.5. The project lies within the Upper Mississippi River National Wildlife and Fish Refuge. Project drawings (appendix A) show the location of project features.

Because the Indian Slough project is located on Federal lands managed as a National Wildlife Refuge, operation and maintenance are to be carried out in compliance with Section 906(e) of the 1986 Water Resources Development Act and policies set forth in the Fourth and Fifth Annual Addendums.

DESCRIPTION OF PROJECT

General

Prior to construction of the lock and dam system, what is now known as lower pool 4 was made up of islands intertwined with sloughs, ponds, and marshes. Following inundation (1930's), a large backwater complex known as Big Lake was formed. Indian Slough is a major side channel transporting main channel water into the Big Lake complex.

The expansion of the the Crats Island dredged material containment area, located immediately downstream of the mouth of Indian Slough, in the 1970's is believed to have contributed to the increased flow and sediment entering Indian Slough and eventually the Big Lake complex. The Corps of Engineers under its operation and maintenance program constructed a partial closure structure at the mouth of Indian Slough to reduce flows and sediment entering the slough. This construction was completed in November, 1993.

The Indian Slough Habitat Rehabilitation and Enhancement Project was designed to (1) restore lithophilic fish habitat in Indian Slough, and (2), restore water depths in important fish wintering habitat in a portion of Big Lake. The restoration of lithophilic fish habitat involved the construction of a riffle-pool complex within Indian Slough. The restoration of water depths consisted of deepening approximately 9.3 acres of a portion of Big Lake by about 2.5 feet. The Definite Project Report/Environmental Assessment (SP-8), Indian Slough Habitat Rehabilitation and Enhancement Project, September 1990, provides details on the overall project.

Design Considerations

The riffle-pool complex consists of two rock riffle areas alternating with two 200 feet long pool areas. The rock riffles were designed with a minimum rock thickness of 30 inches to withstand anticipated flow conditions. The top elevation of the rock riffles was established at elevation 663.0 to provide a minimum of 4 feet of water over the structures. This will provide for adequate water conveyance over the structures and also will provide adequate clearance for recreational boat traffic. The project drawings for these structures are contained in appendix A along with surveys of the structures taken following the 1993 flood.

The pool areas were dredged to a depth of 8 feet. This depth was selected as part of an optimization process to maximize habitat benefits while limiting the cost of dredging.

The dredging in Big Lake was designed to increase water depths in an area that historically has provided good winter habitat for fish. The area and depth of dredging were sized to match the available placement site capacity. One requirement was that the dredged area tie into the deeper portions of Big Lake. The project drawings for the dredge cuts are contained in appendix A, along with post-dredging surveys.

CONSTRUCTION HISTORY

The Indian Slough project was constructed in two stages. For stage 1, the Corps of Engineers used hired labor to construct the riffle-pool complex. This work was initiated in September 1992 and was completed in November 1992. An estimated 10,000 tons of rock was used in the construction of this feature.

Stage 2 consisted of the dredging in Big Lake. A contract was awarded to J.F. Brennan Co. Inc, P.O. Box 2557, La Crosse, Wisconsin 54602 in September, 1992, to dredge approximately 36,000 cubic yards of sediments from Big Lake. The dredging began in May 1993 and was completed in June 1993. Final dredging quantities were 34,151 cubic yards. The dredged material was placed on old sand deposits adjacent to the Crats Island dredged material placement area to promote revegetation. Grading and seeding of the placement site was completed in June, 1994.

PART II - OPERATION AND MAINTENANCE

GENERAL RESPONSIBILITIES AND PROCEDURES

Approved Responsibilities

Operation and maintenance responsibilities for the Indian Slough habitat project were originally outlined in the Definite Project Report. The acceptance of these responsibilities was formally recognized by an agreement signed by the U.S. Fish and Wildlife Service (USFWS) and the St. Paul District, Corps of Engineers. This agreement, dated September 17, 1992, is contained in appendix B. The capability of the USFWS to carry out the maintenance responsibilities described below will be contingent upon the passage of sufficient appropriations by Congress.

District Manager

Typically, the responsibility for USFWS habitat projects will be given to the district manager in charge of that portion of the appropriate National Wildlife Refuge. For the Indian Slough project, the current address for the district manager is District Manager, U.S. Fish and Wildlife Service, 51 East 4th Street, Winona, Minnesota 55987. 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 habitat goals and objectives would be coordinated with other involved agencies.

Procedure for Reviewing Operation and Maintenance Responsibilities

The District Engineer or his/her representative will be kept informed on operation and maintenance activities for the Indian Slough habitat project through a periodic inspection of the project by the Corps and through an annual report submitted by the USFWS. The Corps will inspect the project with a USFWS representative at least once every five years and at other times as may be required. The Corps should contact the District Manager so that a mutually convenient date can be set up for the joint inspection. The District Manager is encouraged to invite the Wisconsin Department of Natural Resources to participate in the inspection.

The findings of these inspections will be transmitted to the USFWS and could include recommendations for any remedial work considered necessary to maintain the habitat project in a satisfactory operating condition. Any agreed upon remedial work should be completed as soon as possible by the USFWS as provided in the Memorandum of Agreement between the USFWS and the Corps.

Annual Report

A report covering inspection, operation, and maintenance of the habitat project shall be submitted each year to the District Engineer. Given the simple nature of the project, this report can take the form of an annual letter. The report should briefly summarize the condition of the project, including any maintenance work done during the past 1-year period. The USFWS may send the Indian Slough 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 with the annual Cooperative Agreement Report which is done every April by the USFWS.

OPERATION

No specific actions are required for operation of the Indian Slough project.

MAINTENANCE

General Inspection

The established points and times at which the required inspections presented below should be made were developed through coordination between the Corps of Engineers and the USFWS during the preparation of plans and specifications for this project. After the habitat project has been in operation for 5 years, the Corps and the USFWS will review these inspection activities for adequacy. The frequency and nature of the inspections may be modified by mutual written agreement.

The following inspections of the project should be made by the District Manager.

Riffle-Pool Complex: The riffle-pool complex should be inspected visually and by soundings. The visual inspection would primarily be for the purpose of evaluating the general condition of the tie-ins where the riffle structures meet the shoreline. The soundings should be of sufficient detail to discover any substantial loss of rock from the riffle structures, and to identify any substantial deposition occuring in the pools below the structures.

Big Lake Bay Dredge Cuts : The dredge cuts in Big Lake Bay should be inspected visually and by soundings. The inspection should be of sufficient detail to discover any appreciable shoaling of the dredge cuts.

Time of year: This inspection can be made at the discretion of the District Manager.

Frequency: A minimum of once a year for the visual inspection of the riffle-pool structure, and a minimum of once every three years for the soundings of the riffle-pool structure. A minimum of once every three years for the Big Lake Bay dredge cuts. The frequency for inspection will be subject to review by the USFWS and Corps and could change upon mutual agreement of both parties.

Maintenance

No maintenance of the riffle-pool structure or the Big Lake Bay dredge cuts was anticipated during the planning and design of the project. Should inspections reveal maintenance requirements with either feature, the following procedures should be followed.

Riffle-Pool Complex: The USFWS and the Corps will mutually agree whether the required repairs constitute minor unanticipated maintainance and are a USFWS responsibility, or if they constitute "major rehabilitation" and are a Corps responsibility per Section IV, paragraph A.2. of the MOA.

Big Lake Bay Dredge Cuts : Unanticipated siltation of the Big Lake Bay dredge cuts to the degree warranting maintenance dredging would be considered major rehabilitation per Section IV, paragraph A.2. of the MOA.

Repair Materials

Gradations of rock fill for maintenance of the riffle-pool complex are given in appendix C. Project drawings should be consulted for placement and thickness of rock.

INSPECTIONS, TESTS, AND OPERATIONS FOLLOWING MAJOR STORMS OR FLOODS

General

As stated in the Memorandum of Agreement between the USFWS and the Corps, the Corps will be responsible for any mutually agreed upon repair and rehabilitation of the Indian Slough project that exceeds the annual maintenance requirements and that may be needed as a result of a specific flood.

Project Rehabilitation/Abandonment

Should inspection of the project area following a major flood or natural disaster disclose substantial damage to the entire project that appears to exceed the annual operation and maintenance as specified in this manual and the Definite Project Report, the Corps and USFWS should meet and discuss the appropriate course of action in light of original project design. The inspections by the District Manager and the joint inspections with the Corps will be the basis for determining maintenance responsibility 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 may be considered at this time. Any decision would be carried forth only upon written mutual agreement of the USFWS and the Corps. The Wisconsin Department of Natural Resources will be consulted prior to coming to any final determination on a course of action.

Project Monitoring and Evaluation

An evaluation plan has been established for the Indian Slough 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 portions of this project would be the wisest choice. Project evaluation is a Corps responsibility. Work for all habitat projects is limited to measuring changes in physical, water quality, and vegetation habitat conditions. Monitoring beyond the scope of the Corps project evaluation (to determine the response of fish and wildlife to habitat changes, and monitoring for longer duration or in a larger area) will be conducted at the discretion of the sponsoring agency. The Corps monitoring plan is presented in appendix D of this manual. Included is a section on potential evaluation parameters that may be measured by others. If any of this work is performed by the USFWS or the Wisconsin Department of Natural Resources, it can be submitted to the Corps. The USFWS can submit information in conjunction with the annual report for operation and maintenance.

APPENDIX A

PROJECT DRAWINGS

PROJECT CONTROL POINTS

STATION	BEARING	DISTANCE ADJ.	COORDINATES NORTH	COORDINATES EAST
0+00			511,374.55	2,515,666.11
	S83°13'39"E	368.06		
3+86.07			511,331.15	2,516,031.60
	S68°51'19"E	917.20		
12+85.30			511,000.29	2,516,887.05
	S59°03'03"E	374.18		
16+59.49			510,802.29	2,517,204.54
	S79°34'20"E	660.72		
23+20.23			510,682.70	2,517,854.35
	N75°04'49"E	623.59		
29+43.83			510,843.25	2,518,456.91
	N44°47'22"E	429.33		
33+73.16			511,147.95	2,518,759.38
	N58°14'45"E	706.04		
40+79.21			511,519.53	2,519,359.73
	N28°42'46"E	329.00		
44+08.21			511,808.08	2,519,517.79
	N16°16'51"E	28.33		
46+89.53			512,078.12	2,519,596.66
	N17°03'15"E	937.56		
56+27.08			512,974.46	2,519,871.63
	N68°49'59"E	461.64		
60+88.73			513,163.46	2,520,292.81
	S70°02'53"E	532.48		
66+21.23			512,98.76	2,520,793.33
	S88°01'44"E	1,138.01		
77+59.28			512,942.62	2,521,930.68
	S34°33'55"W	963.45		
87+22.74			512,149.23	2,521,364.07
	S5°52'16"W	1,875.09		
105+97.86			510,345.62	2,520,871.28
	S45°03'36"W	339.01		
109+36.96			510,106.09	2,520,631.25
	N85°38'34"W	770.18		
117+07.12			510,164.61	2,519,863.29
	S38°36'27"W	3,728.16		
154+35.18			510,072.92	2,516,136.26
	N19°15'35"W	1,383.94		
0+00			511,374.55	2,515,666.11

CONTROL POINTS

STATION	BEARING	DISTANCE ADJ.	COORDINATES NORTH	COORDINATES EAST
PT-H			507,498.33	2,519,393.7
	S 80°09'49"E	1665.02		
PT-P			507,213.89	2,521,029.2
	S 30°07'41"E	888.52		
PT-S			506,445.14	2,521,475.4
	N61°10'51"E	1468.15		
PT-BH			507,152.86	2,522,761.65
	N13°58'56"E	1361.23		
PT-SS			508,473.76	2,523,090.55
	S80°43'01"W	1506.76		
4-36			508,230.70	2,521,630.53
	N30°09'50"W	2016.77		
6+00			509,974.38	2,520,590.15
	N80°59'19"W	2187.80		
PT-SS			510,317.06	2,519,429.35
	S77°21'18"W	285.27		
8+00			510 254.61	2,518,150.99
	S24°10'55"E	3021.41		
PT-H			507,498.33	2,519,388.67
	S63°13'08"E	2337.39		
PT-S			506,445.14	2,521,475.34
	0°00'00"	598.94		
PT-L			505,846.20	2,521,475.34

CONTROL POINTS

HUB	AZIMUTH	DISTANCE	COORDINATES NORTH	COORDINATES EAST
4-24			505,120.09	2,528,096.54
	135°32'05"	1,723.81		
4-25			506,121.96	2,526,693.77
	55°39'07"	1,484.83		
4-26			505,284.44	2,525,468.23
	136°39'15"	1,050.77		
4-27			506,048.59	2,524,746.98
	105°15'35"	824.62		
4-28			506,265.63	2,523,951.43
	202°03'44"	1,135.96		
4-29			507,318.41	2,524,378.11
	108°13'43"	2,922.72		
4-30			508,232.66	2,521,602.06
	209°05'29"	1,027.26		
4-31			509,130.33	2,522,101.52
	83°22'21"	2,841.81		
4-32			508,802.34	2,519,278.70
	142°28'49"	1,816.66		
4-33			510,243.21	2,518,172.29
	62°22'29"	1,424.29		
4-34			509,582.78	2,516,910.37
	145°13'22"	2,181.43		

CONTROL POINTS

HUB	AZIMUTH	DISTANCE	COORDINATES NORTH	COORDINATES EAST
4-33			510,243.21	2,518,172.29
	62°22'29"	1,424.29		
4-34			509,582.78	2,516,910.37
	145°13'22"	2,181.43		
4-35			511,374.55	2,515,666.11
	72°09'56"	1,213.37		
4-36			511,002.93	2,514,511.06
	117°21'16"	2,446.09		
4-37			512,126.89	2,512,338.48
	161°17'03"	2,255.05		
4-38			514,262.70	2,511,614.89
	103°39'23"	2,034.60		
4-39			514,743.07	2,509,637.81
	160°02'48"			
4-40			517,586.35	2,508,605.56

COORDINATES BASED ON MINNESOTA STATE PLANE GRID SYSTEM, SOUTH ZONE 1927

NOTES

1. PBM 142 (EL. 682.35) 4" METAL PIPE WITH CAP 1° NORTH OF 6" BIRCH TREE IN FRONT YARD OF RESIDENCE 430 LAWRENCE ST. IN WABASHA, MN. (1912 ADJ N.G.V.D.)

REFERENCES

	DWG. NO.
LOCATION, VICINITY & SITE MAP	M-P4-10/3

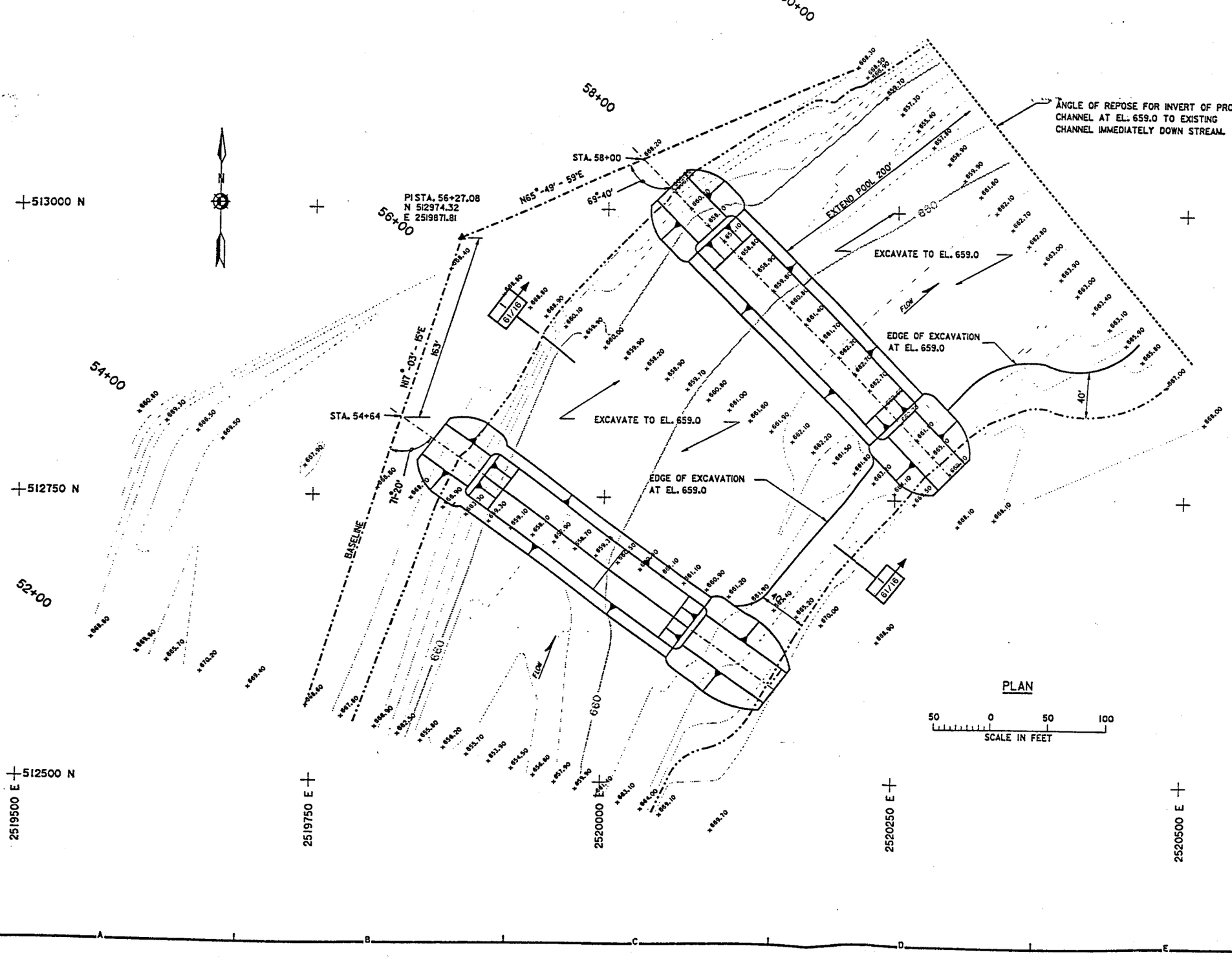
SYMBOL	DESCRIPTION	DATE	APPROVAL

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

CONSTRUCTION DRAWING
INDIAN SLOUGH - STAGE I - POOL 4
ENVIRONMENTAL PROGRAM - UPPER MISSISSIPPI RIVER
SIDE CHANNEL STRUCTURES BUFFALO COUNTY, WISC.

WABASHA INDIAN SLOUGH
VERTICAL & HORIZONTAL CONTROL DATA

ED-D	DESIGNED: WPR		
	CHECKED:		
	DRAWN: FJB		
ED-GH	DESIGNED:		
	CHECKED:	CAD FILE NAME:	DRAWING NUMBER: M-P4-61/12 SHT 2 OF 13
DATE: 2/92		SPEC NO:	



PLAN

50 0 50 100
SCALE IN FEET

NOTES:

1. ALL ELEVATIONS 1912
2. ALL RIPRAP SLOPES
3. TOE OF SLOPE VARIE

REFERENCES:

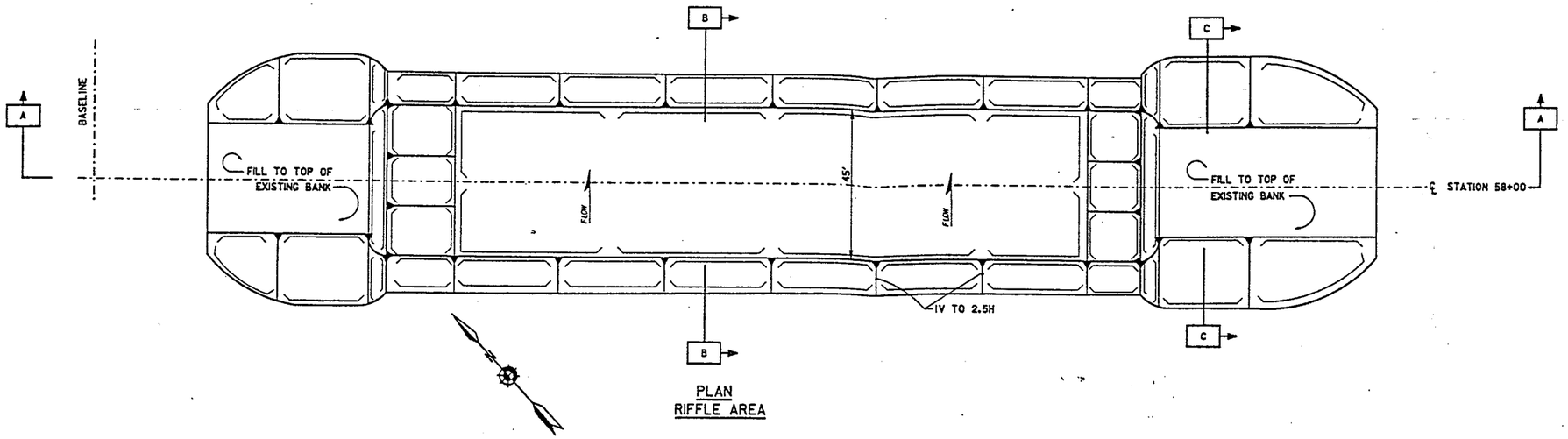
LOCATION, VICINITY &
VERTICAL HORIZONTAL
PLAN & SECTIONS RIF
CROSS SECTIONS STA.
CROSS SECTIONS STA.

SYMBOL	

AE APPROVING OFFICIAL:

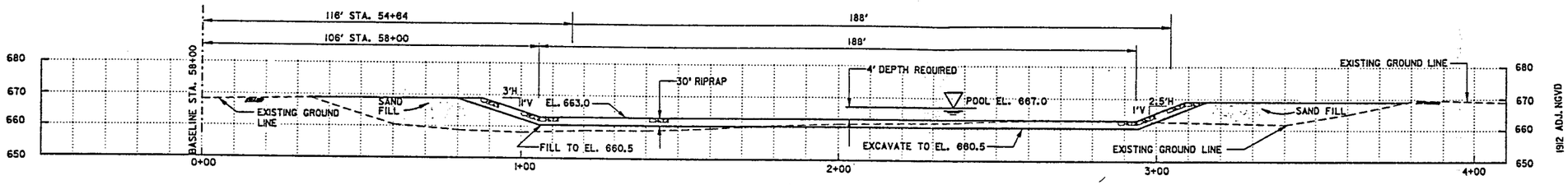
ED-D	DESIGNED:	W.P.R.
	CHECKED:	J.J.G.
	DRAWN:	FJB T.J.
ED-CM	DESIGNED:	SMC
	CHECKED:	SMC

DATE: 2/92

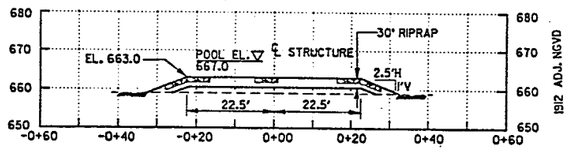


PLAN
RIFFLE AREA

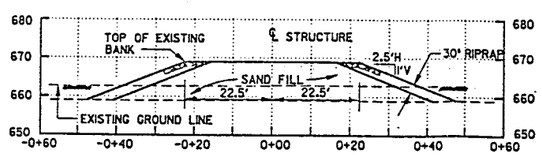
20 0 20 40
SCALE IN FEET



SECTION
RIFFLE AREA (STA. 85+00)
SCALE: AS SHOWN
A



SECTION
RIFFLE AREA
SCALE: AS SHOWN
B



SECTION
RIFFLE AREA
SCALE: AS SHOWN
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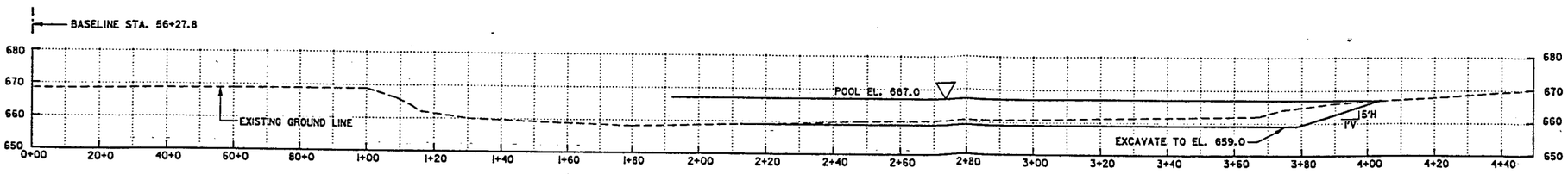


SECTION
POOL EXCAVATION (STA. 56+27.08)
I
61/16

NOTES:
1. TOE OF SLOPE VARIES, TOE SHOWN IS APPROXIMATE.
2. ALL RIPRAP SLOPES ARE NO STEEPER THAN IV TO 2.5H.
3. SAME DETAILS FOR RIFFLE/POOL COMPLEX LOCATED AT STA. 54+64. SEE PLAN VIEW.

REFERENCES:

	DWG. NO.
LOCATION, VICINITY & SITE MAP	M-P4-10/3
VERTICAL HORIZONTAL CONTROL DATA	M-P4-61/12
LAYOUT PLAN RIFFLE POOL	M-P4-61/15
CROSS SECTIONS STA. 50+70 THRU. 56+00	M-P4-61/19
CROSS SECTIONS STA. 58+00 & 60+00	M-P4-61/20

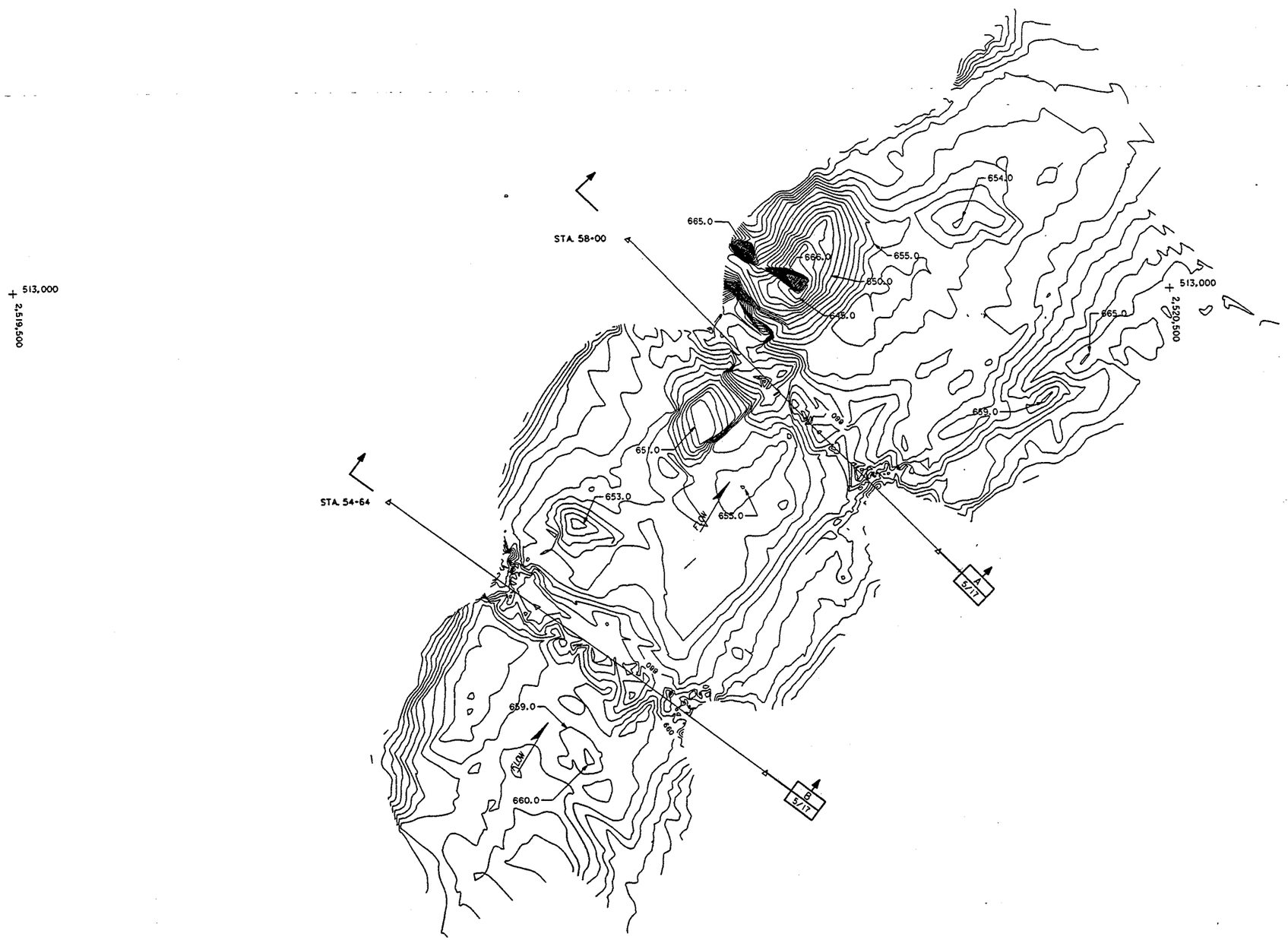
SYMBOL	DESCRIPTION	DATE	APPR

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

AE APPROVING OFFICIAL:

CONSTRUCTION DRAWING
INDIAN SLOUGH - STAGE I - POOL 4
ENVIRONMENTAL PROGRAM - UPPER MISSISSIPPI RIVER
SIDE CHANNEL STRUCTURES BUFFALO COUNTY, WIS.
WABASHA INDIAN SLOUGH
PLAN & SECTIONS RIFFLE POOL

ED-D	DESIGNED: W.P.R.		
	CHECKED: J.J.G.		
	DRAWN: FJB T.J.		
ED-GH	DESIGNED:		
	CHECKED:	CAD FILE NAME: MF04P006.DGN	DRAWING NUMBER: M-P4-61/16
	DATE: 2/92	SPEC NO: DACW37-90-B-0000	SHT OF



PLAN VIEW

50 0 50 100
SCALE IN FEET

NOTE:
1. 1994 SOUNDINGS ONLY NO LAND SURVEY.
2. SEE DRAWING NUMBER M-P4-61/15 OF CONSTRUCTION SET FOR LAYOUT PLAN OF STRUCTURE.
3. WATER SURFACE EL. 668.1

GEN ENG
HYD
HYDR
GEOTECH
STR ENG

SYMBOL	DESCRIPTION	DATE	APPROVAL

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

AE APPROVING OFFICIAL:

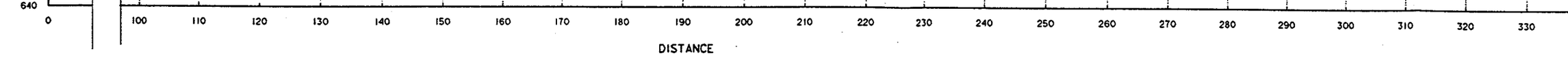
ED-D
DESIGNED: W.P.R.
CHECKED: W.P.R.
DRAWN: F.J.B.

ED-CH
DESIGNED: XXX/XXX
CHECKED: XXX/XXX

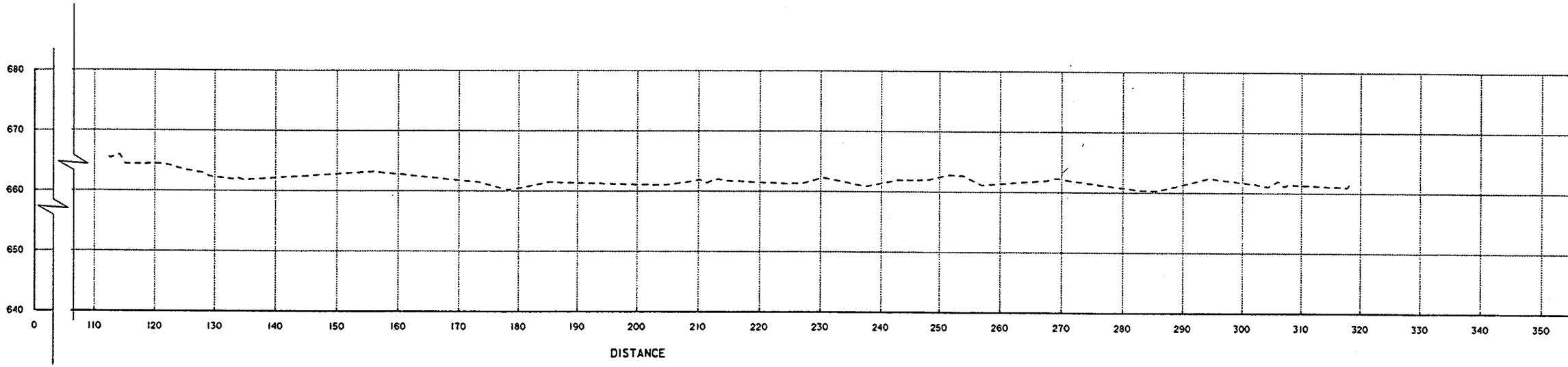
DATE: 6-30-94

REPORT
INDIAN SLOUGH - STAGE I - POOL 4
ENVIRONMENTAL PROGRAM - UPPER MISSISSIPPI RIVER
SIDE CHANNEL STRUCTURES BUFFALO COUNTY, WISC.
WABASHA INDIAN SLOUGH
LAYOUT PLAN RIFFLE POOL
SOUNDINGS 22 APR. 1994

CAD FILE NAME: mf04p014.dgn
SPEC NO: DACW37-90-B-0000
DRAWING NUMBER: M-R4-5/16
SHT 1 OF 2



PROFILE	A
STA. 58+00	5/16



PROFILE	B
STA. 54+64	5/16

GEN ENG

HYD

HYDR

GEOTECH

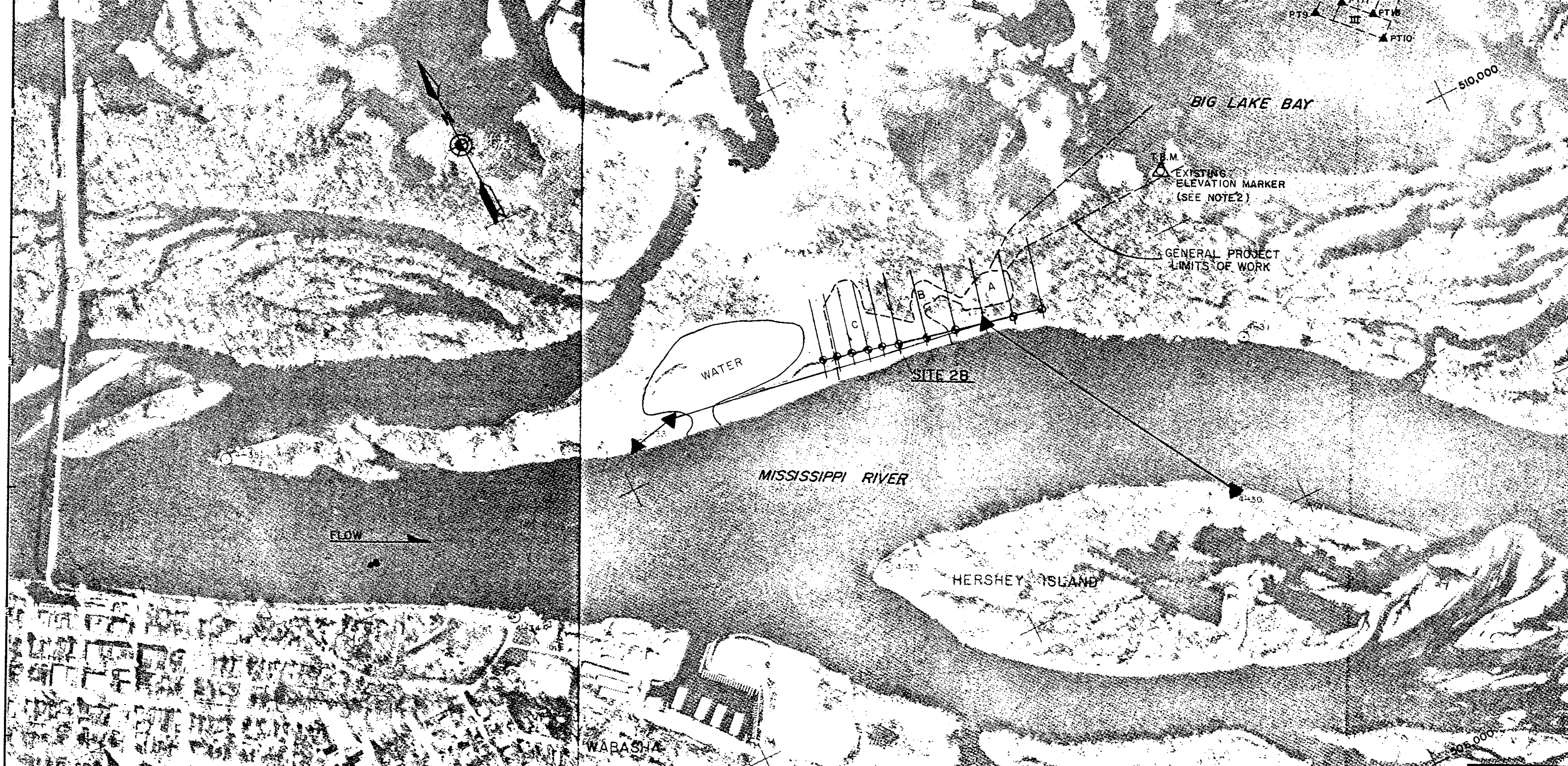
STR ENG

SYMBOL	

AE APPROVING OFFICIAL:

ED-D	DESIGNED:	W.P.R.
	CHECKED:	W.P.R.
	DRAWN:	F.J.B.
ED-GH	DESIGNED:	XXX/XXX
	CHECKED:	XXX/XXX

DATE: 6-30-94



MAPPING

CONTROL POINTS				
HUB	AZIMUTH	DISTANCE	COORDINATES NORTH	COORDINATES EAST
4-24			505,120.09	2,528,096.54
	125°32'05"	1,723.81		
4-25			506,121.96	2,526,693.77
	55°39'07"	1,484.83		
4-26			505,284.44	2,525,468.23
	136°39'16"	1,050.77		
4-27			506,048.59	2,524,746.98
	105°15'36"	824.62		
4-28			506,265.63	2,523,951.43
	202°03'44"	1,135.96		
4-29			507,318.41	2,524,378.11
	108°13'43"	2,922.72		
4-30			508,232.66	2,521,602.06
	209°05'29"	1,027.26		
4-31			509,130.35	2,522,101.52
	83°22'21"	2,841.81		
4-32			508,802.34	2,519,278.70
	142°28'49"	1,816.66		
4-33			510,243.21	2,518,172.29
	62°22'29"	1,424.29		
4-34			509,582.78	2,516,910.37
	145°13'22"	2,181.43		

MAPPING

CONTROL POINTS				
HUB	AZIMUTH	DISTANCE	COORDINATES NORTH	COORDINATES EAST
4-33			510,243.21	2,518,172.29
	62°22'29"	1,424.29		
4-34			509,582.78	2,516,910.37
	145°13'22"	2,181.43		
4-35			511,374.55	2,515,666.11
	72°09'56"	1,213.37		
4-36			511,002.93	2,514,511.05
	117°21'16"	2,446.09		
4-37			512,126.89	2,512,338.48
	161°17'03"	2,255.05		
4-38			514,262.70	2,511,614.89
	103°39'23"	2,034.60		
4-39			514,743.07	2,509,637.81
	160°02'48"			
4-40			517,586.35	2,508,605.56

COORDINATES BASED ON MINNESOTA STATE PLANE GRID SYSTEM, SOUTH ZONE

400 0 400 800
SCALE IN FEET

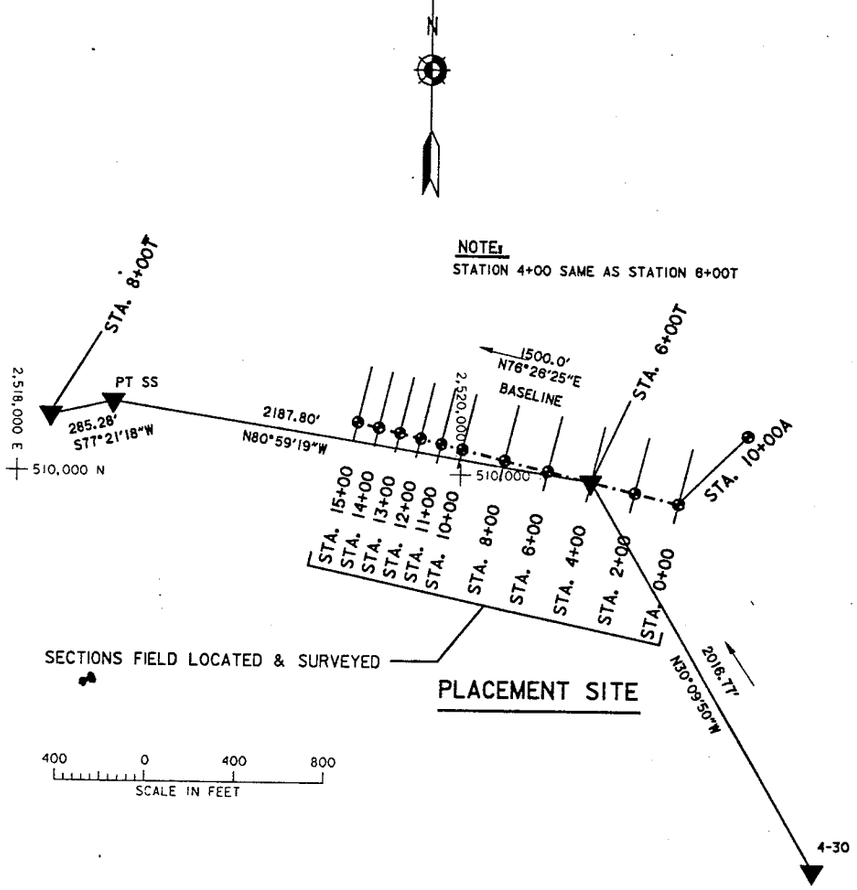
SYMBOL

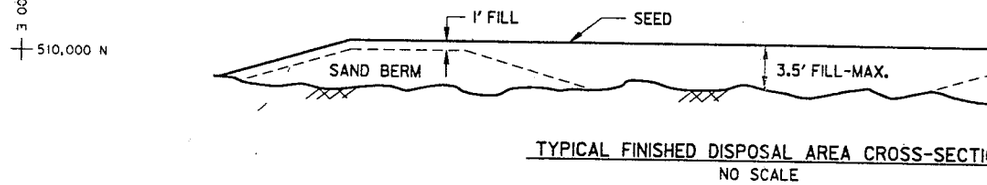
ED-D DESIGNED: WPR
CHECKED: R.J.B
DRAWN: FJB

ED-GH DESIGNED:
CHECKED:

DATE: 6/92

TYPICAL CHANNEL SECTION | 1
BIG LAKE BAY | 61/22





TYPICAL FINISHED DISPOSAL AREA CROSS-SECTI
NO SCALE

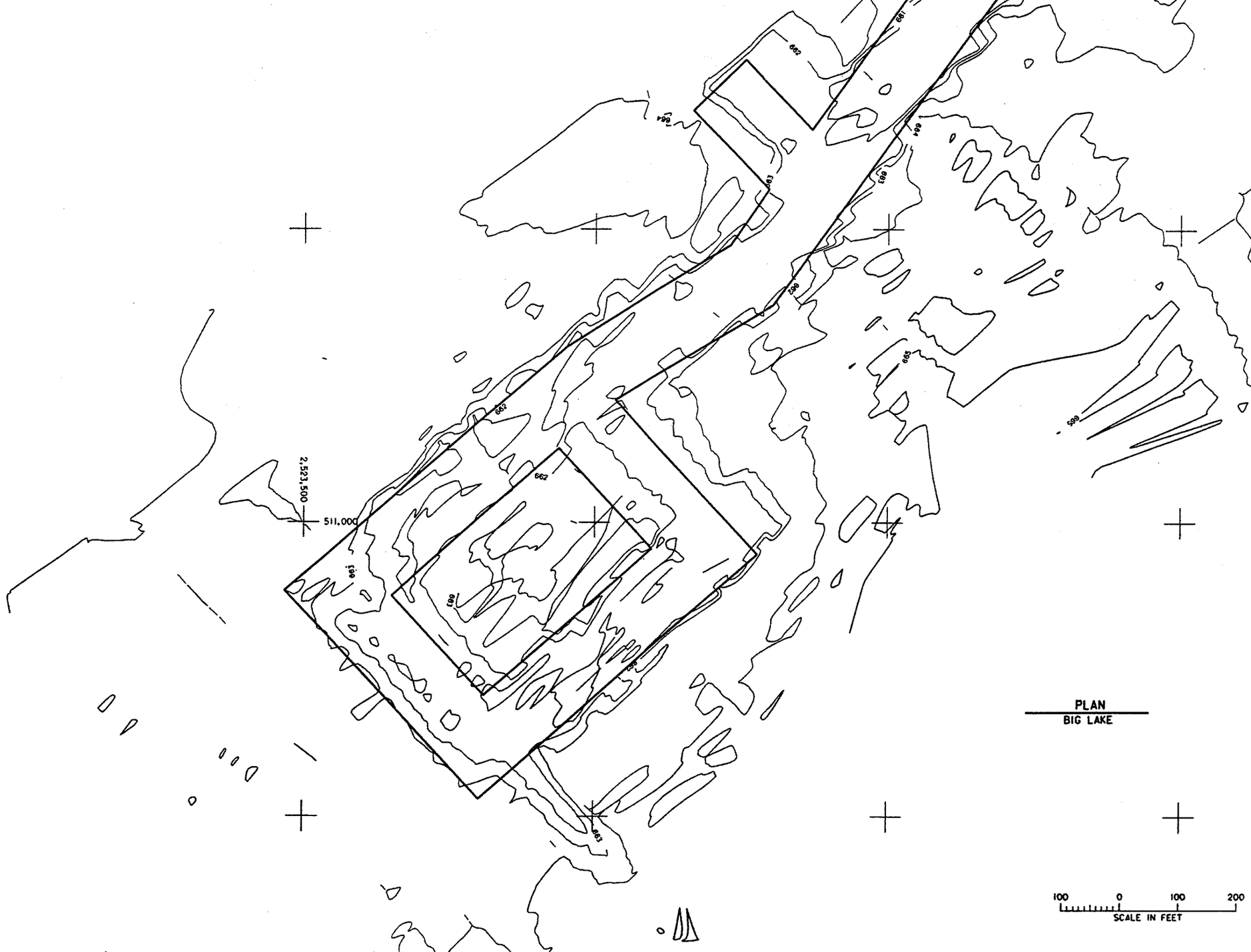
PLACEMENT SITE CONTROL POINTS				
STATION	BEARING	DISTANCE ADJ.	COORDINATES NORTH	EAST
4-30			508,230.70	2,521,603.53
6+00T	N30°09'50"W	2,016.77'	509,974.38	2,520,590.15
PT SS	N80°59'19"W	2,187.80'	510,317.06	2,518,429.35
8+00T	S77°21'18"W	285.28'	510,254.61	2,518,151.00
0+00			509,880.60	2,520,979.00
2+00	N76°26'25"W	200.00'	509,927.49	2,520,784.57
4+00	N76°26'25"W	200.00'	509,974.38	2,520,590.15
6+00	N76°26'25"W	200.00'	510,021.27	2,520,395.73
8+00	N76°26'25"W	200.00'	510,068.16	2,520,201.30
10+00	N76°26'25"W	200.00'	510,115.06	2,520,006.88
11+00	N76°26'25"W	100.00'	510,138.50	2,519,909.66
12+00	N76°26'25"W	100.00'	510,161.94	2,519,812.45
13+00	N76°26'25"W	100.00'	510,185.39	2,519,715.24
14+00	N76°26'25"W	100.00'	510,208.84	2,519,618.02
15+00	N76°26'25"W	100.00'	510,232.28	2,519,520.81

REFERENCES:
LOCATION, VICINITY
VERTICAL HORIZONTA
PLAN VIEW PLACEME
PLAN VIEW PLACEME

SYMBOL	

AE APPROVING OFFICIAL

ED-D	DESIGNED: W.P.R.
	CHECKED:
	DRAWN: F.J.B.
ED-CH	DESIGNED:
	CHECKED:
DATE: 8/4/92	



GEN ENG

HYD

HYDR

GEOTECH

STR ENG

MEA

NOTE:

DATE OF SOUNDINGS 06-11-9

PLAN
BIG LAKE

100 0 100 200
SCALE IN FEET

SYMBOL	

AE APPROVING OFFICIAL:

PE-D	DESIGNED: W.P.R.	BIG
	CHECKED: W.P.R.	
	DRAWN: F.J.B.	
PE-HH	DESIGNED: XXX/XXX	
	CHECKED: XXX/XXX	CAD F
DATE: 10-18-94		SPEC N

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
INDIAN SLOUGH
BUFFALO 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 (FWS) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Indian Slough 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. 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 Indian Slough project are 100 percent Federal, and all operation, maintenance, repair and rehabilitation costs are to be cost shared 75 percent Federal and 25 percent non-Federal.

III. GENERAL SCOPE

The Indian Slough project provides for the construction of two riffle-pool complexes in Indian Slough to provide increased diversity of fish habitat in the slough. A second feature of the project involves the dredging of approximately 34,000 cubic yards of sediments from Big Lake Bay to improve backwater fishery habitat.

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. Construction: Construction of the Project which consists of constructing two riffle-pool complexes in Indian Slough and dredging of Big Lake Bay.

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

3. Construction Management: Subject to and using funds appropriated by the Congress of the United States, DOA will construct the Indian Slough project as described in the Definite Project Report, Indian Slough, Habitat Rehabilitation and Enhancement, dated September 1990, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The FWS 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 DOA encounters potential delays related to construction of the Project, DOA will promptly notify FWS of such delays.

4. Maintenance of Records: 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. 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 FWS.

B. FWS is responsible for:

1. Operation, Maintenance, and Repair: Upon completion of construction as determined by the District Engineer, St. Paul, the FWS shall accept the Project and shall operate, maintain, and repair the Project as defined in the Definite Project Report entitled "Indian Slough Habitat Rehabilitation and Enhancement," dated September 1990, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

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

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:

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

DOA: District Engineer
U.S. Army Engineer District, St. Paul
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

BY: (signature)
RICHARD W. CRAIG
Colonel, Corps of Engineers
St. Paul District

Date: 17 Sept 92

THE U.S. FISH AND WILDLIFE SERVICE

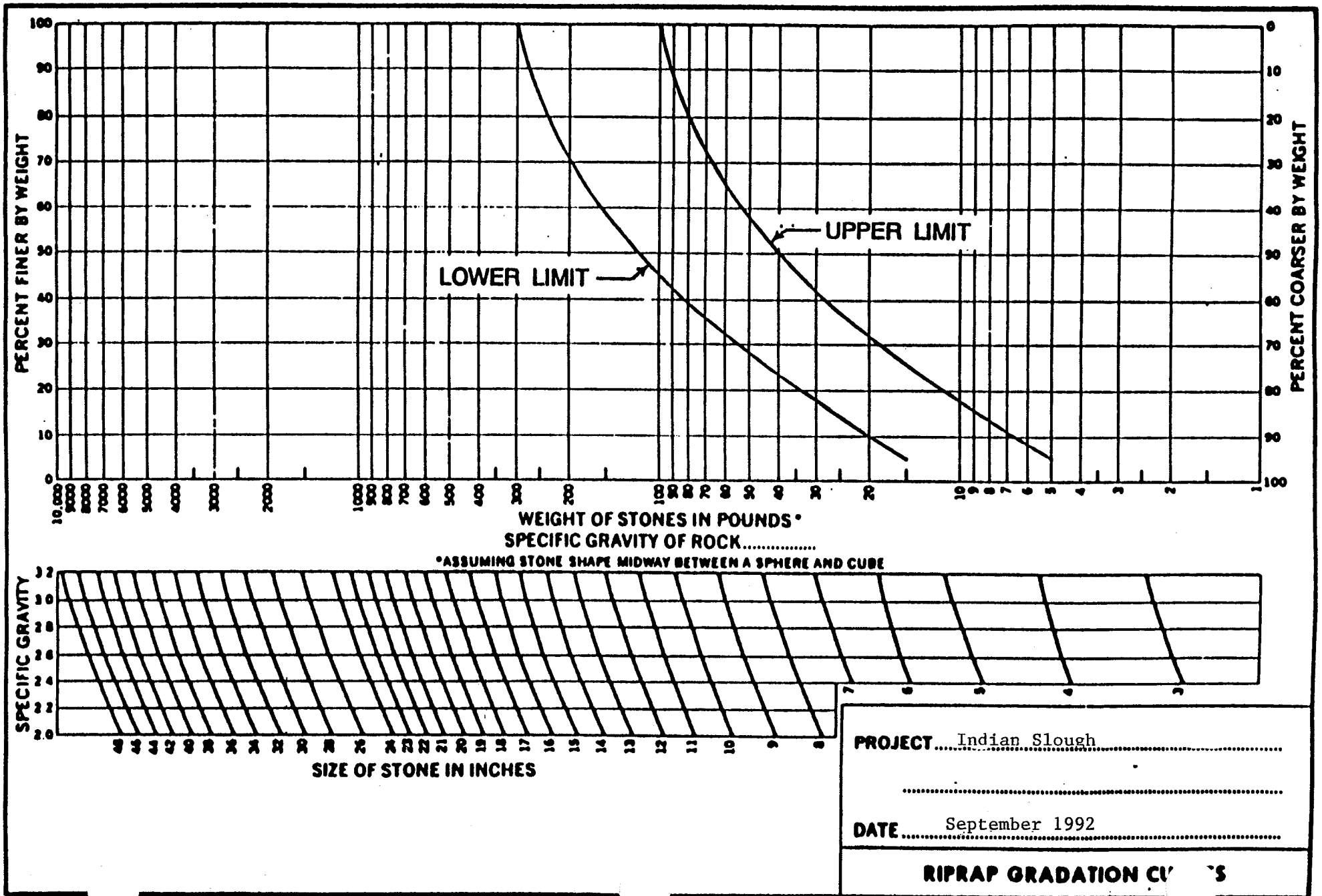
BY: (signature)

Name and Title Marvin E. Moriarty
Acting Regional Director
U.S. Fish and Wildlife Service

Date: 9-3-92

APPENDIX C

REPLACEMENT SPECIFICATIONS



PROJECT Indian Slough

DATE September 1992

RIPRAP GRADATION CU[illegible]S

ENG FORM [illegible]
APR 87

APPENDIX D

EVALUATION AND MONITORING PLAN

INDIAN SLOUGH HABITAT REHABILITATION AND ENHANCEMENT PROJECT

MONITORING AND PERFOMANCE 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. The Environmental Management Program (EMP) is scheduled to expire in 2002, therefore monitoring activities beyond project year 9 will be dependent on renewal of the program or other funding sources.

1. PROJECT OBJECTIVE: To cut by at least 50 percent the rate of conversion of aquatic habitat to land in the Indian Slough delta area. Similarly, to halve the rate of conversion in the adjoining wetland areas of Big Lake where water depths currently range from 2 to 4 feet but are decreasing to 0 to 2 feet.

a. Evaluation Objective: Determine changes in the patterns and rate of Indian Slough delta formation.

Evaluation: Complete aerial photography surveys of the project area immediately after completion of the project and every 5 years thereafter through project year 26 (2019). After project year 26 complete aerial photography survey at project year 40 (2033). Compare to pre-project surveys through the GIS.

b. Evaluation Objective: Determine stability of dredge cut depths in Big Lake Bay.

Evaluation: Complete bathymetric surveys of the Big Lake Bay area immediately after completion of the project and every four years thereafter through 2001. After 2001 complete bathymetric surveys at project year 15 (2008), 25 (2018) and 40 (2033). Compare to pre-project surveys.

c. Evaluation Objective: Determine the net percent reduction in discharge in Indian Slough for river discharges up to the 2-year average peak. Determine changes in flow patterns in Big Lake.

Evaluation: Take discharge measurements for 3 years after project completion in Indian Slough and the delta and compare to pre-project discharge data. Thereafter, beginning in 1999, complete discharge measurements every 5 years through project year 26 (2019). After project year 26 complete discharge measurements at project year 40 (2033). Compare to pre-project surveys through the GIS.

Complete dye studies in Big Lake in 1994 and compare to pre-project dye studies (completed in 1989). Mississippi River discharge should be similar for both measurements.

d. Evaluation Objective: Determine changes in the Indian Slough bank and bed.

Evaluation: Complete bed and bank elevation surveys for 3 years after project completion in Indian Slough at selected transects and compare to pre-project surveys. Thereafter, beginning in 1999, complete bed and bank elevation surveys every 5 years through project year 26 (2019). After project year 26 complete bed and bank elevation surveys at project year 40 (2033). Compare to pre-project surveys.

2. PROJECT OBJECTIVE: To provide conditions so that dissolved oxygen concentrations of greater than or equal to 5 mg/l are maintained, throughout most of the winter in at least 15 percent of the 75 acres of backwater lake habitat in Big Lake (Big Lake Bay) that have historically provided good centrarchid habitat.

a. Evaluation Objective: Determine dissolved oxygen, temperature and current velocity conditions in Big Lake Bay for selected ice and snow conditions.

Evaluation: Complete winter dissolved oxygen (DO), temperature and current velocity monitoring in Big Lake Bay every two years after project completion through project year 8 (2001-2002), then complete DO, temp. and current velocity monitoring at project year 24 (2017-2018).

3. PROJECT OBJECTIVE: To enhance 11 acres of Indian Slough for lithophilic fish species, including the creation of 3 acres of riffle/pool habitat and placement of log snags along the existing cut banks to partially offset the approximately 240 acres of aquatic habitat, at the outlet of Indian Slough, that has been converted to land since inundation by lock and dam 4 in the 1930's.

a. Evaluation Objective: Determine changes in the channel bed over time.

Evaluation: Complete bed and bank elevation surveys as described under 1d above.

b. Evaluation Objective: Determine the amount of exposed underwater rock substrate.

Evaluation: Inspect substrate according to schedule described under 1d above.

c. Evaluation Objective: Determine current velocities across riffle structures and in pool areas.

Evaluation: Complete current velocity measurements in selected areas of Indian Slough according to schedule described under 1c above.

INDIAN SLOUGH – POOL 4

EVALUATION AND MONITORING SCHEDULE

Project Objectives	Pre-Project Conditon Surveys	Post-Project Monitoring	Schedule	Agency
1. REDUCE THE RATE OF CONVERSION OF AQUATIC AND WETLAND HABITATS TO TERRESTRIAL HABITAT				
Maintain land/water ratio in Big Lake	Aerial photography, GIS Corps (74, 84, 89)	Aerial photography, GIS	94,99 [2004,09,14,19,33]*	Corps
Determine dredge cut stability	Bathymetry Corps (92)	Bathymetry	93,97,2001 [2008,18,33]*	Corps
Reduce discharge into project area	Discharge measurement Indian Slough, delta Corps (89, 90)	Discharge measurement Indian Slough, delta	94,95,96,99 [2004,09,14,19,33]	Corps**
Determine flow patterns Big Lake	Dye study WDNR (89)	Dye study, Big Lake	94	Corps
Maintain bed elevation	Indian Slough bed and banks Corps (89)	Indian Slough bed and banks	94,95,96,99 [2004,09,14,19,33]	Corps**
2. MAINTAIN CENTRARCHID HABITAT IN BIG LAKE				
>5 mg/l DO and >2 C Temp. winter	DO, Temp. monitoring – winter WDNR (88–89, 89–90) LTRM (90–91)	DO, Temp. monitoring – winter	93–94,95–96 97–98,99–2000 2001–02 [2017–18]*	LTRM/WI
3. CREATE 11 ACRES OF ROCK SUBSTRATE HABITAT FOR LITHOPHILIC FISH				
Riffle/pool channel configuration	Bed elevation survey Indian Slough bed and banks	Bed elevation survey Indian Slough bed and banks	94,95,96,99 [2004,09,14,19,33]*	Corps
Exposed rock substrate		Inspect substrate	94,95,96,99 [2004,09,14,19,33]*	Corps
>1.0 ft/s current velocity over riffles 0.5 to 0.1 ft/s in pools		Current velocity measurements Indian Slough	94,95,96,99 [2004,09,14,19,33]*	Corps

* The current EMP is funded through 2002, therefore, monitoring activities beyond 2002 are dependent on program renewal or other funding sources.

** Monitoring activities directly associated with the partial closing dam in Indian Slough (i.e. current velocity monitoring in Indian Slough but not the delta area and bed and bank surveys in Indian Slough between the partial closing dam and the first riffle/pool structure) are funded through the Construction–Operations Division of the COE.