US Army Corps
Of Engineers
St. Paul District

# UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM

# DEFINITE PROJECT REPORT AND INTEGRATED ENVIRONMENTAL ASSESSMENT (SP-26)

# LONG MEADOW LAKE HABITAT REHABILITATION AND ENHANCEMENT PROJECT

**Minnesota River**
**Hennepin County, Minnesota**

**July 2004**

# Plates

## Attachment 1

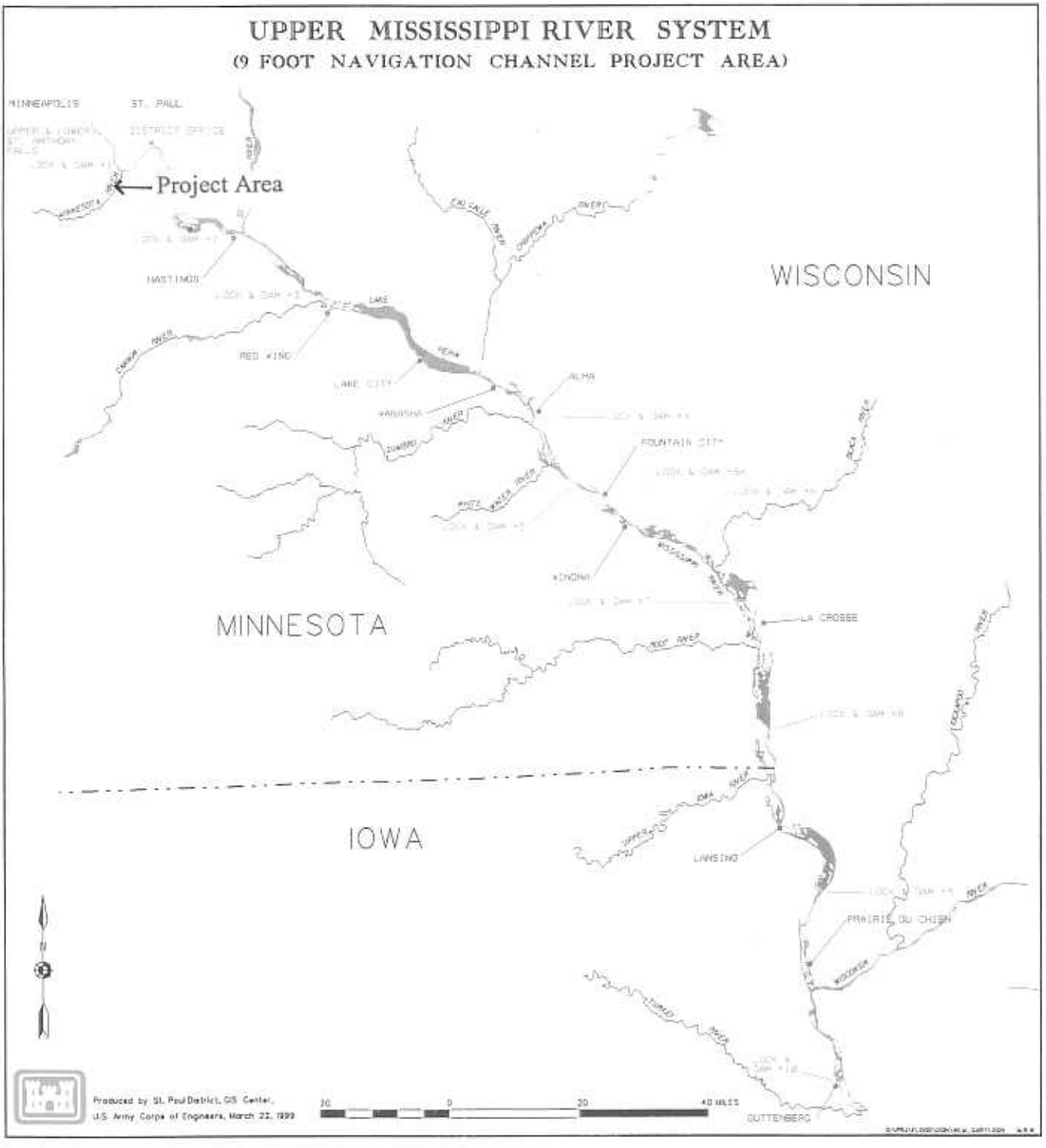
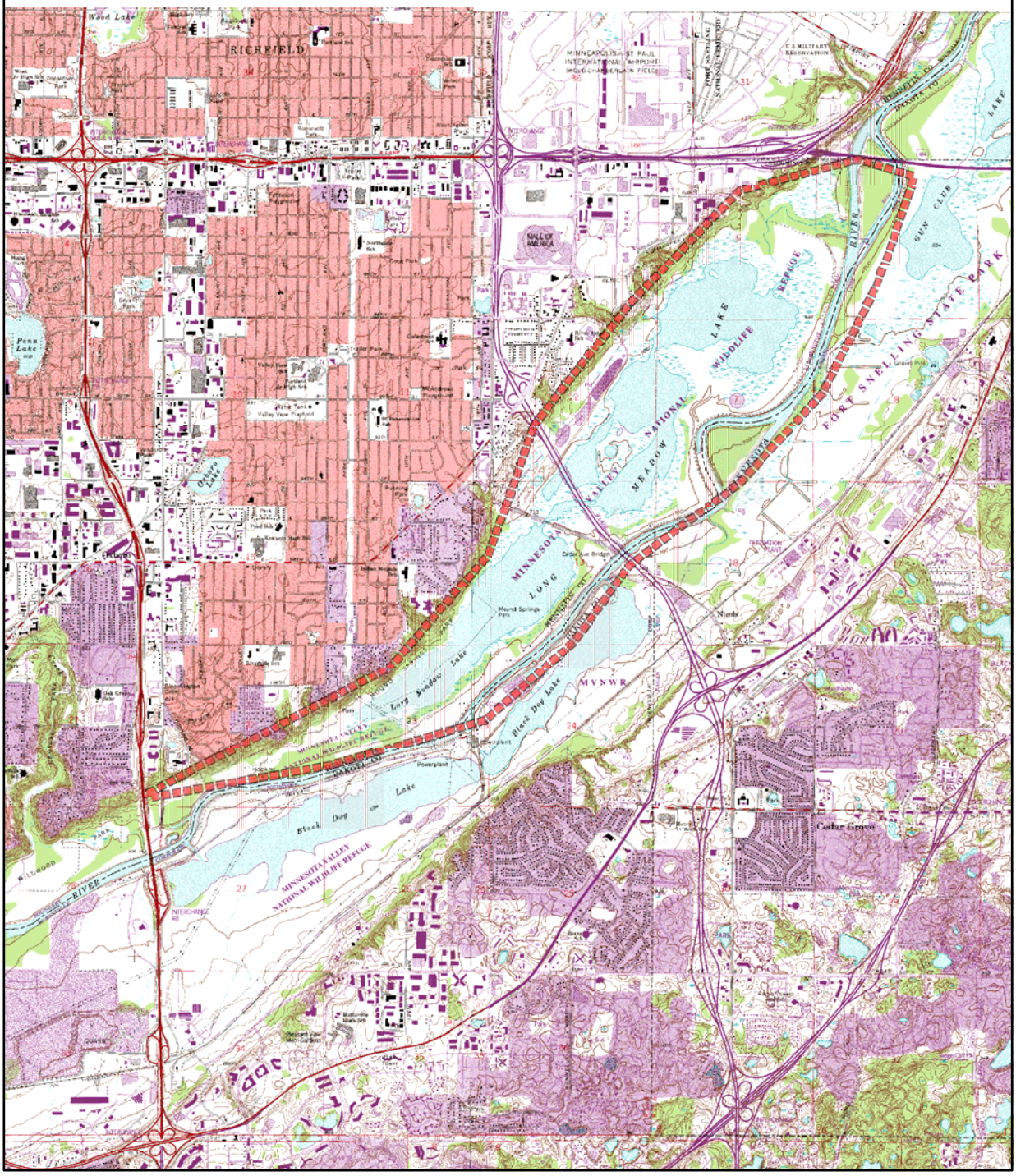
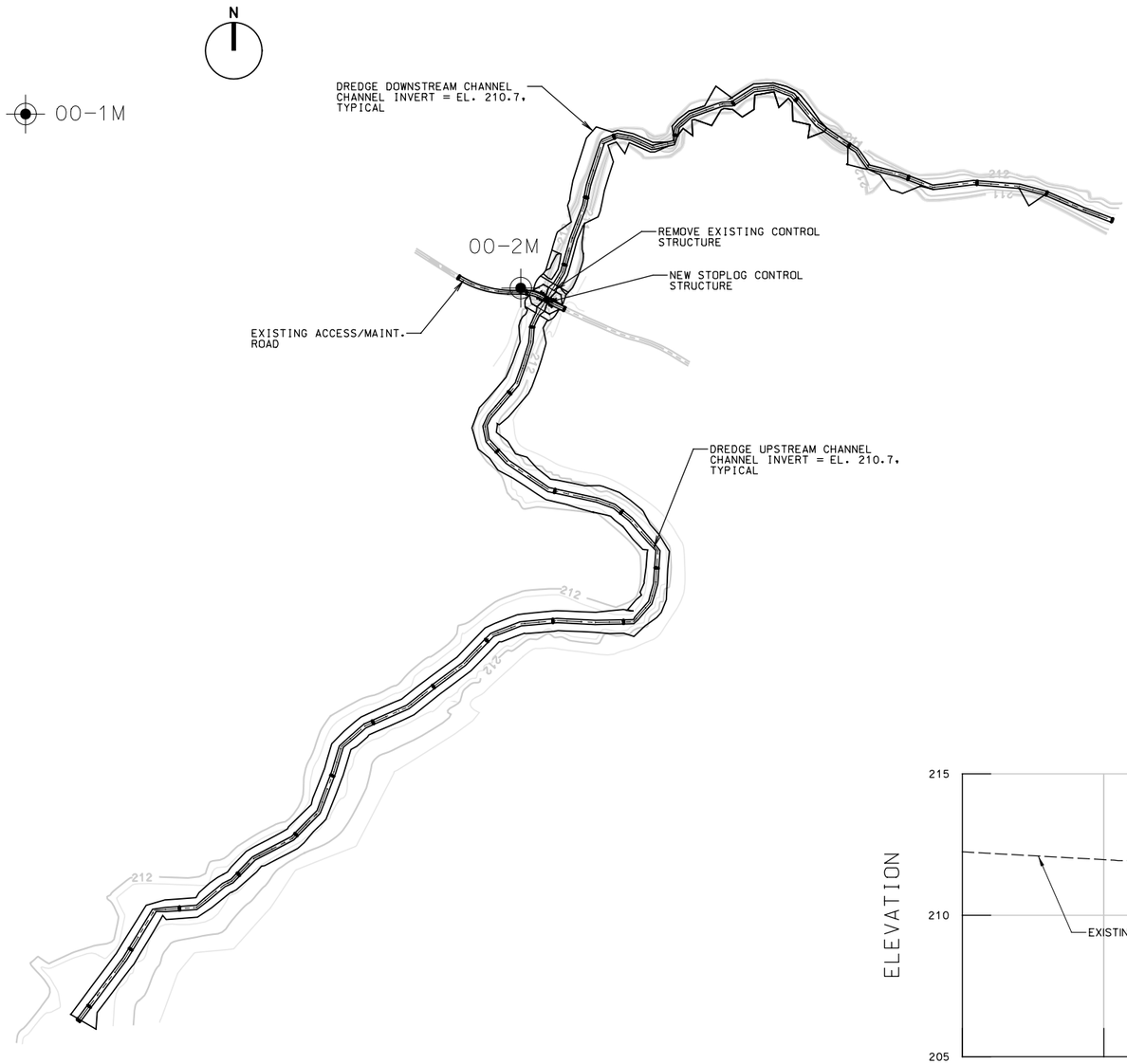

UPPER MISSISSIPPI RIVER SYSTEM
(9 FOOT NAVIGATION CHANNEL PROJECT AREA)
MINNEAPOLIS
ST. PAUL
Project Area
WISCONSIN
MINNESOTA
IOWA
HASTINGS
RED WING
LAKE CITY
ALMA
FOUNTAIN CITY
WINONA
LA CROSSE
LANSING
PRAIRIE DU CHIEN
GUTTENBERG
Produced by St. Paul District, GIS Center,
U.S. Army Corps of Engineers, March 23, 1999
30
0
20
40 MILES

Plate 1


RICHFIELD
MINNEAPOLIS - ST PAUL INTERNATIONAL AIRPORT
MALL OF AMERICA
MINNESOTA VALLEY NATIONAL WILDLIFE REFUGE
FORT SNELLING STATE PARK
MINNESOTA RIVER
Black Dog Lake
Long Meadow Lake
Cedar Grove
5,000
0
Feet
N

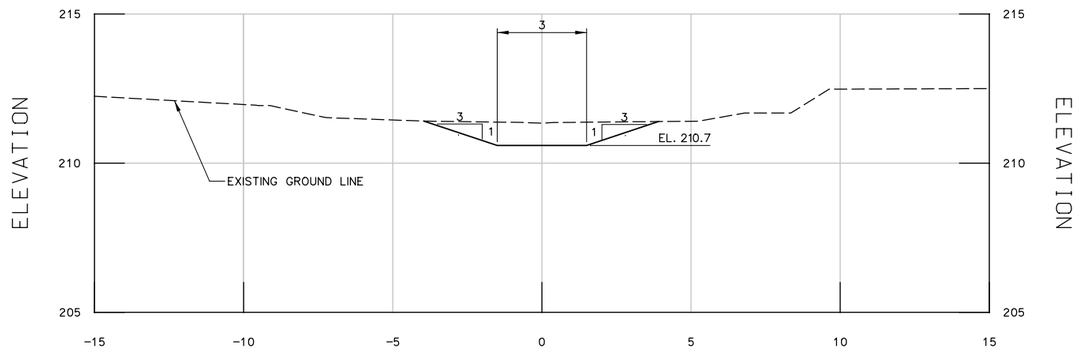



GENERAL PLAN

SCALE: 1:2000

40 0 120

1:2000 SCALE




TYPICAL SECTION

CHANNEL DREDGING

SCALE: NONE

US Army Corps of Engineers
St. Paul District

| Symbol | Description | Date | Appr. |
|---|---|---|---|
| | | | |

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DRAWN: TMG/LKT
CHECKED: CAA
CHECKED: XXX/XXX
SCALE: AS SHOWN
DATE: JULY 2002
CADD FILE NAME: LMLDPR_SHEET1.DGN
SOL. NO.:
RECOMMENDED: KLS
APPROVED: FOR COL. XXX
AE APPROVING OFFICIAL:

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

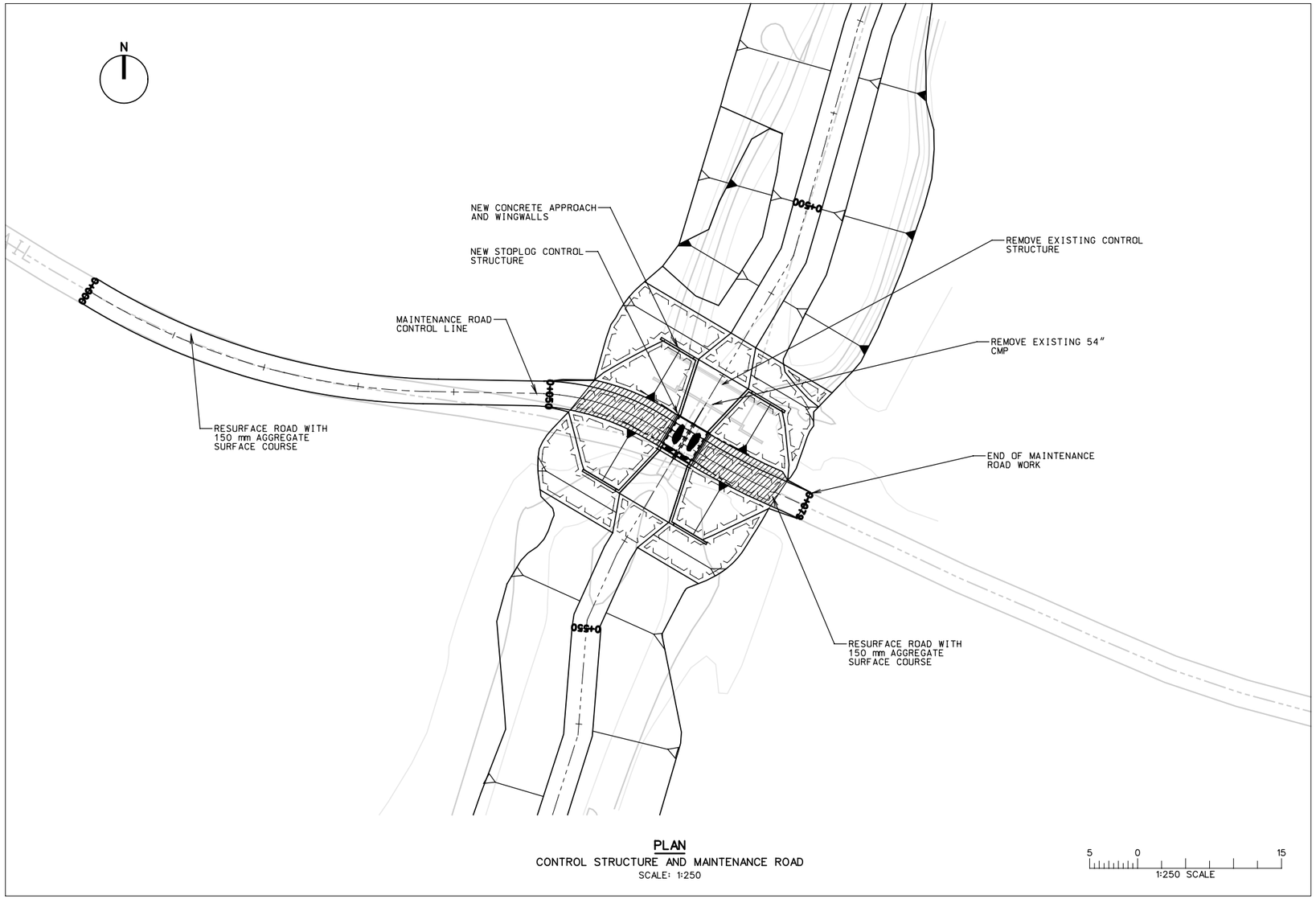
LONG MEADOW LAKE HREP
DESIGN DEVELOPMENT REPORT

# GENERAL PLAN

GENERAL PLAN AND TYPICAL CHANNEL DREDGING SECTION

DRAWING NUMBER:
PLATE 7

SHT 7 OF 10




**PLAN**
CONTROL STRUCTURE AND MAINTENANCE ROAD
SCALE: 1:250

US Army Corps of Engineers
St. Paul District

| Symbol | Description | Date | Appr. |
|---|---|---|---|
| | | | |

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DATE: JULY 2002
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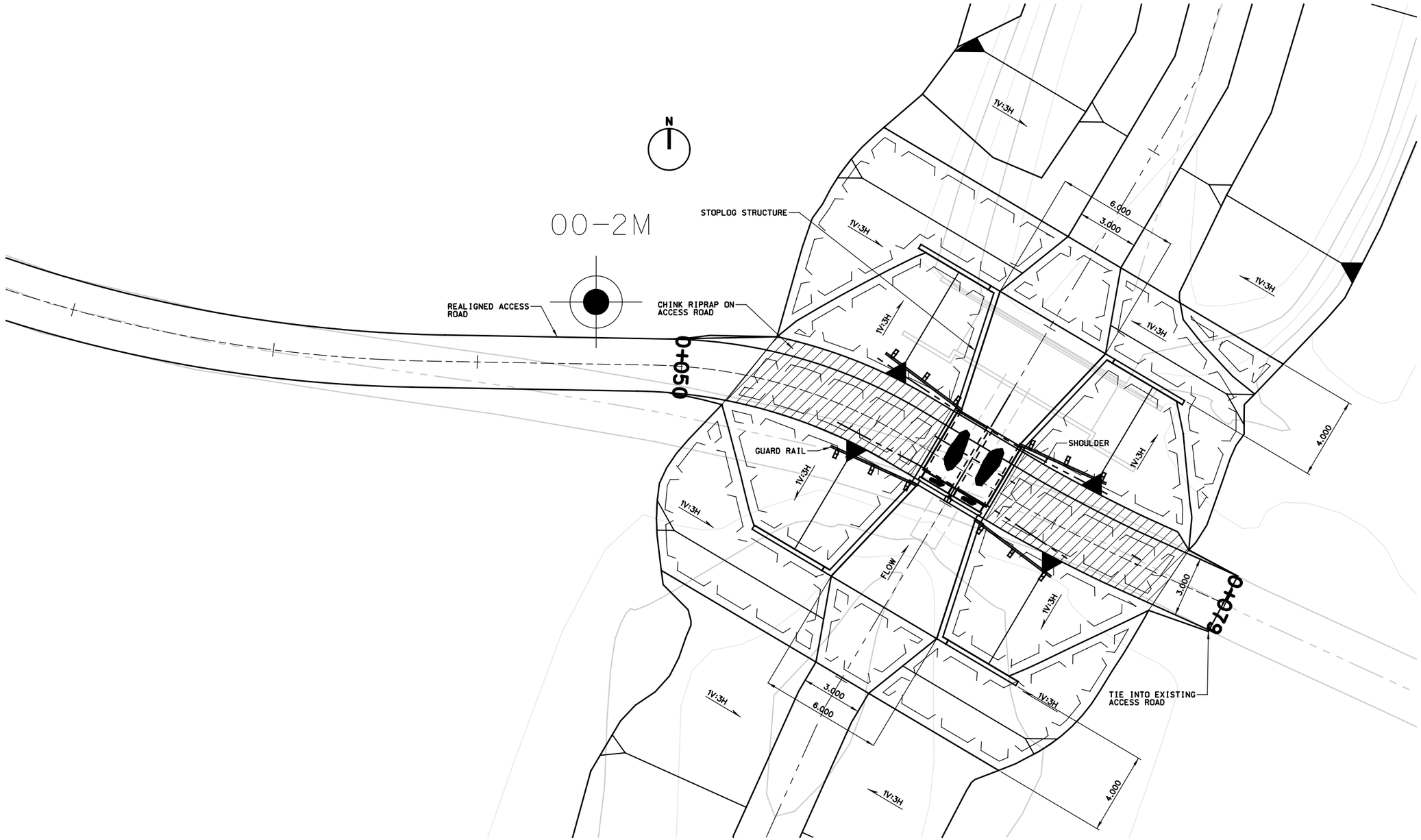
APPROVED: XXX/XXX
DATE: XXX/XXX
AE APPROVING OFFICIAL:

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

LONG MEADOW LAKE HREP
DESIGN DEVELOPMENT REPORT
ACCESS ROAD
LAYOUT

DRAWING NUMBER:
PLATE 8

SHT 8 OF 10




## SITE PLAN
AT STOPLOG STRUCTURE

2 0 6
1:100 SCALE

US Army Corps of Engineers
St. Paul District

| Symbol | Description | Date | Appr. |
|---|---|---|---|
| | | | |

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

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DRAWN: LKT
CHECKED: TMG
QUALITY CHECKED: KLL
EDITED: XXX/XXX
SCALE: AS SHOWN
DATE: JULY 2002
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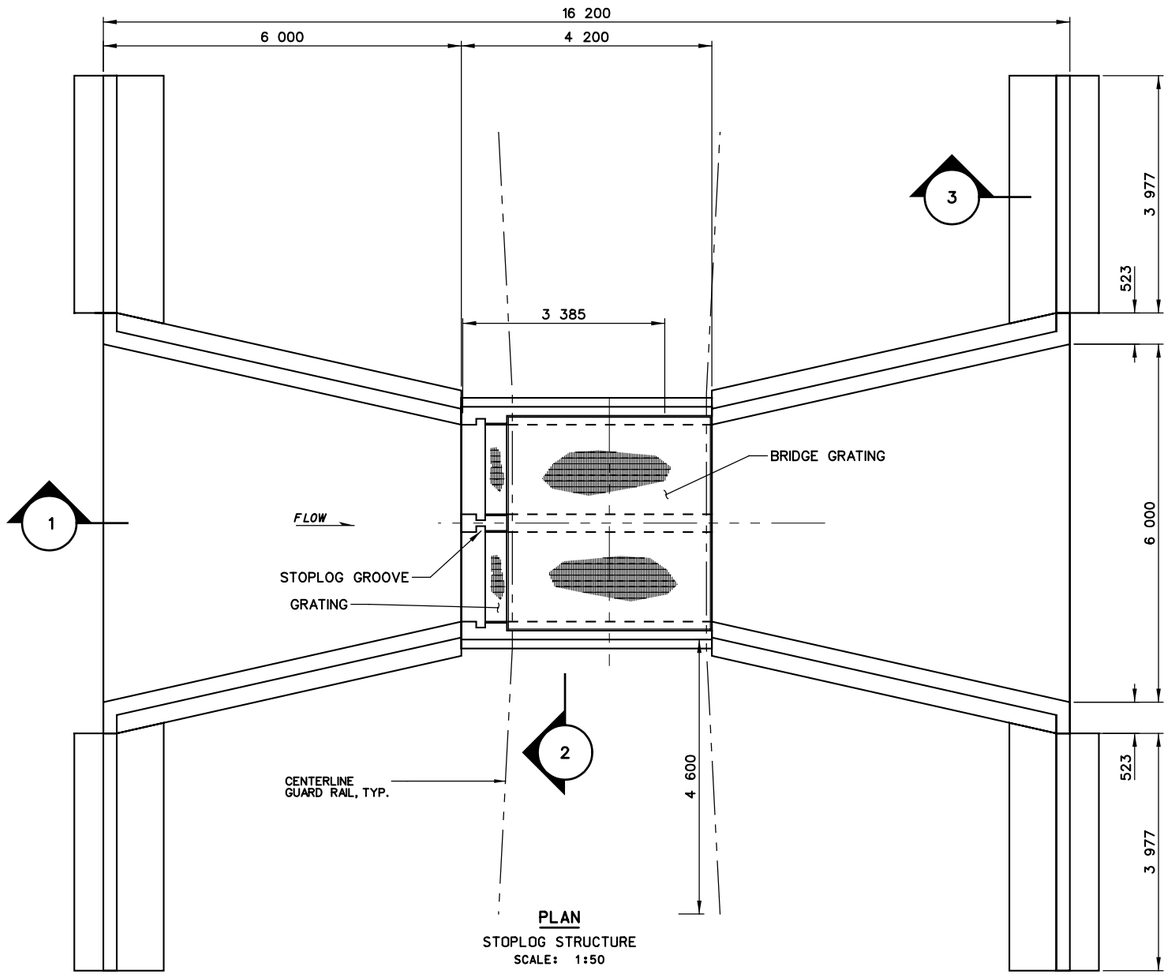
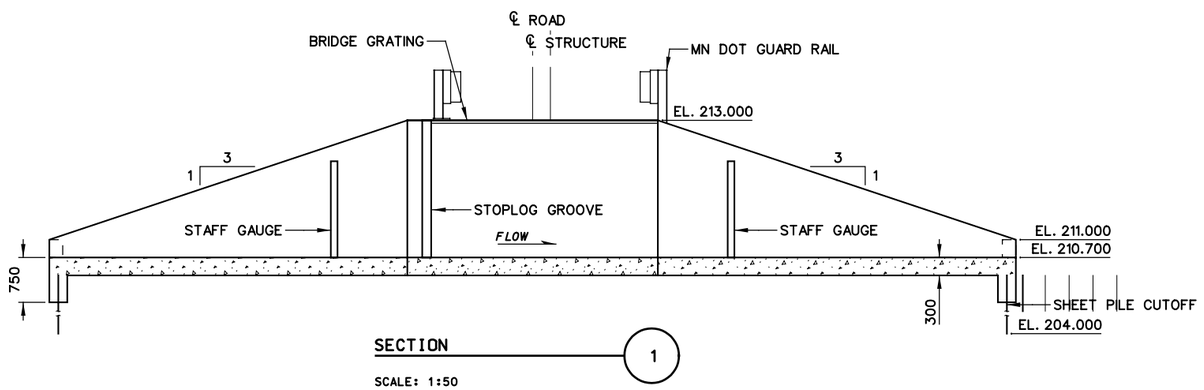
SOL. NO.:
APPROVING OFFICIAL:

LONG MEADOW LAKE HREP
DESIGN DEVELOPMENT REPORT
**STOPLOG STRUCTURE**
SITE LAYOUT

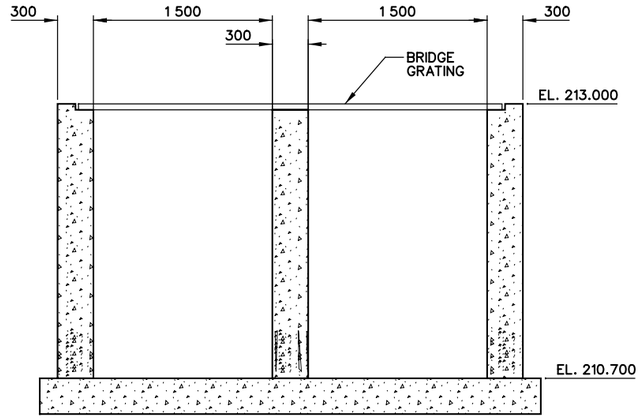
DRAWING NUMBER:
**PLATE 9**
SHT 9 OF 10



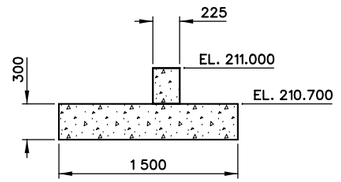

PLAN
STOPLOG STRUCTURE
SCALE: 1:50




SECTION
1
SCALE: 1:50




SECTION
BRIDGE
2
SCALE: NONE




SECTION
TIE-BACK WALL
3
SCALE: NONE

**NOTES:**

1. UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN MILLIMETERS.
2. ALL ELEVATIONS ARE IN METERS.
3. BRIDGE GRATING RATED FOR HS-20 LOADING.

0 500 1000 2000
SCALE: 1:50

US Army Corps of Engineers
St. Paul District

| Symbol | Description | Date | Appr. |
|---|---|---|---|

DESIGNED: TMG
DRAWN: LKT
CHECKED: CAA
SCALE: AS SHOWN
DATE: JULY 2002
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SUBMITTED: XXX/XXX
CHECKED: XXX/XXX
RECOMMENDED: XXX/XXX
APPROVED: XXX/XXX
AE APPROVING OFFICIAL:

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

LONG MEADOW LAKE HREP
DESIGN DEVELOPMENT REPORT

# STOPLOG STRUCTURE

PLAN AND SECTIONS

DRAWING NUMBER:
PLATE
10
SHT 10 OF 10

# Cost Estimate Appendix

## Attachment 2

# ATTACHMENT 2

# COST ESTIMATE AND CONSTRUCTABILITY REVIEW

The baseline cost estimate is provided for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project. The baseline cost estimate (as defined in ER 1110-2-1302) is the current working estimate at the time of the define project report. The estimate includes costs associated with fish and wildlife facilities, engineering & design, and construction management. The estimate was prepared at July 2002 price levels, but has been escalated to October 2004 price level on the cost estimate summary sheet.

## References

The cost estimate was prepared in general accordance with the following Corps' documents:

ER 1110-1-1300 Cost Engineering Policy and General Requirements
ER 1110-2-1302 Civil Works Cost Engineering
EI 01D010 Construction Cost Estimates
ER 1110-2-1150 Engineering and Design for Civil Works Projects
MCACES Micro-Computer Aided Cost Engineering System, Version 5.30

## Project Description

The project is located on an actively managed wildlife preserve in an urban area. The project purpose is to provide greater drainage capacity of the outlet channel to reduce the normal seasonal inundation time during spring flooding. A new stoplog control structure will provide greater ability to manage the lake levels. The tree planting will convert 45 acres of abandoned agricultural grass fields back to forestland that more closely represents the native environment.

The project concept used for this estimate is shown on plates 7, 8, 9 and 10; and as described in the report. The project features include the approximate quantities:

| | |
|---|---|
| Channel Dredging | 2050 $m^3$ |
| Stoplog Control Structure | 1 EA |
| Culvert Removal | 1 EA |
| Tree Planting | 45 Acre |

## Organization

An itemized listing of the estimate is included at the end of this appendix. The estimate has categorized the costs into tiers as indicated below:

Civil Works Breakdown Structure: Tier 1 is the feature code in the Civil Works Breakdown Structure (CWBS) as presented in the models database for MCACES. The CWBS is a consistent hierarchy framework for summarizing information and quantitative reporting concerning Corps projects.

Work Feature. Tier 2 includes separable work features of the project, similar to contract bid items.

Work Description. Complex work features are broken out into work descriptions. The work descriptions are construction tasks, generally broken out into reasonable incremental parts.

Detail Level. Most of the work descriptions are further detailed by itemized labor, equipment and material costs in the MCACES estimate. This detail level has not been included in the report to reduce reproduction requirements. A hard copy or electronic copy of the MCACES estimate is available for review from the St. Paul District office. There is also miscellaneous backup information in hard copy.

## Estimating Methodology

Most of the work descriptions are supported by a "work breakdown" that includes a crew (labor and equipment) and material prices. The construction pricing includes all costs that a prudent, experienced contractor would expect to incur. The crew productivity is a primary factor influencing contractors' assumptions, as well as the Government estimate. For most of the earthwork, a crew is assumed based on typical practice of contractors and requirements necessary to accomplish the work. Crew productivity for significant work quantities are based on the Caterpillar Performance Handbook, and typical productivity for crews in the commercial unit cost books by R. S. Means Company, Inc. For small work quantities, selected crew productivity has been reduced to inflate pricing to compensate for fixed costs such as mobilization.

## Price Sources

1. Separately detailed crews and materials within the MCACES database were used for project unique work, such as the channel dredging, and demolition.

2. MCACES Unit Price Book (UPB). The UPB generally is based on a crew and material pricing (work breakdown), and is calibrated to national averages.

3. Commercial Unit Price Books. The R. S. Means books are similar to the MCACES UPB.

4. Historical unit prices have been used for some work descriptions when such pricing is considered to be equally accurate to a work breakdown approach. Historical pricing, when available, is also used as verification (reality check) for unit prices derived from one of the

other sources.

## Contingencies

Contingency allocations are added to provide sufficient funding for the total project. Contingencies represent allowances to cover unknowns, uncertainties, and unanticipated conditions not completely revealed at the time of this report. Contingencies do not cover work scope changes deviating from the plan described in the report. The uncertainties are related to measurement precision, contractor costs (such as changes in union labor wages and fuel pricing), market conditions (number of responsive bidders), differing site conditions, and minor plan refinements within the project scope. Contingencies have been assigned by the Cost Engineering Section, with input from the designers. Some guidelines for appropriate contingencies for Corp's projects are summarized: Corps' contracting regulations (EFAR part 36) allow award of contracts up to 125% of the government estimate prepared for bid openings. Corps' regulations (ER 5-7-1 (FR)) also require a minimum contingency of 5% of the contract award amount to be retained after award (to cover contract changes, modifications, etc.). ER 1110-2-1302 provides guideline overall project contingencies for total project cost less than $10 million ranging from 20% for design memorandums to 25% for feasibility estimates. Typical contingencies at the feasibility level include:

| | |
|---|---|
| Lands and Damages | 25% |
| Earthwork and Dredging | 15 to 30% |
| Flood Control Structures | 15 to 30% |
| Relocations (not detailed in plans) | 50% |

## Work Plan for Cost Estimate

The dredging is the majority of the work effort. Site access is difficult to the marsh environment. There is an access road that enters the wildlife preserve near the FWS offices and interpretative center, and cross the channel at the new stoplog control structure. There are 3 primary options for completing the channel dredging: (1) hydraulic dredging, (2) constructing a temporary access road along the channel for truck access, or (3) mechanical dredging using backhoes on floating deck barges. Hydraulic dredging is not considered a reasonable option due to the relatively small quantities for mobilization of hydraulic plant, the high fines content of the material would involve intensive effort to reduce turbidity in the return water, and the excavated materials will be distributed in thin lifts on the fields for topsoil. Construction of a temporary access road along the channel was the approach taken for the Rice Lake EMP, and is a potential option. The temporary access road would be favorable for low water conditions, and the mechanical dredging option would be favorable for high water conditions. This estimate considered mechanical dredge plant to excavate the channel, based on speculation that the typical water levels during the construction season favor floating plant.

The mechanical dredge plant has the advantage that it will not require imported or borrowed fill to

construct a temporary road, and it will not cause disturbance of the wetland along side the channel upon removal of the temporary road. As a disadvantage, it will cause disturbance of the channel during movement of floating plant. However, the channel disturbance will be limited to the excavation reach (with the exception of one small area on the downstream channel), where the area will already be disturbed by typical excavation depths of several feet. Silt screens to block turbidity within the work limits will be required due to movement of floating plant in the channel.

It is assumed the mechanical dredge plant will be trucked in and launched near the new stoplog control structure. The size of equipment will be limited by equipment that can be transported by truck, and the channel size. Floating plant may be able to access the downstream channel from the Minnesota River during high water events, but the existing channel is too shallow and narrow for operation of floating plant, and the lower portion of channel near the river is not being dredged. The lake level should be controlled at the existing culvert during the upstream channel excavation to provide adequate water level for movement of floating plant.

The dredging crew used in the estimate consisted of a 12,000 kg backhoe operating on a deck barge, a small tug moving 30 $m^3$ barges that unload near the new stoplog control structure, and 2 triaxle end-dumps that haul the excavated material to the fields. One-way traffic is assumed in the channel, with a pool for exchanging barges at the stoplog control structure, and several turnouts for exchanging barges at the excavator.

## Constructability

The tree planting is relatively simple work that can be accomplished by many landscaping companies. Other than coordination with the FWS for burning and other site preparation work, there are no particular concerns.

The new stop log control structure will require dewatering and cofferdams. The level of effort for this depends on seasonal conditions. Generally, water levels are lowest and the most predictable during the fall. There is a sandy silt layer at shallow depths below the invert elevation that could contribute to boils and seepage problems if not properly dewatered. Other than requirements for wells or well points and a suitable cofferdam, the work is routine.

Channel dredging has significant constructability concerns due to the difficult site access. There are a limited number of contractors that will pursue this work due the limited availability of floating plant, and the risk involved with construction of a temporary road.

Long Meadow Lake
Feasibility Level Estimate
Habitat Rehabilitation and Enhancement Project
June 3, 2004

**Civil Works**

| Breakdown Structure | Item | Description | Quantity | U/I | Unit Price | Extended Amount | Contingencies % | Contingencies Amount | Reasons |
|---|---|---|---|---|---|---|---|---|---|
| 06 Fish and Wildlife Facilities | | | | | | | | | |
| | 1 | Upstream Channel Dredging | 2050 | M3 | $43.60 | $89,380.00 | 30% | $26,814.00 | 1, 2 |
| | 2 | Mech. Dredging Mobe/Demobe | 1 | LS | $57,700.00 | $57,700.00 | 30% | $17,310.00 | 1, 2 |
| | 3 | Demolition of Existing Culvert | 1 | LS | $8,800.00 | $8,800.00 | 30% | $2,640.00 | 1, 2 |
| | 4 | Clearing | 1 | LS | $1,250.00 | $1,250.00 | 30% | $375.00 | 1, 2 |
| | 5 | New Stoplog Control Structure | | | | | | | |
| | a | Cofferdam | 300 | M3 | $17.10 | $5,130.00 | 20% | $1,026.00 | 1, 2 |
| | b | Dewatering | 1 | LS | $7,700.00 | $7,700.00 | 20% | $1,540.00 | 1, 2 |
| | c | Excavation | 1 | LS | $2,850.00 | $2,850.00 | 20% | $570.00 | 1, 2 |
| | d | Backfill | 1 | LS | $5,100.00 | $5,100.00 | 20% | $1,020.00 | 1, 2 |
| | e | Concrete, cast in place | 50 | M3 | $515.00 | $25,750.00 | 20% | $5,150.00 | 1, 2 |
| | f | Metals | 1 | LS | $13,400.00 | $13,400.00 | 20% | $2,680.00 | 1, 2 |
| | g | Riprap | 320 | MT | $52.50 | $16,800.00 | 20% | $3,360.00 | 1, 2 |
| | h | Aggregate Surface | 35 | M3 | $43.00 | $1,505.00 | 20% | $301.00 | 1, 2 |
| | l | Turf | 1 | LS | $950.00 | $950.00 | 20% | $190.00 | 1, 2 |
| | | TOTAL - New Stoplog Control Structure | | | | $79,185.00 | | $15,837.00 | |
| | 6 | Tree Planting | | | | | | | |
| | a | Materials | 15750 | EA | $6.75 | $106,312.50 | 10% | $10,631.25 | 1, 2 |
| | b | Planting & Decorating | 15750 | EA | $0.90 | $14,175.00 | 10% | $1,417.50 | 1, 2 |
| | | TOTAL - Tree Planting | 45 | AC | $2,677.50 | $120,487.50 | | $12,048.75 | |
| | | Construction Cost | | | | $356,802.50 | 21% | $75,024.75 | |
| 06 | | SUBTOTAL CONSTRUCTION COSTS: | | | | $356,802.50 | | | |
| 06 | | CONSTRUCTION CONTINGENCIES: | | | | | 21% | $75,024.75 | |
| 30 | | Engineering & Design (10%) | | | | $35,680.25 | | | |
| 31 | | Construction Management (7%) | | | | $24,976.18 | | | |
| | | SUBTOTAL PROJECT COSTS | | | | $417,458.93 | | | |
| | | SUBTOTAL PROJECT CONTINGENCIES | | | | | | $75,024.75 | |
| | | TOTAL PROJECT COSTS (July 2002 Price Level) | | | | $492,483.68 | | | |
| | | ESCALATED COST (Oct 2004 Price Level @ 3%) | | | | $526,351.17 | | | |
| | | ANNUALIZED PROJECT COSTS | | | | $32,812.74 | | | |
| | | O & M COSTS | | | | $8,087.54 | | | |
| | | TOTAL ANNUALIZED COSTS | | | | $40,900.28 | | | |

Discount Rate 5.875%

Note: Predominant contingencies: 1 - pricing, 2 - quantities

# LONG MEADOW LAKE - HREP

## OPERATION AND MAINTENANCE (ETL 1110-2-361 Method)

## FEASIBILITY ESTIMATE

| | |
|---|---|
| Life Cycle (yrs) | 50 |
| IIF (Inflation/Interest Factor) | 0.98 |
| Discount Rate | 5.875% |

| | CURRENT COSTS | | | O & M CYCLE | | | | O&M and MAJOR REPLACEMENT COSTS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ITEM DESCRIPTION | PROJECT QUANTITY | U/I | UNIT PRICE | CYCLIC COSTS (Yrs) First | Last | Cycle | O & M QUANTITY FACTOR | O&M QUANTITY | PRESENT VALUE | ANNUAL COST |
| **PERIODIC INSPECTIONS** | | | | | | | | | | |
| Years 1, 2, 3, 4 & 5 | 1 | LS | 5,000.00 | 1 | 5 | 1 | 100% | 1 | $23,539 | $1,467 |
| Years 7, 9 & 11 | 1 | LS | 5,000.00 | 7 | 11 | 2 | 100% | 1 | $12,513 | $780 |
| Every 5 years beginning year 15 | 1 | LS | 5,000.00 | 15 | 50 | 5 | 100% | 1 | $21,305 | $1,328 |
| Routine Annual Inspections | 1 | LS | 1,000.00 | 1 | 50 | 1 | 100% | 1 | $16,041 | $1,000 |
| **UPSTREAM CHANNEL DREDGING** | 2,050.0 | M3 | 71.75 | 20 | 40 | 20 | 25% | 512.5 | $40,936 | $2,552 |
| **STOPLOG CONTROL STRUCTURE** | | | | | | | | | | |
| Concrete | 50.0 | M3 | 515.00 | 20 | 40 | 20 | 20% | 10 | $5,734 | $357 |
| Metals | 1.0 | LS | 13,400.00 | 20 | 40 | 20 | 50% | 0.5 | $7,459 | $465 |
| Riprap | 320.0 | MT | 52.50 | 20 | 40 | 20 | 10% | 32 | $1,870 | $117 |
| Aggregate Surface | 35.0 | M3 | 43.00 | 20 | 40 | 20 | 20% | 7 | $335 | $21 |
| **Total O&M** | | | | | | | | | **$129,732.75** | **$8,087.54** |

# Section 404(b)(1) Evaluation

## Attachment 3

*PRELIMINARY*

SECTION 404(b)(1) EVALUATION
LONG MEADOW LAKE
HABITAT REHABILITATION AND ENHANCEMENT PROJECT
HENNEPIN COUNTY, MINNESOTA

## I. PROJECT DESCRIPTION

A. Location - The project area is located along the lower Minnesota River in southeast Hennepin County, Minnesota in the Minneapolis-St. Paul metropolitan area. The general project area is that portion of the Minnesota River floodplain lying between the main channel and the uplands between river miles 5.0 and 10.0 (See plates 1 and 2 of the Main Report).

B. General Description - The Corps of Engineers is proposing to replace the outlet control structure located in lower Long Meadow Lake to restore and improve hydrologic conditions on this 1500-acre wetland. The proposed action includes replacing the existing culvert and deteriorating concrete sidewalls with a poured in place concrete 2 bay water control structure, raising a small portion of the access road, replacing a culvert that serves as secondary outlet to Long Meadow Lake, deepening the outlet channel on the upstream side of the structure, excavating low spots in the channel on the downstream side of the structure and providing bank stabilization immediately downstream of the control structure to stop/prevent additional channel erosion in the outlet channel.

C. Authority and Purpose – The Long Meadow Lake Habitat Rehabilitation and Enhancement Project is being constructed under authority of Section 1103 of the Water Resources and Development Act (WRDA) of 1986, as amended (Public Law99-662). The goal of the project is to maintain and improve habitat conditions for wildlife and fish in Long Meadow Lake. Long Meadow Lake is a high quality wetland that has been affected by changed hydrologic conditions on the Minnesota River and increased development on the surrounding uplands. The proposed action would reduce the frequency of Minnesota River flood high water events entering the Long Meadow Lake complex during the growing season, and would allow for a more rapid discharge of storm water surcharge. The control structure would also provide effective water control capabilities to facilitate management of the wetland complex for aquatic vegetation composition and distribution.

D. General Description of Dredged and Fill Material

1. General Characteristics and Source of Material – Fill material for the embankments would come from existing borrow facilities in the metropolitan area. Some fill material may be obtained from a designated location on the refuge.

Clean rock riprap would be obtained from any of several quarries located within the metropolitan area.

2. Chemical Characteristics - Clean earth fill and riprap would be used for the proposed fill activities.

3. Quantity of Fill Material - The total quantities of various fill materials to be used are as follows: earth fill – 400 cubic yards, rock fill – 420 cubic yards, concrete –70 cubic yards, culvert – 40 linear feet. If an temporary access road is constructed to facilitate dredging above that control structure, an additional 1000 cubic yards of earth fill would be used.

E. Description of Proposed Discharge site

1. Location – Fill activities would occur primarily along the north shoreline of Long Meadow Lake. Riprap would be placed along the unnamed stream immediately downstream of the control structure to provide bank stabilization. A temporary access road may be constructed into the north bay of Long Meadow Lake to facilitate dredging of the channel.

2. Size - Approximately 100 lineal feet of road would be raised to tie the control structure into high ground, requiring that a minor amount fill be placed in wetlands along the toe of the road. The road would be raised a maximum of about 3 feet in height in some places. In addition a cofferdam would need to be constructed to facilitate construction of the control structure. The cofferdam would be 6 feet in height, with 1V:3H sideslopes and 10 foot top width. Approximately 1000 feet of stream bank would be riprapped at select locations on both sides for erosion protection. A two bay control structure, measuring 15 feet by 15 feet, along with attendant wing walls and riprap, would be constructed at the existing outlet of Long Meadow Lake. Typical cross sections are presented in plates XX, XX, and XX of the main report.

3. Types of Habitat – Habitat in the project area generally can be best described as a mix of old field, bottomland forest and marsh. Fill would be places primarily in what would be considered emergent marsh or eroding stream bank.

4. Timing and Duration - Construction would be completed in one construction season and would likely be completed during the summer of 2004. Delays in funding may delay implementation until the summer of 2005. Construction would be timed to avoid work during high water periods.

F. Description of Fill and Dredged Material Placement Methods – Fill material would be placed with equipment working off the access road, the top of the cofferdam or from the top of the stream bank. Dredging of the entrance channel may be done hydraulically, or mechanically with equipment working from a small floating platform or temporary access road constructed into the north bay of Long Meadow Lake. The access road would be removed after construction is completed.

Best management practices (BMP's) would be utilized to minimize erosion from the site during construction.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

1. Substrate Elevation and Slope – Fill activities would occur primarily in shallow wetland along the north shore of Long Meadow Lake. The existing road would be raised about XX feet with a finished sideslope of 1V:3H.

2. Substrate Changes – Sediment in proposed fill area is primarily silt. Less than an acre of the 1500-acre marsh would be converted to upland with the raise of the access road. Some wetland and stream bottom would be converted to riprap with bank stabilization around and downstream of the control structure.

3. Dredged/Fill Movement – There would be no movement the proposed fill material. The sideslopes of the raised access road would be vegetated and riprap placed at critical locations where the potential for erosion would be great. The use of BMP's would limit the potential the movement of material from the site during localized storm events.

4. Actions Taken to Minimize Impacts – Construction would occur after the potential for high spring runoff has passed and Best Management Practices would be employed during construction to limit runoff and erosion from the site.

B. Water Circulation and Fluctuations

1. General Water Chemistry – The proposed action would have no effect on water chemistry or characteristics including salinity, clarity, color, odor, taste, dissolved gas levels, nutrients, eutrophication or temperature.

2. Current Patterns and Circulation - The proposed action have minimal effects on current patterns or circulation because it replaces an existing outlet structure. The new control structure would reduce the frequency with which backwater flows entered Long Meadow Lake during high water events on the Minnesota River. The project would have no effect on velocity, stratification or hydrologic regime.

3. Normal Water Level Fluctuations – The new control structure would affect water level fluctuations in that it would provide enhanced water level management capability. This would allow for a more stable water level in Long Meadow Lake during the growing season and the ability to manipulate water levels to improve vegetation composition and distribution is desired.

4. Sedimentation Patterns – The proposed action would have not effect on sedimentation patterns in Long Meadow Lake.

C. Suspended Particulate/Turbidity Determinations

1. Suspended Particulates and Turbidity – Construction activities may result in some temporary localized increases in turbidity. Levels of turbidity would return to normal after construction.

2. Effects on Physical and Chemical Properties of the Water Column

a. Light Penetration – There would be no appreciable effect on light penetration in the

water column.

b. Dissolved Oxygen – There would be no appreciable effect on dissolved oxygen levels in Long Meadow Lake.

c. Toxic Metals and Organics - No increase in contaminants in the aquatic environment would result from the proposed project.

d. Aesthetics – There would be no effects on aesthetics with respect to water quality.

3. Actions Taken To Minimize Impacts - Impacts will be minimized by requiring the use of best management practices during construction.

D. Contaminant Distribution Determinations

The proposed action would have no appreciable affects on the location or levels of contaminants in the aquatic system.

E. Aquatic Ecosystem and Organisms Determinations

1. Effects on Plankton - the proposed action would have no appreciable effect on plankton.

2. Effects on Benthos – The proposed actions would have no appreciable effect on benthos in Long Meadow Lake or the stream immediately below the control structure.

3. Effects on Fish – Improved vegetation conditions in Long Meadow Lake may improve spawning habitat for some species of fish that utilize Long Meadow Lake.

4. Effects on Wildlife – Long Meadow Lake provides valuable seasonal and year-round habitat for a wide variety of waterfowl, shorebirds, neotropical migrants and many species of reptiles and amphibians. Overall, the proposed project would have substantial beneficial effects on wildlife resources by providing the capability for improved water management, thereby increasing the quality of the habitat in Long Meadow Lake.

5. Effects on Aquatic Food Web – The proposed action would have no appreciable effects on the aquatic food web.

6. Effects on Special Aquatic Sites

a. Sanctuaries and Refuges – The project area is a National Wildlife Refuge. The proposed action would allow for enhanced water level management on refuge lands.

b. Wetlands, Mud Flats, and Vegetated Shallows – Less than 1 acre of wetland would be filled with raising the access road. About 5 acres of wetland would be temporarily affected with the construction and removal of the access road for dredging and the cofferdam. This tradeoff is considered acceptable for the capability to effectively manage water levels in Long Meadow Lake.

7. Threatened and Endangered Species - No State listed or federally listed threatened or endangered species would be adversely affected by the proposed action.

8. Actions Taken To Minimize Impacts – Due to the overall beneficial effects of the proposed action on the aquatic ecosystem, no additional actions would be required.

F. Proposed Disposal Site Determinations

1. Mixing Zone – Not applicable. The material would not be dispersed.

2. Compliance with Applicable Water Quality Standards - Fill material would consist of clean material from approved sources. State water quality standards would not be violated due to the fill activities. Best management practices would be used to minimize runoff from the construction site.

3. Potential Effects on Human Use Characteristics - The proposed actions would have no adverse effects on municipal or private water supplies; recreational or commercial fisheries; navigation, or aesthetics, parks, national historic monuments or similar preserves.

G. Cumulative Effects on the Aquatic Ecosystem

The proposed action would not cause any significant adverse cumulative impact on the aquatic system.

H. Secondary Effects on the Aquatic Ecosystems

No significant negative affects should result from the proposed project. The ability to effectively manage water levels in Long Meadow Lake would result in long-term benefits to aquatic vegetation, and related secondary benefits to fish and wildlife are expected.

## III. FINDINGS OF COMPLIANCE WITH RESTRICTIONS ON DISCHARGE

The proposed fill activity would comply with Section 404(b)(1) guidelines of the Clean Water Act. No significant adaptations to the Section 404(b)(1) guidelines were made for this evaluation. No alternatives were identified that would accomplish the purposes of the proposed control structure that would not involve the deposition of fill. Other alternatives considered to improve habitat conditions in Long Meadow Lake included variations in the location and number of water control structures, the construction of a rock dike in upper Long Meadow Lake and no action. The proposed action represents the best combination of engineering and environmental considerations to achieve the desired water level management and habitat improvement goals.

The proposed fill activity would be in compliance with all State of Minnesota water quality standards, Section 307 of the Clean Water Act and the Endangered Species Act of 1973, as amended. The proposed fill activities would not have a significant adverse impact on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, wildlife, and special aquatic sites. The activities would have no

significant adverse effect on the life stages of aquatic organisms or other wildlife. No significant adverse effects on aquatic ecosystem diversity, productivity and stability, or on recreational, aesthetic, and economic values would occur.

Steps taken to minimize potential adverse effects on the aquatic ecosystem include timing of disposal activities and the use of best management practices during construction.

On the basis of this evaluation, I specify that the proposed action complies with the requirements of the guidelines for discharge or placement of fill material.

_____
Date

Robert L. Ball
Colonel, Corps of Engineers
District Engineer

# Habitat Evaluation

## Attachment 4

# HABITAT EVALUATION PROCEDURE USED FOR THE LONG MEADOW LAKE HABITAT AND REHABILITATION PROJECT

Habitat evaluation procedures (HEP) were used to evaluate the potential benefits of the proposed habitat improvement features for the Long Meadow Lake project area. Active participants included biologists from the St. Paul District, the U.S. Fish and wildlife Service and the Minnesota Department of Natural Resources.

## MEHTODS

### METHODOLOGY

The U.S. Fish and Wildlife Service's 1980 version of Habitat Evaluation Procedures (HEP-80) was used to quantify the potential project effects and benefits. The HEP methodology utilizes a Habitat Suitability Index (HSI) to rate habitat quality on a scale of 0 to 1 (1 being optimum). The HSI is multiplied by the number of acres of available habitat to obtain Habitat Units (HU's). One HU is defined as the equivalent of one acre of optimum habitat. By comparing existing HU's to HU's expected to be gained with the proposed action, the benefits can be quantified.

### EVALUATION SPECIES SELECTION

Long Meadow Lake is an important component of the Minnesota Valley Wildlife Refuge as a large diverse wetland located in the heart of an urban area. As such, management objectives for this component of the refuge are focused on improving and maintaining overall wetland values for a wide variety of wildlife. As such, an approach that would quantify habitat benefits more on a community level was desirable.

There are numerous species models available for evaluating habitat quality of wetlands. However, available models are either season specific addressing critical habit needs, such as wintering or migration habitat, designed for areas outside the geographic region of the study area, such as the prairie potholes, or are species that are more generalist in nature, such as the muskrat or blackbird. Many of these models could be modified for use in this study. However, the Minnesota Wetland Evaluation Methodology for the North Central United States (Corps of Engineers and Minnesota Environmental Quality Board, 1988) was identified as a source for providing a validated model for quantifying potential habitat benefits. The methodology was developed as means of evaluating and quantifying the functional values of wetlands as part of the regulatory process. As such, the methodology provided components for evaluating flood flow characteristics, water quality, wildlife, fish, shoreline anchoring and visual values. Functional values from each specific component are then utilized to generate synthesis ratings that can be used to develop a "bottom-line" value to compare wetlands in a general way. The intent was to

provide a methodology that allowed the users to make and document a structured decision.

While the entire methodology is not particularly applicable for evaluating habitat projects, the wildlife values component is structured in a manner that can produce an index that is equivalent to a Habitat Suitability Index (HSI) that is produced by more traditional HEP species models. The component is an adaption of procedures developed by Golet (1978) and Adamus (1983) and is well documented. This was the methodology used to primarily quantify the benefits of the proposed project, and the model is presented in attachment 1.

The only drawback of the above model is that it is not sensitive to habitat changes associated with proposed management features of refuge lands surrounding Long Meadow Lake. In particular, restoration of bottomland forest around Long Meadow Lake. The wetland methodology assumes that acceptable land-use around a wetland includes, grassland, pasture, woodlands The black-capped chickadee model (Schroeder 1982) was selected because this species is a common inhabitant of bottomland forests and the model easily tracks successional trends. There are two life requisites for this model: food and reproduction. The food requisite includes tree canopy closure and height of overstory trees as variables. The reproduction requisite considers the presence or absence of snags. The HSI determination is equal to the lowest life requisite value. For this analysis, the reproduction requisite was not considered to be a limiting factor, as old growth forests adjacent to the restoration areas provide suitable reproduction habitat.

## EVALUATION AREA AND PLAN COMPONENTS

The study area encompasses the 2,400-acre Long Meadow Lake management unit of the Minnesota Valley National Wildlife Refuge. Long Meadow Lake, a 1,500-acre wetland complex, comprises the bulk of the management unit, with most of the remaining area being woodlands and grassland. The lake is separated from the Minnesota River by a natural levee, and divided into two basins separated by an abandoned roadway and bridge (Upper Long Meadow Lake and Lower Long Meadow Lake respectively). The grasslands are primarily old agricultural lands that have been allowed to revert. Due to increased periods of high water, open areas immediately adjacent to Long Meadow Lake have reverted almost exclusively to reed canary grass, limiting the natural re-establishment of woodlands in selected areas around the lake.

Upper Long Meadow Lake is connected to the Minnesota River via a natural channel. Depending on river stages water flows in either direction through this channel. The downstream outlet to the lake is located in Lower Long Meadow Lake via an unnamed creek. The Minnesota River Backs up into Long Meadow Lake via this creek during high river stages. Increased runoff from the lake's drainage basin, and an increase in frequency of high river stages during the growing season, has affected the ability of refuge personnel to manage Long Meadow Lake for optimum vegetation composition.

Early studies identified several alternatives for consideration in managing lake levels including: A rock dike across Upper Long Meadow Lake to limit the frequency of inflows at the upper inlet to the lake, a separate outlet for Upper Long Meadow Lake near the Old Cedar Avenue Bridge, rehabilitation of the outlet structure on Lower Long Meadow Lake, and a combination of the above features. Early field evaluations and hydrologic modeling identified that a rock dike in Upper Long Meadow Lake would provide limited benefits at high cost and with extensive impacts associated with construction. Studies also indicated that a separate outlet feature for Upper Long Meadow Lake would not appreciably increase the drawdown elevation in Upper Long Meadow Lake (about .18 feet) or shorten the time necessary to reach desired target lake elevation (<0.5 day). As a result, these features were dropped from further consideration and potential habitat benefits were not quantified for these features.

Two plan components were analyzed in detail for this study: a control structure located on Lower Long Meadow Lake at the site of the current outlet, and restoration of about 45 acres to bottomland forest. Detailed data regarding vegetation composition and distribution is not available. Available aerial photographs from several different years and observational information from refuge personnel regarding long-term changes in habitat conditions that have occurred in the lake provided the basis for existing habitat conditions and expected changes in Long Meadow Lake.

Hydraulic modeling provided the basis for identifying the reduction in inundation during the growing season and is presented in the hydraulic appendix. This information was a basis for some of the assumptions in determining input values for some of the habitat model variables.

## HABITAT SUITABLILITY INDEX AND HABITAT UNIT CALCULATIONS

Model matrixes, Habitat Suitability Indexes (HSI), and Habitat Unit calculations for the two features are presented in Enclosure 2. HSI's were calculated for the existing conditions and for the future without conditions for each feature. Habitat Unit calculations were rounded to the nearest HU.

The assumptions and data sources used to arrive at variable values are listed on the evaluation sheets under the comments section. Other general assumptions use in completing this evaluation were:

1. Habitat benefits associated with changes in vegetation composition and extent in Long Meadow Lake would be realized within 5 years.

2. At least 15 years would be required before any appreciable habitat benefits for bottomland forest species would be realized on the restored acres.

3. The period of analysis for this project is 50 years.

## LOWER LONG MEADOW LAKE CONTROL STRUCTURE

The evaluation area for this feature is the entire 1500-acre Long Meadow Lake wetland complex. The current invert elevation of the culvert at the outlet in Lower Long Meadow Lake is 211.27m. The low water surface elevation for Upper Long Meadow Lake 211.38 and is controlled by the Old Cedar Avenue Bridge and attendant utility crossings at this location. Water from the Minnesota River currently enters the Long Meadow Lake complex at elevation 212m at lower end as water backs up the outlet channel, and at elevation 213m as the river spills into the upper end of Upper Long Meadow Lake. The lake also receives storm water runoff from the extensive urban development on the bluffs immediately to the west. Installation of a new control structure on Lower Long Meadow Lake would reduce the frequency with which the Minnesota River would back up into the lake, and would increase the rate at which storm water surcharge could be discharged from the lake. A more detailed discussion of the hydrodynamic analysis is presented in the Hydraulics Appendix. Setting the invert of the control structure at 210m would also allow for opportunities to better manage water levels in Lower Long Meadow Lake for optimum composition and distribution of aquatic vegetation.

A summary of the potential HSI and Habitat Unit gains for the control structure is presented below.

Table 1. Long Meadow Lake Control Structure – Summary of Habitat Unit Gains

| ALTERNATIVE | AREA INFLUENCED BY FEATURES | HSI | | | | HU'S | INCREMENTAL GAIN |
|---|---|---|---|---|---|---|---|
| | | *TARGET YEAR* | | | | | |
| | | 0 | 5 | 15 | 50 | | |
| **Future Without Conditons** *Refuge builds structure in 15 yrs* | 1500 | 0.8 | 0.79 | 0.78 | 0.96 | 1350 | |
| **New Control Structure** | 1500 | 0.8 | 0.96 | 0.96 | 0.96 | 1426 | 76 |

**EXISTING CONDITONS:** Long Meadow Lake is considered to be a high quality wetland with an HSI of 0.8. The presence of a wetland of this size and diversity in a highly urbanized environment is remarkable. Increased periods of high water levels during the growing season has adversely affected the extent and diversity of aquatic vegetation, and has at times resulted in entire growing seasons where open water conditions prevail.

**FUTURE WITHOUT PROJECT CONDITIONS:** Future conditions within the watershed, and their effect on Long Meadow Lake are difficult to predict. However, it is reasonable to assume that continued changes in the hydrologic conditions would result in at least a 10 percent decrease in overall conditions over the next 50 years if no action were taken. However, given that the management objectives of the Long Meadow Lake Unit include providing a developed trail and public education opportunities, it is unlikely that a structure would never be constructed if it were not constructed at this time. Coordination with refuge personnel indicates that if the control were not constructed at

this time, it would be replaced within the next 10-15 years. The timing of the replacement would be dependent on funding availability. For this analysis, it is assumed that the control structure would be replaced in 15 years. Improvement in habitat conditions would be same as those described below for the Future With Project, only they would be delayed by 15 years.

**FUTURE WITH PROJECT CONDTIONS:** Replacement of the existing control structure would allow for the immediate restoration of favorable hydrologic conditions to the wetland complex during the growing season, primarily by reducing the frequency and duration with which the Minnesota River floods the wetland from the lower end. The control structure would also provide the ability to manipulate water levels, when needed, for optimum aquatic vegetation composition and distribution. Improvement in these conditions is expected to result in an increase of the HSI to .96.

## TREE PLANTINGS

With the various forms of development that has take place in the Long Meadow Lake floodplain, the forest has been fragmented to some degree, and the diversity of tree species has decreased. Since the phase-out of farming on the refuge, many of the areas have reverted to old field dominated by reed canary grass. These areas have little or no regeneration of tree species because of the high-density reed canary grass, and possible over browsing by deer. In those areas where tree seedlings area becoming established, they are primarily monotypical stands of box elder, eastern cottonwood and willow. Re-establishment of woodlands on selected areas would help to reduce habitat fragmentation between some of the larger tracts of woods on Lower Long Meadow Lake and provide a diversity of desired tree species. No attempt was made to quantify the habitat benefits associated with improving overall habitat conditions on existing woodlands as result of increased species diversity or decreased fragmentation. In lieu of detailed field studies for this small feature, potential habitat benefits associated with this feature were calculated only for the acres being restored. The evaluation area with this feature is 45 acres.

A summary of the potential HSI and Habitat Unit gains for the proposed tree plantings is presented below.

Table 2. Long Meadow Lake tree Plantings – Summary of Habitat Unit Gains

| | AREA INFLUENCED BY FEATURES | HSI *TARGET YEAR* 0 | 10 | 25 | 50 | HU'S | INCREMENTAL GAIN |
|---|---|---|---|---|---|---|---|
| **Future Without** *Refuge plants trees within 15 yrs* | 45 | 0 | 0.2 | 0.45 | 0.8 | 19 | |
| **RESTORE 45 AC** | 45 | 0 | 0.45 | 0.75 | 0.97 | 29 | 10 |

**EXISTING CONDITONS:** The fields targeted for tree planting are dominated primarily by reed canary grass and provide no habitat value to woodland bird species.

**FUTURE WITHOUT PROJECT CONDITIONS:** It is assumed that over time, succession would result in the evaluation areas becoming re-established with some woodlands. The overall habitat value would likely be somewhat lower than predicted with tree planting due to the tree species that would likely become established (Green ash, cottonwood and willow). As with the control structure, this analysis assumes that trees would be planted as part of the refuge management plan for the Long Meadow Lake unit within 15 years. Habitat conditions at the end of the 50 year evaluation period would be slightly less (HSI=0.8) than if the trees were planted as part of this project.

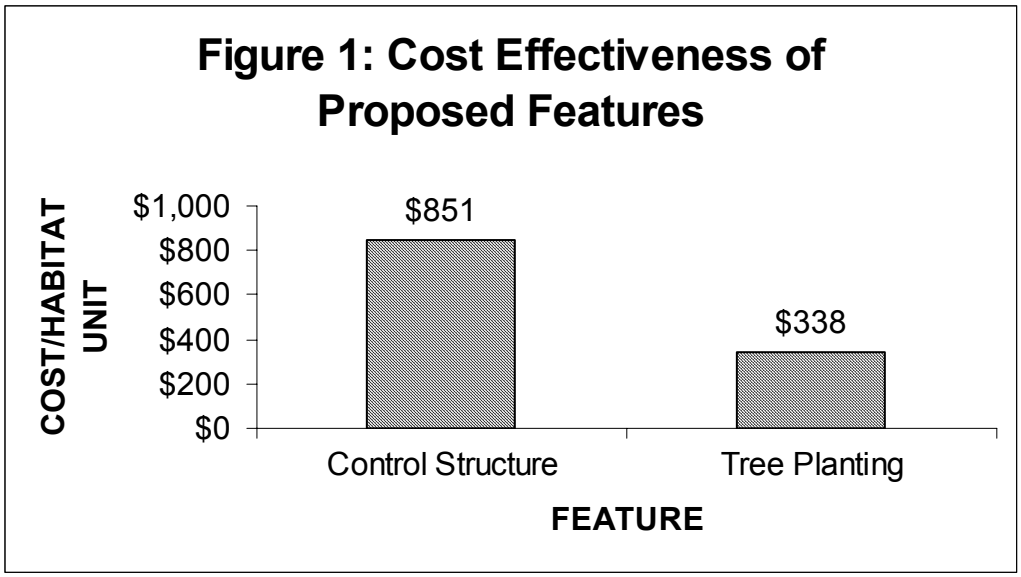
**FUTURE WITH PROJECT CONDTIONS:** Reforestation efforts would likely result in near optimum habitat conditions for the evaluation species with an HSI of .97.

## COST EFFECTIVENESS

Due to the limited number of alternative considered, a detailed incremental analysis is not warranted. While several alternatives to the single control structure on Lower Long Meadow Lake were initially developed, they were eliminated from further consideration early in the planning process either because of the potentially high cost or ineffectiveness in meeting project objectives. As such, cost estimates and a quantification of habitat benefits were completed for only the two features. A comparison of the cost effectiveness of the proposed features is presented in table 3 and figure 1.

Table 3. Average Annual Cost/Habitat Unit for Proposed Features

| PROJECT FEATURE | TOTAL COST | AVERAGE ANNUAL COST | AVERAGE ANNUAL HU | AA COST/HU |
|---|---|---|---|---|
| Control Structure | $1,037,631 | $64,686 | 76 | $851 |
| Tree Planting | $128,379 | $3,382 | 10 | $338 |



Both features appear justified based on the reasonableness of the costs and the importance of the resource being benefited. Long Meadow Lake is an outstanding wetland complex in the midst of a heavily urbanized area. As such, it not only provides important year round bottomland habitat for wildlife, it receives remarkable use by waterfowl and neotropical migrant bird species during migration. The proposed features would provide timely capability to maintain and restore this important habitat in the Minnesota River corridor.

REFERENCES

Adamus, P. 1983. A method for wetland functional assessment, volumes I and II. Fed. Hwy. Ad. Rpt. No. FEWA-IP-82-23.

Corps of Engineers and Minnesota Environmental Quality Board. 1988. The Minnesota wetland evaluation methodology for the North Central United States. Minnesota Environmental Quality Board. 97pp.

Golet, F.C. 1978. Rating the wildlife value of Northeastern fresh water wetland functions and values: the state of our understanding. Greeson, P.E., J.R. Clark (eds). Am. Water Res. Assn., Mpls. Mn.

Schroeder, R.L. 1982. Habitat suitability index models: Black-capped chickadee. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.37 12pp.

ATTACHMENT 1

Wetland Evaluation Model

# A GENERAL WILDLIFE DIVERSITY/PRODUCTIVITY MODEL USED FOR QUANTIFYING WETLAND HABITAT BENEFITS FOR THE LONG MEADOW LAKE HREP PROJECT

There are numerous species models available for evaluating the habitat quality of wetlands. However, available models are either very season specific addressing specific critical habitat needs, such as wintering or migration habitat, are designed more for areas outside the geographic region of the study area, such as prairie potholes or southern floodplain forests, or are species that are more generalist in nature, such as the muskrat, mink or blackbird. While any of these models could potentially be modified for use in this study, it was discovered that a methodology had been developed for evaluating wetlands for the north central United States. The methodology was developed in the late 1980's as means of evaluating and quantifying the functional values of wetlands as part of the regulatory process.

One component of this methodology addresses wildlife values and is an adaption of procedures developed by Golet (1978) and Adamus (1983). This component of the methodology is structured in a manner that can produce an index that would be equivalent to a Habitat Suitability Index (HSI) that is produced by HEP habitat models.

FROM

The Minnesota

# WETLAND EVALUATION METHODOLOGY

# FOR THE

# NORTH CENTRAL UNITED STATES

Prepared by
Corps of Engineers
In Conjunction With
The Minnesota Environmental Quality Board
Wetland Evaluation Methodology Task Force
John R. Wells, Chairman
September 1988

This work was done in response to a request from the
Minnesota Environmental Quality Board
to the
St. Paul District, U.S. Army Corps of Engineers
for planning assistance under Section 22
of the
Water Resources Development Act of 1974 (Public Law 93-251).

# WILDLIFE

## INTRODUCTION

This section describes a step-by-step procedure for measuring the wildlife value of wetlands in the north central region of the United States. It is anticipated that most applications of the method will focus on general wildlife diversity/productivity and that values for any given waterfowl group will be assessed at the option of the user. The procedures for evaluating major waterfowl groups follow in Appendix D.

The general wildlife diversity/productivity section is an adaptation of procedures developed by Golet (1978) while the waterfowl section is based on methods proposed by Adamus (1983). Both the Golet and Adamus procedures had to be modified to make them applicable to the north central region of the country. Descriptions of the modifications made to the Golet and Adamus procedures, including waterfowl, are presented in Appendix C.

## PROCEDURE FOR EVALUATING GENERAL WILDLIFE DIVERSITY AND PRODUCTIVITY

***Step 1: Select Appropriate Region*** - The north central portion of the country has been broken into three ecoregions. Select the appropriate ecoregion for the wetland being evaluated using figures 15a and 15b and the descriptions of the ecoregions given in Appendix C. The maps in figures 15a and 15b should be considered approximate, and greater emphasis should be placed on the ecoregion descriptions. The ecoregions described here are similar to those developed by the U.S. Environmental Protection Agency (EPA) at the Corvallis Environmental Research Laboratory. Information on these ecoregions and how they compare to those in this methodology can also be found in Appendix C.

***Step 2: Rank the Wetland for Each of the Evaluation Criteria*** - Table 8, 9, or 10 should be used to rank the wetland according to the criteria described below. The choice of table is based on the ecoregion identified in step 1. An example of the procedure is given in table 11.

*Wetland Class Richness* - Wetland class richness serves as an indication of the diversity of the wetland and therefore as an indicator of potential wildlife species richness and diversity. The following criteria should be used to determine the minimum size of a wetland class unless there are specific reasons for using different criteria.

a) Prairie Region - Each class should be a minimum of 2 acres in size.

b) Northern and Southern Forest Regions - Each class should be at least 5 acres in size.

Wetlands smaller than the minimum size criteria should be counted as having one class.

*Dominant Wetland Class* - Certain classes of wetlands are more valuable than others because they support a greater diversity of wildlife species. Certain classes may also be more valuable because they are scarce and make important contributions to regional diversity. Wetland classes and subclasses are described in Appendix C.

*Size Category* - The principle used in ranking wetland size is that larger wetlands tend to provide greater wildlife value. The specific size categories used for an ecoregion are intended to provide separation between the wetlands in the ecoregion.

*Subclass Richness* - Similar to wetland class richness, the number of wetland subclasses also provides an indication of potential wildlife diversity. A subclass should be at least one acre or 20 percent of the size of the wetland class (whichever is smaller). Subclass definitions are given in Appendix C.

*Site Type* - The site type criterion is an indicator of water permanence in the wetland. Sites with more permanent water are given higher scores.

*Lacustrine* - Wetlands 20 acres or more in size that have a permanent hydrologic connection with a lake, pond, or flowage ("L" hydrologic modifier on Wisconsin wetland maps).

*Riverine* - Wetlands with permanent hydrologic connection to the primary or secondary channels of rivers or streams ("R" hydrologic modifier on Wisconsin wetland maps).

*Palustrine-Streamside* - Wetlands with an intermittent hydrologic connection to the primary or secondary channel of a river or stream.

*Palustrine-Lakeside* - Wetlands with an intermittent connection to a lake, pond, or flowage.

*Palustrine-Isolated* - Wetlands that are not connected to a lake or river (e.g., prairie pothole wetland).

*Surrounding Habitat* - Wetlands surrounded by habitat that provides cover, feeding, or reproductive value are more valuable to wildlife than wetlands surrounded by land not providing these values (e.g., wetlands with primarily developed shorelines). The ranking categories consider the type, amount, and diversity of the surrounding habitat. For the purposes of this methodology,

surrounding habitat should be considered the area within 200 feet of the wetland's edge.

*Cover Category* - The cover categories provide a measure of the percent and interspersion of open water in the wetland. Categories are illustrated on figure 16.

*Vegetative Interspersion Category* - The interspersion categories are a measure of the amount and variety of edge between vegetation types. Categories are illustrated on figure 17.

*Low Interspersion* - Length and types of edge are at a minimum. The wetland consists of concentric class or subclass zones or a single subclass zone. Subclass zones are large and unbroken.

*Moderate Interspersion* - Edge is moderate in length and diversity. There is some irregularity in the distribution of subclass stands, but class stands remain largely intact.

*High Interspersion* - Edge is abundant and consists of many kinds. Class zones are broken into segments of variable size and shape. Subclass stands are small and scattered.

*Wetland Juxtaposition* - A wetland that is located near other wetlands is generally of higher wildlife value because of the increased area (and possibly diversity) provided by the surrounding wetlands. The hydrologic connection is important in the northern and southern forest regions because wetlands tend to be more widely distributed, and movement corridors (hydrologic connections) become critical. In the prairie grassland region, wetlands are more closely spaced and travel corridors are not as important. What is more important in the prairie region is whether or not the wetland is functioning as a part of a complex of wetlands. In a wetland complex, the wetlands are closely spaced, and each provides a portion of the habitat requirements for species using the complex. The following criteria can be used to determine if the wetland being evaluated is part of a wetland complex.

a) Distance to Surrounding Wetlands - Locate the 5 wetlands closest to the site being evaluated. Measure the shortest distance between the evalu ation site and the third-closest wetland. If this distance is less than 0.5 mile, consider the wetland to be part of a complex (rank = 8 or 12).

b) Complex Diversity - If none of the 5 closest wetlands identified in step (a) are of the same dominant class as the evaluation wetland, then the wetland should be considered critical to the complex (rank = 12).

*Water Chemistry* - Measurement of wetland pH is included for the laurentian mixed forest ecoregion for reasons presented in Appendix C. The ranking categories (pH greater than 7.4, pH 5.5 to 7.4, pH less than 5.5) are the same as those proposed by Golet (1978) and correspond to critical pH values used by Cowardin (1979).

***Step 3: Compute the Value Score*** - The general wildlife diversity/productivity score is the sum of the rank scores for criteria. The score is then normalized using the following equations so that the maximum score for each ecoregion is 100.

Northern Forest Region:
Wetland score x 100/108 (round to closest whole number)

Prairie Grassland Region:
Wetland score x 100/108 (round to closest whole number)

Southern Forest Region:
Wetland score x 100/120 (round to closest whole number)

Figure 15a

# ECOREGION MAP
# WISCONSIN

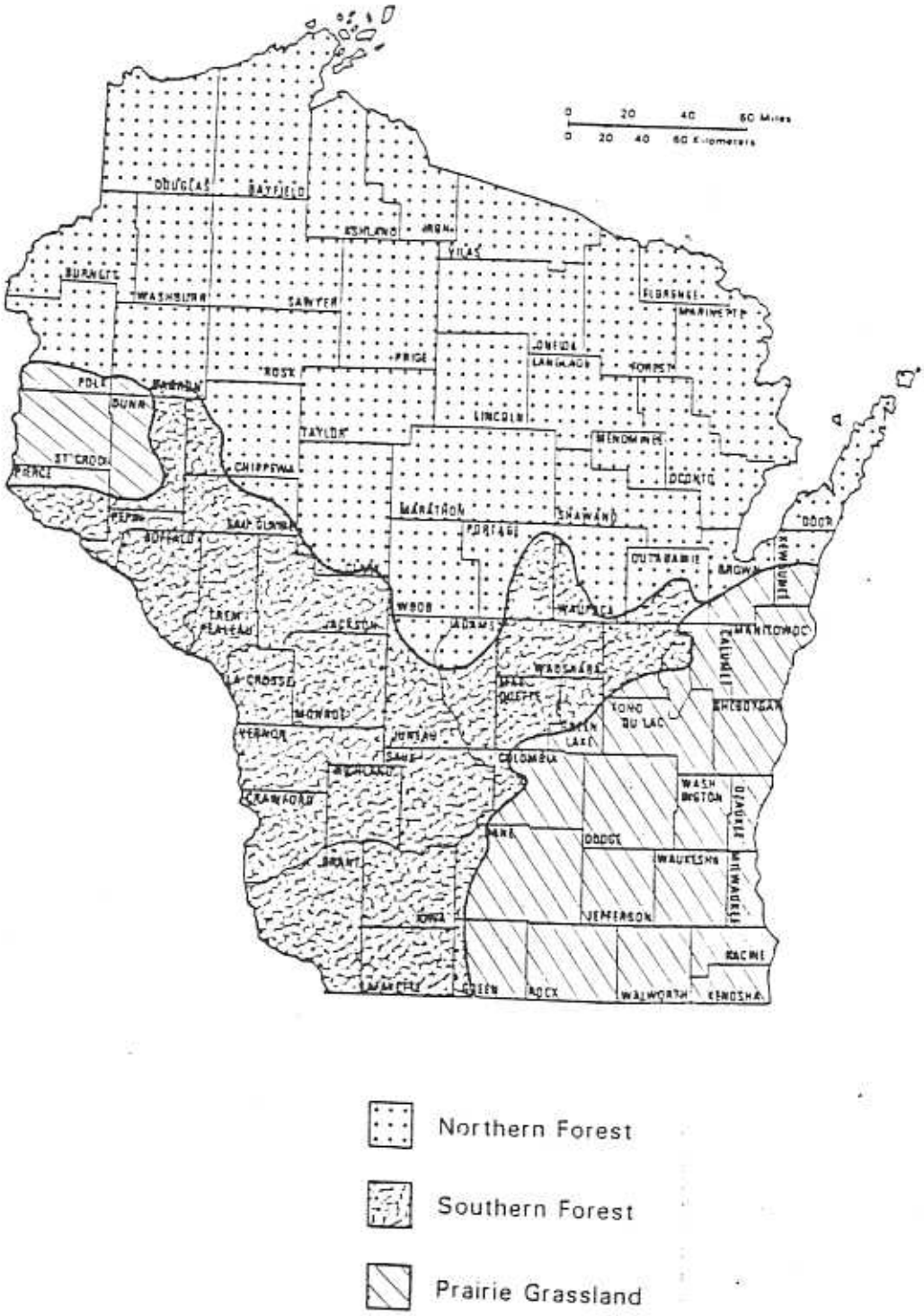
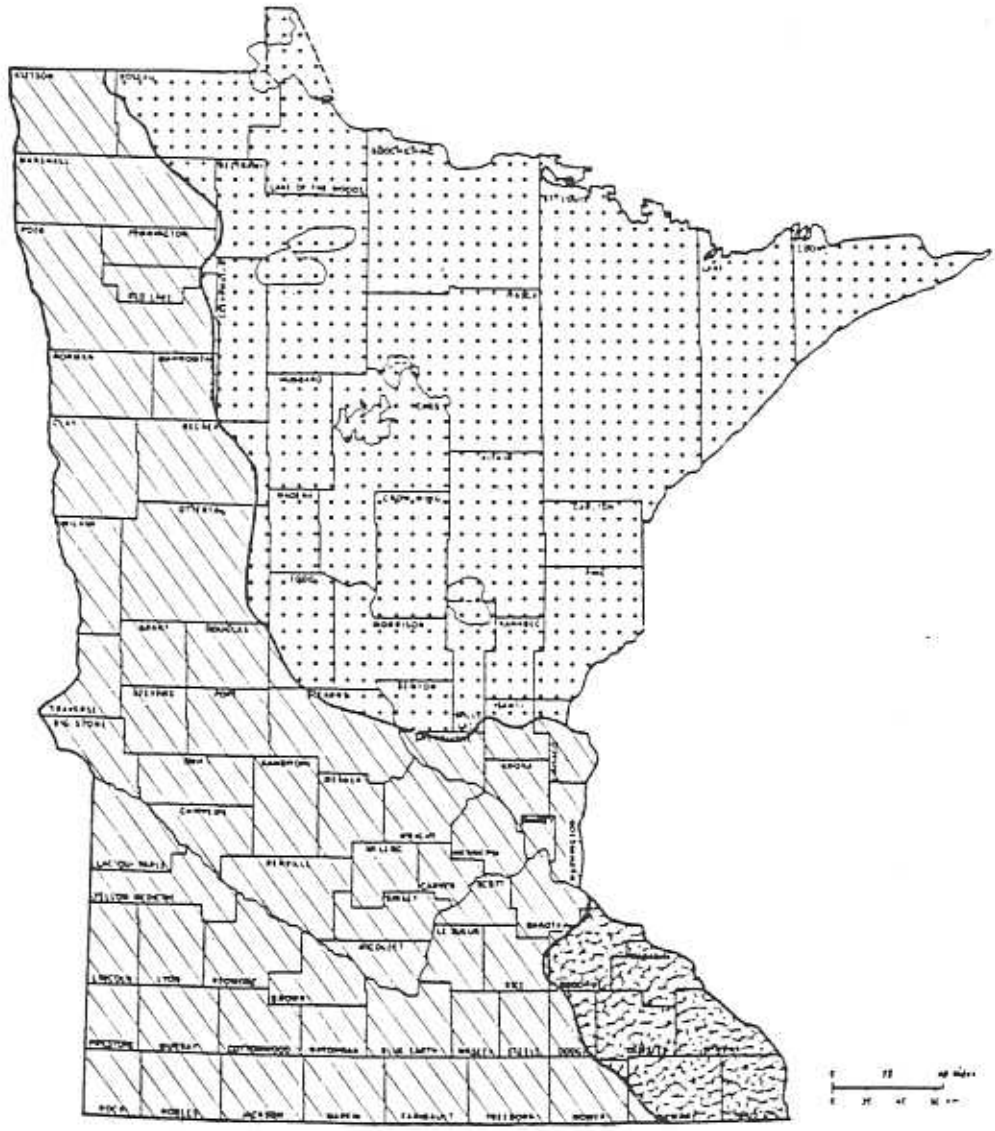


Figure 15b

ECOREGION MAP
MINNESOTA



Northern Forest

Southern Forest

Prairie Grassland

Table 8: General Wildlife Diversity/Productivity – Southern Forest Region.

| Rank | (12) | (10) | (8) | (6) | (4) |
|---|---|---|---|---|---|
| Criteria | Specifications | | | | |
| Wetland Class Richness | 5 or more classes | 4 classes | 3 classes | 2 classes | 1 class |
| Dominant Wetland Class | DM, SM, | WS, SS, | M–ungrazed | OW–veg, M–G | BG<br>OW–no veg |
| Size Category (acres) | over 500 | 100–499+ | 50–99+ | 10–49+ | under 10 |
| Subclass Richness | 10 or more subclasses | 6–9 subclasses | 4–5 subclasses | 2–3 subclasses | 1 subclass |
| Site Type | Lacustrine, Riverine | | Palustrine–streamside, Palustrine–lakeside | | Palustrine–isolated |
| Surrounding Habitat | 10% of surr. habitat is developed and at least 2 of the following habitat types are present:<br>1. forestland<br>2. agricultural land<br>3. pasture or grassland<br>4. shrubland | | 50% of surr. habitat is developed and at least 2 of the following habitat types are present:<br>1. forestland<br>2. agricultural land<br>3. pasture or grassland<br>4. shrubland<br>(or)<br>10% of surr. habitat is developed and one of the above habitat types are present. | | All<br>Other<br>Possibilities |

Table 8: General Wildlife Diversity/Productivity – Southern Forest Region. (cont'd)

| Rank | (12) | (10) | (8) | (6) | (4) |
|---|---|---|---|---|---|
| Criteria | Specifications | | | | |
| Cover Category | Category 5 | Category 4 | Category 3<br>Category 7 | Category 1<br>Category 2<br>Category 6 | Category 8 |
| Vegetative Interspersion Category | Category 3 | | Category 2 | | Category 1 |
| Wetland's Hydrologic Relationship | Permanently connected by streams to other wetlands (diff. dominant class) or open water bodies within 1 mile<br>(or)<br>Permanently connected by streams to other wetlands (same dominant class) within 1/4 mile<br>(or)<br>Wetland greater than 500 acres with 3 or more wetland classes (including DM or SM) | Seasonally connected by streams to other wetlands (diff. dominant class) or open water bodies within 1 mile<br>(or)<br>Seasonally connected by streams to other wetlands (same dominant class) within 1/4 mile | Permanently connected by streams to other wetlands (diff. dominant class) or open water bodies within 1–3 miles<br>(or)<br>Permanently connected by streams to other wetlands (same dominant class) within 1/4 – 1 mile<br>(or)<br>within 1/2 mile of other wetlands (diff. dominant class) or open water bodies but not connected by streams | Seasonally connected by streams to other wetlands (diff. dominant class) within 1–3 miles<br>(or)<br>Seasonally connected by streams to other wetlands (same dominant class) within 1/4 – 1 mile | All<br><br>Other<br><br>Possibilities |

Table 9: General Wildlife Diversity/Productivity – Prairie Grassland Region.

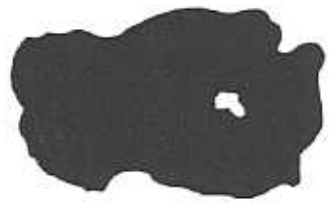
| Rank | (12) | (10) | (8) | (6) | (4) |
|---|---|---|---|---|---|
| Criteria | Specifications | | | | |
| Wetland Class Richness | 3 or more classes | | 2 classes | | 1 class |
| Dominant Wetland Class | DM, SS–D, SM–R | SM–NP | M–ungrazed | OW–vegetated<br>M–grazed | OW–no veg. |
| Size Category (acres) | over 10 | 5–10 | 2–under 5 | 1–under 2 | under 1.0 |
| Subclass Richness | 7 or more subclasses | 5–6 subclasses | 3–4 subclasses | 2 subclasses | 1 subclass |
| Site Type | Lacustrine, Riverine | | Palustrine–streamside, Palustrine–lakeside | | Palustrine–isolated |
| Surrounding Habitat Types (within 200 feet of the wetland's edge) | 1 or more of the following constitute more than 75 percent of surrounding habitat:<br>1. forestland<br>2. shrubland<br>3. grazed grassland<br>4. ungrazed grassland including hay | | 1 or more of the following constitute 25 to 75 percent of surrounding habitat:<br>1. forestland<br>2. shrubland<br>3. grazed grassland<br>4. ungrazed grassland including hay | | All<br>Other<br>Possibilities |
| Cover Category | Category 5 | Category 4 | Category 3<br>Category 7 | Category 1<br>Category 2<br>Category 6 | Category 8 |
| Vegetative Interspersion Category | Category 3 | | Category 2 | | Category 1 |
| Wetlands Hydrologic Relationship | Wetland is the only one in its veg. class within a wetland complex | | Wetland is part of a wetland complex | | Wetland is not a part of a wetland complex |

Table 10: General Wildlife Diversity/Productivity – Northern Forest Region.

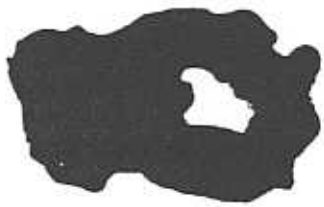
| Rank | (12) | (10) | (8) | (6) | (4) |
|---|---|---|---|---|---|
| Criteria | Specifications | | | | |
| Wetland Class Richness | 5 or more classes | 4 classes | 3 classes | 2 classes | 1 class |
| Dominant Wetland Class | DM, SM, | SS, M–ungrazed | WS, M–grazed | OW–veg | BG, OW–no veg<br>OW–no veg |
| Size Category (acres) | over 500 | 100–499+ | 50–99+ | 10–49+ | under 10 acres |
| Subclass Richness | 10 or more subclasses | 6–9 subclasses | 4–5 subclasses | 2–3 subclasses | 1 subclass |
| Site Type | Lacustrine, Riverine | | Palustrine–streamside, Palustrine–lakeside | | Palustrine–isolated |
| Surrounding Habitat | 10% of surr. habitat is developed and at least 2 of the following habitat types are present:<br>1. forestland<br>2. agricultural land<br>3. pasture or grassland<br>4. shrubland | | 50% of surr. habitat is developed and at least 2 of the following habitat types are present:<br>1. forestland<br>2. agricultural land<br>3. pasture or grassland<br>4. shrubland<br>(or)<br>10% of surr. habitat is developed and one of the above habitat types is present. | | All<br>Other<br>Possibilities |

Table 10: General Wildlife Diversity/Productivity – Northern Forest Region. (cont'd)

| Rank | (12) | (10) | (8) | (6) | (4) |
|---|---|---|---|---|---|
| Criteria | Specifications | | | | |
| Cover Category | Category 5 | Category 4 | Category 3<br>Category 7 | Category 1<br>Category 2<br>Category 6 | Category 8 |
| Vegetative Interspersion Category | Category 3 | | Category 2 | | Category 1 |
| Wetland's Hydrologic Relationship | Permanently connected by streams to other wetlands (diff. dominant class) or open water bodies within 1 mile<br>(or)<br>Permanently connected by streams to other wetlands (same dominant class) within 1/4 mile<br>(or)<br>Wetland greater than 500 acres with 3 or more wetland classes (including DM or SM) | Seasonally connected by streams to other wetlands (diff. dominant class) or open water bodies within 1 mile<br>(or)<br>Seasonally connected by streams to other wetlands (same dominant class) within 1/4 mile | Permanently connected by streams to other wetlands (diff. dominant class) or open water bodies within 1–3 miles<br>(or)<br>Permanently connected by streams to other wetlands (same dominant class) within 1/4 – 1 mile<br>(or)<br>within 1/2 mile of other wetlands (diff. dominant class) or open water bodies but not connected by streams | Seasonally connected by streams to other wetlands (diff. dominant class) within 1–3 miles<br>(or)<br>Seasonally connected by streams to other wetlands (same dominant class) within 1/4 – 1 mile | All<br><br>Other<br><br>Possibilities |
| Water Chemistry | pH greater than 7.4 | | pH 5.5–7.4 | | pH less than 5.5 |



COVER CATEGORY 1



COVER CATEGORY 2

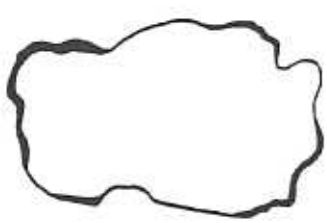
COVER CATEGORY 3

COVER CATEGORY 4

COVER CATEGORY 5

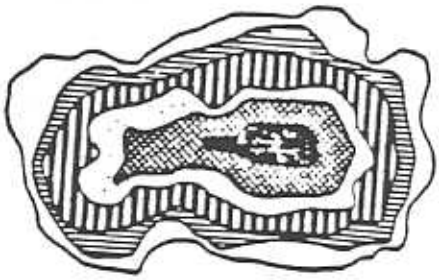
COVER CATEGORY 6

COVER CATEGORY 7



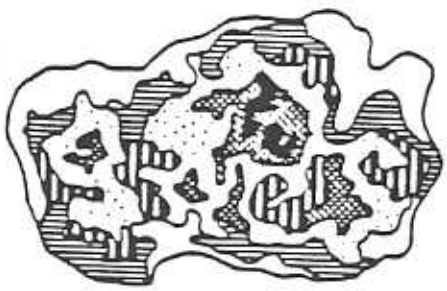
COVER CATEGORY 8

Figure 16. Wetland cover categories: white areas indicate water (with or without surface plants); black area sindicate emergents, shrubs, or trees (from Golet, 1976)



INTERSPERSION CATEGORY 1

INTERSPERSION CATEGORY 2



INTERSPERSION CATEGORY 3

- Deciduous trees
- Tall slender shrubs
- Bushy shrubs
- Tall meadow emergents
- Robust emergents
- Broad-leaved emergents

FIGURE. 17 Examples of the three wetland vegetative interspersion categories (from Golet, 1976).

Table 11. An example illustrating determination of the general wildlife diversity and productivity score for a tall-grass prairie wetland.

| Criterion | Characteristics of the wetland | Rank score |
|---|---|---|
| Class richness | 3 classes | 12 |
| Dominant class | Shallow marsh | 10 |
| Size | 50 acres | 12 |
| Subclass richness | 9 subclasses | 12 |
| Site type | Upland-isolated | 4 |
| Surrounding habitat | 25 percent grassland, 10 percent forest, remainder is agricultural | 8 |
| Cover category | Category 4 | 10 |
| Interspersion category | Category 2 | 8 |
| Juxtaposition | Wetland is a significant part of complex | 12 |
| pH | N/A | |
| | Total | 88 |

General diversity/productivity score: 88 x 100/108 = 81

Wetland Classes and Subclasses

**Open Water (OW)**. This class applies to water 3 to 6 feet deep, associated with any of the other wetland classes, but usually with deep or shallow marshes. Submergent and surface vegetation are dominant.

*(OW-V) Vegetated open water*. Surface vegetation is present. Submergents that reach to within 6 inches of the surface may be present.

*(OW-NV) Nonvegetated open water*. Surface vegetation and near surface submergents are absent.

**Deep Marsh (DM)**. This class applies to wetlands with an average water depth between 6 inches and 3 feet during the growing season. Emergent marsh vegetation is usually dominant, with surface and submergent plants present in open areas.

*(DM-DW) Dead woody deep marsh*. Standing dead trees, dead shrubs or stumps are the most abundant form of cover.

*(DM-P) Persistent emergent deep marsh*. Herbaceous plants that stand above the surface of the water or soil and their plant remains persist into next year's growing season.

*(DM-NP) Nonpersistent emergent deep marsh*. Emergents that fall beneath the water and decompose over winter.

*(DM-A) Aquatic deep marsh*. Surface and/or submergent aquatic vegetation is the dominant form of cover.

***Shallow Marsh (SM)***. This class applies to wetlands dominated usually by persistent emergents with an average water depth less than 6 inches during the growing season. Surface water may be absent during the late summer and abnormally dry periods.

*(SM-P) Persistent emergent shallow marsh*. See (DM-2) for definition of persistent emergent. Classified as shallow marsh since the average water depth is less than 6 inches.

*(SM-NP) Nonpersistent emergent shallow marsh*. See (DM-3) for definition of nonpersistent emergent. Classified as shallow marsh since average water depth is less than 6 inches.

**Meadow (M)**. This class applies to wetlands dominated by meadow emergents with up to 6 inches of surface water during the late fall, winter, and early spring. During the growing season, the soil is saturated and the surface exposed except in shallow depressions and drainage ditches. Meadows occur most commonly on agricultural land where periodic grazing or mowing keeps shrubs from becoming established. The structural differences in meadow vegetation often result from grazing; therefore, meadows have been divided into grazed and ungrazed subclasses.

*(M-UG) Ungrazed meadow*. The effects of grazing are absent. By early summer, most ungrazed meadows support dense, unbroken stands of meadow emergents, and broad-leaved herbs are often present, but rarely dominant.

*(M-G) Grazed meadow*. Cover plants are greatly modified as a result of grazing, and most of the grasses and sedges are selectively removed.

**Shrub Swamp (SS)**. This class applies to wetlands dominated by woody plants less than 20 feet tall. Tussock sedge ( Carex stricta ) is the characteristic ground cover beneath shrubs.

*(SS-D) Deciduous shrub swamp*. Woody plants less than 20 feet tall that drop their leaves in the fall. Includes both needle-leaved and broad-leaved deciduous shrubs.

*(SS-DW) Dead shrub swamp*. Dead shrubs are dominant.

*(SS-E) Evergreen shrub swamp*. Needle-leaved evergreen shrubs that keep their leaves over winter. Broad-leaved evergreen shrubs (heath family) are excluded because they typically grow on peat in bogs and will be addressed in the Bog class.

**Wooded Swamp (WS)**. This class applies to wetlands dominated by woody plants greater than 20 feet tall. Several levels of vegetation are usually present, including trees, shrubs, and herbaceous plants.

*(WS-D) Deciduous wooded swamp*. Deciduous trees are dominant. Includes both needle-leaved and broad-leaved deciduous trees.

*(WS-E) Evergreen wooded swamp*. Evergreen trees with needle-like or scale-like leaves are dominant.

**Bog**. This class applies to wetlands where the accumulation of sphagnum moss, as peat, determines the nature of the plant community. Young bogs commonly have floating peat mats that creep outward from shore over the surface of open water. Black spruce and tamarack are characteristic tree species. A bog is differentiated from a sedge meadow by the presence

of a nearly continuous carpet of sphagnum moss on the groundlayer. The two most important families are the Ericaceae (heath family) and Cyperaceae (cyperaceae) (sedge family). Orchids of many species such as the pitcher plant, sundews, and bladderworts are characteristic of the bog class.

***(BOG-EM) Emergent bog***. Persistent emergents, usually sedges, are dominant.

***(BOG-S) Shrub bog***. Ericaceous (heath) shrubs are the dominant vegetation. Species include leatherleaf, bog Rosemary, bog laurel, and Labrador tea. This subclass also includes non-ericaceous shrubs such as bog birch and bog holly.

***(BOG-F) Forested bog***. Evergreen trees and needle-leaved deciduous trees are dominant, particularly black spruce and tamarack.

**Freshwater Wetland Classes and Subclasses**

| Wetland Class | Wetland Subclasses | Wis. Wetland Inventory Subclass |
|---|---|---|
| Open Water (OW) | (OW-V) Vegetated | (A) Aquatic Bed (A1) (A2) (A3) (A4) |
| | (OW-NV) Nonvegetated | (W) Open Water (W) (W1) (W2) (W3) (W4) |
| Deep Marsh (DM) | (DM-DW) Dead Woody | (T7) (S7) |
| | (DM-P) Persistent emergent | (E1) (E2) |
| | (DM-NP) Nonpersistent emerg. | (E4) (E5) (E6) |
| | (DM-A) Aquatic | (A1) (A2) (A3) (A4) |
| Shallow Marsh (SM) | (SM-P) Persisitent emergent | (E1) (E2) |
| | (SM-NP) Nonpersistent emergent | (E4) (E5) (E6) |
| Meadow (M) | (M-UG) Ungrazed | (E1) (E2) (E3) |
| | (M-G) Grazed | (E1) (E2) (E3), special modifier "g" |
| Shrub Swamp (SS) | (SS-D) Deciduous | (S1) (S2) (S3) |
| | (SS-DW) Dead Woody | (S7) |
| | (SS-E) Evergreen | (S5) (S6) |
| Wooded Swamp (WS) | (WS-D) Deciduous | (T1) (T2) (T3) |
| | (WS-E) Evergreen | (T5) (T8) |
| | (WS-DW) Dead Woody | (T7) |
| Bog | (BOG-EM) Emergent | (E2), special modifier "m" |
| | (BOG-S) Shrub | (S2) (S4) (S5) (S6) (S8) (S9) |
| | (BOG-F) Forested | (T2) (T5) (T8) |

GENERAL WILDLIFE DIVERSITY/PRODUCTIVITY MODEL
SOUTHERN FORESTED REGION-MINNESOTA
(from: Minnesota Wetland Evaluation Methodology - Sep 1988)

| VARIABLE | | VALUE | COMMENTS |
|---|---|---|---|
| **1) Wetland Class Richness** | | | |
| a) 5 or more classes | 12 | | |
| b) 4 classes | 10 | | |
| c) 3 classes | 8 | ENTER | |
| d) 2 classes | 6 | VALUE=_____ | |
| e) 1 class | 4 | | |
| **2) Dominant Wetland Class** | | | |
| a) Deep marsh, Shallow marsh | 12 | | |
| b) Wooded Swamp, Shrub Swamp | 10 | ENTER | |
| c) Meadow - ungrazed | 8 | VALUE=_____ | |
| d) Open water - vegetated, Meadow - grazed | 6 | | |
| e0 Bog, Open Water-no vegetation | 4 | | |
| **3) Size Category** | | | |
| a) Over 500 ac | 12 | | |
| b) 100 - 499+ ac | 10 | ENTER | |
| c) 50 - 99+ ac | 8 | VALUE=_____ | |
| d) 10 - 49+ ac | 6 | | |
| e) Under 10 ac | 4 | | |
| **4) Subclass Richness** | | | |
| a) 10 or more subclasses | 12 | | |
| b) 6 - 9 subclasses | 10 | | |
| c) 4 - 5 subclasses | 8 | ENTER | |
| d) 2 - 3 subclasses | 6 | VALUE=_____ | |
| e) 1 subclass | 4 | | |
| **5) Site Type** | | | |
| a) Lacustrine, Riverine | 12 | ENTER | |
| b) Palustrine-streamside, Palustrine-lakeside | 8 | VALUE=_____ | |
| c) Palustrine-isolated | 4 | | |
| **6) Surrounding Habitat** | | | |
| a) 10% of surrounding habitat is developed & at lea of the following habitat types are present: Forestlar Agricultural Land, Pasture/Grassland, Shrub land | 12 | | |
| b) 50% of surrounding habitat is developed and at l of the following habitat types are present: Forestland, Agricultural Land, Pasture/Grassland, Shrub land **OR** 10% of the surrounding habitat is developed and one of the above habitat types are present. | 8 | ENTER VALUE=_____ | |
| c) > 50% developed with 2 habitat types present or >10% developed with 1 habitat type present | 4 | | |
| **7) Cover Category** | | | |
| a) Category 5 | 12 | | |
| b) Category 4 | 10 | | |
| c) Category 3 or Category 7 | 8 | ENTER | |
| d) Category 1, Category 2 or Category 6 | 6 | VALUE=_____ | |
| e) Category 8 | 4 | | |

| VARIABLE | | VALUE | COMMENTS |
|---|---|---|---|
| **8) Vegetative Interspersion Category** | | | |
| a) Category 3 | 12 | | |
| b) Category 2 | 8 | ENTER | |
| c) Category 1 | 4 | VALUE= | |
| **9) Wetlands Hydrologic Relationship** | | | |
| a) Permanently connected by stream to other wetlands (different dominant class) or open water bodies < 1 mile away **or** Permanently connected by streams to other wetlan (same dominant class) <1/4 mile away **or** Wetland > 500 acres in size with 3 or more wetland classes (including DM or SM). | 12 | | |
| b) Seasonally connected by streams to other wetlands (different dominant class) or open water bodies < 1 mile away **or** Seasonally connected by streams to other wetlands (same dominant class) <1/4 mile away | 10 | ENTER | |
| c) Permanently connected by stream to other wetlands (different dominant class) or open water bodies within 1- 3 miles away **or** Permanently connected by streams to other wetlands (same dominant class) within 1/4 - 1 mile away **or** Within 1/2 mile of other wetlands (different dominant class) or open water body but not connected by streams. | 8 | VALUE= | |
| d) Seasonally connected by streams to other wetlands (different dominant class) or open water bodies within 1 - 3 miles away **or** Seasonally connected by streams to other wetlands (same dominant class) within 1/4 - 1 mile away | 6 | | |
| e) All other possibilities | 4 | | |

TOTAL= 0

MAXIMUM POSSIBLE TOTAL = 108

**HSI** = 0.00

ATTACHMENT 2

Habitat Suitability Index and Habitat Unit Calculations

# EXISTING CONDITIONS - HSI CALULATIONS - LONG MEADOW LAKE

EXISTING CONDITIONS

GENERAL WILDLIFE DIVERSITY/PRODUCTIVITY MODEL
SOUTHERN FORESTED REGION-MINNESOTA
(from: Minnesota Wetland Evaluation Methodology - Sep 1988)

| VARIABLE | | VALUE | | COMMENTS |
|---|---|---|---|---|
| **1) Wetland Class Richness** | | | | |
| a) 5 or more classes | 12 | | | 5 classes present: Deep Marsh, Shallow Marsh, Open Water, Shrub and Meadow |
| b) 4 classes | 10 | | | |
| c) 3 classes | 8 | ENTER | | |
| d) 2 classes | 6 | VALUE= | 12 | |
| e) 1 class | 4 | | | |
| **2) Dominant Wetland Class** | | | | |
| a) Deep marsh, Shallow marsh | 12 | | | The dominant wetland class varies dependent on the water conditions that occure in any given year. Under historic hydrologic conditions, LM Lake was predominately a mix sof Shallow Marsh and Deep marsh. It now varies between this condition and Open Water. The latter condition is more common - especially in Lower LM Lake. |
| b) Wooded Swamp, Shrub Swamp | 10 | ENTER | | |
| c) Meadow - ungrazed | 8 | VALUE= | 7 | |
| d) Open water - vegetated, Meadow - grazed | 6 | | | |
| e0 Bog, Open Water-no vegetation | 4 | | | |
| **3) Size Category** | | | | |
| a) Over 500 ac | 12 | | | |
| b) 100 - 499+ ac | 10 | ENTER | | LM Lake is approximately 1500 ac. |
| c) 50 - 99+ ac | 8 | VALUE= | 12 | |
| d) 10 - 49+ ac | 6 | | | |
| e) Under 10 ac | 4 | | | |
| **4) Subclass Richness** | | | | |
| a) 10 or more subclasses | 12 | | | Under historic conditions, it is likely that at least 8 subclasses were consistently present. Increased frequency of flooding has reduced this to between 3 - 5 on a regular basis. |
| b) 6 - 9 subclasses | 10 | | | |
| c) 4 - 5 subclasses | 8 | ENTER | | |
| d) 2 - 3 subclasses | 6 | VALUE= | 7 | |
| e) 1 subclass | 4 | | | |
| **5) Site Type** | | | | |
| a) Lacustrine, Riverine | 12 | ENTER | | |
| b) Palustrine-streamside, Palustrine-lakeside | 8 | VALUE= | 12 | |
| c) Palustrine-isolated | 4 | | | |
| **6) Surrounding Habitat** | | | | |
| a) 10% of surrounding habitat is developed & at least of the following habitat types are present: Forestland, Agricultural Land, Pasture/Grassland, Shrub land | 12 | | | |
| b) 50% of surrounding habitat is developed and at lea of the following habitat types are present: Forestland, Agricultural Land, Pasture/Grassland, Shrub land **OR** 10% of the surrounding habitat is developed and one of the above habitat types are present. | 8 | ENTER VALUE= | 12 | |
| c) > 50% developed with 2 habitat types present or >10% developed with 1 habitat type present | 4 | | | |
| **7) Cover Category** | | | | |
| a) Category 5 | 12 | | | Ranges from Category 5 to Category 6 - Dependent on hydrologic conditions in any given year - the latter is the predominately more common situation. |
| b) Category 4 | 10 | | | |
| c) Category 3 or Category 7 | 8 | ENTER | | |
| d) Category 1, Category 2 or Category 6 | 6 | VALUE= | 7 | |
| e) Category 8 | 4 | | | |

| VARIABLE | | VALUE | | COMMENTS |
|---|---|---|---|---|
| **8) Vegetative Interspersion Category** | | | | |
| | | | | Varies - dependent on Hydrologic conditions |
| a) Category 3 | 12 | | | Increased Water fluctuations and frequency of flooding |
| b) Category 2 | 8 | ENTER | | results in conditions similar primarily to category 1 in most |
| c) Category 1 | 4 | VALUE= | 5 | years |
| **9) Wetlands Hydrologic Relationship** | | | | |
| a) Permanently connected by stream to other wetlands (different dominant class) or open water bodies < 1 mile away **or** Permanently connected by streams to other wetlands (same dominant class) <1/4 mile away **or** Wetland > 500 acres in size with 3 or more wetland classes (including DM or SM). | 12 | | | |
| b) Seasonally connected by streams to other wetlands (different dominant class) or open water bodies < 1 mile away **or** Seasonally connected by streams to other wetlands (same dominant class) <1/4 mile away | 10 | ENTER | | |
| c) Permanently connected by stream to other wetlands (different dominant class) or open water bodies within 1- 3 miles away **or** Permanently connected by streams to other wetlands (same dominant class) within 1/4 - 1 mile away **or** Within 1/2 mile of other wetlands (different dominant class) or open water body but not connected by streams. | 8 | VALUE= | 12 | |
| d) Seasonally connected by streams to other wetlands (different dominant class) or open water bodies within 1 - 3 miles away **or** Seasonally connected by streams to other wetlands (same dominant class) within 1/4 - 1 mile away | 6 | | | |
| e) All other possibilities | 4 | | | |



| | |
|---|---|
| TOTAL= | 86 |
| MAXIMUM POSSIBLE TOTAL = | 108 |
| **HSI =** | 0.80 |

# WITH PROJECT CONDITIONS – HSI CALCULATIONS – LM LAKE

WITH PROJECT CONDTIONS

GENERAL WILDLIFE DIVERSITY/PRODUCTIVITY MODEL
SOUTHERN FORESTED REGION-MINNESOTA
(from: Minnesota Wetland Evaluation Methodology - Sep 1988)

| VARIABLE | | VALUE | | COMMENTS |
|---|---|---|---|---|
| **1) Wetland Class Richness** | | | | |
| a) 5 or more classes | 12 | | | 5 classes present: Deep Marsh, Shallow Marsh, Open Water, Shrub and Meadow |
| b) 4 classes | 10 | | | |
| c) 3 classes | 8 | ENTER | | |
| d) 2 classes | 6 | VALUE= | 12 | |
| e) 1 class | 4 | | | |
| **2) Dominant Wetland Class** | | | | |
| a) Deep marsh, Shallow marsh | 12 | | | Improved water control capabililty would provide ability to maintain Deep Marsh -Shallow Marsh conditions/ |
| b) Wooded Swamp, Shrub Swamp | 10 | ENTER | | |
| c) Meadow - ungrazed | 8 | VALUE= | 12 | |
| d) Open water - vegetated, Meadow - grazed | 6 | | | |
| e0 Bog, Open Water-no vegetation | 4 | | | |
| **3) Size Category** | | | | |
| a) Over 500 ac | 12 | | | |
| b) 100 - 499+ ac | 10 | ENTER | | LM Lake is approximately 1500 ac. |
| c) 50 - 99+ ac | 8 | VALUE= | 12 | |
| d) 10 - 49+ ac | 6 | | | |
| e) Under 10 ac | 4 | | | |
| **4) Subclass Richness** | | | | |
| a) 10 or more subclasses | 12 | | | Assume water control capabilites would maintain consistent presence of 8 subclasses |
| b) 6 - 9 subclasses | 10 | | | |
| c) 4 - 5 subclasses | 8 | ENTER | | |
| d) 2 - 3 subclasses | 6 | VALUE= | 10 | |
| e) 1 subclass | 4 | | | |
| **5) Site Type** | | | | |
| a) Lacustrine, Riverine | 12 | ENTER | | Same as Existing Conditions |
| b) Palustrine-streamside, Palustrine-lakeside | 8 | VALUE= | 12 | |
| c) Palustrine-isolated | 4 | | | |
| **6) Surrounding Habitat** | | | | |
| a) 10% of surrounding habitat is developed & at least of the following habitat types are present: Forestland, Agricultural Land, Pasture/Grassland, Shrub land | 12 | | | Same as Existing Conditions |
| b) 50% of surrounding habitat is developed and at lea of the following habitat types are present: Forestland, Agricultural Land, Pasture/Grassland, Shrub land **OR** 10% of the surrounding habitat is developed and one of the above habitat types are present. | 8 | ENTER VALUE= | 12 | |
| c) > 50% developed with 2 habitat types present or >10% developed with 1 habitat type present | 4 | | | |
| **7) Cover Category** | | | | |
| a) Category 5 | 12 | | | Assume that Category 5 will be the dominant cover condition with improved water control |
| b) Category 4 | 10 | | | |
| c) Category 3 or Category 7 | 8 | ENTER | | |
| d) Category 1, Category 2 or Category 6 | 6 | VALUE= | 12 | |
| e) Category 8 | 4 | | | |

| VARIABLE | | VALUE | | COMMENTS |
|---|---|---|---|---|
| **8) Vegetative Interspersion Category** | | | | |
| a) Category 3 | 12 | | | Assume a condtion betweeen categories 2&3 would be maintained with improved water control capability |
| b) Category 2 | 8 | ENTER | | |
| c) Category 1 | 4 | VALUE= | 10 | |
| **9) Wetlands Hydrologic Relationship** | | | | |
| a) Permanently connected by stream to other wetlands (different dominant class) or open water bodies < 1 mile away **or** Permanently connected by streams to other wetlands (same dominant class) <1/4 mile away **or** Wetland > 500 acres in size with 3 or more wetland classes (including DM or SM). | 12 | | | Same as Existing Conditions |
| b) Seasonally connected by streams to other wetlands (different dominant class) or open water bodies < 1 mile away **or** Seasonally connected by streams to other wetlands (same dominant class) <1/4 mile away | 10 | ENTER | | |
| c) Permanently connected by stream to other wetlands (different dominant class) or open water bodies within 1- 3 miles away **or** Permanently connected by streams to other wetlands (same dominant class) within 1/4 - 1 mile away **or** Within 1/2 mile of other wetlands (different dominant class) or open water body but not connected by streams. | 8 | VALUE= | 12 | |
| d) Seasonally connected by streams to other wetlands (different dominant class) or open water bodies within 1 - 3 miles away **or** Seasonally connected by streams to other wetlands (same dominant class) within 1/4 - 1 mile away | 6 | | | |
| e) All other possibilities | 4 | | | |
| | | TOTAL= | 104 | |
| | | MAXIMUM POSSIBLE TOTAL = | 108 | |
| | | **HSI =** | 0.96 | |

**HABITAT UNIT CALCULATION - Long Meadow Lake Control Structure - No Action ( Refuge Builds Project in 15 years)**

| HABITAT UNIT CALCULATION COMPONENTS | | Existing Conditions | | Future With Project - Year 1 | | Future With Project - Year 15 | | Future With Project - Year 20 | | Future With Project - Year 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Description | DATA | HSI | DATA | HSI | DATA | HSI | DATA | HSI | DATA | HSI | |
| | **HSI** | | 0.80 | | 0.80 | | 0.78 | | 0.96 | | 0.96 | |
| | **Acreage** | | 1500.0 | | 1500.0 | | 1500.0 | | 1500.0 | | 1500.0 | |
| | **Year** | | 0.0 | | 1.0 | | 15.0 | | 20.0 | | 50.0 | |
| | **Average Annual Habitat Units (AAHU)** | | 1200.0 | | 16590.0 | | 6525.0 | | 43200.0 | | **Total** | **67515.0** |
| | | | | | | | | | | | **AAHU** | **1350** |

**HABITAT UNIT CALCULATIONS - Long Meadow Lake Control Structure - With Project**

| HABITAT UNIT CALCULATION COMPONENTS | | Existing Conditions | | Future With Project - Year 1 | | Future With Project - Year 5 | | Future With Project - Year 25 | | Future With Project - Year 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Description | DATA | HSI | | HSI | | HSI | | HSI | | HSI | |
| | **HSI** | | 0.80 | | 0.80 | | 0.96 | | 0.96 | | 0.96 | |
| | **Acres** | | 1500.0 | | 1500.0 | | 1500.0 | | 1500.0 | | 1500.0 | |
| | **Target Year** | | 0.0 | | 1.0 | | 5.0 | | 25.0 | | 50.0 | |
| | **Average Annual Habitat Units (AAHU)** | | 1200.0 | | 5280.0 | | 28800.0 | | 36000.0 | | **Total** | **71280.0** |
| | | | | | | | | | | | **AAHU** | **1426** |

**HSI/HABITAT UNIT CALCULATIONS FOR BLACK-CAPPED CHICKADEE**: Due to adjacent cover, reproduction habitat is assumed not to be a limiting factor. HU values for restored woodlands is based on calculation of habitat component for food.

***Long Meadow Lake Tree Plantings - Existing Conditions (Assumes Refuge Plants Trees in year 15)***

| EXISTING HSI BLACK-CAPPED CHICKADEE MODEL - FOOD | | Existing Conditions | | Future Without Project - Year 1 | | Future Without Project - Year 15 | | Future Without Project - Year 25 | | Future Without Project - Year 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Description | DATA | HSI | DATA | HSI | DATA | HSI | DATA | HSI | DATA | HSI | |
| V1 | Percent tree canopy closure. | 0 percent | 0 | 0 percent | 0 | <10 percent | 0.1 | 25 percent | 0.4 | 45-50 percent | 0.8 | |
| V2 | Average height of overstory trees | 0 feet | 0 | 0 feet | 0 | 15 feet | 0.4 | 20 feet | 0.5 | 35-40 feet | 0.8 | |
| | **HSI for Food** | | 0.00 | | 0.00 | | 0.20 | | 0.45 | | 0.80 | |
| | **HSI for Reproduction** (Assumed not limiting) | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| | **Overall HSI (lowest HSI for Food/Repropduction)** | | 0.00 | | 0.00 | | 0.20 | | 0.45 | | 0.80 | |
| | Acreage | | 45.0 | | 45.0 | | 45.0 | | 45.0 | | 45.0 | |
| | Year | | 0.0 | | 1.0 | | 10.0 | | 25.0 | | 50.0 | |
| | Average Annual Habitat Units (AAHU) | | 0.0 | | 40.5 | | 218.4 | | 701.6 | | **Total** | **960.5** |
| | | | | | | | | | | | **AAHU** | **19** |

***Long Meadow Lake Tree Plantings - With Project***

| WITH PROJECT HSI BLACK-CAPPED CHICKADEE MODEL - FOOD | | Existing Conditions | | Future With Project - Year 1 | | Future With Project - Year 10 | | Future With Project - Year 25 | | Future With Project - Year 50 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Description | DATA | HSI | DATA | HSI | DATA | HSI | DATA | HSI | DATA | HSI | |
| V1 | Percent tree canopy closure. | 0 percent | 0 | 0 percent | 0 | 25 percent | 0.4 | 35-45 percent | 0.7 | 50-75 percent | 0.95 | |
| V2 | Average height of overstory trees | 0 feet | 0 | 0 feet | 0 | 20 feet | 0.5 | 35 feet | 0.8 | 40-50 feet | 1 | |
| | **HSI for Cover** | | 0.00 | | 0.00 | | 0.45 | | 0.75 | | 0.97 | |
| | **HSI for Reproduction** (Assumed not limiting) | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| | **Overall HSI (lowest HSI for Cover/Water)** | | 0.00 | | 0.00 | | 0.45 | | 0.75 | | 0.97 | |
| | Acreage | | 45.0 | | 45.0 | | 45.0 | | 45.0 | | 45.0 | |
| | Year | | 0.0 | | 1.0 | | 10.0 | | 25.0 | | 50.0 | |
| | Average Annual Habitat Units (AAHU) | | 0.0 | | 90.6 | | 403.5 | | 969.2 | | **Total** | **1463.3** |
| | | | | | | | | | | | **AAHU** | **29** |

# Hydraulics Appendix

## Attachment 5

## 1.0 GENERAL

This Appendix summarizes the hyrodynamic analyses completed for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project (HREP). Unless otherwise specified, vertical elevations are provided in NGVD 1929.

This project is located on the left bank of the Minnesota River between river miles 5.0 and 10.00. The lake is separated from the river by a natural levee generally a few hundred feet wide. The lake is divided into two basins separated by an abandoned roadway and bridge (Old Cedar Avenue). The basin profile is shown in Figure 1.1. The two basins are called Upper and Lower Long Meadow Lake. During low river stages, shallow channels passing under the Old Cedar Avenue Bridge connect the two basins. During high river stages, the two basins function as one.

During a "normal" hydrologic season, Long Meadow Lake will rise in elevation during the spring runoff period. This rise will usually be caused by snowmelt and precipitation runoff and/or high water on the Minnesota River backing up into the lake via the inlets/outlets noted above. Once the spring high water recedes, the water surface elevation of Long Meadow Lake declines during the summer due to outlet discharges and evapotranspiration. Groundwater inflows and runoff from the lake's drainage basin maintain the lake during the summer period.

Over time, the number of bankfull floods occurring each year has increased due to landuse changes in the watershed. This results in more frequent inflows of turbid water into floodplain lakes such as Long Meadow. This can be problematic, especially when the inundation occurs during the growing season.

The two major objectives of the proposed project are: (1) Reduce the inundation of Long Meadow Lake during the growing season (May1 - September 30); (2) Improve water surface elevation control. Four alternatives were considered to address the project goals. These alternatives will be discussed in the following sections.

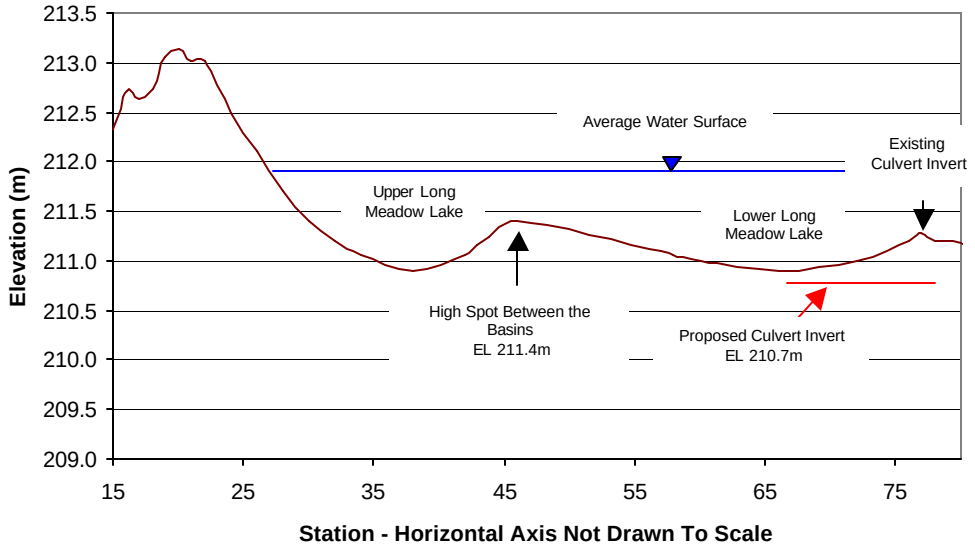



Figure 1.1 Long Meadow Lake Basin Profile.

## 2.0 Project Alternatives

### *A. Do Nothing*

Figure 2.1 shows that the frequency of inundation has increased at Long Meadow Lake. Inundation during the growing season has been particularly detrimental to the lake's water quality and surrounding habitat. This evidence, along with watershed and water quality degradations on the Minnesota River, suggests that without intervention the lake's ecosystem will continue to degrade.

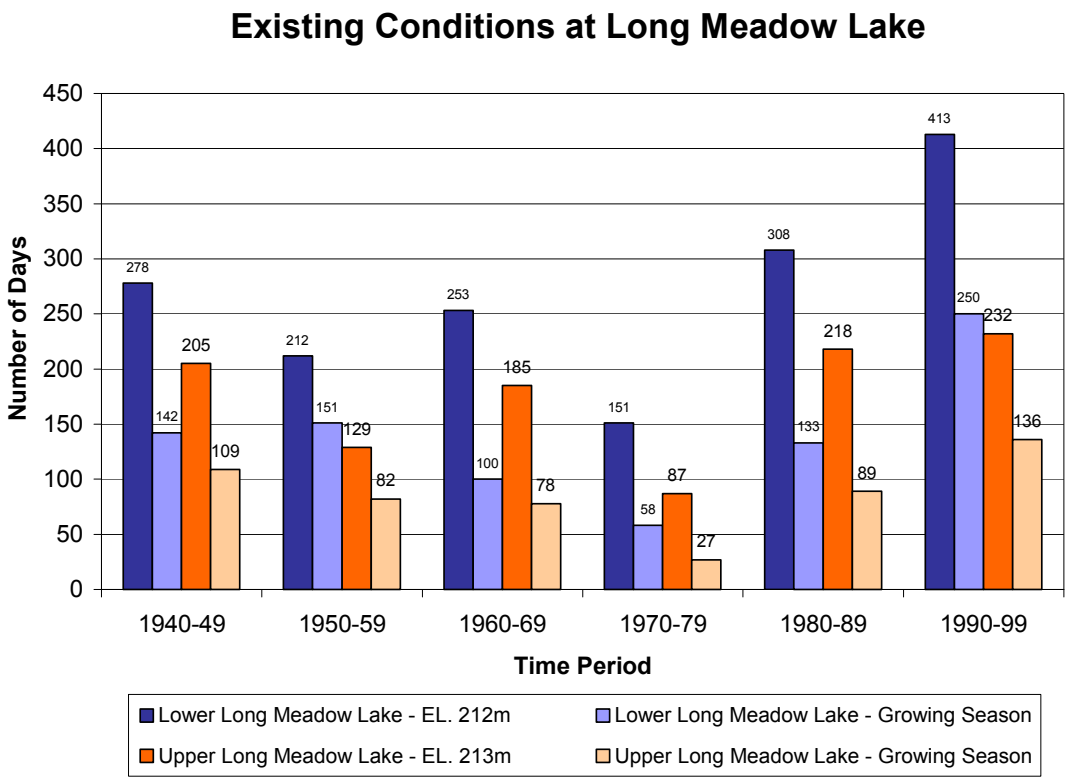



Figure 2.1 Number of days per decade and per decade growing season that Long Meadow Lake is inundated by water from the Minnesota River.

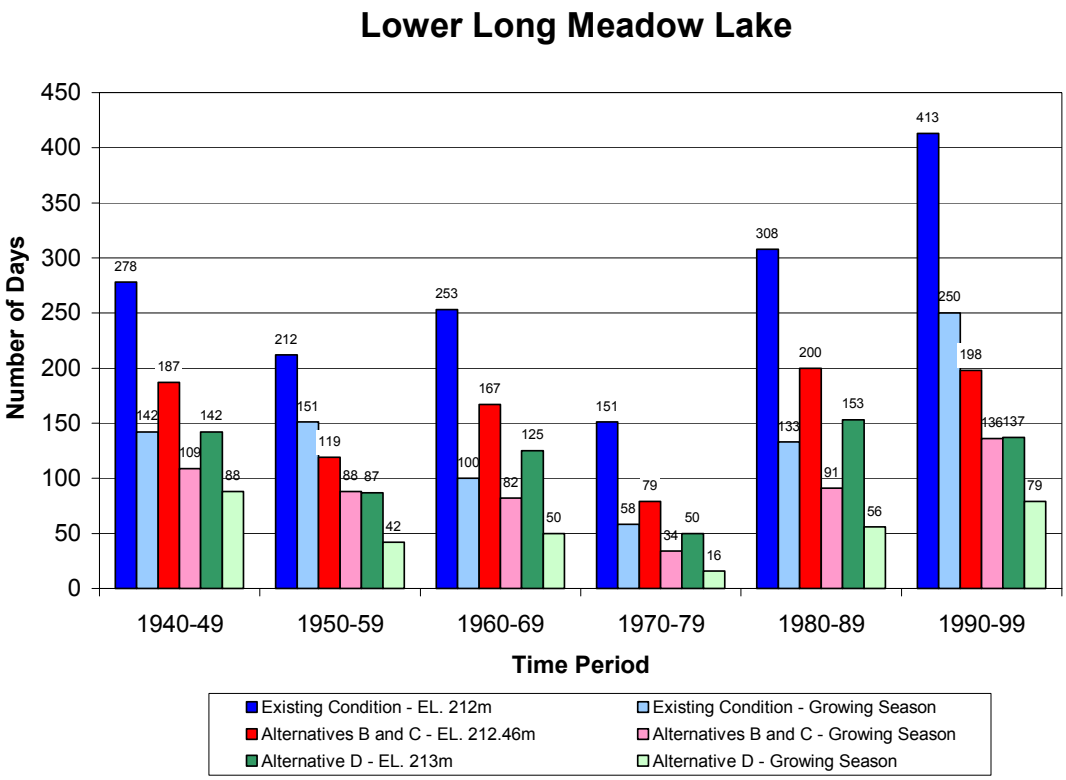



Figure 2.2 Number of days per decade and per decade growing season that Lower Long Meadow Lake
is inundated by water from the Minnesota River.

## *B. One Gated Structure at Lower Long Meadow Lake*

**Gated Structure at Lower Long Meadow Lake**

A 1.5m diameter corrugated metal culvert with a mitered entrance is the structure under consideration. The expected discharges for this design are provided in Table 1. This structure would replace the culvert currently located on the Lower Long Meadow Lake inlet/outlet channel. The existing structure can drawdown Lower Long Meadow Lake and Upper Long Meadow Lake to elevations of 211.37m and 211.38m respectively. The new structure will provide drainage to an elevation of 210m for Lower Long Meadow Lake and 211.38m for Upper Long Meadow Lake. Drawdown time, to an elevation of 211.38m, is also provided in Table 1.

**Table 1: 1.5m Corrugated Metal Culvert**

| Starting WSEL (m) | Ending WSEL (m) | Layer Volume ($m^3$) | Culvert Invert EL (m) | Culvert Discharge ($m^3/s$) | Drawdown Period (days) |
|---|---|---|---|---|---|
| 211.53 | 211.38 | 361410 | 210.00 | 3.5 | 1.2 |
| 211.84 | 211.38 | 1360530 | 210.00 | 4.2 | 3.7 |
| 212.14 | 211.38 | 2479298 | 210.00 | 4.8 | 6.0 |

| | | | | | |
|---|---|---|---|---|---|
| 212.45 | 211.38 | 3716481 | 210.00 | 5.4 | 8.0 |
| 212.75 | 211.38 | 5067143 | 210.00 | 5.9 | 10.0 |

In addition to the drainage, a gated structure will decrease the frequency of inflows to Long Meadow Lake. Currently, water enters Lower Long Meadow Lake at 212m. After the project, water will not enter the lower basin until 212.46m. This will result in a 30-50% reduction in the annual number of days water from the Minnesota River could enter Long Meadow Lake from the lower end (which corresponds to a 20-45% reduction during the growing season). These reductions are presented in figure 2.2 as Alternative B.

**Two Bay Stop Log Structure at Lower Long Meadow Lake**
This analysis is similar to the culvert analysis. The reduction in inundation, layout, and invert will be the same as the gated culvert. The only change will be the drainage time. A stop log structure consisting of two 5ft bays (an example is shown in Attachment 5) will convey water through the channel more efficiently. The drainage times for a 1.5year event are given in Table 1-a.

**Table 1-a: Two Bay Stop Log Structure**

| Starting WSEL (m) | Ending WSEL (m) | Layer Volume ($m^3$) | Culvert Invert EL (m) | Culvert Discharge ($m^3/s$) | Drawdown Period (days) |
|---|---|---|---|---|---|
| 211.53 | 211.38 | 361410 | 210.00 | 5 | 0.8 |
| 211.84 | 211.38 | 1360530 | 210.00 | 6.5 | 2.4 |
| 212.14 | 211.38 | 2479298 | 210.00 | 7.3 | 3.9 |
| 212.45 | 211.38 | 3716481 | 210.00 | 8.5 | 5.1 |
| 212.75 | 211.38 | 5067143 | 210.00 | 9.5 | 6.2 |

Benefits:
- 20-45% reduction in the number of days water from the Minnesota River could enter Lower Long Meadow Lake from the lower end during the growing season.
- Provide drainage for both basins.

Limitations:
- Upper Long Meadow Lake cannot be drawn below 211.38m.
- Drawdown may take too long.
- 20-45% reduction during the growing season may not be enough to curb the degradation.

***C. Gated Structures in Lower Long Meadow Lake and Upper Long Meadow Lake***
The structures considered for Upper and Lower Long Meadow Lake are 1.2m diameter corrugated metal culverts with mitered entrances. The expected discharges for each culvert are provided in Tables 2 and 3. These structures will provide drainage to an elevation of 210m for Lower Long Meadow Lake and 211.2m for Upper Long Meadow Lake. Location for the Lower Long Meadow Lake structure is the same as previously discussed. The structure in the upper basin will be located at

the narrowest width in the natural levee. To allow drainage to 211.2m, a channel will have to be dredged into Upper Long Meadow Lake. The time required for the structures to drain the lake to an elevation of 211.38m is provided in Table 4.

**Table 2. Lower Long Meadow Lake - 1.2m Corrugated Metal Culvert**

| Starting WSEL (m) | Ending WSEL (m) | Culvert Invert EL (m) | Culvert Discharge ($m^3/s$) |
|---|---|---|---|
| 211.53 | 211.38 | 210.00 | 2.55 |
| 211.84 | 211.38 | 210.00 | 2.83 |
| 212.14 | 211.38 | 210.00 | 3.26 |
| 212.45 | 211.38 | 210.00 | 3.68 |
| 212.75 | 211.38 | 210.00 | 3.96 |

**Table 3. Upper Long Meadow Lake - 1.2m Corrugated Metal Culvert**

| Starting WSEL (m) | Ending WSEL (m) | Culvert Invert EL (m) | Culvert Discharge ($m^3/s$) |
|---|---|---|---|
| 211.53 | 211.38 | 211.23 | 0.14 |
| 211.84 | 211.38 | 211.23 | 0.57 |
| 212.14 | 211.38 | 211.23 | 0.85 |
| 212.45 | 211.38 | 211.23 | 1.27 |
| 212.75 | 211.38 | 211.23 | 2.55 |

**Table 4. Drain Time for Two 1.2m Corrugated Metal Culverts**

| Starting WSEL (m) | Ending WSEL (m) | Layer Volume ($m^3$) | Culvert Discharge ($m^3/s$) | Drawdown Period (days) |
|---|---|---|---|---|
| 211.53 | 211.38 | 361410 | 2.69 | 1.6 |
| 211.84 | 211.38 | 1360530 | 3.40 | 4.6 |
| 212.14 | 211.38 | 2479298 | 4.11 | 7.0 |
| 212.45 | 211.38 | 3716481 | 4.95 | 8.7 |
| 212.75 | 211.38 | 5067143 | 6.51 | 9.0 |

Benefits:

- 20-45% reduction in the number of days water from the Minnesota River could enter Lower Long Meadow Lake from the lower end during the growing season.
- Increased drainage capability for Upper Long Meadow Lake.
- Less drainage time then 1 culvert

Limitations:

- Drawdown capability for the upper basin only increases by 0.18m (See Attachment 1)

- Placement of culvert in the upper basin will be costly

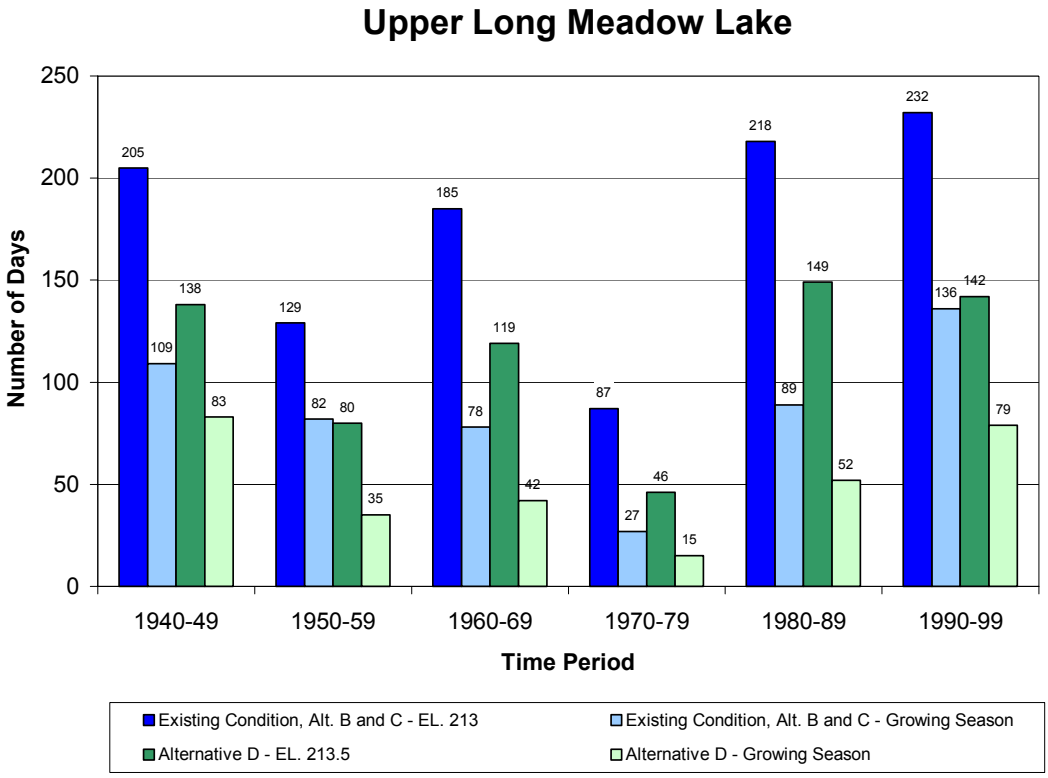



Figure 2.3 Number of days per decade and per decade growing season that Upper Long Meadow Lake
is inundated by water from the Minnesota River.

***D. Dike across the marsh leading into Upper Long Meadow Lake and a road raise at the lower end.***

A 0.5m rock dike in the upper basin will raise the inundation stage at Upper Long Meadow Lake to 213.5m. This will provide a 31-47% reduction in the annual number of days water from the Minnesota River can enter Long Meadow Lake through the upper basin (which corresponds to a 24-57% reduction during the growing season). This information is provided in figure 2.3 as Alternative D.

In addition to the dike, the access road elevation (in the lower basin) would be increased to 213m so water will overtop the rock dike first. This increase will raise the inundating stage at Lower Long Meadow Lake and provide a 50-68% reduction in the annual number of days water from the Minnesota River can enter Lower Long Meadow Lake (which corresponds to a 38-72% reduction during the growing season). This is shown in figure 2.2 as Alternative D. The layout and design are given in Attachments 2, 3, and 4.

Benefits:

- 38-72% reduction in the number of days water from the Minnesota River could enter Lower Long Meadow Lake from the lower end during the growing season.
- 24-57% reduction in the number of days water from the Minnesota River could enter Upper Long Meadow Lake from the upper end during the growing season.
- Elevation of the rock dike is lower than the elevation of the low spot in the natural levee (213.98m)

Limitations:

- Heavy Imprint

**Recommendations:**

The project alternatives are compared in table 4. The evidence provided suggests that the lake's water quality and habitat will continue to degrade if nothing is done (Alternative A).

One culvert/stop log structure in Lower Long Meadow Lake (Alternative B) seems to provide adequate drainage with the least impact on the basin. In addition, the gated structure will reduce the frequency of inflow to Lower Long Meadow Lake.

Two gated structures (Alternative C) will increase the drawdown capability by 0.18m for Upper Long Meadow Lake. In addition, the drawdown rate will be slightly faster than Alternative A. Relative to the other alternatives, the benefits of a second culvert are small and may not justify the cost.

To see a more significant reduction in the number of events that inundate Long Meadow Lake, the rock dike in combination with the road raise (Alternative D) would need to be implemented. It is not clear whether the benefits will justify this magnitude of project.

**Table 4: Project Alternative Comparison**

| Project Alternative | Drawdown Elevation (m) | | Inundation Reduction - Growing Season (%) | | Construction Impacts |
|---|---|---|---|---|---|
| | Lower LML | Upper LML | Lower LML | Upper LML | |
| A | 211.37 | 211.38 | - | - | - |
| B | 210.00 | 211.38 | 20-45 | - | Light |
| C | 210.00 | 211.20 | 20-45 | - | Heavy |
| D | - | - | 38-72 | 24-57 | Heavy |

# Geotechnical Appendix

## Attachment 6

## TABLE OF CONTENTS

DEFINITE PROJECT REPORT/ENVIRONMENTAL ASSESSMENT

LONG MEADOW LAKE
HABITAT REHABILITATION AND ENHANCEMENT PROJECT
LONG MEADOW LAKE, LOWER MINNESOTA RIVER
HENNEPIN COUNTY, MINNESOTA

ATTACHMENT NO. 6
GEOLOGY AND GEOTECHNICAL /STRUCTURAL DESIGN

## 1. PHYSIOGRAPHY:

Long Meadow Lake, Habitat Rehabilitation and Enhancement Project (HREP) is located in the Minnesota River Valley at approximately river mile 5 above the confluence with the Mississippi River. The Minnesota River Valley is located in the Central Lowlands Physiographic Province of the U.S. This physiographic province may be further subdivided into the Western Lakes Physiographic Region of Minnesota.

2. The uplands area adjacent to the river consists of broad alluvial terraces on the north side of the river. On the south side there is a narrow terrace and glacially derived sediment of mixed deposition.

3. The Minnesota River lies in a broad valley in the project area. The walls of the valley are of mixed composition. The walls consist of Paleozoic sandstone and limestone at the confluence of the Mississippi River, to glacial deposits in the project area. The valley is a relatively youthful, U-shaped feature with steep-sided walls and bluffs rising approximately 40 meters above river level on either side. In the project area the valley is about 1.6 kilometers across. The river gradient is slight throughout its course. The valley area has many springs, and peaty soils are common.

## 4. GENERAL GEOLOGY:

**T**he Minnesota River valley probably existed in some form prior to the last glacial age, the major geologic event that created the valley we see today occurred near the end of Pleistocene glaciation. During this period the Minnesota River valley was buried with glacial sediment. As glacial melt water flowed from the retreating margin of ice a new channel formed. Successively younger outwash plains formed up the valley as the ice retreated. By the time the river was an outlet for Glacial Lake Agassiz it was well entrenched in its present location. At this time the valley gained its present grandeur. After

deposition of the outwash sediments, large volumes of meltwater from the southward outflow of glacial Lake Agassiz eroded the sands and gravels while simultaneously scouring and deepening the valley. The river during this period was known as the Glacial River Warren. Today the Minnesota River is much smaller than its predecessor and it seems dwarfed by the valley it occupies.

5. Bedrock exposures are not readily observable along the Minnesota River bluffs in the area of the project. They are mantled with glacial deposits. Bedrock ranges from 50 to 100 meters below ground surface. In the project area a buried bedrock valley bisects the existing Minnesota River valley. The buried valley was cut into the Upper Cambrian, St. Lawrence and Franconia Formations. Middle Ordovician period sandstone, limestone and shale make up the exposed bedrock downstream near the confluence of the Mississippi and Minnesota Rivers. In descending order, the cliffs consist of the Platteville Limestone, Glenwood Shale, and, St. Peter Sandstone. Sedimentary rock that is not exposed in the project area but has been observed in borings, in descending order are; Lower Ordovician Prairie Du Chien Group, Upper Cambrian Jordan Sandstone, St. Lawrence Formation, Franconia Sandstone, Ironton and Galesville Sandstone, Eau Clair Formation, and the Mount Simon Sandstone. Older Precambrian sedimentary and crystalline rocks lie below the Mount Simon Sandstone and are assumed to be thousands of feet thick.

**6. STRUCTURAL GEOLOGY:**

Sedimentary rock in this region was deposited in the Hollandale Embayment. This embayment was a shallow epicontinental sea. Within the embayment is the Twin Cities basin. The basin was the result of graben or down thrust block faulting that originated during the time of mid continental rift. The project is located centrally within the basin. It is believed during Paleozoic time faulting and folding was reactivated in the basin. The region is now considered structurally stable and without tectonic disturbances of regional or local magnitude.

**7. GENERAL GEOTECHNICAL DESIGN:**

The Geotechnical Design philosophy used for Environmental Management Program (EMP) projects is different than that used for flood control projects. The acceptable level of risk is higher for EMP projects because failure has relatively smaller consequences then for flood control projects. No soil shear strengths or consolidation tests were completed for this project. Stability was analyzed using parameters that were correlated to test results from other EMP projects.

**8. SELECTED PLAN SUMMARY:**

The selected plan is a control structure at the outlet of Long Meadow Lake. The plan view of the control structure is shown in the main report with the costs in Appendix No. 2. Stability and bearing capacity were analyzed for the selected plan. Because the proposed control structure will add a negligible amount of stress to the foundation soil, settlement was not analyzed.

## 9. SUBSURFACE INVESTIGATIONS:

The St. Paul District for the Long Meadow Lake project completed 5 borings and 2 hand augers. However, only two of these borings are shown because they are the only ones in the vicinity of the selected alternative. The locations of these two borings are shown on Plate 7 in Attachment 1. The logs are shown on Plate 6-1 in this appendix. They show over 9 meters of compressible soil at each boring.

The testing results on the samples taken from this subsurface investigation was as follows:

| Testing Summary | | |
|---|---|---|
| Type of Test | Number of Tests Completed | Results |
| Atterbergs w/moisture content | 10 | Average $M_C$= 36%, LL= 46%, PL= 23%, PI= 23% |
| Specific Gravity | 7 | Range 2.29 to 2.69 |
| Dry Unit Weight | Computed | Average = 12.9 kN/m$^3$ (82 lbs./ft$^2$) |

## 10. SLOPE STABILITY:

A slope stability analysis was completed for the Long Meadow Lake project because the proposed design slopes are steeper then the existing slope in some areas around the stoplog structure. A stability analysis was not done for the dredged slopes because their failure will not cause damage. The analysis used drained shear strengths because little vertical stress will be added to the foundation soil. This analysis used the computer program UTEXAS4 (a general-purpose software program for limit equilibrium slope stability computations) and the soil stratigraphy from boring 00-2M. The UTEXAS4 input file is shown on Plate 6-3 and the stability results on Plate 6-4. Undrained shear-strengths for bearing capacity calculations $\phi = 0°$ and $s_u$ =14 kPa (300 lbs./ft$^2$) were computed using correlations to plasticity index (after Robertson and Campanella, 1984, and Jamiolkowski et al, 1985) and liquid limit (after Larsson, 1980) for undrained conditions. For the foundation material, a $\phi = 22°$ was used, however, the areas around the structure will be compacted so a $\phi = 28°$ was used for the embankment. Assuming this drained shear strength the computed factor-of-safety was equal to 1.47, which is greater than 1.4 required in EM 1110-2-1913 for long-term stability.

## 11. SETTLEMENT AND BEARING CAPACITY:

The proposed control structure will add a negligible amount of stress to the foundation soil. The amount of fill added will be, in most areas, less than 0.3 m. so the settlement calculated from its load increase is less than the error of the calculation. The allowable bearing capacity computation assuming undrained conditions and a factor-of-safety of 3 is shown on Plate 6-2. The calculation resulted in an allowable capacity of 28 kPa (585 lbs./ft$^2$), which is greater than the actual bearing of 20.0 kPa.

**12. SEEPAGE:**

Seepage through the embankment and under the structure was modeled using the finite element program SEEP/W. The critical gradient was computed using ETL 1110-2-555 "Design Guidance on Levees" Nov. 1997, as 0.27 with a factor-of-safety of 3.0. SEEP/W computed gradients downstream of the structure that were well below that with the proposed sheet pile cut-off walls on both the upstream and downstream side of the structure. Volume of seepage doesn't matter because there are no structures in the area to be damaged.

**13. MATERIAL SOURCES:**

There is no need for a source of fill material since the volume of fill required is small it will be obtained from the areas of cut. The riprap is available from quarries that are within 40 kilometers.

**14. CONSTRUCTIBILITY:**

Construction of the culverts and control structure will require dewatering. The fact that silty material will be expected to be dewatered should be explained in the specifications. Boring no. 00-2M shows that there is a layer of silt, which will require extra effort to dewater. Additional work required is the removal of existing structures in the area. Boring no. 00-2M also hit about 5 feet of concrete so the removal is more extensive then the concrete that is visible. This will involve demolition of a small concrete bridge and a separate concrete abutment. Both the control structure construction and concrete removals require standard construction equipment.

**15. ROCK GRADATION:**

The calculation of the minimum weight of the 50 percent-less-than-by-weight rocks for the rockfill is explained in the Hydraulic Appendix. The selected gradation is shown on Plate 6-5 and in the table below.

Table: Rock Gradation

| Percent Less-than-by-Weight: | Maximum (kg.) | Minimum (kg.): |
|---|---|---|
| 100 | 136 | 45 |
| 50 | 54 | 18 |
| 15 | 11 | 4 |

This gradation should be placed in a 0.46-meter layer thickness with a geotextile under it to act as a

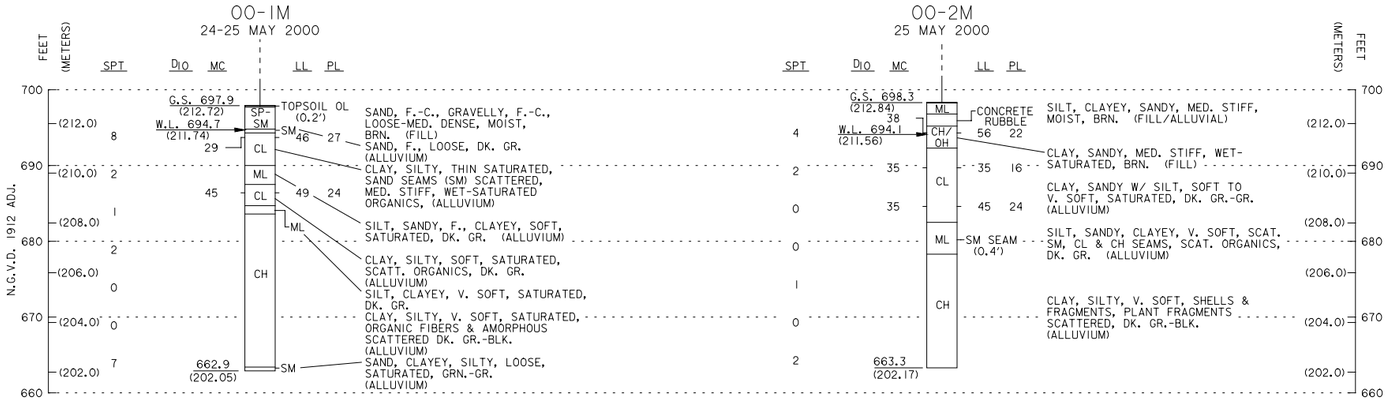
filter.

**16. FUTURE WORK:**

No further borings or testing will be done on this project. The work for plans and specifications will be as follows: assure that uplift is not a problem, once structural design is finalized; designation of specific quarries; input to the specifications especially dewatering; and review the contract documents. Work during construction should include field verification of soil conditions at the control structure.

**Bibliography**


1. **Jamiolkowski, M.**, et al, (1985), "New Developments in Field and Laboratory Testing of Soils," Proceedings, Eleventh International Conference on Soil Mechanics\s and Foundation Engineering, San Francisco, Vol. 1, pp.57-154.
2. **Ladd, C.C.** et al, (1977), "Stress-Deformation and Strength Characteristics," Proceedings of the Ninth International Conference on Soil Mechanics and Foundation Engineering, Tokyo, V. 2, p. 421-494
3. **Larsson, E.** (1980), "Undrained Strength in Stability Calculation of Embankments and Foundations on Soft Clays," Canadian Geotechnical Journal, V. 24, No. 1, p. 23-24.
4. **Robertson, P.K. and Campanella, R.G.** (1984), "Guideline for Use and Interpretation of the Electronic Cone Penetration Test," Soil Mechanics Series No. 69, Dept. of Civil Engineers, The University of British Columbia, Vancouver.
5. **Terzaghi, Karl, Ralph B. Peck, and Mersi, Gholamreza** (1996), Soil Mechanics in Engineering Practice, 3rd ed., Fig. 25.7 p.230.




NOTES

1. WATER LEVEL DETERMINED IN OFFSET OPEN HOLE AFTER 6 DAYS. HOLE DRILLED TO EL. 689.9′ (210.27) AND OPEN TO EL. 692.1′ (210.94).
2. 4¼″ I.D. HOLLOW STEM AUGER SET TO EL. 667.9′. (203.57)
3. HOLE BACKFILLED WITH TREMIED CEMENT-BENTONITE GROUT.

NOTES

1. WATER LEVEL DETERMINED AFTER 5 DAYS.
2. 4¼″ I.D. HOLLOW STEM AUGER SET TO EL. 668.3′. (203.69)
3. HOLE BACKFILLED WITH TREMIED CEMENT-BENTONITE GROUT.
4. HOLE LOCATION N4966877, E483488 UTM ZONE 15, 1983.

## GENERAL BORING LEGEND

84-1M — YEAR OF BORING-BORING NUMBER, BORING TYPE ( EG: M-MACHINE, A-AUGER, TP-TEST PIT, P-PIEZOMETER ).

1 MAY 1984 — DATE OF BORING

W.S. 1026.7 (312.92) — WATER SURFACE ELEVATION ON DAY OF BORING

G.S. 1020.2 (310.94) — GROUND SURFACE ELEVATION AT BORING

| | |
|---|---|
| GW | WELL GRADED GRAVELS, GRAVEL - SAND MIXTURE, LITTLE OR NO FINES |
| GP | POORLY GRADED GRAVELS, LITTLE OR NO FINES |
| GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| SW | WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| SP | POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| SM | SILTY SANDS, SAND - SILT MIXTURES |
| SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| ML | INORGANIC SILTS, LIQUID LIMIT LESS THAN 50 |
| MH | INORGANIC SILTS, LIQUID LIMIT GREATER THAN 50 |
| CL | INORGANIC CLAYS, LOW TO MEDIUM PLASTICITY, LIQUID LIMIT LESS THAN 50 |
| CH | INORGANIC CLAYS, HIGH PLASTICITY, LIQUID LIMIT GREATER THAN 50 |
| OL | ORGANIC SILTS OR CLAYS, LOW PLASTICITY, LIQUID LIMIT LESS THAN 50 |
| OH | ORGANIC SILTS OR CLAYS, MEDIUM TO HIGH PLASTICITY, LIQUID LIMIT GREATER THAN 50 |
| PT | PEAT |
| SP-SM | BORDERLINE MATERIAL |
| SP&SM | STRATIFIED MATERIAL |
| I | LOCATION AND SAMPLE NUMBER FOR UNDISTURBED SAMPLE |
| | NO RECOVERY |

W.L. 726.7 (221.49) — WATER LEVEL ON DATE OF BORING

700.1 (213.39) — ELEVATION AT BOTTOM OF BORING

ELEVATION IN METERS

## GENERAL BORING NOTES

1. GENERAL: THE UNIFIED SOIL CLASSIFICATION SYSTEM IS USED TO IDENTIFY BASIC SOIL TYPE. THE LEGEND REPRESENTS ONLY THE BASIC SOILS. TO COMPLETE THE CLASSIFICATION, PERTINENT INFORMATION IS ADDED TO THE RIGHT OF THE BORING STAFF, NOTES PERTAINING TO A SPECIFIC BORING ARE SHOWN BELOW THE BORING STAFF.

2. MOISTURE CONTENT: THE NATURAL MOISTURE CONTENT IN PERCENT OF DRY WEIGHT (MC) IS SHOWN TO THE LEFT OF THE BORING STAFF.

3. BLOW COUNT (SPT): BLOW COUNTS ARE SHOWN TO THE LEFT OF THE BORING STAFF AND, EXCEPT AS NOTED, ARE THE NUMBER OF BLOWS NECESSARY TO DRIVE THE SAMPLER USED A DISTANCE OF 12". STANDARD BLOW COUNTS ARE FOR A STANDARD PENETRATION TEST (SPT) USING A 1⅜" X 2" SAMPLER, 140 LB. HAMMER AND A 30" DROP. FOR NON-STANDARD BLOW COUNTS, SAMPLER SIZE, HAMMER WEIGHT AND HEIGHT OF DROP ARE AS SHOWN.

4. ATTERBERG LIMITS: LIQUID LIMIT (LL) AND PLASTIC LIMIT (PL) ARE SHOWN TO THE RIGHT OF THE BORING STAFF.

5. $D_{10}$ SIZE: THE GRAIN SIZE IN MILLIMETERS OF WHICH 10% OF THE SAMPLE IS FINER IS SHOWN TO THE LEFT OF THE BORING STAFF.

6. RQD: ROCK QUALITY DESIGNATION (RQD) IS SHOWN TO THE LEFT OF THE PERCENT RECOVERY COLUMN. ROD IS THE PERCENT RECOVERY CONSISTING OF UNBROKEN PIECES LONGER THAN 4".

7. % RECOVERY: PERCENT CORE RECOVERY IS SHOWN TO THE LEFT OF THE BORING STAFF. PERCENT RECOVERY IS LENGTH OF CORE RECOVERED/LENGTH OF CORE CUT X 100. UNLESS SPECIFIED OTHERWISE, ALL CORE IS 4" DIAMETER.

8. ELEVATIONS REFERENCED TO N.G.V.D. 1912 ADJ.

9 THE BORINGS SHOW SUMMARIES OF INFORMATION RECORDED ON THE ORIGINAL FIELD LOGS. THESE LOGS ARE AVAILABLE FOR INSPECTION AT THE ST. PAUL DISTRICT OFFICE. ARRANGEMENTS TO INSPECT LOGS CAN BE MADE BY CALLING (651) 290-5599.

US Army Corps of Engineers
St. Paul District

| Symbol | Description | Date | Appr. |
|---|---|---|---|
| | | | |

DESIGNED: KSN | DATE: MAY 2002
CHECKED: JJF/KSN | SCALE: AS SHOWN
DRAWN: ORS | CADD FILE NAME: LongMeadLb-1.dgn
DESIGNED: | LOCATION: DACW37-93-B-0044
CHECKED: | AE APPROVING OFFICIAL:

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

REFERENCE DRAWING
LONG MEADOW LAKE MINNESOTA RIVER
GEOLOGICAL DATA
LEGEND, GENERAL NOTES & BORING LOGS: 00-1M & 00-2M

DRAWING NUMBER:
PLATE NO. 6-1
SHT 1 OF 1

Long Meadow Lake: Bearing Capacity
Assuming a mat foundation

U-Structure for Wing Walls

| | | | | |
|---|---|---|---|---|
| $L$ = | 6.5 | m = | 21.3 | ft |
| $B_{min}$ = | 3.3 | m = | 10.8 | ft |
| $c_u$ = | 14.4 | kPa = | 300 | lbs/ft$^2$ |
| $D_f$ = | 0.3 | m = | 1.0 | ft |

using the equation for saturated clays where $\phi$ = 0 degrees
Das, B. M. (1990). Principles of Foundation Engineering, 2nd edition, eq. 4.11, p. 219

| | | | | | |
|---|---|---|---|---|---|
| $q_{all(net)}$ = | $1.713c_u(1+0.195B/L)(1+0.4D_f/B)$ = | 585 | lbs/ft$^2$ = | 28.0 | kPa |

This equation assumes a factor of safety of 3.
The actual bearing of the structure is 20.0 kPa.

HEADING
Long Meadow Lake EMP
File: longMeadRtest.xls
Levee top= 213.0 Water 212.0

GRAPHICS
PROFILE LINES

| | | |
|---|---|---|
| 1 | 1 | Embankment fill saturated |
| 30.48 | 210.01 | |
| 36.42 | 211.99 | |
| 47.03 | 211.99 | |
| 52.97 | 210.01 | |
| 2 | 2 | Embankment fill moist |
| 36.42 | 211.99 | |
| 39.44 | 212.99 | |
| 44.01 | 212.99 | |
| 47.03 | 211.99 | |
| 3 | 3 | Foundation soil (CH) |
| -15.24 | 210.01 | |
| 30.48 | 210.01 | |
| 53.89 | 210.01 | |
| 53.89 | 210.01 | |
| 99.61 | 210.01 | |
| 4 | 4 | Foundation soil (MH) |
| -15.24 | 208.79 | |
| 99.61 | 208.79 | |
| 5 | 5 | Foundation soil (CL) |
| -15.24 | 207.26 | |
| 99.61 | 207.26 | |

MATERIAL PROPERTIES
1 Embankment fill saturated
18.1
C
0.00 28
PIEZOMETRIC LINE
1
2 Embankment fill moist
17.4
C
0.00 28
PIEZOMETRIC LINE
1
3 Foundation soil (CH)
18.1
C
0.00 22
PIEZOMETRIC LINE
1
4 Foundation soil (MH)
18.1
C
0.00 22
PIEZOMETRIC LINE
1
5 Foundation soil (CL)
18.1
C
0.00 22
PIEZOMETRIC LINE
1

PIEZOMETRIC LINE
1 9.8 Groundwater (kN/m$^3$)
-15.24 211.99
76.20 211.99

| top_el | | c | ϕ | |
|---|---|---|---|---|
| 213 | embank. | 0.00 | 28 | degrees |
| 210 | CH | 0.00 | 22 | degrees |

```
UTEXAS4 - Version: 1.0.0.1 - Latest Revision: 4/15/99
U. S. Army Corps of Engineers
Time and date of run: Tue Mar 16 09:42:01 2004
Input file: C:\…\longmeadow\stability\longMeadR28.dat


TABLE NO. 33
*******************************************
* 1-STAGE FINAL CRITICAL CIRCLE INFORMATION *
*******************************************
X Coordinate of Center . . . . . 106.31
Y Coordinate of Center . . . . . 713.78
Radius . . . . . 27.78
Factor of Safety . . . . . 1.47
Side Force Inclination/Lambda  . 6.53
```



PLATE 6-3

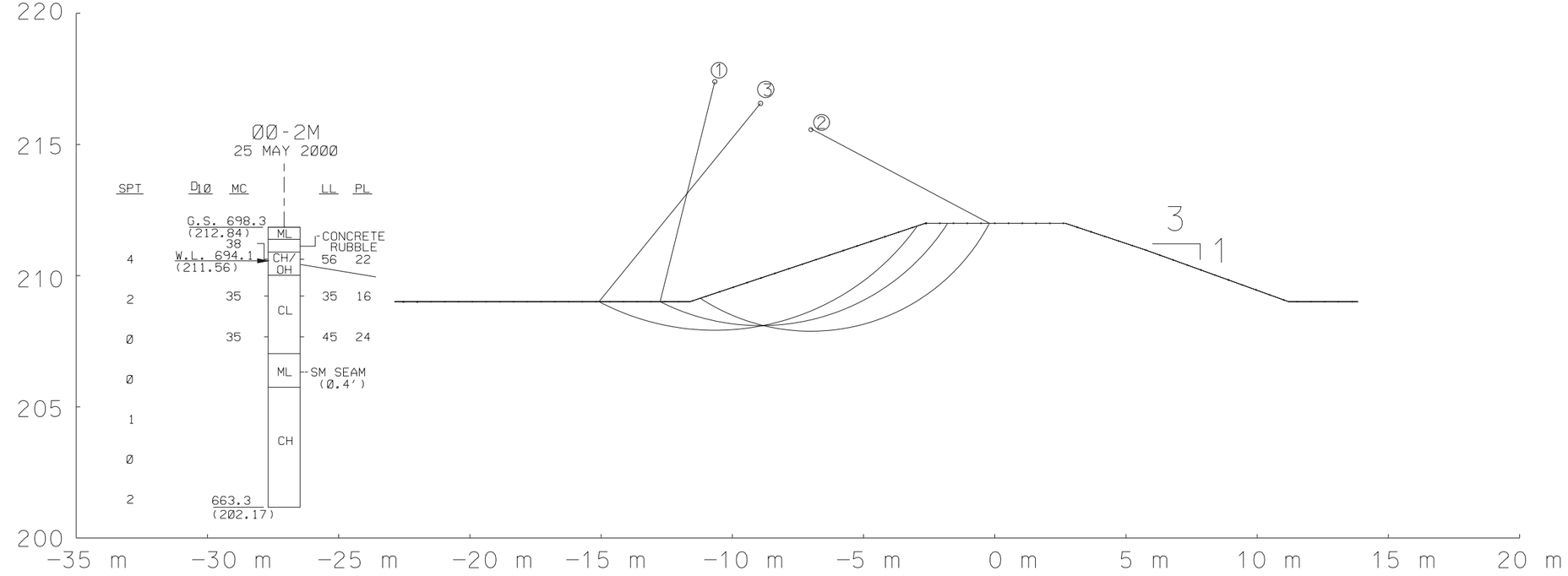
```
DISTRIBUTED LOADS
        1
ANALYSIS/COMPUTATION DATA
            Circular        Search              1
                32.49          218.39          0.1    182.88
            POINT
                32.49          209.09
ITErations
                    100
CRACK
                0       DEPTH
WATER
                0       DEPTH
PROCEDURE
SPENCERS

COMPUTE
```



PLATE 6-3

| SOIL | | UNIT WEIGHT (KN/m³) | | ESTIMATED S-STRENTHS | |
|---|---|---|---|---|---|
| NO. | DESCRIPTION | MOIST | SATURATED | C | PHI |
| FOUNDATION | CH/OH | 17.4 | 18.1 | 0 | 22 |
| EMBANKMENT | CL | 17.4 | 18.1 | 0 | 28 |

| CRITICAL CIRCLE FAILURE SURFACE | | | | |
|---|---|---|---|---|
| CIRCLE | CENTER COORDINATES | | | FACTOR OF |
| NO. | X | Y | RADIUS | SAFETY |
| 1 | -11.1 | 218.4 | 9.5 | 1.88 |
| 2 | -7.4 | 216.6 | 7.7 | 1.86 |
| 3 | -9.3 | 217.6 | 8.5 | 1.47 |




US Army Corps of Engineers
St. Paul District

| Symbol | Description | Date | Appr. |
|---|---|---|---|
| | | | |

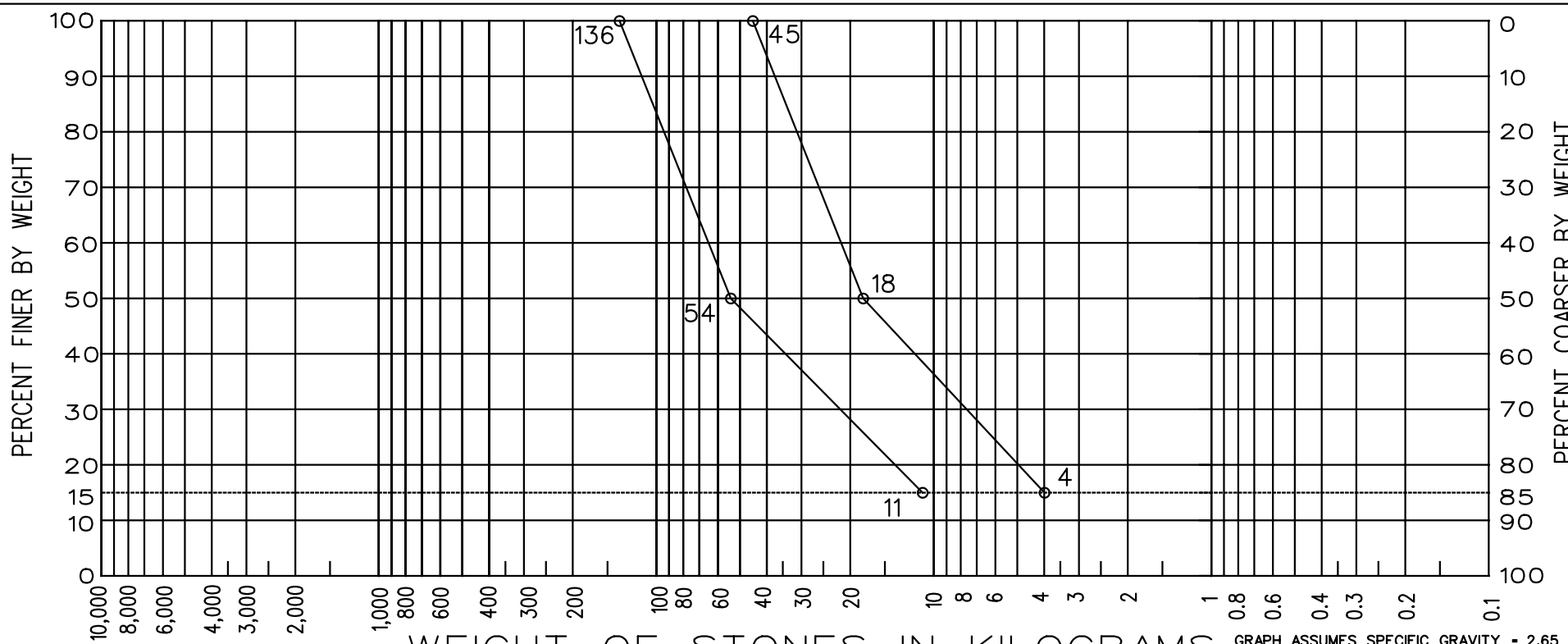
DESIGNED: JJF
DRAWN: JJF
CHECKED:
SCALE: AS SHOWN
DATE: MAR 2004
CADD FILE NAME: STABMEADOW.DGN
SOL. NO:
DESIGNED:
CHECKED:
AE APPROVING OFFICIAL:

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

LONG MEADOW LAKE EMP - DPR
STABILITY ANALYSIS
WORST CASE

DRAWING NUMBER:
PLATE 6-4
SHT OF

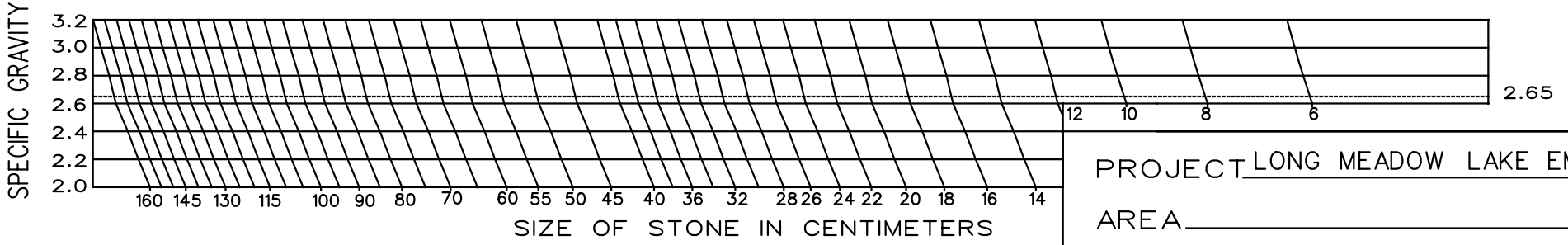
PLATE 6-5




WEIGHT OF STONES IN KILOGRAMS

GRAPH ASSUMES SPECIFIC GRAVITY = 2.65

(ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)




SIZE OF STONE IN CENTIMETERS

SPECIFIC GRAVITY OF STONE= [ ]

PROJECT LONG MEADOW LAKE EMP

AREA

DATE

RIPRAP OR ROCKFILL GRADATION CURVES

ENG FORM 4055 JULY 2001 *COMPUTER GENERATED*

# Memorandum of Agreement

Attachment 7

**DRAFT**

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
**LONG MEADOW LAKE PROJECT**
**HENNEPIN COUNTY, MINNESOTA**

## 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 **Long Meadow Lake** project 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 land 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 **Long Meadow Lake 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 **Long Meadow Lake project** are 100 percent Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of rehabilitating and improving the fish and wildlife habitat in **Long Meadow Lake** on the Minnesota Valley National Wildlife Refuge. **The project consists of demolition of existing metal culvert at Lower Long Meadow Lake and the installation of a concrete control structure with stop log controls to permit regulation of Long Meadow Lake water levels for habitat management; excavation of an existing channel upstream and downstream of the concrete control structure; and tree plantings to promote reforestation of former agricultural fields.**

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. Construction: **Construction of the project consists of excavating material from the channel upstream and downstream of new control structure; installation of a concrete control structure at the existing access/maintenance road located at the north end of Lower Long Meadow Lake and planting trees.**

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, DOA will construct the **Long Meadow Lake project** as described in the **Definite Project Report and Integrated Environmental Assessment, Long Meadow Lake Habitat Rehabilitation and Enhancement Projects, dated _____2004**, 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 DOA encounters potential delays related to construction of the project, DOA will promptly notify 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. 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 and Integrated Environmental Assessment entitled "Long Meadow Lake Habitat Rehabilitation and Enhancement Project," dated _____ 2004,** 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
U.S. Army Corps of Engineers, St. Paul District
190 Fifth Street East
St. Paul, Minnesota 55101-1638

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: _____ | BY: _____ |
| (signature) | (signature) |
| ROBERT L. BALL | ROBYN THORSON |
| Colonel, Corps of Engineers | Regional Director |
| St. Paul District | U.S. Fish and Wildlife Service |
| DATE: _____ | DATE: _____ |

# Coordination/Correspondence

## Attachment 8

The draft Integrated Definite Project Report and Environmental Assessment or Executive Summary/Notice of Availability (*) was sent to the following agencies, interests, media, and libraries. In addition, the Executive Summary/Notice of Availability was sent to all private citizens on the project mailing list.

Congressional

Sen. Mark Dayton (Washington Office, Metro Area Office)
Sen. Norm Coleman (Washington Office, St. Paul Office)
Rep. Jim Ramstad (Washington Office, District Office)

Federal

Environmental Protection Agency – Region V Administrator
Department of Transportation - Region V Administrator
U.S. Coast Guard – St. Paul Office
U.S. Geological Survey – St. Paul Offices
U.S. Geological Survey – Upper Midwest Environmental Sciences Center
National Park Service – Midwest Regional and St. Paul Offices
National Resource Conservation Service – St. Paul Offices
Advisory Council on Historic Preservation
U.S. Fish and Wildlife Service (Thorson, Hultman, Baylor, Schultz, Rowse, Thiel, Dobrovolny)

State of Minnesota

Department of Natural Resources (Merriam, Sc. Johnson, St. Johnson, Ekman, Polasik, Barstad, Regenscheid, Ellison)
Minnesota Pollution Control Agency (Corrigan, Mader)
State Historic Preservation Office
Water and Soil Resource Board

Local Government

Lower Minnesota River Watershed District
Mendota Mdewakanton Sioux Community
Shakopee Mdewakanton Sioux Community
Prairie Island Mdewakanton Sioux Community
City of Burnsville, MN
City of Bloomington, MN
City of Eagan, MN

Interest Groups

American Rivers
Audubon Society
Upper Mississippi River Basin Association
Mississippi River Citizen Commission
Sierra Club
Friends of the Minnesota Valley
Nature Conservancy
Izaak Walton League

Media/Libraries

Carver County News*
City Pages*
This Week Newpaper*
Eden Prairie News*
Shakopee Valley News*
S. Washington Cty Bulletin*
Star Tribune*
St. Paul Pioneer Press*
Sun Newspaper*

Public Libraries

Dakota County Library
Hennepin County Library

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Minnesota Valley National Wildlife Refuge
3815 East 80th Street
Bloomington, Minnesota 55425-1600


June 5, 2000

Randy Devendorf
ST. Paul District, Corps of Engineers
190 Fifth Street East
ST. Paul, Minnesota 55101-1638

Dear Randy:

As discussed at the May 12th interagency coordination meeting for the Long Meadow Lake HREP, Minnesota Valley NWR staff have put together a proposal for the reforestation of old farm fields on this unit. Included in the plan are current conditions, objectives, our participation in preparing the site and specifics on methods and materials. We have provided maps of the proposed sites to give you a general idea of the locations and size of the fields. Maps with more detail will be provided as things progress.

We're very excited by the prospect of adding this project to the rehabilitation and enhancement of the Long Meadow Lake unit. Please contact us if you have any questions.

Sincerely,

Thomas Ken
for

Rick Schultz
Refuge Manager

Enclosure

CC: Keith Beseke

This = 400 Trees/Acre

# Tree Planting Proposal: Long Meadow Lake Habitat Rehabilitation and Enhancement Project

## 1. Introduction

The Long Meadow lake unit of the Minnesota Valley National Wildlife Refuge provides habitat for the majority of the 275 species of birds recorded within the river valley during migration. Northern floodplain forest on this unit is important for migrating and nesting birds. Neotropical migrants are of particular concern with regard to providing quality floodplain forest habitat.

## 2. Condition of Habitat

With the various forms of development that has taken place in the Long Meadow Lake floodplain, the forest has been fragmented and the diversity of tree species has decreased. Farming activities prior to refuge acquisition have had a significant impact. Since the phase-out of farming, these areas have reverted to old field, dominated by exotic reed canary grass. Most areas have little or no regeneration of tree species due to the high density of reed canary grass and possibly over-browsing by white-tailed deer. Those areas where seedlings are thriving are composed of monotypical stands of box elder, eastern cottonwood and willow.

## 3. Objective

In order to reestablish quality floodplain forest habitat in the Long Meadow Lake unit it will be necessary to plant trees. This will not only provide trees where reed canary grass is preventing germination of existing seed, but will also add to the diversity of tree species which was historically present.

## 4. Ground Preparation

Refuge staff will prepare sites for planting through the use of fall and/or spring prescribed burning and treatment with a herbicide after regrowth of reed canary grass. Mowing and herbicide treatment is another option if conditions are not within prescription for burning.

## 5. Species and Materials

Swamp white oak, burr oak, green ash and silver maple (25% each) is desired. Trees up to one foot in height (1-0 designation) will be easier to plant and may be better able to withstand flooding than larger trees. Trees from one to two feet in height (2-0) would be a second option. Tubes and matting should be used for each tree in order to provide protection from browsing white-tailed deer, inhibit growth of reed canary grass and to create a microclimate where

individual trees can grow as fast as possible to withstand flooding and plant competition. Tubes should be 44 inches in height. Matting should be 3 by 3 feet.

**6. Planting**

Spacing between each tree should be 12 feet. Although the arrangement of species will generally be random, areas in individual fields may be more suited to oak versus other species depending on relief, ie. higher ground would favor the success of oak species. Some fields have areas where eastern cottonwood is well established and would not be included in the planting.

Planting in mid-May to early June would allow any floodwaters to recede and also allow a healthy green-up of reed canary grass and subsequent spraying in May, if not accomplished the previous fall. The exception to this is field 2 where there is a bald eagle nest. Planting should not be conducted any sooner than the last week in June. Fall planting would be another option in this field.

**7. Acreage**

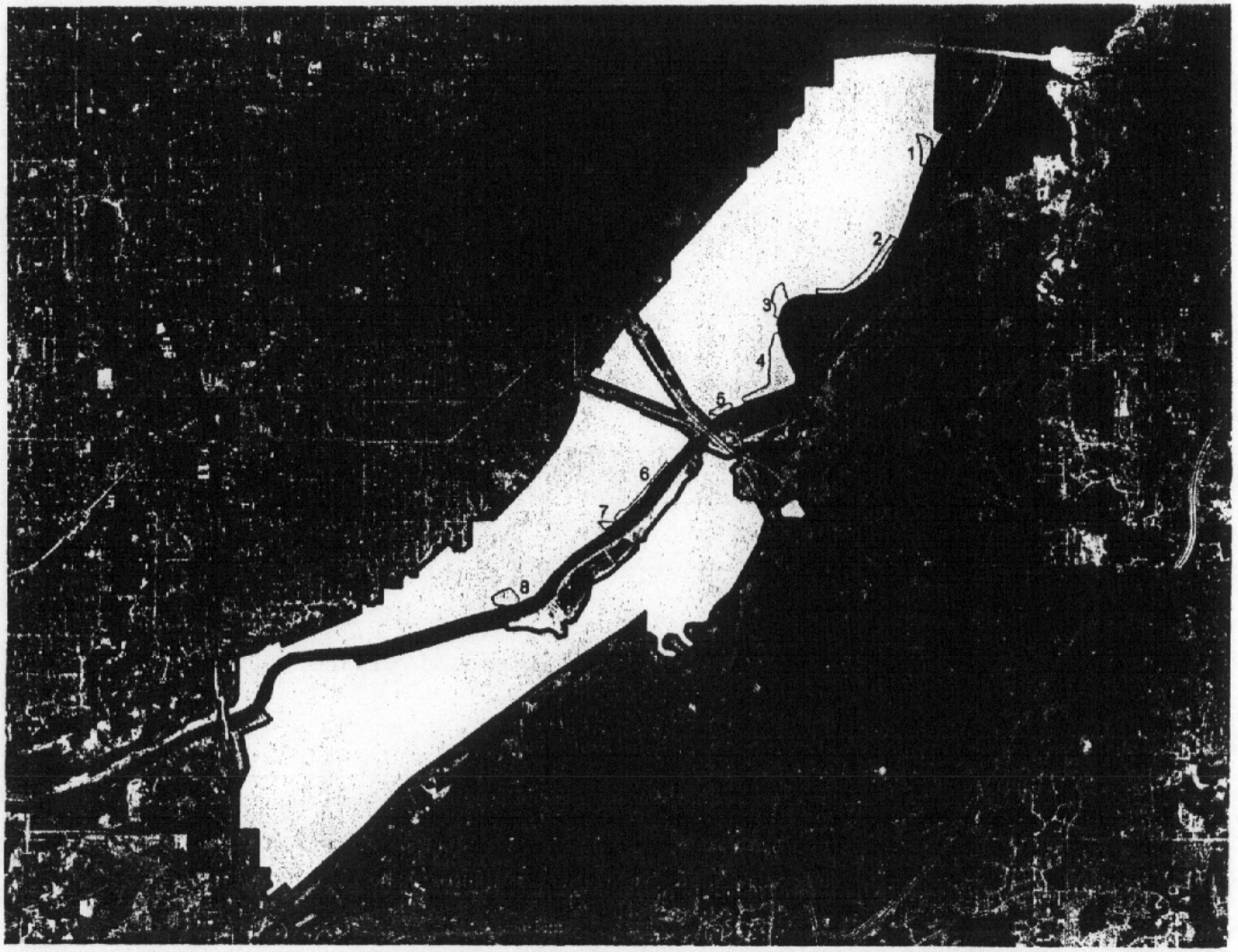
Field 1- 4
Field 2- 6
Field 3- 6
Field 4- 18
Field 5- 2
Field 6- 5
Field 7- 1
Field 8- 3

Total- 45

# Long Meadow Lake HREP
# Tree Planting Proposal

Minnesota Valley National Wildlife Refuge

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR




Planting areas
Refuge boundry

N
W
E
S

## Novak, Tom MVP-PM-A

**From:** Crum, Douglas A MVP
**Sent:** Monday, August 21, 2000 6:18 PM
**To:** Novak, Tom MVP-PM-A
**Cc:** Face, Joel J MVP; Williams, Terryl L MVP; Layman, Kari L MVP
**Subject:** Trip report & costs for upstream dike and Long Meadow Lake

Doug Crum and Joel Face visited the Long Meadow Lake project on 21 August 2000. The purpose was to determine a constructible method for transporting riprap to the proposed upstream rock dike. The upstream rock dike is proposed by the Minnesota Valley Wildlife Refuge to reduce flooding from the river through upper long meadow lake.

It was determined that access to the site will require rock transported by barge. The trails from the Lyndale Ave. parking lot are not accessible by truck. The dike is over one mile from the parking lot. The trails on the north side of the wetland are too narrow, and would require considerable clearing for construction equipment. The trails on the riverside of the wetland cross three ravines that are about 15 feet deep near the river and branch out inland. The trail improvements necessary for movement of construction equipment would likely outweigh the benefits for construction of the dike. They would also be an environmental impact. Access from the historic house on the bluff above the dike was also inspected. The trail down the hillside is too steep to hauling rock.

It is anticipated that rock can be transported by barge to the shoreline directly south of the proposed dike. Unloading rock will likely required some minor dredging to steepen the shoreline so the barge can moor close to the shoreline. The bank is about 15 feet in height from normal water level in the river and is about 1V:1H.

The dike will require clearing of about 20 to 30 trees in the range of 8 to 16 inch diameter. About half of these are in the dike alignment, and half are required for a haul road from the river shoreline. It is anticipated these can be piled onsite.

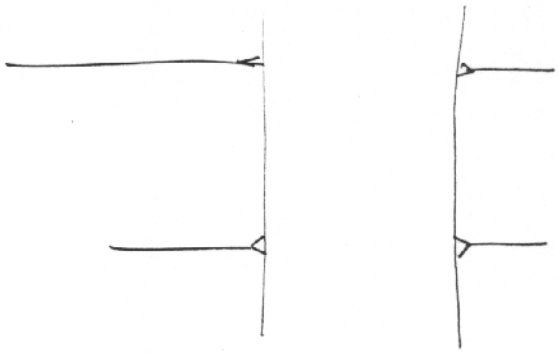
Some preliminary cost estimates for comparison are as follows:

Joel told me structural comp.'s look like about 15 feet deep sheet piling would be required. Sheetpile is usually about $15.00/LF. The vinyl pile is cheaper, but sometimes more difficult to install, so cost savings are speculative. Also, the equipment would either need a mandrel to break through frost, or work off mats to float in the swamp. For these assumptions, the cost would be about $225/LF for a sheetpile dike.

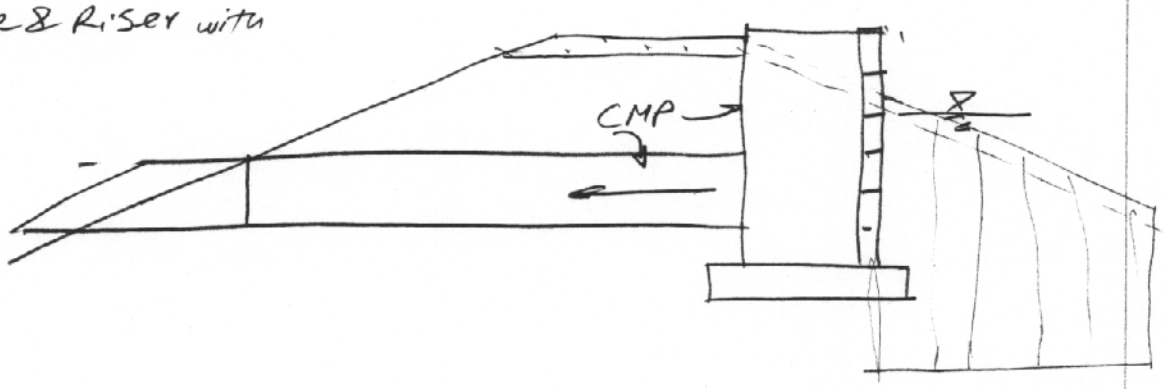
Riprap at the Lock and dams is usually placed at about $30.00/CY. It would be about another $10.00/CY to place this rock since it is not in the river, about $10/CY for geotextile and impacts on equipment mobility due to soft ground, and about another $10/CY to reshape it after it consolidates. Assume $60.00/CY and about 2.5 CY/LF of dike = $150/LF for a riprap dike.

For both options, there would be some additional costs for mobilization, clearing, dredging for site access, and cleanup. We will also need contingencies, E & D, and contract administration for funding.

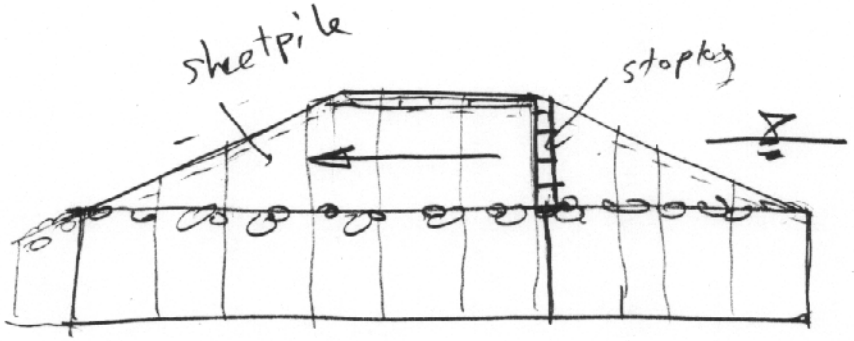
| US Army Corps of Engineers<br>Saint Paul District | PROJECT TITLE: | COMPUTED BY: | DATE: | SHEET: | |
|---|---|---|---|---|---|
| | SUBJECT TITLE: | CHECKED BY: | DATE: | CONTRACT NO.: | |



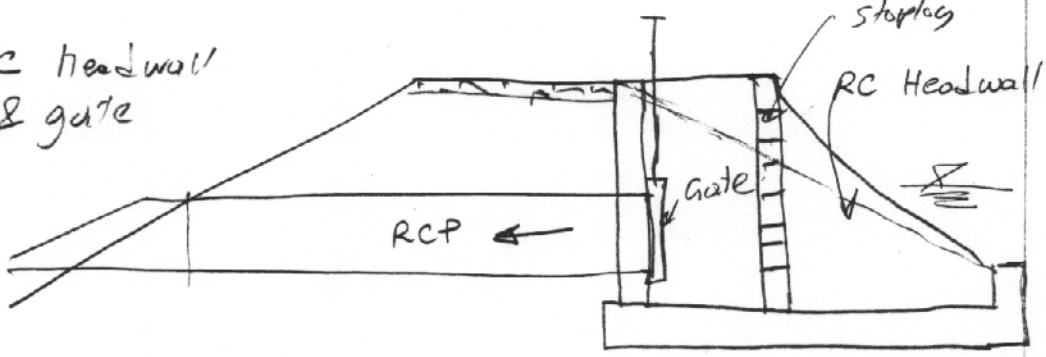
CMP pipe & Riser with stoplog




Steetpile culvert with stoplog Can be a concrete structure too




RCP pipe & RC headwall with stoplog & gate



CEMVP-PM-A 12 September 2000

MEMORANDUM FOR RECORD

SUBJECT: Long Meadow Lake HREP - Site Meeting

A site meeting was held at Upper Long Meadow Lake Channel area on 12 September 2000 at 0930 hrs. The purpose of which was to investigate miscellaneous channels between Upper Long Meadow Lake and the river. Attendees included:

| Corps Representatives | U.S. Fish and Wildlife Representatives |
|---|---|
| Tom Novak | Keith Beseke |
| Kari Layman | Chris Kane |
| Joel Face | Terry Schreiner |
| Randy Devendorf | |

Based upon observations and discussion the team agreed to the following,

1. The rock plug will be dropped from further consideration at this time. Preliminary evaluations indicate that the potential benefits of the plug would likely be limited. Location of the plug closer to the river, to reduce costs, may not be effective. The existing elevations of the marsh leading into Upper Long Meadow Lake will prevent a 1.5year storm from inundating the lake. Substantial additional surveys and sediment analysis would be required to fully evaluate the effectiveness of relocating the plug.

   The DPR will include a recommendation for monitoring the effects of the drawdown effort and impacts to Upper Long Meadow Lake.

   There may be an opportunity in the future to add a rock plug as part of a DNR trail system.

2. Hydraulic analysis will focus on the outlet design at Lower Long Meadow Lake. A stop log structure will allow the following water level management capabilities:

   - Prevent water from the Minnesota River from entering Lower Long Meadow Lake during smaller storm events.
   - Draw water off both basins of Long Meadow Lake to enhance establishment of preferred aquatic vegetation species.
   - Hold water on Long Meadow Lake if the need arises.

Tom Novak
Project Manager

CEMVP-PM-A 19 July 2001

MEMORANDUM FOR RECORD

SUBJECT: Long Meadow Lake HREP - Site Meeting

A site visit was held today at 0930 to look at changed conditions from spring flooding at Lower Long Meadow and impacts to existing outlet structure. The discussion items are summarized below. Attendees included:

Tom Novak/PM-A
Kari Layman/ED-H
Joel Face/ED-D
Randy Devendorf/PM-E
Tim Grundhoffer/ED-D
Keith Beseke/USFWS
Chris Kane/USFWS

1. Control Structure Location - USFWS asked whether it would be less expensive to construct the new control structure 150 to 200 feet upstream of current road location. Joel wanted to keep structure where it is because poor soils in this area have been consolidated at its existing location. In addition, some of the trees will need to be removed in either location. Moving the site would also require additional access.

2. Existing culvert - The existing culvert has been displaced from spring flooding. USFWS will repair culvert/road this summer. USFWS is uncertain at this time as to what design will be adopted for the repair. The possibility of preparing and providing a design for the proposed control structure in the near future to the USFWS, which they would implement now as the repair instead of under the HREP program was proposed by the COE. This was not considered to be a viable option by the USFWS as they have no flood mitigation funding for the refuge at this time and would not have adequate funding to construct such a feature. They indicated that due to funding limitations, any repairs to the damaged structure at this time will likely focus primarily on providing access across the outlet location.

3. Straighten channel meander - The team discussed the possibility of easing the channel meander (dredge a channel shortcut) a couple of hundred feet upstream of structure. The concern is future maintenance may increase due to sedimentation. However, upon inspection, the channel conveyance seems to be adequate and it was agreed to leave as is.

4. Spillway/elevations of roadway - The team discussed whether

additional roadway elevations are needed between culverts to determine if new structure will lead to erosion elsewhere along the road. The secondary culvert showed signs of erosion too, which may need to be protected as part of the design.

5. Airport Runway - Any potential conflict of increasing waterfowl (especially geese) use in an area that is along the flight path of the runway extension will need to be addressed in the Environmental Assessment. MAC is permitted under the current agreement with the refuge to harvest geese in an effort to control their numbers near the airport.

The team asked the service if they anticipated any opposition to the project from Metropolitan Airports Commission (MAC). The service noted that the mitigation agreement with MAC placed no restrictions on how service will operate the refuge at this location. The USFWS opinion is that since the project is providing partial restoration of the natural hydrologic regime of Long Meadow Lake it should not be an issue. The potential conflict of increasing waterfowl use in an area that is along the flight path of the runway extension will need to be addressed in the Environmental Assessment.

Tom Novak
Project Manager

# PUBLIC INFORMATION MEETING

## LONG MEADOW LAKE
## HABITAT REHABILITATION AND ENHANCEMENT PROJECT

The St. Paul District Corps of Engineers, in cooperation with the U.S. Fish and Wildlife Service and the Minnesota Department of Natural Resources, has been investigating measures to restore/maintain natural processes and native species in Long Meadow Lake. Long Meadow Lake is located on the Minnesota River in the vicinity of Bloomington, Minnesota and lies within the boundaries of the Minnesota Valley National Wildlife Refuge. The study has been conducted under the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

**Date:** **September 12, 2001**

**Time:** **7:00 p.m. – 9:00 p.m.**

**Location:** **Minnesota Valley National Wildlife Refuge**
**3815 East 80th Street**
**Bloomington, Minnesota**
**Auditorium**

A preliminary study has been completed and a problem appraisal report has been prepared recommending a number of measures to restore, or provide the capability to mimic as much as possible, the natural hydrology of the system and to accelerate the successional recovery of floodplain forests adjacent to Long Meadow Lake. These include:

(1) Modify the inlet/outlet to Upper Long Meadow Lake

(2) Construct a new outlet for Upper Long Meadow Lake

(3) Modify the outlet of Lower Long Meadow Lake

(4) Modify the secondary outlet of Lower Long Meadow Lake

(5) Tree Plantings

The purpose of the public meeting is to discuss the recommended habitat restoration features and provide the public an opportunity to provide comment on the proposed measures.

If there are any questions concerning the public meeting, please contact Tom Novak, Project Manager, at (651) 290-5524 or at tom.novak@usace.army.mil.

Brad J.

**DEPARTMENT OF THE ARMY**
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

July 3, 2003

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

Mr. John Dobrovolny
U.S. Fish and Wildlife Service
1 Federal Drive, Room 603
Bishop Henry Whipple Federal Building
Fort Snelling
Minneapolis, Minnesota 55111-4007

Dear Mr. Dobrovolny:

The St. Paul District, Corp of Engineers is planning an environmental restoration project to be constructed in the U.S. Fish and Wildlife Service's Minnesota River National Wildlife Refuge, Long Meadow Lake Unit. The selected plan involves the demolition of an existing culvert and concrete appendage, excavation of an upstream/downstream channel and the installation of a 2-bay concrete stoplog control structure to manage lake water levels, as well as tree planting in numerous areas. We believe that this project has the potential to affect historic properties and will require coordination with the Minnesota State Historic Preservation Office.

The area of potential effect for the project has not been formally determined, because the plans for the project are still in a draft stage. However, we need to address the potential effects resulting from the management of the lake after installation of the control structure, dredging and the disposal of dredged material, the removal of existing structures and the construction of the new structure, any stream bank protection that will be planned as part of this project, as well as the proposed tree planting.

We believe, that at a minimum, archaeological investigations will be necessary within the construction limits for the control structure. The scope of this investigation may need to be expanded depending on the level of concern with the proposed dredging, tree planting, and operation of the control structure once constructed.

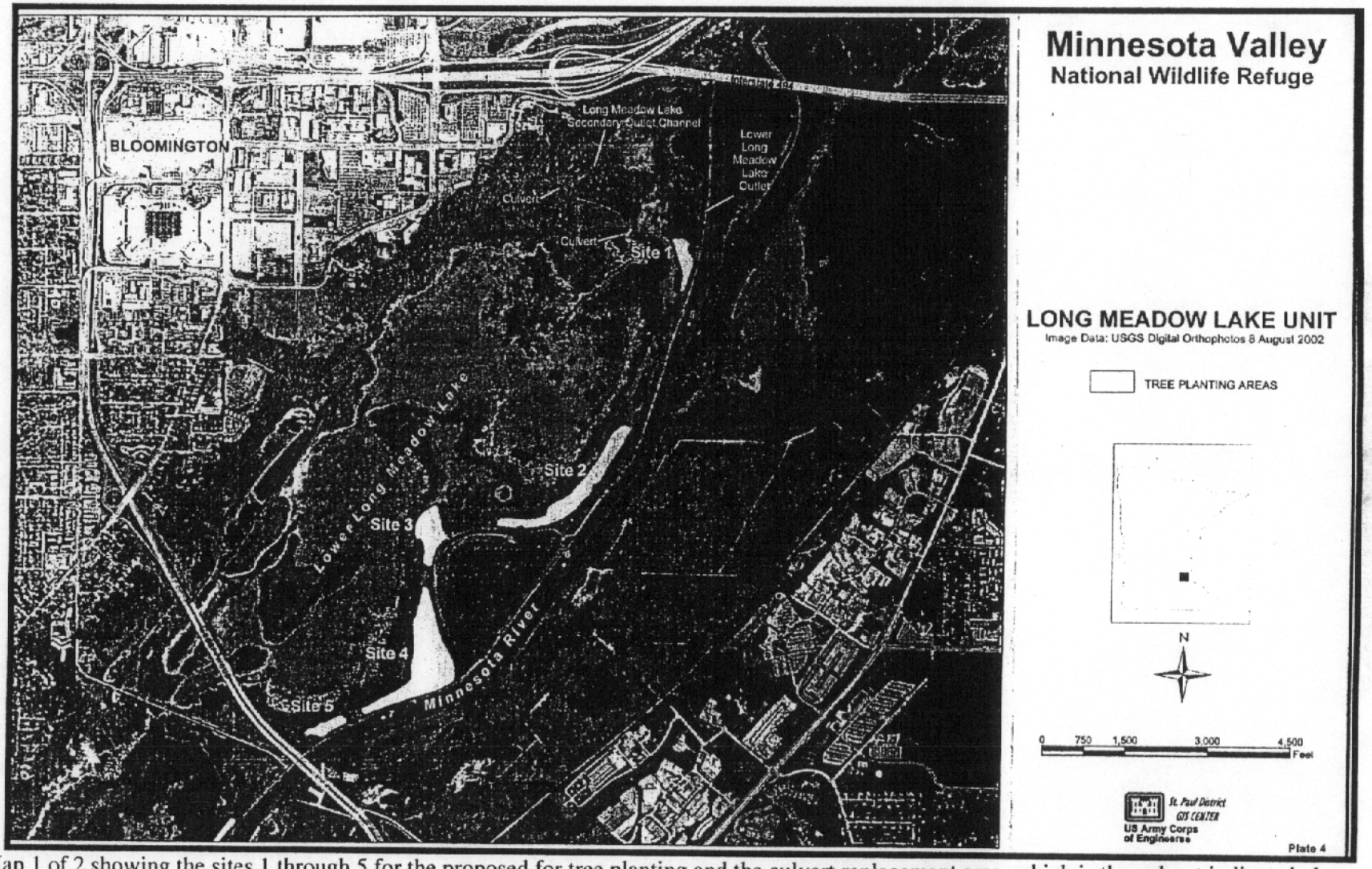
Enclosed are copies of maps and plans that show the project features discussed above. Please review the enclosures and provide us with your comments. If you have any questions please call Mr. Bradley Johnson at (615) 290-5250.

Sincerely,

Terry J. Birkenstock
Chief, Environmental and
Economic Analysis Branch

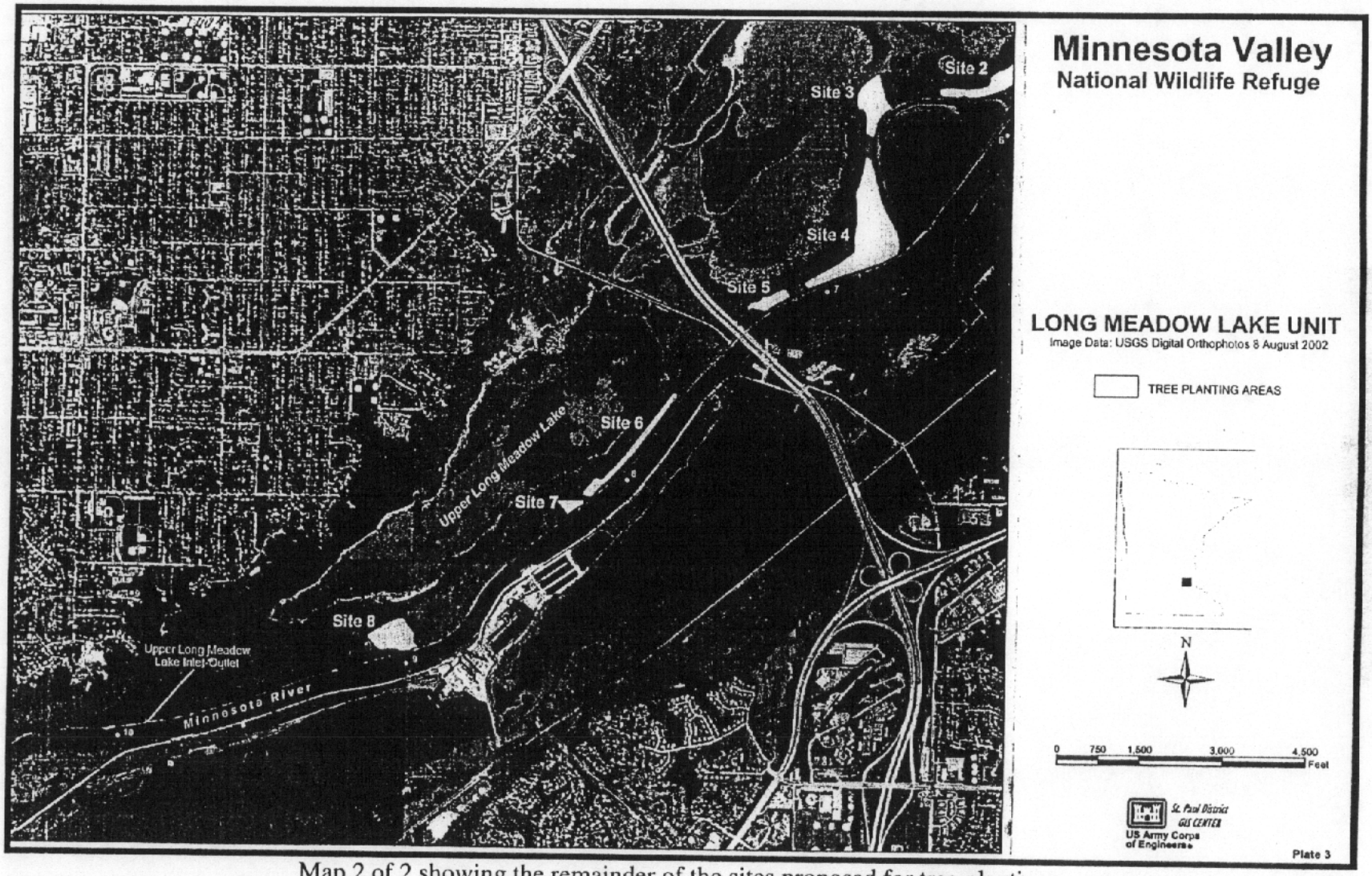
Enclosures

**Enclosure 1**
Long Meadow Lake Environmental Restoration




Map 1 of 2 showing the sites 1 through 5 for the proposed for tree planting and the culvert replacement area, which is the culvert indicated closest to Site 1.

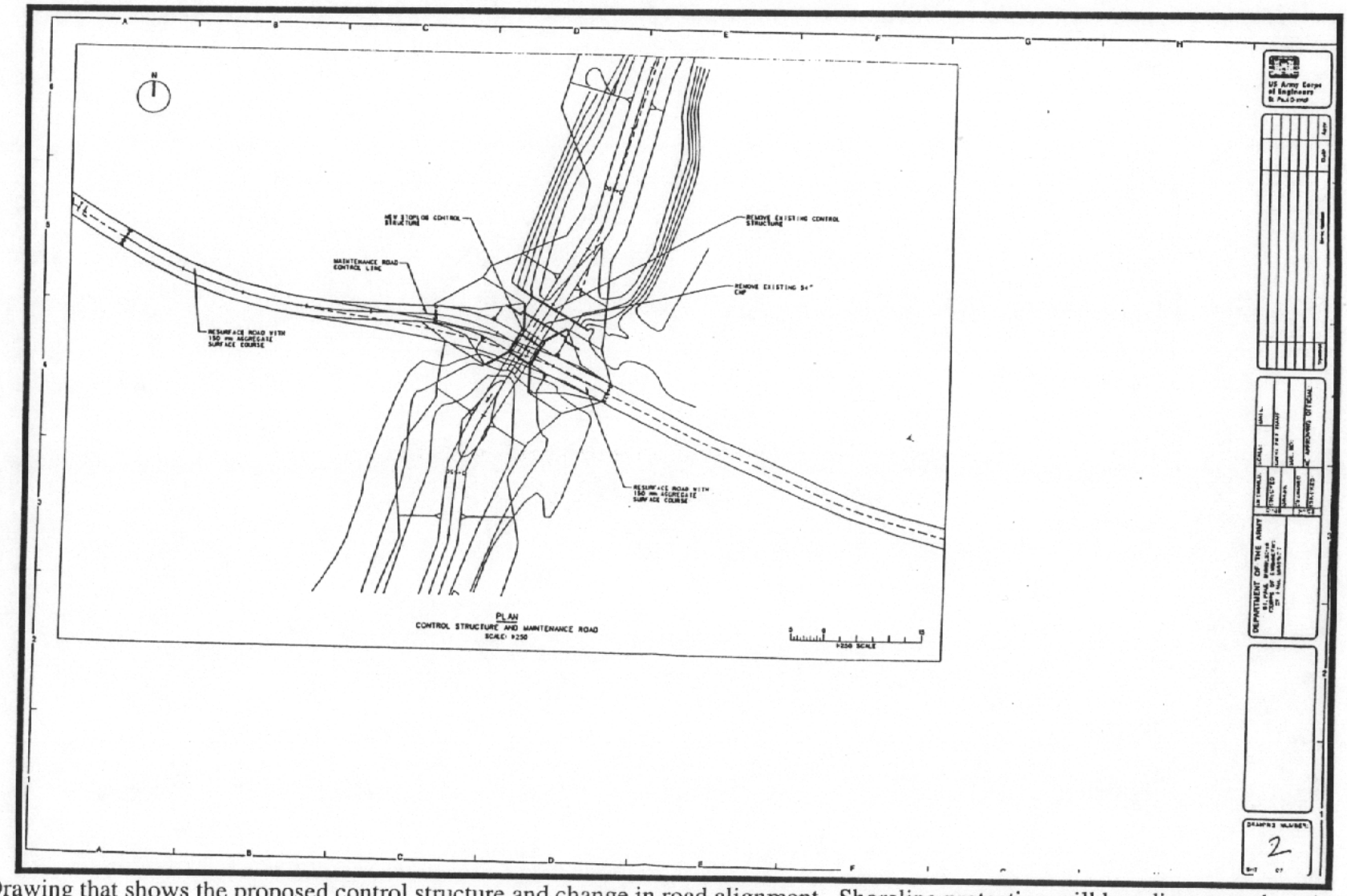
**Enclosure 2**
Long Meadow Lake Environmental Restoration




Map 2 of 2 showing the remainder of the sites proposed for tree planting.

## Enclosure 3

Long Meadow Lake Environmental Restoration




Drawing that shows the proposed control structure and change in road alignment. Shoreline protection will be adjacent to the wings.

Brad J

DEPARTMENT OF THE ARMY
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

July 11, 2003

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

Mr. John Dobrovolny
U.S. Fish and Wildlife Service
1 Federal Drive, Room 603
Bishop Henry Whipple Federal Building
Fort Snelling
Minneapolis, Minnesota 55111-4007

Dear Mr. Dobrovolny:

Enclosed is an application for an Archaeological Resource Protection Act Permit to conduct a phase I archaeological survey of the construction work limits for the control structure to be built at the outlet to Long Meadow Lake. This is a joint project between the St. Paul District, Corps of Engineers and the Region 3, Fish and Wildlife Service.

Please review the application and provide the Corps with this permit at your earliest possible convenience. If you have any questions please call Mr. Bradley Johnson at (615) 290-5250.

Sincerely,

Terry J Birkenstock

Terry J. Birkenstock
Chief, Environmental and
Economic Analysis Branch

Enclosures

**FOR OFFICIAL USE ONLY**
Date Received:_____
Sent for Review: _____
Control No.: _____

DI Form 1926 (June 1988)
OMB No. 1024-0037
Approved through 10/31/2001

UNITED STATES DEPARTMENT OF THE INTERIOR

**APPLICATION for a FEDERAL PERMIT under**
**THE ARCHAEOLOGICAL RESOURCES PROTECTION ACT**
approved October 31, 1979
(P.L. 96-95; Stat. 721; 16 U.S.C. 470aa-mm; 43 CFR 7)
or
**THE ANTIQUITIES ACT**
approved June 8, 1906
(P.L. 59-209; 34 Stat. 225; 16 U.S.C. 431-433; 43 CFR 3)

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Instructions: Complete and return two copies of this application form and attachments to each state of regional office of the land managing agencies involved. All information requested must be completed before the application will be considered. Use separate sheets of paper if more space is need to complete a section.

| 1. Name of Institution: | 2. Address: (include zip code, phone number, email) |
|---|---|
| St. Paul District, U.S. Army Corps of Engineers | 190 Fifth Street East, St. Paul Minnesota 55106<br>(651) 290-5250 brad.a.Johnson@mvp02.usace.army.mil |

3. Type of permit requested:

___X_ a. Surveys, limited testing and/or limited collections on lands identified in No. 4.

____ b. Excavation, collection and intensive study of specific sites described below in No. 4

4. Lands of the United States for which a permit is requested:

a. Description: Specify State and land managing agency(ies) including regions or districts. If on surveyed lands, descriptions must be by subdivisions of the Public Land Surveys. If on unsurveyed lands, description must be by metes and bounds with ties to some topographic feature.

Land Managing Agency: U.S. Fish and Wildlife Service - Region 3
Project area is located in the SE1/4 of the SE1/4 of the NE1/4 of Section 6 Township 27 North, Range 23 West.

b. Attach a readable copy of a map or plan showing specific sites or areas for which the permit is desired.

5. Nature and extent of work proposed, including how and why it is proposed to be conducted: (include research design, methods, curation)

The proposed work will be a phase I survey using shovel and auger testing to identify potential archaeological resources that may be affected within the construction work limits for a control structure that will be built as joint Corps/USFW project at the outlet of Long Meadow Lake.

6. Name address and institutional affiliation, if any, of persons in "a" and "b" below:

a. Individual(s) proposed to be responsible for conducting the work (i.e., in direct charge of field work): Include evidence of qualifications (vitae) in accordance with Section 7.8 of the Final Uniform Regulation (43 CFR 7).

Frank Florin of Florin Cultural Resource Services N12047 280th Street, Boyceville, WI 54725

b. Individual(s) proposed to be responsible for carrying out the terms and conditions of the permit (i.e., in general charge):

Bradley Johnson, District Archaeologist, St. Paul District, Corps of Engineers

7. Proposed date project will begin: 7/24/03 8. Proposed date project will be completed: 7/15/03

9. University, museum or other scientific or educational institution in which the applicant proposes to store all collections and copies of records, data, photographs and other documents derived from the proposed work: (The applicant must include a written certification, signed by an authorized official of the institution , of willingness to assume curatorial responsibility, and to safeguard and preserve these materials as property of the United States or, in the case of an application on Indian lands, in the event the Indian owners do not wish to take custody.)

All cultural materials will be curated at the Minnesota Historical Society under the current FWS Curatorial Cooperative Agreement 141600391991

10. Proposed outlet for public written dissemination of the results:

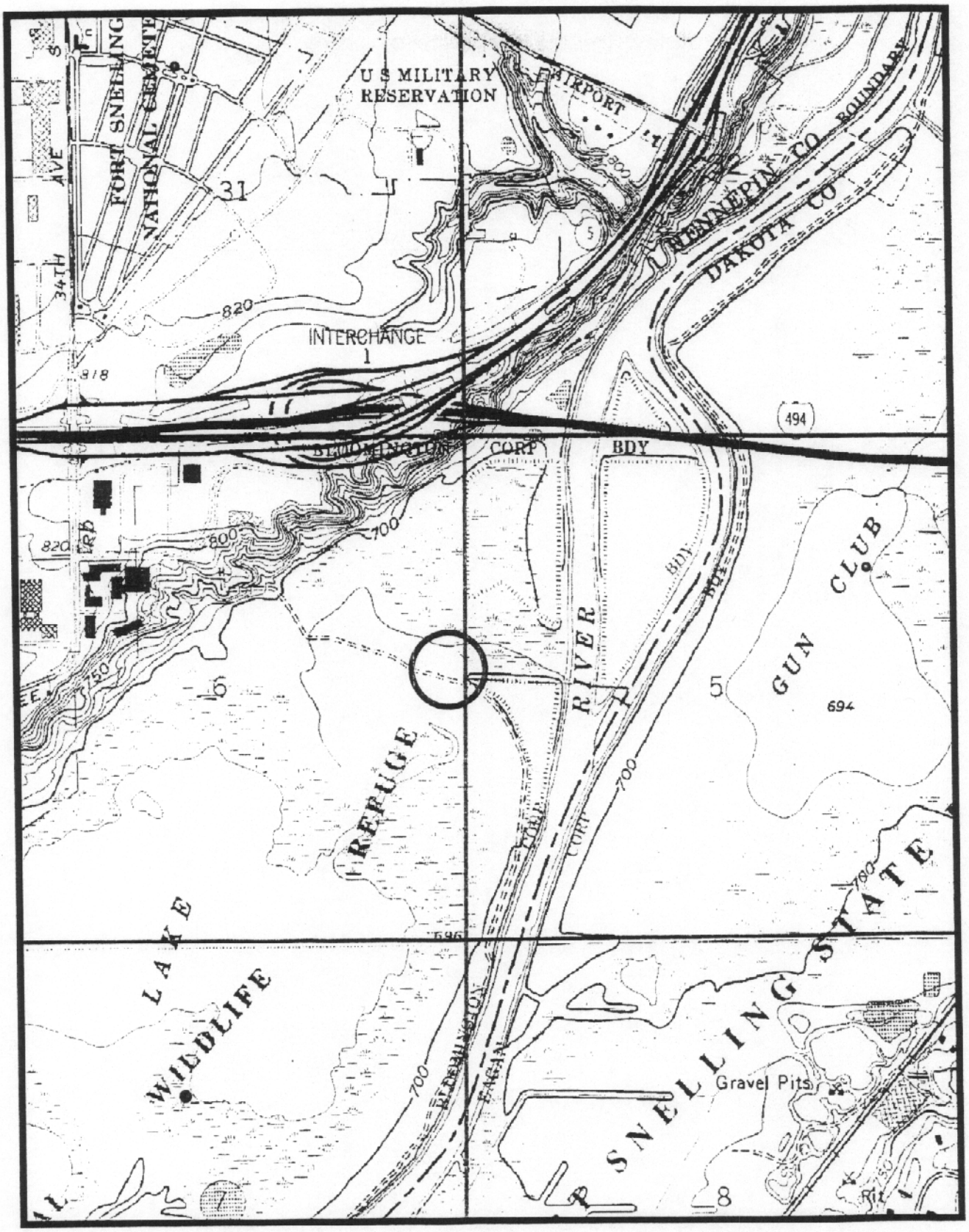
A report of investigation will be on file at the Minnesota State Historic Preservation where it will be available as a reference for future researchers.

11. Evidence of the applicant's ability to initiate, conduct, and complete the proposed work, including evidence of logistical support and laboratory facilities.

12. Signature of Individual in general charge: Bradley A. Johnson 13. Date of application 7/11/03

**Paperwork Reduction Act Statement**

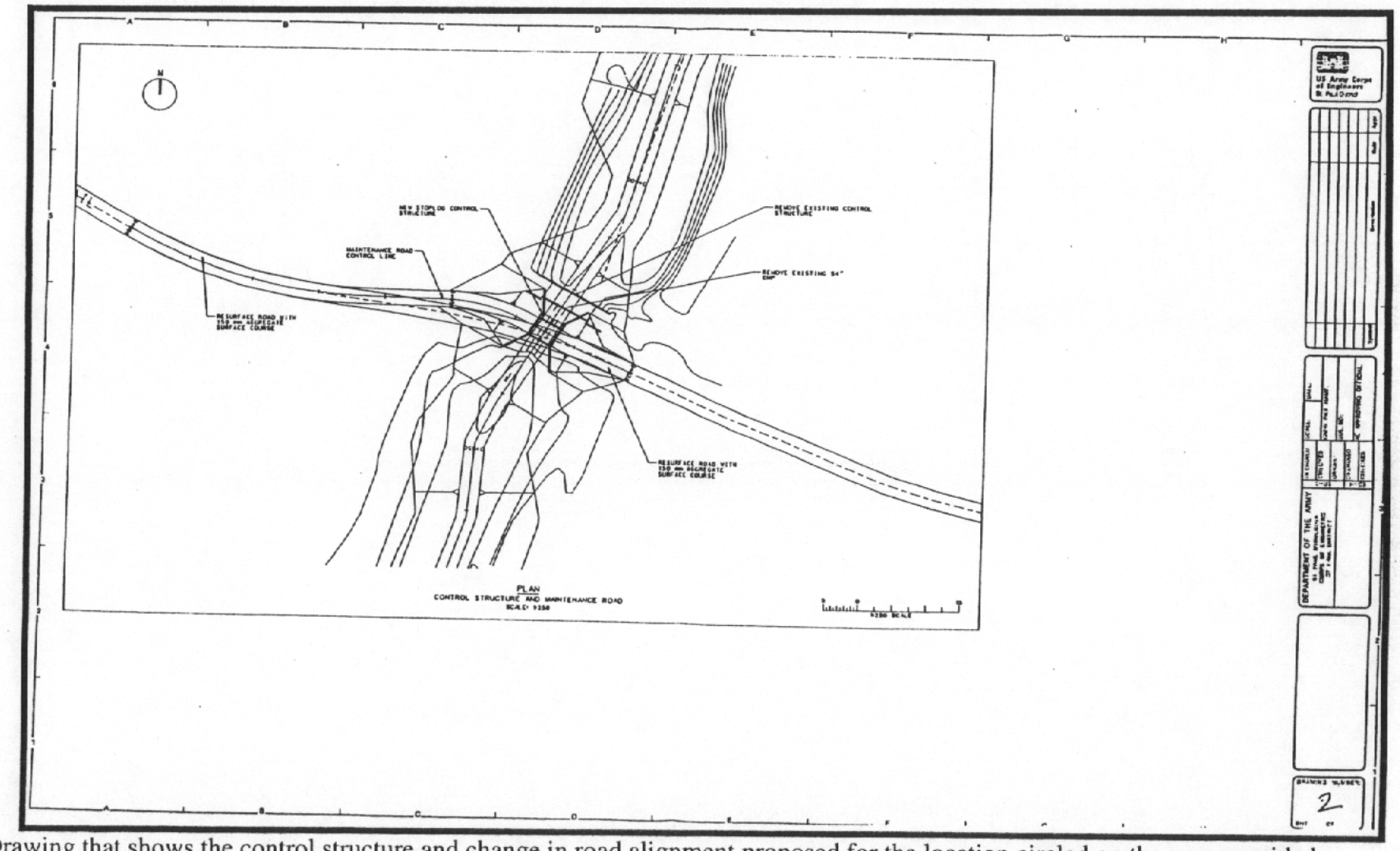
This information is being collected to conduct archaeological studies on lands under the jurisdiction of the Department of the Interior. This information will be used to ensure that the proposed studies meet statutory and regulatory requirements. Response to this request is required to obtain a benefit. The public reporting burden for this form is estimated to average one hour per response, including the time for reviewing the instructions, searching existing data sources, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, National Park Service, 1849 C Street N.W., Room 3317, Wahington D.C. 20240 and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503.




Portion of the St. Paul SW Quadrangle showing the project location circled in red.

## Enclosure

Long Meadow Lake Environmental Restoration




Drawing that shows the control structure and change in road alignment proposed for the location circled on the map provided. Shoreline protection will be adjacent to the wings.

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**
**Bishop Henry Whipple Federal Building**
**1 Federal Drive**
**Fort Snelling, MN 55111-4056**

IN REPLY REFER TO:

FWS/NWRS-VSO

JUL 22 2003



Mr. Bradley A. Johnson
District Archaeologist
Saint Paul District, Army Corps of Engineers
190 Fifth Street East
Saint Paul, Minnesota 55106

Dear Mr. Johnson:

Enclosed is Federal Archeological Resources Protection Act Permit No. 2003-MN/3-1 as requested on your application for archeological surveys and limited testing and limited collections on lands within the Minnesota Valley National Wildlife Refuge, Hennepin County, Minnesota. This permit is expected to cover the field work commencing on or after July 24, 2003, with field work completion anticipated within 30 days; and report preparation including submission of the final report to this office is expected to be completed by October 31, 2003. The permit can be extended at your request.

This archeological permit is between you as the archeologist and the U.S. Fish and Wildlife Service (FWS) as the authorizing agency; the permit requirements are separate from arrangements between you and other organizations.

Neither this permit nor the special use permit you obtain from the Refuge Manager constitutes any approval for construction or any other project or activity by any person or organization.

A summary of environmental and cultural background, if included in the report, should be limited to the project area vicinity, i.e., the county or adjacent counties in which the project is located.

The permit requires you to submit a draft report to the Regional Director, and then three copies of the final report. Initiate no contacts with the media for the purpose of disseminating information relating to the investigation until the final report is approved by the FWS. Questions from the media shall be referred to the Regional Historic Preservation Officer. Likewise, make no independent distribution of interim, letter, draft, or final reports until final report is approved.

You must request a special use permit prior to commencement of field work on Refuge System land: contact Refuge Manager Rick Schultz at 952-854-5900.

Contact John Dobrovolny, Regional Historic Preservation Officer, by telephone at 612-713-5439 if you have questions concerning this archeological permit. Inform Mr. Dobrovolny of actual field work dates so that he can observe the work in the field if the opportunity becomes available.

Sincerely,

Marvin E. Moriarty
Acting Regional Director

Enclosure: Signed permit

Please use this number
when referring to this permit
No.: 2003-MN/3-1

DI Form 1991 (Sept. 1992)
OMB No. 1024-0037
Approved through 10/31/2001

# UNITED STATES DEPARTMENT OF THE INTERIOR

## FEDERAL ARCHEOLOGICAL PERMIT

To conduct work upon public and Indian lands, owned, controlled or held in trust by the Department of the Interior under:
☐ The Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 721, 16 USC 470aa-mm) and its regulations (43 CFR 7)
☐ The Antiquities Act of 1906 (P.L. 59-209; 34 Stat. 225, 16 U.S.C. 431-433) and its regulations (43 CFR 3).

1. Permit issued to:
Bradley A. Johnson

2. Under application dated:
July 11, 2003

3. Name, address and official status of person:
a. In general charge: Bradley A. Johnson, US Army Corps of Engineers, 190 Fifth St E, St. Paul, MN 55106; 651-290-5250

b. In actual direct charge: Frank Florin, N12047 280th St., Boyceville, WI 54725

4. Activity authorized:
Surveys and limited testing and limited collections

5. On lands described as follows:
Within the boundaries of the Long Meadow Lake Unit, Minnesota Valley National Wildlife Refuge; in the SE/4 NE/4, Section 6, T.27N., R.23W., Hennepin County, Minnesota

Control No.

6. For period:
July 24, 2003 to October 31, 2003

7. University, museum or other scientific or educational institution in the material collected under this permit will be deposited for permanent preservation: (A copy of a current, valid curation agreement must be kept on file with the land managing agency (ies)).
Collections will be curated and stored at the Minnesota Historical Society, under terms of FWS cooperative agreement 14-16-003-91-991.

8. Special conditions: This permit, as checked above, is subject to the provisions of the Archaeological Resources Protection Act of 1979, and its regulations (43 CFR 7), or the Antiquities Act of 1906, its regulations (43 CFR 3), and interdepartmental regulations (25 CFR 261) as to Indian lands. All permits are subject to the provisions of the Native American Graves Protection and Repatriation Act of 1990, the regulations for the curation of Federally-owned and administered archeological collections (36 CFR 79), and the special conditions as listed on the reverse side.

9. Preliminary report: Within approximately 6 weeks of the conclusion of field work, a preliminary report of work performed under this permit, illustrated with representative photographs and listing new and significant collected materials, should be furnished to:
H. John Dobrovolny, Regional Historical Preservation Officer, U.S. Fish and Wildlife Service, BH Whipple Federal Building, 1 Federal Drive, Fort Snelling, Minnesota 55111-4056

10. Signature and title of approving official:
ACTING
Regional Director
Marvin E. Moriarty

11. Date
7/22/03

**Paperwork: Reduction Act Statement**

This information is being collected to report on the results of archeological studies conducted on lands under the jurisdiction of the Department of the Interior. This information will be used to ensure that the work was conducted in accordance with statutory and regulatory requirements and any terms and conditions stipulated in the permit. Response to this request is required to obtain a benefit. The public reporting burden for the preliminary and final reports is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining data, and completing and reviewing the reports. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, National Park Service, 1849 C Street N.W., Room 3317, Washington, D.C. 20240, the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503.

8. (CONTINUED) Special conditions are checked (X) as appropriate to this permit:

a. X This permit shall not be exclusive in character, and there is hereby reserved unto the landowners the right to use, lease or permit the use of said land or any part thereof for any purpose.

b. X Other institutions may be engaged in archeological research in the general area covered by this permit. In case there should be conflict with respect to a site not specifically designated in a permit, the parties concerned shall reach agreement between themselves as to which shall work the site.

c. X The Department of the Interior including its bureaus and employees and the landowners and their grantees, shall be held blameless for any and all events, deeds or mishaps, regardless of whether or not they arise fro m operations under this permit.

d. X Such guidance and protection as is consistent with duties of the Department of the Interior official in charge of the area will be afforded the permit holder and his party.

e. X Transportation in Department of the Interior vehicles cannot be furnished, except cases where no extra expense to the Department is involved.

f. X All costs shall be home by the permittee.

g. X Excavation o r r emoval o f a ny N ative A merican h uman r emains, f unerary o bjects, sa cred o bjects, and objects of cultural patrimony must be preceded by consultation with or, in case of tribal lands, consent of the appropriate Indian Tribe or Native Hawaiian organization. Consultation should be conducted with the lineal descendants, tribal land owners, Native American representatives and traditional religious leaders of all Indian tribes and Native Hawaiian organizations that can reasonable be assumed to be culturally associated with the cultural items or, if the cultural affiliation of the objects cannot be reasonably ascertained, from whose judicially established aboriginal lands the cultural items originated.

h. X All excavated areas shall be restored by filling in the excavations and otherwise leaving the area in as near to original condition as is practicable.

I. X The permittee shall conduct all operations in such a manner as to prevent the erosion of the land, pollution of the water resources, and damage to the watershed, and to do all things necessary to prevent reduce to the fullest extent the scarring of the lands.

j. X Any findings of mined or processed metals or other treasure or treasure trove in the area covered by this permit are the exclusive property of the landowners, and shall not be disturbed or removed from the site without specific written permission from the Department of the Interior.

k. _ Two copies of the final report, a completed NTIS report documentation form (optional form 272), and required information for listing in the National Archeological Database (NADB-Reports) administered by the National Park Service will be submitted to the office issuing the permit:

Procedures for submitting the required information for NADB listing are available from the issuing office.

---

l. _ Before undertaking any work on lands administered by the Bureau of Reclamation, clearance should be obtained from the official in charge of the area.

m. _ Before undertaking any work on lands administered by the National Park Service, clearance should be obtained from the superintendent in charge of the area.

n. _ Before undertaking any work on lands administered by the Bureau of Land Management, clearance should be obtained from the Office of the State Director and from BLM District Officer in direct charge of the area concerned.

o. x Before undertaking any work on lands administered by the Fish and Wildlife Service, clearance should be obtained from the Office of the Regional Director and from the Refuge Manager in charge at the appropriate Fish and Wildlife Refuge. Possession or use of firearms in such areas is prohibited.

p. _ Before undertaking any work on Indian tribal lands or on individually owned trust or restricted Indian lands, clearance should be obtained from the Bureau of Indian Affairs official having immediate jurisdiction over the property.

q. x Other Special Conditions:

1. The permittee shall immediately notify the Regional Director upon discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony, and shall cease activity in the area of the discovery and make reasonable effort to protect the human remains and cultural objects.

2. Archeological materials shall be collected and limited to those of archeological interest as defined in 43 CFR 7.3.

3. The permittee will clean, identify, and catalog archeological materials collected from Service land, in a manner acceptable to the institution accepting the materials for curation and storage. Permittee will provide an inventory of the collections including accession and catalog numbers, cubic feet of material, and linear feet of documentation.

4. The permittee shall not initiate contacts with the media for the purpose of disseminating information relating to the study until the final report is approved. Questions from the media shall be referred to the RHPO. Make no independent distribution of interim, letter, draft, or final reports until final report is approved by the RHPO.

5. Summary of environmental and cultural background must be limited to the county or adjacent counties of the APE.

6. This report shall include the number of U.S. Fish and Wildlife Service fee-title acres covered by this survey.

7. Line drawings and maps shall be clean, clear, and easily reproducible. Maps and sketches will be north-oriented to the top of the page and will contain appropriate scale and keys. With rare and justified exception approved by the RHPO, maps will be on or based on the USGS 7.5 minute quadrangles: unapproved deviation from the 1 mile equals 2.62 or 2&5/8 inches scale will not be accepted.

8. Identify and provide the location of archeological sites within 2 miles of the project area known to the State Historic Preservation Officer and plot on USGS map(s) by site numbers.

9. Permittee recommendations for a phase 2 or evaluation study will be presented to the RHPO as a research design proposal, not a part of the report of this investigation.

10. If the investigation authorized under this permit is not accomplished, permittee shall notify the Regional Director in writing no later than the expiration date of this permit.

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**
**Bishop Henry Whipple Federal Building**
**1 Federal Drive**
**Fort Snelling, MN 55111-4056**

IN REPLY REFER TO:

FWS/NWR-VSO

JUL 22 2003



Mr. Stanley R. Crooks
Chairman
Shakopee Mdewakanton Sioux Community
2330 Sioux Trail, N.W.
Prior Lake, Minnesota 55372-9077

Dear Mr. Crooks:

Application has been made to the U.S. Fish and Wildlife Service (FWS) for an Archeological Resources Protection Act permit. Mr. Bradley A. Johnson of the Saint Paul District, U.S. Army Corps of Engineers, and Mr. Frank Florin of Florin Cultural Resources Services, propose to conduct archeological investigations on Minnesota Valley National Wildlife Refuge.

Field investigation under the permit would occur on the Long Meadow Lake unit and would be for "Surveys and limited testing and limited collections on lands identified" in Section 6, T.27N., R.23W., Hennepin County, Minnesota.

This investigation is part of the planning for proposed culvert and water control structure replacement associated with the Long Meadow Lake Environmental Management Program project between the Corps and the FWS.

The FWS desires to learn of concerns the tribe might have about traditional cultural and sacred places and areas of cultural practice that could be affected by the archeological survey and the subsequent project. Enclosed are copies from the state highway map and the USGS quadrangle map locating the project area.

Address questions and concerns to the Regional Historic Preservation Officer John Dobrovolny at 612-713-5439 or e-mail (john_dobrovolny@fws.gov).

The requested permit under the Archaeological Resources Protection Act is being developed simultaneously with this letter to you.

Sincerely,

/S/MARVIN E. MORIARTY

Acting Regional Director

Enclosure: Maps

cc: Dallas Ross, Upper and Lower Sioux

bcc: Mr. Bradley A. Johnson, St Paul District, US Army Corps of Engineers
Minnesota Valley Refuge
RHPO
Native Americans Liaison (John Leonard)

DEPARTMENT OF THE ARMY
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

24 JUL 2003

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

Honorable Audrey Bennett
Tribal Chairwoman
Prairie Island Indian Community of
Minnesota Mdewakanton Sioux Indians
Prairie Island Community Council
1158 Island Boulevard
Welch, Minnesota 55089-9540

Dear Chairwoman Bennett:

The St. Paul District, Corps of Engineers is beginning consultation pertaining to an environmental restoration project to be constructed in the U.S. Fish and Wildlife Service's Minnesota Valley National Wildlife Refuge, Long Meadow Lake Unit, in Bloomington, Minnesota. The proposed plan involves the demolition of an existing culvert, dredging of the upstream/downstream channel, and installation of a 2-bay concrete stop log control structure to manage lake water levels, as well as tree planting in numerous areas.

We invite your participation in the consultation process for this project. If possible, please let us know of your interest by August 25, 2003, so that we may coordinate future meetings and planning efforts with you. Please contact me at (651) 290-5300 or by writing to the address given above. If you feel it is appropriate, you may also appoint a representative on your staff to coordinate with Mr. Bradley Johnson of my cultural resource staff at (651) 290-5250. We look forward to your participation in this project.

Sincerely,

Robert L. Ball
Colonel, Corps of Engineers
District Engineer

Identical letters to:

Honorable Ann Larsen
Tribal Chairperson
Lower Sioux Indian Community of
Minnesota Mdewakanton Sioux Indians
RR 1, Box 308
Morton, Minnesota 56270-9801

Honorable Helen Blue
Tribal Chairperson
Upper Sioux Indian Community
P.O. Box 147
Granite Falls, Minnesota 56241

Honorable Stanley Crooks, Sr.
Tribal Chairman
Shakopee Mdewakanton Sioux Community
2330 Sioux Trail NW
Prior Lake, Minnesota 55372-9077

Copy furnished:

Mr. Dallas Ross
Lower Sioux Indian Community of
Minnesota Mdewakanton Sioux Indians
RR 1, Box 308
Morton, Minnesota 56270-9801

Mr. Tom Ross
Upper Sioux Indian Community
P.O. Box 147
Granite Falls, Minnesota 56241

PM-B

# Shakopee Mdewakanton Sioux Community

2330 SIOUX TRAIL NW • PRIOR LAKE, MINNESOTA 55372
TRIBAL OFFICE: 952•445-8900 • FAX: 952•445-8906



July 31, 2003

Robert L. Ball
Colonel, Corps of Engineers
District Engineer
Dept. of the Army
St. Paul District Corps of Engineers
190 Fifth Street East
St.Paul, MN 55101-1638

**RE: Environmental Restoration Project**
**Long Meadow Lake Unit**
**Bloomington, MN**

Dear Colonel Ball:

Thank You for your letter of request for consultation dated July 24th, 2003 regarding the proposed restoration project in the Minnesota Valley National Wildlife Refuge. The Shakopee Mdewakanton Sioux Community is concerned with any disturbances of areas of potential historical significance, especially those areas that may contain objects of Dakota Culture, History, or Religion. Please keep us informed of the progress of this project.

For further consultation meetings, etc. please contact us in writing at the above address to the attention of Stan Ellison, Land Dept.

Sincerely,

Leonard E. Wabasha
Shakopee Mdewakanton Sioux Community
Cultural Resource Specialist
crs@shakopeedakota.org

Florin Cultural Resource Services

August 18, 2003

Mr. Bradley Johnson, PM-E
Archaeologist
St. Paul District U.S. Corp of Engineers
190 5th Street East
St. Paul, MN 55101-1638

**Re: Letter Report for Phase I Archaeological Survey - Replacement of Water Control Structure at Long Meadow Lake, Hennepin County, MN**

Dear Mr. Johnson,

Florin Cultural Resource Services (FCRS) was contracted by the Corps to conduct an archaeological survey for replacement of the water-control structure at Long Meadow Lake in Hennepin County, Minnesota. This letter report includes the methods, results, and recommendations of the survey. The U.S. Fish and Wildlife Service issued Special Use Permit No. 32590-03-030 for conducting the survey.

**Project Description**

The project area is located on the floodplain of the Minnesota River Valley at the north end of Long Meadow Lake, which is an abandoned channel of the Minnesota River. The area is wooded. The soils are mapped as the Chaska series and consist of very deep, somewhat poorly drained soils that formed in recent calcareous loamy alluvium on flood plains. The mapped soils consist of an A horizon (0 to 20 cm) overlying multiple C horizons (20 to 154 cm). The project is situated at the outlet of the lake where it drains into a stream channel that is incised into the floodplain at a level several feet below that of the lake. The Corps is planning to replace the existing culvert with a new water-control structure at the lake outlet, realign a small portion of the gravel road near the structure, and add erosion control around the banks. The survey area included a 15-meter-wide area on each side of the existing culvert. Because the project area is located on an alluvial setting that has the potential for deeply buried sites, field work included deep testing. The goal of the archaeological survey was to determine if archaeological sites were present within the project area. Fieldwork was conducted on July 30, 2003 by Frank Florin (PI) and Nate Donaldson. Field conditions were good as temperatures were in the 80s, and there was no rain. Surface visibility was about 20 percent.

**Methods**

Prior to conducting fieldwork, the Trygg map of the project area was reviewed (Trygg 1964). The Trygg map was compiled from the general land office maps and notes from the original land survey in the mid 1800's. The map indicates that Long Meadow Lake occupied a much larger area than its current extent, and the lake appears to have covered the project area.

Four tests were placed in the project area (Figure 1). One test was placed in each corner of the project area to provide systematic survey coverage. The upper 70 cm of soil was dug with a shovel, and a Seymour auger with a 20-cm (6-inch) bucket was used to recover soil below 70 cm. An attempt was made to auger test to a depth of 3 meters (10 feet). However the water table prohibited testing to this depth. All soil was screened through ¼" hardware mesh.

• N12047 280th Street Boyceville, WI 54725 • Phone/Fax: (715) 643-2918
• florin@pressenter.com

A record of daily activity was maintained on daily log forms. A sketch map of the project area was prepared using a compass and tape. Photographs were taken of the project area. A soil profile was drawn for each test. Soil color, texture, horizons, and disturbances were recorded on the profile.

**Results**

No artifacts were recovered from the four tests. Test 1 was dug to a depth of 250 cm below surface (cmbs) (Table 1). Modern items (clear glass, slag, and metal fragments) and gravels were observed to a depth of 144 cmbs. The soil from 144 to 250 cmbs was undisturbed and consisted of an A horizon overlying a C horizon. The water table was encountered at 190 cmbs. Test 2 was dug to a depth of 110 cmbs. (Table 2). Cement pieces and disturbed soils were observed to a depth of 50 cmbs. The soil from 50 to 110 cmbs was undisturbed and consisted of an A horizon overlying a C horizon. The water table was encountered at 95 cmbs. Test 3 was dug to a depth of 80 cmbs (Table 3). The water table was encountered at 70 cmbs. No disturbances were noted in Test 3, and the soils consisted of recent flood deposits overlying a buried A horizon. Test 4 contained rocks and fill near the surface and could not be dug below 20 cmbs.

Table 1. Test 1 Soil Profile.

| Depth (cmbs) | Description |
|---|---|
| 0-30 | Very dark gray (2.5Y 3/1) silt loam with gravel; fill |
| 30-35 | Dark grayish brown (2.5Y 4/2) silt with gravel; fill |
| 35-50 | Very dark gray (2.5Y 3/1) silt loam with gravel; fill |
| 50-144 | Dark grayish brown (2.5Y 4/2) silt loam with gravel; fill |
| 144-190 | Very dark gray (2.5Y 3/1) silty clay loam; A horizon; water table at 190cmbs; |
| 190-250 | Dark gray (5Y 4/1) silty clay; massive; C horizon |

Table 2. Test 2 Soil Profile.

| Depth (cmbs) | Description |
|---|---|
| 0-23 | Very dark grayish brown (2.5Y 3/2) silt loam with gravel; fill |
| 23-35 | Dark grayish brown (2.5Y 4/2) clay loam with gravel; fill |
| 35-42 | Olive brown (2.5Y 4/3) silt loam with gravel; fill |
| 42-50 | Dark grayish brown (2.5Y 3/3) silt loam with gravel; fill |
| 50-80 | Very dark gray (2.5Y 3/1) silty clay; A horizon |
| 80-110 | Dark gray (2.5Y 4/1) silty clay; massive; C horizon; water table at 95 cmbs |

Table 3. Test 3 Soil Profile.

| Depth (cmbs) | Description |
|---|---|
| 0-45 | Dark grayish brown (2.5Y 4/2) silt loam; AC horizon; recent deposits |
| 45-80 | Very dark gray (2.5Y 3/1) clay loam gravel; 2Ab horizon; water table at 70cmbs |

**Conclusions and Recommendations**

No archaeological sites were identified in the project area. Based on the original land survey map, the project area was submerged by Long Meadow Lake in the mid 1800s. Currently the project area is above the lake level, but the area is low and wet. The lake has likely been infilling over the last 150 years as a result of sedimentation caused by flooding along the Minnesota River. The sedimentation process within the lake has probably been accelerated by agricultural activities which have caused increased erosion.

The soils identified from tests in the project area formed in historic-age flood sediments. Lacustrine sediments are inferred to be present below the flood deposits as the area was formerly a lake. Neither of these deposits are likely to yield archaeological sites. In addition, prior to the deposition of lacustrine sediments in the abandoned channel, the area was an active river channel and any potential sites would have been eroded by the river when it flowed through this area. Based on these factors, the project area appears to have a low potential for containing archaeological sites at testable depths. No further archaeological work is recommended for the project.

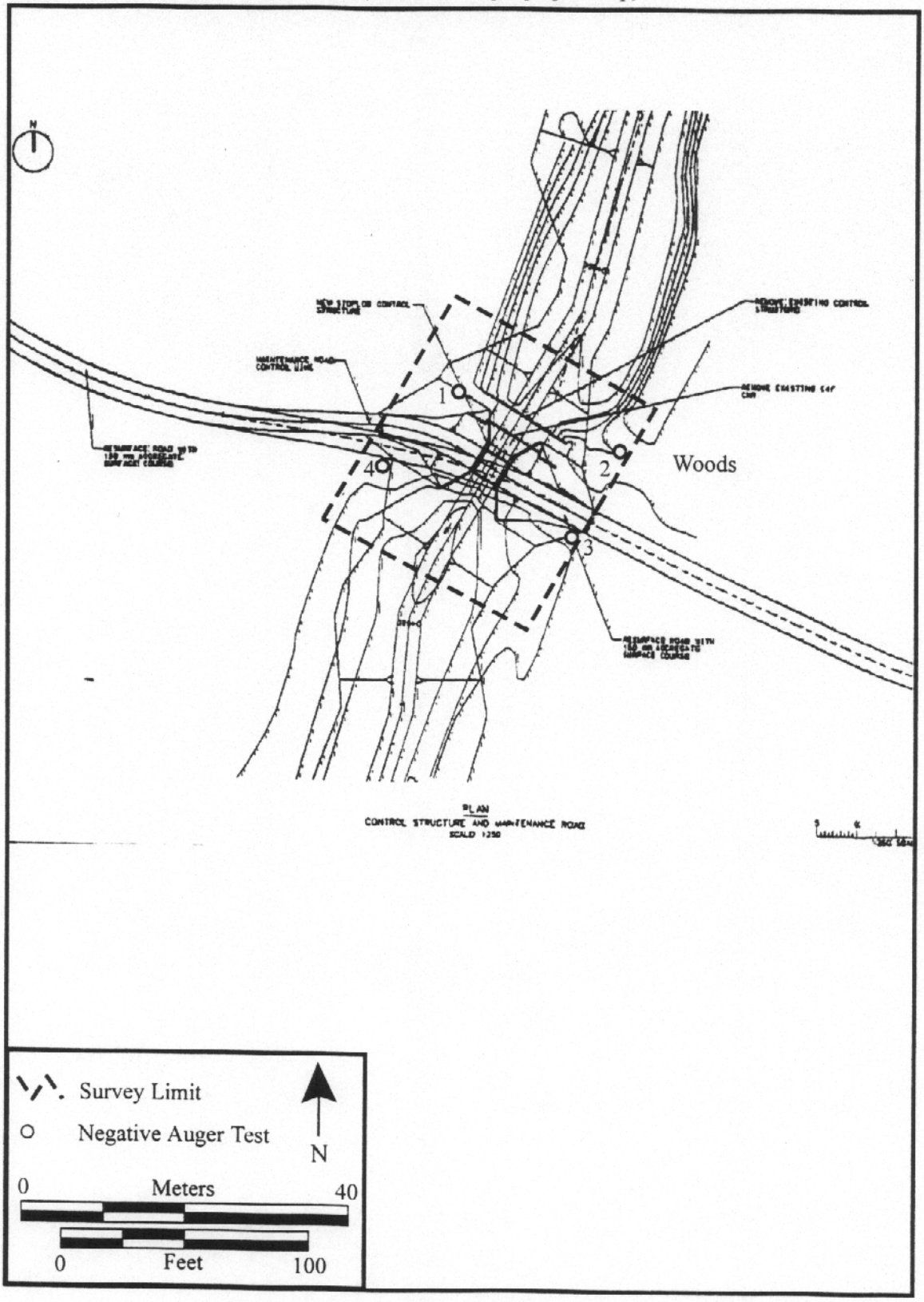
Sincerely,

Frank Florin
Owner and Principal Investigator

**References**

Trygg, J. W.
1964 *Composite Map of United States Land Surveyor's Original Plats and Field Notes – Sheet 7 Minnesota Series*. Ely, Minnesota.

Figure 1. Sketch Map of Project Area (based on Corps' project map).



Brad J

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

August 26, 2003

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

Mr. Stan Ellison
Land Department
Shakopee Mdewakanton Sioux Community
2330 Sioux Trail NW
Prior Lake, Minnesota 55372

Dear Mr. Ellison:

Thank you for your response to our letter of July 24, 2003, inviting consultation concerning the environmental restoration project at Long Meadow Lake in Bloomington, Minnesota. Since that time, we have had the area of the proposed control structure surveyed to identify archaeological resources that may be present in that area. The results of the survey were negative. If you would like a copy of the report, please let us know and we will send it to you.

The project will involve a certain amount of dredging to remove sediment from the lake's outlet channel. When the scope of that work has been determined and a placement site for the material has been identified, we will do additional survey work.

Please let us know of any concerns you may have or additional information you would like to receive. We would be pleased to schedule a meeting with you to discuss this project further. If you have questions or comments, please call Mr. Bradley Johnson at (651) 290-5250.

Sincerely,

for Terry J. Birkenstock
Chief, Environmental and Economic
Analysis Branch

Long Meadow Lake HREP
Preliminary Draft DPR (Aug 2003)

Clarification Comments and Questions to Corps of Engineers
By Sharonne Baylor, USFWS
September 4, 2003

*Note: These comments and questions are for clarification purposes only. The FWS will provide formal comments under a separate letter.*

**I spoke with Kari Layman on 05 Sep 03 and Joel Face on 08 Sep 03.**

1. Please use terms for existing and new culverts, outlets, and control structures consistently throughout the DPR, attachments, appendices, drawings, etc. This can get confusing, especially the way Plates 3 & 4 in Attachment 1 label project features. (i.e. sometimes the existing control structure is called an outlet, or outlet/inlet culvert, or culvert, etc…)

2. Page 1.2: You can update the FWS personnel with Pam Thiel, Nick Rowse, John Dobrovolny, and me.

3. Page 11-1, Table 11-1: Complete table.

4. Page 11-1, paragraph 11.3: I did not find a breakdown of projected operation and maintenance costs contained in "attachment 2". Is this referring to the "Cost Estimate and Constructability Review" attachment? That's where I was looking and did not see any breakdowns for O&M costs. Concur. O & M Costs will be added.

5. Page 11-2, Table 11-2, Complete table.

6. Attachment 1, Plate 2: This map is difficult to read. Also, if used, show project location on it.

7. Attachment 1, Plate 4: Suggest showing and clearly labeling the preferred alternative project features such as the channel excavation and new stoplog control structure.

8. Cost Estimate Appendix: Tree planting in this appendix and throughout the DPR shows up as "acre". Do you mean hectares? Need consistency using metric throughout DPR. Concur. Will change to hectares.

9. Hydraulic Appendix, Figure 1.1: The new control structure invert (210.0) and the new channel elevation (209.5) are well below the lake profile – it seems odd. **04 Sep 03 Kari looked at it and said it looked odd to her too. She will double check elevations shown on structural drawings – 1' might have turned into 1m. (She said that might be why the channel excavation quantities were higher than they thought they should be.)**

10. Hydraulic Appendix, Figures 2.2 and 2.3: These figures show Alternatives B and C together. Shouldn't there be one of just Alternative B by itself since that's what we're going to do? **04 Sep 03 Kari said yes it should be separate and will separate it out.**

11. Hydraulic Appendix, Alternative D (7th page): This makes reference to Attachments 2, 3, and 4 for the layout and design. I did not find these attachments. There is also a reference to Attachment 1 on my 8th page – I didn't find that attachment either. **04 Sep 03 Kari said they weren't electronic so apparently didn't get in package. She'll scan and send to me.**

12. Hydraulic Appendix: Please add page numbers. I think some pages in my DPR were mixed up ( pages 7 & 8???). **04 Sep 03 Kari said she'll add page numbers and yes, it appears a page did get out of order.**

13. Geotechnical Appendix, page 2, paragraph 7: The last sentence states that stability and settlement were not analyzed, but paragraph 10 on page 3 states that a slope stability analysis was completed. **08 Sep 03 Joel said he wasn't going to analyze under the new control structure but then he did. (Originally just going to analyze the rock dike, but then that was eliminated.) He'll change verbiage.**

14. Geotechnical Appendix, page 2, paragraph 8: Please clarify the last sentence: "The parts of the project requiring geotechnical analysis are not part of the selected plan." Paragraph 10 states that a slope stability analysis was completed. **08 Sep 03 Joel said he'll change verbiage.**

15. Geotechnical Appendix, page 3, paragraph 9: I did not find the locations of the two soil borings called out on "Plate 1" or anywhere else. **08 Sep 03 Joel said he'll add this information. He told me 00-1M was by the culvert and 00-2M was by the structure.**

16. Geotechnical Appendix, page 4, paragraph 14: I didn't find any explanation of the minimum weight of the rock in the Hydraulics Appendix. **08 Sep 03 Joel said that this was normally information he gets from hydraulics. He'll get with Kari on this.**

**Long Meadow Lake**
**Preliminary Draft DPR Meeting**
**Minnesota Valley National Wildlife Refuge**
**3815 E. 80th Street, Bloomington, MN**

**16 October 2003**
**0900-1200**

**AGENDA**

1. Recommended Plan (Novak) – 10 minutes
   - Brief summary of goals/objectives/features

2. Review comments/responses (Team) – 2-3 hours
   - Review USFWS/DNR comments and Corps responses. See attached.

3. Schedule
   - Issue Draft DPR/EA 14 Nov 03
   - Public Meeting 02 Dec 03
   - Final DPR 15 Jan 04
   - DPR Approval 15 Feb 04
   - Begin P&S 15 Feb 04
   - Final P&S 15 Apr 04
   - Solicitation Budget dependent

# MnDNR Comment/Responses

Goal A

The stated goal is to provide high quality habitat for migratory birds and aquatic wildlife. The Executive Summary states that the project would give the Refuge the ability to optimize aquatic vegetation growth for migratory waterfowl and other wildlife. Throughout the development of this project, the DNR has encouraged management, not just for waterfowl, but also for nongame species, especially species of management concern such as Foresters terns and other colonial waterbirds and shorebirds. Our fisheries managers also would like to see the project maximize conditions for fish. A management plan would be helpful for clarifying goals and strategies for achieving those goals.

***Goals for the Long Meadow Lake HREP project will be discussed/clarified at the meeting.***

Tree Planting

DPR item number 6.3.3 states that some of the former agricultural fields are dominated by monotypic stands of green ash and cottonwood. We notice that the planting plan includes 25% green ash, but no cottonwood. Cottonwood has been lost from much of the Minnesota River floodplain forest. It's re-establishment (through planting or natural regeneration) should be encouraged as much as possible.

***Refuge personnel provided the original planting mix, however, based upon this comment and USFWS comments in item 2 below, the group needs to discuss and agree on a final planting plan.***

# USFWS Comment/Responses

1. Channel

   1.1. The downstream channel banks are now stabilized by native trees. Minimize the downstream channel excavation disturbance, especially on the banks, as much as possible. ***Concur. There are currently some high spots in the downstream channel that will need to be excavated. Channel excavation will be limited to these areas. These areas will be specifically defined during the Plans and Specifications stage.***

   1.2. Ensure that the upstream channel excavation extends far enough into Lower Long Meadow Lake to provide adequate drainage.
   ***Concur. The upstream channel is currently designed to daylight into Lower Long Meadow Lake. The analysis completed to determine drawdown time assumed a bottom elevation of 210m.***

   1.3. We have concerns that the channel will silt in and require additional excavation, but we do not want to have operation and maintenance (O&M) responsibilities

for the channel. Ensure that the channel design is such that O&M of the channel is eliminated or minimal.
***Although the sedimentation cannot be completely eliminated, the channel will be designed to minimize operation and maintenance costs. Lowering the bottom elevation of the control structure and dredging the channel will improve channel efficiency. Additional excavation may be required periodically, but it is not expected to be an annual occurrence.***

1.4. When the surveyors perform the survey of the upstream channel, make sure they survey the channel at the end of the peninsula in the middle Lower Long Meadow Lake. Verify this channel is low enough to drain the upper part of Lower Long Meadow Lake.
***Concur, will be done as part of Plans and Specifications.***

1.5. Site 2 is one of the two sites designated for channel excavation material disposal. This site has developed a nice natural growth of trees and we would like to minimize disturbance in this area (with the exception of constructing elevated areas as described in comment 2.2 below).
***Concur, will define disposal areas at the meeting.***

2. Tree Plantings

2.1. We would like to revise the planting plan. Since the conception of this project, natural regeneration has already provided native saplings on some of the fields. Our proposed planting plan is attached. OR We will provide our proposed planting plan at a later date.
***Concur. Will include any additional information provided by FWS in the discussion.***

2.2. We recommend creating 0.25 acre elevated areas with the channel excavation material disposed in the fields. Additional plant diversity would be achieved by planting 1" caliper Bur Oak, Hackberry and Kentucky Coffee trees in those areas. We understand that these areas may be difficult to construct if the channel is hydraulically dredged.
***Concur. The current strategy is to mechanically dredge the channel. Will include any additional design information provided by FWS in the discussion.***

3. Structure

3.1. Provide a minimum of 12' access road width across the new structure for maintenance equipment access.
***Concur.***

3.2. Ensure the structure grating can carry maintenance loads (such as a loaded dump truck) and can be lifted off with maintenance equipment. Size grating into manageable pieces.
***Concur.***

3.3. More grating around the stoplog grooves is needed to support personnel during stoplog operations. Suggest slightly modifying the wing walls and adding grating on the three non-grated sides of the stoplog grooves. (Handrail might be needed with this option.)
***Concur. Will include any additional information provided by FWS in the discussion.***

3.4. We suggest using an aesthetically pleasing guardrail rather than the typical steel "W" beam. Some suggestions include painting the steel, using Cortan steel, or using a steel-backed timber guardrail. We understand that this type of guardrail may require more maintenance.
***Concur.***

3.5. Provide locks on the grating and stoplogs to secure from vandalism. (Please note that the stoplog locking system used on Rice Lake project was ineffective.)
***Concur.***

3.6. We need to further evaluate the best way to control and remove debris from the structure area. Beavers are a big problem at control structures on the Refuge. Some ideas we have at this point include trash racks and/or a maintenance platform area where the debris can be reached with the Refuge's backhoe (Case 590 loader/backhoe).
***Concur.***

3.7. We need to further evaluate whether to place the stoplogs on the upstream or downstream side of the structure. Hydraulically, the stoplogs can be operated from either side. The placement will depend on the primary operation of the stoplogs (for ponding water in the lake or preventing the Minnesota River from backing up into the lake) and the maintenance requirements.
***Concur. Will include any additional information provided by FWS in the discussion.***

3.8. We would like to save the big cotton wood tree on the northwest side of the existing structure if possible.
***Will evaluate during P&S.***

4. Access Road

4.1. West of the control structure, there is another culvert under the access road. Please determine if this culvert is needed anymore. If not, then remove the existing culvert and plug the channel. If the culvert is needed, provide for the removal of the existing culvert and installation of a new one. (Please note that the existing culvert is not adequate to support construction equipment.)
***The design/drawings will be changed to show installation of new culvert.***

4.2. Regrading and resurfacing the access road between the gate and the structure, as well as any other areas damaged by construction, is required.
***Concur. Will be added to draft DPR.***

5. Habitat Analysis

5.1. Page 4-2, paragraph 4.1.3, first sentence. Provide additional documentation or description of why conditions at Long Meadow Lake are not likely to improve.
***Concur. Will include any additional information provided by FWS in the discussion.***

5.2. Page 5-3, Goal A, descriptive paragraph under goal, first sentence. Long Meadow Lake is also influenced by groundwater seepage, springs, and storm water drainage.
***Will include in report.***

5.3. The black-capped chickadee was used as an indicator species for the HEP. We suggest also using a species related to a marsh environment. ***Do not concur. Reasoning for approach/model selection for the evaluation is presented on page 4-1 of Appendix 4.*** THIS COMMENT WAS WITHDRAWN

6. Other Comments

6.1. We plan to operate the control structure in a way that will maximize the benefits to both the fish and wildlife. We should be able to follow the recommendation of MnDNR to have the control structure open from March 1- May 31.

6.2. Please coordinate the cultural resource and NEPA aspects of this project with our Regional Historic Preservation Officer.

**United States Department of the Interior**

**U.S. FISH AND WILDLIFE SERVICE**
Minnesota Valley National Wildlife Refuge
3815 East 80th St.
Bloomington, MN 55425

Celebrating a Century of Conservation!

IN REPLY REFER TO:

FWS/MNV

September 26, 2003

Mr. Thomas Novak
Project Manager
US Army Corps of Engineers, St. Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638

Dear Mr. Novak:

Thank you for the opportunity to review and comment on the Long Meadow Lake preliminary draft Definite Project Report (DPR) dated August 2003. We are excited about this project and look forward to its completion because we believe it will greatly improve wildlife habitat in the Refuge. The following are our comments regarding the DPR.

1. Channel

   1.1. The downstream channel banks are now stabilized by native trees. All construction should minimize the downstream channel excavation disturbance, especially on the banks, as much as possible.

   1.2. We need to ensure that the upstream channel excavation extends far enough into Lower Long Meadow Lake to provide adequate drainage.

   1.3. We have concerns that the channel will silt in and require additional excavation, but we do not want to have operation and maintenance (O&M) responsibilities for the channel. Ensure that the channel design is such that O&M of the channel is eliminated or minimal.

   1.4. When the surveyors perform the survey of the upstream channel, make sure they survey the channel at the end of the peninsula in the middle Lower Long Meadow Lake. Verify this channel is low enough to drain the upper part of Lower Long Meadow Lake.

   1.5. Site 2 is one of the two sites designated for channel excavation material disposal. This site has developed a nice natural growth of trees and we would like to

minimize disturbance in this area (with the exception of constructing elevated areas as described in comment 2.2 below).

2. Tree Plantings

   2.1. We would like to revise the planting plan. Since the conception of this project, natural regeneration has already provided native saplings on some of the fields. We will provide you an updated planting plan in the near future.

   2.2. We recommend creating 0.25 acre elevated areas with the channel excavation material disposed in the fields. Additional plant diversity would be achieved by planting 1" caliper Bur Oak, Hackberry and Kentucky Coffee trees in those areas. We understand that these areas may be difficult to construct if the channel is hydraulically dredged.

3. Structure

   3.1. Provide a minimum of 12' access road width across the new structure for maintenance equipment access.

   3.2. Ensure the structure grating can carry maintenance loads (such as a loaded dump truck) and can be lifted off with maintenance equipment. Size grating into manageable pieces.

   3.3. More grating around the stoplog grooves is needed to support personnel during stoplog operations. Suggest slightly modifying the wing walls and adding grating on the three non-grated sides of the stoplog grooves. (Handrail might be needed with this option.)

   3.4. We suggest using an aesthetically pleasing guardrail rather than the typical steel "W" beam. Some suggestions include painting the steel, using Cortan steel, or using a steel-backed timber guardrail. We understand that this type of guardrail may require more maintenance.

   3.5. Provide locks on the grating and stoplogs to secure from vandalism. (Please note that the stoplog locking system used on Rice Lake project was ineffective.)

   3.6. We need to further evaluate the best way to control and remove debris from the structure area. Beavers are a big problem at control structures on the Refuge. Some ideas we have at this point include trash racks and/or a maintenance platform area where the debris can be reached with the Refuge's backhoe (Case 590 loader/backhoe).

   3.7. We need to ensure that the stoplogs on the structure are designed to be placed on the upstream side of the structure.

3.8. We would like to save the big cotton wood tree on the northwest side of the existing structure if possible.

4. Access Road

4.1. West of the control structure, there is another culvert under the access road. Please determine if this culvert is needed anymore. If not, then remove the existing culvert and plug the channel. If the culvert is needed, provide for the removal of the existing culvert and installation of a new one. (Please note that the existing culvert is not adequate to support construction equipment.)

4.2. Regrading and resurfacing the access road between the gate and the structure, as well as any other areas damaged by construction, is required.

5. Habitat Analysis

4.1 Page 4-2, paragraph 4.1.3, first sentence. Provide additional documentation or description of why conditions at Long Meadow Lake are not likely to improve.

5.1. Page 5-3, Goal A, descriptive paragraph under goal, first sentence. Long Meadow Lake is also influenced by groundwater seepage, springs, and storm water drainage.

5.2. The black-capped chickadee was used as an indicator species for the HEP. We suggest also using a species related to a marsh environment.

6. Other Comments

6.1. We plan to operate the control structure in a way that will maximize the benefits to both the fish and wildlife. We should be able to follow the recommendation of MnDNR to have the control structure open from March 1- May 31.

6.2. Please coordinate the cultural resource and NEPA aspects of this project with our Regional Historic Preservation Officer.

Thank you again for the chance to comment on the Long Meadow Lake preliminary draft DPR. We look forward to working with the St. Paul District and the state of Minnesota on this beneficial project. If you need additional information for development of the DPR, or if you have any questions about these comments, please contact Ms. Sharonne Baylor, our EMP coordinator, at (507) 494-6207.

Sincerely,

Rick Schultz
Refuge Manager

cc: FWS; Nick Rowse
FWS; Pam Thiel
FWS; John Dobrovolny
FWS; Sharonne Baylor
MN DNR; Wayne Barstad

## Novak, Tom MVP - PM-A

**From:** Wayne Barstad [wayne.barstad@dnr.state.mn.us]
**Sent:** Tuesday, October 07, 2003 12:59 PM
**To:** tom.novak@mvp02.usace.army.mil
**Subject:** Re: LOng Meadow Lake

Tom, here are comments I sent on 9/29. ..wb

The DNR offers the following comments on the preliminary draft Definite Project Report (DPR).

Goal A
The stated goal is to provide high quality habitat for migratory birds and aquatic wildlife. The Executive Summary states that the project would give the Refuge the ability to optimize aquatic vegetation growth for migratory waterfowl and other wildlife. Throughout the development of this project, the DNR has encouraged management, not just for waterfowl, but also for nongame species, especially species of management concern such as Foresters terns and other colonial waterbirds and shorebirds. Our fisheries managers also would like to see the project maximize conditions for fish. A management plan would be helpful for clarifying goals and strategies for achieving those goals.

Tree Planting
DPR item number 6.3.3 states that some of the former agricultural fields are dominated by monotypic stands of green ash and cottonwood. We notice that the planting plan includes 25% green ash, but no cottonwood. Cottonwood has been lost from much of the Minnesota River floodplain forest. It's re-establishment (through planting or natural regeneration) should be encouraged as much as possible.

I look forward to meeting in mid-October. ..wb

Wayne Barstad
Regional Environmental Assessment Ecologist
Central Region
651 772-7940
wayne.barstad@dnr.state.mn.us

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

October 27, 2003

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

Mr. John Dobrovolny
U.S. Fish and Wildlife Service
1 Federal Drive, Room 603
Bishop Henry Whipple Federal Building
Fort Snelling
Minneapolis, Minnesota 55111-4007

Dear Mr. Dobrovolny:

The St. Paul District, Corps of Engineers has reviewed the report on the phase one archaeological survey of the location for the water control structure to be constructed for the environmental restoration project in the U.S. Fish and Wildlife Service Minnesota River National Wildlife Refuge, Long Meadow Lake Unit. Florin Cultural Resource Services conducted the survey, and we have enclosed a copy of the report for your review.

We agree with the results of the survey, which were negative, and believe that no historic properties will be affected by construction of the control structure. As the remaining portions of this project become better defined, such as dredging and the disposal of dredged material or any stream bank protection, we will coordinate them with you.

Please review the enclosed report, and if you agree that no historic properties will be affected by construction of the control structure, we will coordinate this portion of the project with the Minnesota State Historic Preservation Office. If you have any questions, please call Mr. Bradley Johnson at (651) 290-5250.

Sincerely,

For Dennis Anderson
Terry J. Birkenstock
Chief, Environmental and Economic
Analysis Branch

Enclosure

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

November 5, 2003

Environmental and Economic Analysis Branch
Planning, Programs and Project Management Division

SUBJECT: Water Control Structure: Minnesota River National Wildlife Refuge
Long Meadow Lake Unit, SE1/4, NE1/4, S6, T27 N, R23W, Hennepin County

Mr. Dennis Gimmestad
State Historic Preservation Office
Minnesota Historical Society
345 Kellogg Boulevard West
St. Paul, Minnesota 55102-1906

Dear Mr. Gimmestad:

The St. Paul District, Corps of Engineers contracted for a phase one archaeological survey of the location for the water control structure proposed as part of an environmental restoration project in the U.S. Fish and Wildlife Service's Minnesota River National Wildlife Refuge, Long Meadow Lake Unit. Florin Cultural Resources Services conducted the survey, and we have enclosed a copy of the report for your review.

We believe that the area of potential effects for the project is limited to individual project features and ancillary areas needed for construction of those features. Although a key component of the project is a water control structure, operation of that structure will be to eliminate the backup of water from the Minnesota River and to allow temporary lowering of water levels to stimulate plant growth. The structure will not be used to increase the water storage capacity of Long Meadow Lake.

We agree with the survey results, which were negative, and believe that there will be **no historic properties affected** by construction of the control structure. As other features proposed for this project become better defined, we will coordinate them with your office. This may include dredging and dredged material disposal areas as well as downstream bank protection areas.

Please review the enclosed report and provide us with your comments. If you have any questions, please call Mr. Bradley Johnson at (651) 290-5250.

Sincerely,

Terry J. Birkenstock
Chief, Environmental and Economic
Analysis Branch

Enclosure

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**
**Bishop Henry Whipple Federal Building**
**1 Federal Drive**
**Fort Snelling, MN 55111-4056**


IN REPLY REFER TO:

FWS/NWRS-VSO

NOV -7 2003

Mr. Bradley Johnson
Archeologist
Saint Paul District, US Army Corps of Engineers
Army Corps of Engineers Center
190 Fifth Street East
Saint Paul, Minnesota 55101-1638

Dear Mr. Johnson:

Thank you for the opportunity to review and comment on the draft letter report for Phase I archeological survey of replacement of water control structures at Long Meadow Lake accomplished under ARPA (Federal Archaeological Resources Protection Act) Permit No. 2003-MN/3-1 issued by the Regional Director.

The letter report appropriately describes the negative results of the investigation of 0.3 acres on Minnesota Valley National Wildlife Refuge. The report should someplace acknowledge that the archeological investigation was accomplished in part under the ARPA permit.

I did not look for editorial problems and did not notice any.

Please provide us with the final report in three copies.

Thank you for your continuing efforts to assist the Refuge in understanding and managing its archeological sites. As suggested, the Corps should continue consultation with the Minnesota State Historic Preservation Officer about these negative results for this part of the Environmental Management Program project.

Sincerely,

H. John Dobrovolny
Regional Historic Preservation Officer

## Novak, Tom MVP - PM-A

**From:** Layman, Kari L MVP
**Sent:** Friday, November 14, 2003 10:18 AM
**To:** 'Sharonne_Baylor@fws.gov'
**Cc:** Novak, Tom MVP - PM-A
**Subject:** Long Meadow Lake; Channel and Structure Elevations

LML.pdf

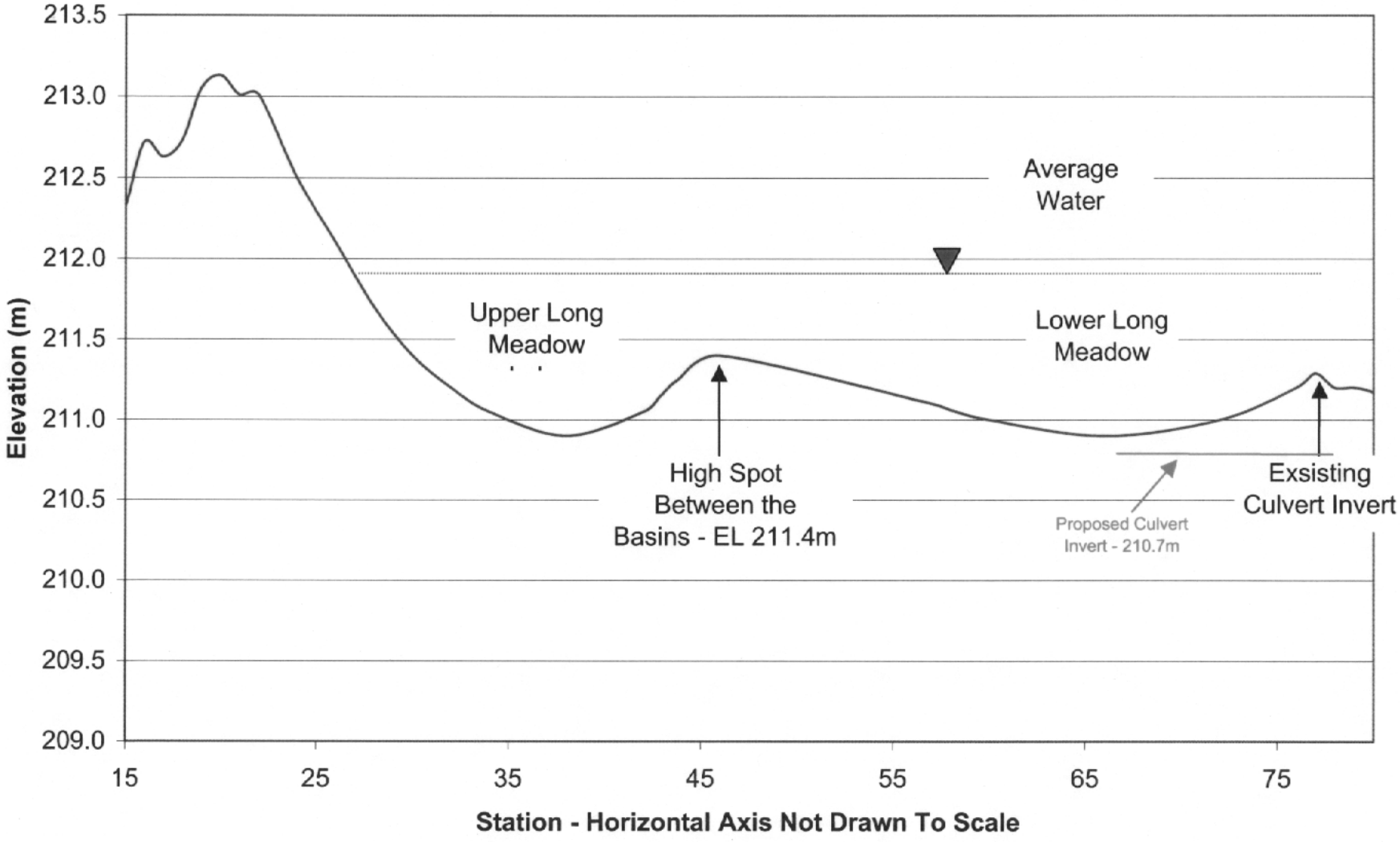
Sharonne,

I have attached the channel profiles for Long Meadow Lake. The proposed culvert invert of 210.7m is shown in Red. As discussed, this is a change from the draft DPR which shows the invert at 210m. Based on the bathymetry data that we have for Long Meadow, I believe the invert elevation of 210m is incorrect.

At an elevation of 210.7m, the culverts can be operated to drain the vast majority of Lower Long Meadow Lake. This change also minimizes our dredging. On the downstream side, this change will enable us to limit dredging to the area near the structure.

If you and Rick agree with this change or you have any questions, please let me know.

Sorry for all of the confusion,
Kari


213.5
213.0
212.5
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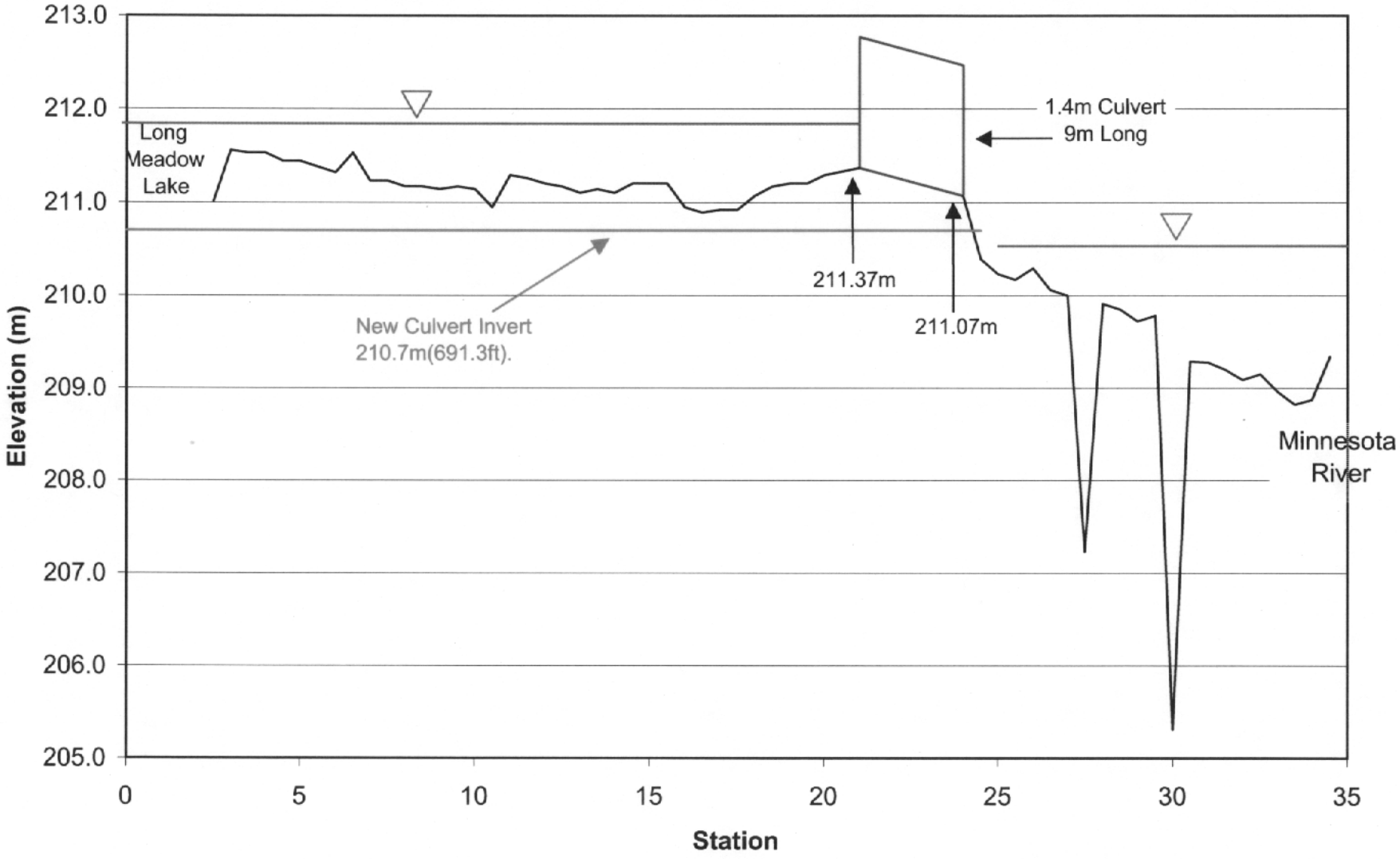
210.5
210.0
209.5
209.0
Elevation (m)
Average
Water
Upper Long
Meadow
Lower Long
Meadow
High Spot
Between the
Basins - EL 211.4m
Proposed Culvert
Invert - 210.7m
Exsisting
Culvert Invert
15
25
35
45
55
65
75
Station - Horizontal Axis Not Drawn To Scale

# Fig. 1: Lower Long Meadow Lake Inlet/Outlet Channel Profile




Horizontal Axis Not Drawn To Scale

MINNESOTA HISTORICAL SOCIETY
STATE HISTORIC PRESERVATION OFFICE

December 1, 2003

Mr. Terry Birkenstock
Chief, Environmental & Economic Analysis Branch
U.S. Army Corps of Engineers
190 5th Street East
St. Paul, MN 55101-1638

RE: Water Control Structure: Minnesota River National Wildlife Refuge
Long Meadow Lake Unit
T27 R23 S6 SE-NE, Hennepin County
SHPO Number: 2004-0458

Dear Mr. Birkenstock:

Thank you for the opportunity to review and comment on the above project. It has been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

We have reviewed the results of the survey of the project area. Based on the results of this survey, we conclude that **no historic properties eligible for or listed on the National Register of Historic Places will be affected** by this project.

Please contact Dennis Gimmestad at (651) 296-5462 if you have any questions on our review of this project.

Sincerely,

Britta L. Bloomberg
Deputy State Historic Preservation Officer

cc: Brad Johnson, COE

Florin Cultural Resource Services

December 8, 2003

Mr. Bradley Johnson
St. Paul District, U.S. Corps of Engineers
190 5th Street East
St. Paul, MN 55101-1638

**Re: Field Report – Soil Borings for Long Meadow Lake EMP in Hennepin County, Minnesota**

Dear Mr. Johnson,

Florin Cultural Resource Services was retained by the U.S. Army Corps of Engineers, St. Paul District to conduct soil borings at two soil disposal sites (Corps' Sites # 1 and #3) for the Long Meadow Lake Environmental Management Project in Hennepin County, Minnesota. The purpose of the borings was to determine if the project areas have the potential to yield archaeological sites based on the soil characteristics. This letter report includes the methods, results, and recommendations of the investigation. The U.S. Fish and Wildlife Service issued Special Use Permit No. 32590-04-16. Fieldwork was conducted on November 26, 2003 by Frank Florin.

**Project Description**

The project area is in T27N, R23W, NW1/4, SW1/4, Section 5 and NE1/4, SW1/4, Section 7, Bloomington, Minnesota (Figure 1). The project is located on the floodplain within the Minnesota River Valley. Specifically, the disposal sites are situated on natural levees along the west side of the Minnesota River. Low-lying marshes associated with Long Meadow Lake are located just west of the disposal areas.

Disposal Site #1 is approximately 300 by 70 meters (5 acres) in size and is situated on a prominent embankment of fill along the west side of the Minnesota River. The extent of the fill is depicted on the USGS 7.5' quadrangle map. The embankment of fill rises about 2 meters above the surrounding landscape. Vegetation consists grasses and plants.

Disposal Site #3 is approx 220 by 180 meters (10 acres) in size and is situated on a levee along a former channel of the Minnesota River. Based on a review of the original land survey map, the river flowed through this former channel in the mid 1800s. The USGS 7.5' quadrangle map (rev. 1993) illustrates that the course of the river was straightened and diverted through a man-made channel sometime during the last 100 years. The east half of the disposal site is wooded, and the west half is in a grassy field.

• N12047 280th Street Boyceville, WI 54725 • Phone/Fax: (715) 643-2918
• florin@pressenter.com

## Soil Boring Methods and Results

Soil borings were conducted using a shovel and auger. The shovel was used to extract the upper 80 cm of soil. A Seymour auger with a 6" bucket was used to extract soil below 80 cm. One boring was conducted at Disposal Site #1, and it extended to a depth of 320 cm below surface (Table 1). Two borings were conducted at Disposal Site #3, and they extended to the water table at 200 cm below surface (Table 2).

A soil profile was drawn for each shovel test, which included Munsell color and soil structure. The locations of the soil borings were recorded with a GPS unit that had an accuracy of +/- 5 meters (Table 3).

Table 1. Soil Profile Disposal Site #1.

| Depth Below Surface (cm) | Soil Description |
|---|---|
| 0-170 | Fill |
| 170-220 | Very dark grayish (2.5Y 3/2) silt loam; very weak to massive, very fine subangular block structure; C1 horizon; historic-age alluvial deposits |
| 220-270 | Dark gray (5Y 4/1) silt loam; C2 horizon; historic-age alluvial deposits |
| 270-320 | Black (2.5Y 2.5/1) silty clay loam; rootlets present; weak, very fine subangular structure; 2Ab horizon |

Table 2. Soil Profile from Disposal Site #3.

| Depth Below Surface (cm) | Soil Description |
|---|---|
| 0-20 | Black (2.5Y 2.5/1) silty clay loam; moderate, very fine subangular blocky structure; A horizon |
| 20-30 | Very dark grayish (2.5Y 3/2) silt loam; moderate, very fine subangular blocky structure; B horizon |
| 30-200 | Dark grayish brown (2.5Y 4/2) silty clay loam; massive structure; C horizon |

Table 3. UTM Coordinates (1927 NAD) of Soil Borings.

| Provenience | Northing | Easting |
|---|---|---|
| Disposal Site #1 | 4966504 | 483800 |
| Disposal Site #3 Boring 1 | 4964951 | 482546 |
| Disposal Site #3 Boring 2 | 4964947 | 482433 |

**Conclusions and Recommendations**

The soil profile at Disposal Site #1 has stratified deposits that include a 2-meter-thick layer of fill and historic-age alluvial deposits that overlie a buried soil of unknown age. The buried soil is thick and extends from 270 to 320 cm below surface. The potential for intact archaeological sites above the buried soil is low to nil. The buried soil represents a former stable land surface and therefore it has the potential to yield archaeological sites. Because the buried soil is capped by 2.7 meters of fill and historic-age alluvium, the proposed project will probably not affect any potential sites that exist within or below the buried soil. Therefore no archaeological testing is recommended at Disposal Site #1.

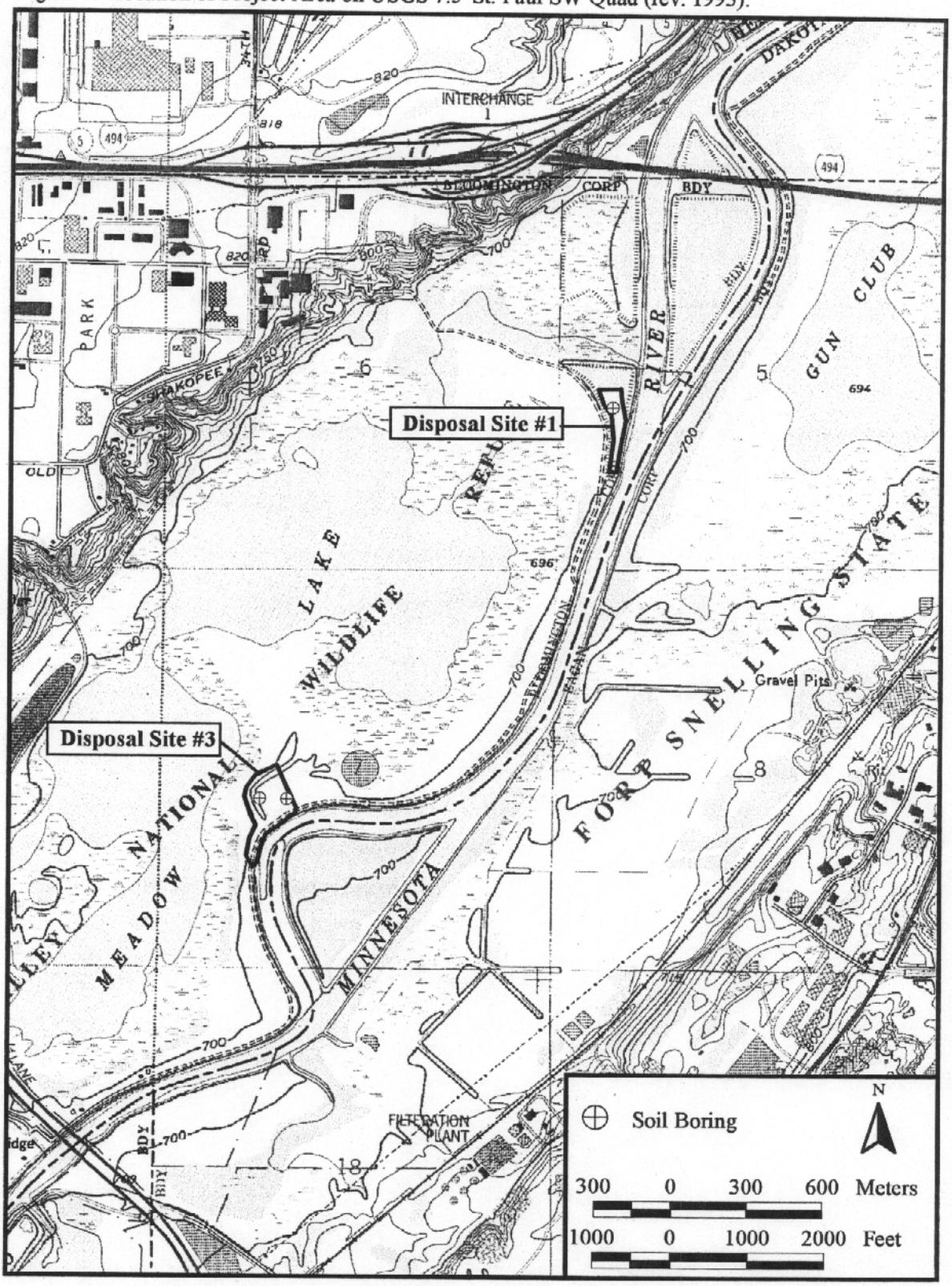
The soils at Disposal Site #3 are unstratified and consist of a surface soil that formed in alluvium. The soil is relatively thin (ca. 30 cm ) and is not well developed, suggesting that it is relatively young (late Holocene to historic in age). The landscape at Disposal Site #3 has the potential to yield an archaeological site. The highest archaeological potential is near the surface in the A and B horizons where soil forming processes have occurred as a result of landscape stability. The subsurface deposits (C horizon) lack soil development and are rated as having a low potential for containing intact archaeological deposits. It is recommended that testing be conducted at Disposal Site #3 to determine if any archaeological sites are present.

Sincerely,

Frank Florin

Frank Florin
Owner and Principal Investigator

Figure 1. Location of Project Area on USGS 7.5' St. Paul SW Quad (rev. 1993).



DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

Project Management Branch
Planning, Programs, and Project Management Division

SUBJECT: Long Meadow Lake Habitat Rehabilitation and Enhancement Project

Dear Interested Parties:

Enclosed for your information, review, and comment is the draft Integrated Definite Project Report and Environmental Assessment for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project (HREP). The report contains an integrated environmental assessment, a draft Finding of No Significant Impact (FONSI), and a Section 404(b)(1) evaluation. We are distributing this report to concerned agencies, local units of government, interested groups, and individuals. If you have any comments on the report or environmental assessment, please submit them within 30 days of the date of this letter.

The Section 404(b)(1) evaluation is being distributed as part of this report in lieu of a separate Section 404 public notice. Anyone may request a public hearing on this project. The request must be submitted in writing within 15 working days of the date of this letter. Interested parties are also invited to submit to this office written facts, arguments, or objections to this project within 30 days of the date of this letter. These statements should clearly state the interest that the project would affect and how the project would affect that interest. All statements, oral or written, will become part of the official project file and will be available for public examination.

Questions concerning the Long Meadow Lake HREP should be directed to Mr. Tom Novak, Project Manager, at (651) 290-5524 or at tom.novak@mvp02.usace.army.mil. Please address all correspondence to the St. Paul District, Corps of Engineers, ATTN: CEMVP-PM-A, 190 Fifth Street East, St. Paul, Minnesota 55101-1638.

Sincerely,

Judith L.A. DesHarnais, P.E.
Deputy for Programs and Project Management

Enclosure

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

Project Management Branch
Planning, Programs, and Project Management Division

SUBJECT: Long Meadow Lake Habitat Rehabilitation and Enhancement Project

Dear Interested Parties:

This is to inform you that the draft Integrated Definite Project Report and Environmental Assessment for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project (HREP) has been completed and is available for public review. The report contains an integrated environmental assessment, a draft Finding of No Significant Impact (FONSI), and a Section 404(b)(1) evaluation. The executive summary for the report is attached.

The Section 404(b)(1) evaluation is being distributed as part of the report in lieu of a separate Section 404 public notice. Anyone may request a public hearing on this project. The request must be submitted in writing within 15 working days of the date of this letter. Interested parties are also invited to submit to this office written facts, arguments, or objections to this project within 30 days of the date of this letter. These statements should clearly state the interest that the project would affect and how the project would affect that interest. All statements, oral or written, will become part of the official project file and will be available for public examination.

A copy of the draft Integrated Definite Project Report and Environmental Assessment for the Long Meadow Lake HREP can be obtained by contacting Mr. Tom Novak, Project Manager, at (651) 290-5524 or at tom.novak@mvp02.usace.army.mil. Please address all correspondence to the St. Paul District, Corps of Engineers, ATTN: CEMVP-PM-A, 190 Fifth Street East, St. Paul, Minnesota 55101-1638.

Sincerely,

Judith L.A. DesHarnais, P.E.
Deputy for Programs and Project Management

Attachment

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

January 27, 2004

Project Management Branch
Planning, Programs, and Project Management Division

Mr. Wayne Barstad
Regional Environmental Assessment Ecologist
Division of Ecological Services
Minnesota Department of Natural Resources
1200 Warner Road
St. Paul, Minnesota 55106

Dear Mr. Barstad:

Enclosed for your review and comment is the draft Integrated Definite Project Report and Environmental Assessment for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project. Copies of the report have also been provided to the following individuals within the Minnesota Department of Natural Resources: Scot Johnson, Steve Johnson, Julie Ekman, Tom Polasik, Diana Regenscheid, and Daryl Ellison.

Please furnish any comments you may have on the document by March 1, 2004. If you have questions, please contact me at (651) 290-5524 or at tom.novak@mvp02.usace.army.mil.

Sincerely,

Tom Novak
Project Manager

Enclosure

## Novak, Tom MVP - PM-A

**From:** Wayne Barstad [wayne.barstad@dnr.state.mn.us]
**Sent:** Tuesday, March 02, 2004 2:21 PM
**To:** tom.novak@mvp02.usace.army.mil
**Cc:** Julie Ekman; Molly Shodeen
**Subject:** Long Meadow Lake Draft Integrated Definite Project Report and Environmental Assessment

Section 8.1.1

The proposal to use a mechanical dredge plant, launch from near the control structure, and barge materials to the structure appears to be the least impacting approach to cleaning the channel.

Construction of the control structure will require a DNR permit. If the channel excavation is to be done below the ordinary high water level (OHW), it also may need a permit. An OHW for this basin has never been established.

Section 9.2.2

The filling of five acres of wetland to the access road is an action that may require permitting either through the Wetland Conservation Act or the DNR permitting process. Again, this depends on the location of the OHW. Replacement of the outlet structure would likely trigger the need to officially establish an OHW for this basin. In either case, a 1:1 replacement would be required.

If you have any questions about this comments, please feel free to contact Julie Ekman, Area Hydrologist, at 651 772-7919.

Wayne Barstad
Regional Environmental Assessment Ecologist
Central Region
651 772-7940
wayne.barstad@dnr.state.mn.us

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

Project Management Branch
Planning, Programs, and Project Management Division

28 JAN 2004

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

Dear Ms. Thorson:

Enclosed for your review is the draft Integrated Definite Project Report and Environmental Assessment for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project. The entire project is located within the Minnesota Valley National Wildlife Refuge. The report contains an integrated environmental assessment, a draft Finding of No Significant Impact (FONSI), and a Section 404(b)(1) evaluation.

We request that you review this document and provide any comments you may have within 30 days of the date of this letter. We also request that you provide a statement assuring that the Fish and Wildlife Service will assume operation and maintenance responsibilities for the project in accordance with Section 906(e) of the Water Resources Development Act of 1986, as amended. General operation and maintenance responsibilities are outlined in the report and in the draft Memorandum of Agreement contained in attachment 7 of the report.

If you have any questions concerning the proposed project, please contact Mr. Tom Novak, Project Manager, at (651) 290-5524.

Sincerely,

for Robert L. Ball
Colonel, Corps of Engineers
District Engineer

Enclosure

Copy furnished: (w/o enclosure)

Mr. Don Hultman
District Manager
U.S. Fish and Wildlife Service
51 East 4th Street
Winona, Minnesota 55987

Ms. Sharonne Baylor
EMP HREP Coordinator
U.S. Fish and Wildlife Service
51 East 4th Street
Winona, Minnesota 55987

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

January 27, 2004

Project Management Branch
Planning, Programs, and Project Management Division

Ms. Sharonne Baylor
EMP HREP Coordinator
U.S. Fish and Wildlife Service
51 East 4th Street
Winona, Minnesota 55987

Dear Ms. Baylor:

Enclosed for your review and comment are two copies of the draft Integrated Definite Project Report and Environmental Assessment for the Long Meadow Lake Habitat Rehabilitation and Enhancement Project. Copies of the report have also been provided to the following individuals within the U.S. Fish and Wildlife Service: Rick Schultz, Chris Kane, Nick Rowse, Pam Thiel, and John Dobrovolny. In addition, the report was provided to the Regional Director with a letter requesting confirmation that the Fish and Wildlife Service would assume operation and maintenance responsibilities for the project (copy furnished to you and Don Hultman).

Please furnish any comments you may have on the document by March 1, 2004. If you have questions, please contact me at (651) 290-5524 or at tom.novak@mvp02.usace.army.mil.

Sincerely,

Tom Novak
Project Manager

Enclosure
(2 copies)

IN REPLY REFER TO:

# United States Department of the Interior

## U.S. FISH AND WILDLIFE SERVICE

Minnesota Valley National Wildlife Refuge
3815 East 80th St.
Bloomington, MN 55425

Celebrating a Century of Conservation!

March 1, 2004

Thomas Novak
Project Manager
US Army Corps of Engineers, St. Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638

Dear Mr. Novak:

Thank you for the opportunity to review and comment on the Long Meadow Lake Draft Definite Project Report (DPR) dated January 2004. We look forward this project and believe it will greatly improve wildlife habitat in the Refuge. The following are our comments regarding the DPR as well as for the plans and specification phase of this project.

**Comments for the DPR**

1. Section 6.2.5, Socioeconomic/Recreational: This narrative is the same as the preceding section, 6.2.4, Cultural Resources.

2. Section 6.5.3, Tree Planting: We will finalize the planting plan during the plans and specifications phase of this project. However, please note that we will not include swamp white oak in the planting species list.

3. Attachment 9, Sediment Analysis Data: Include a discussion and explanation of the analysis.

4. Address the secondary outlet culvert under the access road. This culvert will not support construction equipment and will need to be replaced during the construction contract. We would like to consider a slide or sluice gate on a new culvert which would give us flexibility to control the water flow through this area – not only to prevent back flow into Long Meadow Lake, but also to protect the eagle nesting site and manage the riparian habitat downstream. We envision a simple structure at this location, not a large concrete one like the stoplog structure.

5. Hydraulics Appendix, page 5-2, Figure 1.1: Add proposed channel and structure elevation (210.7) to this profile (or to a new profile showing the selected alternative profile).

6. Pages 3-4 and 3-5, Assessment of Existing Resources: Cultural resources have been appropriately addressed for the water control structure and the dredged material placement. However, discussion and determination for tree planting are not covered. It seems unlikely that tree planting in this floodplain condition would impact historic properties, but the DPR needs to so state. (These situations are addressed on page 9-4.)

7. Include discussion of fish passage issues in the DPR.

8. 36 CFR 800.2(a)(2) identifies the possibility for a lead Federal agency when two or more Federal agencies are involved in a project. Please inform the Regional Director that the Corps of Engineers will be the lead Federal

agency for the Section 106 (National Historic Preservation Act) process for this project, including an assurance that the Regional Historic Preservation Officer will be kept advised of compliance steps taken in accordance with 36 CFR Part 800. Include this arrangement for lead Federal agency in the final DPR.

9. We have some concerns about the way NEPA is being handled on this and other projects. We propose to meet with you to discuss these issues.

**Comments for the Plans and Specifications**

10. Many of our September 26, 2003 Preliminary Draft DPR comments were not addressed in this revised DPR because they were more appropriate to the plans and specifications phase of this project. Please address those comments when we get to the plans and specifications phase of the project.

11. Provide additional bathymetry data for Lower Long Meadow Lake. After analyzing that data, we can fine-tune the channel and structure invert elevations.

12. Ensure the channel design eliminates or minimizes operation and maintenance responsibilities. Also, ensure the construction tolerances for the channel excavation do not allow the channel to be left above the structure invert elevation. Or, the channel elevation could be lowered a bit further to allow for reasonable +/- construction tolerances.

13. Locate the stoplog structure staff gauges where they will be least susceptible to damage by flood debris.

14. Please salvage the existing 54" CMP and return it to the Refuge.

15. We prefer aluminum rather than wood stoplogs in order to eliminate beaver damage and the potential for the boards to warp. We would also like to have some extra stoplogs in case of damage or loss.

Thank you again for the chance to comment on the Long Meadow Lake Draft DPR. We look forward to working with you and the state of Minnesota on this beneficial project. If you need additional information for development of the DPR, or if you have any questions about these comments, please contact Ms. Sharonne Baylor, our EMP coordinator, at (507) 494-6207.

Sincerely,

Rick Schultz

Rick Schultz
Refuge Manager

cc: FWS; Nick Rowse
FWS; Pam Thiel
FWS; John Dobrovolny
FWS; Sharonne Baylor
MN DNR; Wayne Barstad

# Minnesota Pollution Control Agency

May 18, 2004

Colonel Robert L. Ball
District Engineer, St. Paul District
U.S. Army Corps of Engineers
190 Fifth Street East
St. Paul, Minnesota 55101-1638

RE: U.S. Army Corps of Engineers Habitat Rehabilitation and Enhancement Project – Long Meadow Lake Section 401 Certification Waiver

Documents submitted:

Draft Environmental Assessment
Draft Findings of No Significant Impact
404(b)(1) Evaluation

Dear Colonel Ball:

This letter is submitted by the Minnesota Pollution Control Agency (MPCA) under authority of Section 401 of the Clean Water Act (33 USC 1251 et seq.), Minn. Stat. chs. 115 and 116, and Minn. R. 7001.1400-.1470. The referenced project involves a proposal to construct Long Meadow Lake Habitat Rehabilitation and Enhancement Project located in Hennepin County, Minnesota.

The MPCA waives its authority to certify the referenced project application.

This action does not eliminate, waive or vary the applicant's responsibility of complying with all water quality standards and requirements contained in Minn. R. 7050 and all other applicable MPCA statutes and rules regarding water quality in the construction, installation and operation of the project. In addition, this action does not waive MPCA's authority to take necessary actions, including enforcement actions, to ensure that the applicant and the project's construction, installation and operation comply with water quality standards and all other applicable MPCA statutes and rules regarding water quality.

This MPCA decision is made, in part, on the applicant's representations that environmental review under the Minnesota Environmental Quality Control Board's (EQB) rules, Minn. R. chapter 4410 is not needed for the project or alternatively, that all necessary environmental reviews and related decisions have been completed and made. If environmental review for this project is needed and has not been completed, this MPCA waiver decision is null and void and of no legal effect. In that situation, MPCA reserves the right to make a section 401 decision when the environmental review process is completed.

This action does not release the applicant from any liability, penalty or duty imposed by Minnesota or federal statutes, regulations, rules or local ordinances and it does not convey a property right or an exclusive privilege.

Sincerely,

Leo Raudys
Division Director
Metro District

LR:jgo

cc: Kevin M. Pierard, U.S. Environmental Protection Agency, Chicago
Dan Stinnet, Field Supervisor, U.S. Fish and Wildlife Service
Kent Lokkesmoe, Director, DNR Waters
Steve Colvin, Ecological Services, Environmental Review, MDNR

**Novak, Tom MVP - PM-A**

**From:** Mader, Judy [Judy.Mader@state.mn.us]
**Sent:** Monday, March 15, 2004 4:17 PM
**To:** Novak, Tom MVP - PM-A
**Cc:** Scot Johnson (E-mail); Sharonne N. Baylor (E-mail); Wayne Barstad (E-mail); Brownell, Kurt A MVP; Devendorf, Randall; Face, Joel; Machajewski, Paul R MVP; Riggin, Lewis T MVP; Wege Gary [USFWS] (E-mail); Warburton Dave [USFWS] (E-mail)
**Subject:** RE: Long Meadow Lake HREP - Draft DPR

Tom:

I have finally put my comments together -- I apologize for the delay.

## Comments on Long Meadow Lake Draft DPR and EA

Section 3.1 Physical Setting
The Minnesota River drains much of west central, southwestern and south central Minnesota. Part or all of 37 counties (out of 87) in Minnesota drain to the Minnesota River. This does not include parts of or whole counties in Iowa that comprise that state's portion of the Blue Earth River watershed, which enters the Minnesota River at Mankato, Minnesota.

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Again, the Minnesota River drains large portions of west central, southwestern and south central Minnesota.

The Corps should mention that, although there are water quality problems due to the nature of the watershed, several agencies are working to reduce or eliminate those problems.

Some water quality data does exist for Long Meadow Lake. Between 1975 to 1978, the U.S. Geological Survey (USGS) took samples at four locations. That data is available through the USGS' website on the internet. More current data may be available from the Black Dog Watershed Management Organization (terry.schultz@ci.burnsville.mn.us).

Page 17-1 Coordination
It is possible that the reason there was no citizen attendance at the public meeting in Bloomington is the fact that the meeting was held the day after the September 11, 2001 attacks on the World Trade Center and the Pentagon. The Corps should mention this possible explanation in future documents for this project rather than leave the impression that citizens were not interested in the project.

**Sediment data**
Spectrum Labs
The surrogate recovery rates appeared to be very low for the PAH analyses.

The detection limits were above Ontario Ministry of the Environment's (OME) low effect level (lel) and/or the MPCA's Sediment Quality Target (SQT) Level I for:

acenaphthene, acenaphthylene, endrin, hepatchlor epoxide and toxaphene for all of the samples;

# SECTION II

## II. INTRODUCTION AND PURPOSE

### A. General

This Surface Water Management Plan has been developed to provide the City of Bloomington with direction concerning the administration and implementation of water resource activities within the City. This plan is intended to meet the requirements for a local watershed management plan as required by the Metropolitan Surface Water Management Act (Chapter 601 Laws of 1990) and be in conformance with Board of Water and Soil Resources (BWSR) Rules Chapter 8410.

In addition to being in conformance with the above state law, this plan has also been developed to meet the needs, requirements, and direction outlined by the following list:

1. The Nine Mile Creek Watershed District Plan
2. The Riley-Purgatory-Bluff Creek Watershed District Plan
3. Lower Minnesota River Watershed District Plan
4. Richfield-Bloomington Watershed Management Organization Plan
5. State Laws and Rules concerning wetland management as outlined in the Wetland Conservation Act of 1991 and amendments.
6. State and Federal laws regarding the need to secure a National Pollutant Discharge Elimination System (NPDES) permit for storm water outfalls to designated drainage ways.
7. Applicable erosion control and soil loss guidelines that are available through Hennepin County Conservation District and the Minnesota Pollution Control Agency (MPCA).

This plan incorporates the approaches and direction provided in the programs and documents listed above into a comprehensive plan that can be consistently applied across the City.

### B. Personnel Contacts

To implement this plan, a coordinated water resource management approach must be used. This approach utilizes the services of staff personnel within the City and surrounding communities, as well as staff personnel associated with the various watershed districts and water management organizations having jurisdiction over areas within the City. The watershed districts and watershed management organizations having jurisdiction within the City are shown on **Figure II-1.**

The primary implementation responsibility will lie with the appropriate staff members at the City. Assistance from the surrounding municipalities and Water Management Organizations will also be expected. Outlined below are the names, addresses, and

telephone numbers for personnel having responsibilities for overseeing or implementing various aspects of the Surface Water Management Plan.

City of Bloomington
City Engineer
Shelly Pederson, P.E.
9750 James Avenue S.
Bloomington, MN 55431-2514
(952) 948-3866

or

City of Bloomington
2215 West Old Shakopee Rd
Bloomington, MN 55431
(952) 948-8700

City's Website: www.ci.bloomington.mn.us

City of Bloomington
Deputy Director of Public Works
Jim Gates, P.E.
9750 James Avenue S.
Bloomington, MN 55431-2514
(952) 948-8730

Riley-Purgatory-Bluff Creek Watershed District
Contact: Bob Obermeyer, P.E.
Barr Engineering
4700 W 77th Street
Edina, MN 55435
(952) 832-2600

Nine Mile Creek Watershed District
Contact: Bob Obermeyer, P.E.
Barr Engineering
4700 W 77th Street
Edina, MN 55435
(952) 832-2600

Lower Minnesota River Watershed District
Contact: Larry Samstad, P.E.
Itasca Engineering
327 Marshall Road, Ste 200
Shakopee, MN 55379
(952) 445-7993

Richfield-Bloomington Watershed Management Organization

Contact: City of Bloomington
Jim Gates, P.E.
9750 James Avenue S.
Bloomington, MN 55431
(952) 948-8730

Contact: City of Richfield
Mike Eastling, P.E.
6700 Portland Avenue
Richfield, MN 55423
(612) 861-9700

## C. Water Resource Related Agreements

The City has entered into water resource-related agreements that govern in part how the City must manage its water resources. These agreements include joint powers agreements between the City and Watershed Management Organization having jurisdiction within its boundaries, agreements between the City and adjoining communities, or agreements it may have with other governmental units or private parties. Listed below is a description of the water resource related agreements which the City has entered into. A copy of these agreements or appropriate portions thereof, are included in **Appendix A.**

### City of Edina

- Agreement with the City of Edina to study and construct improvements between Xerxes Avenue and Normandale Boulevard, 1984.

### City of Richfield

- Agreement with the City of Richfield to construct a storm sewer from Bloomington Avenue and TH494 to a ponding area on the south side of 80th Street, 1966.
- Agreement between the village of Bloomington and the village of Richfield relative to the interconnection of storm sewers, 1955.
- Joint Powers Agreement between the Cities of Bloomington and Richfield establishing the Richfield-Bloomington Watershed Management Organization, 1983, 1992.

### City of Eden Prairie

- Study for the City of Eden Prairies for the CSAH 1 and 18 Area Storm Sewer Improvements, 1989.

### Nine Mile Creek

- Agreement between Nine Mile Creek and the City of Bloomington for the maintenance of the Lower Valley Basic Water Management Project, 1993.
- Resolution petitioning the Nine Mile Creek Watershed District to undertake the Bush Lake Outlet Basic Water Management Project, 1996.

### Hennepin County

- Cooperative Agreement between the City of Bloomington and Hennepin County for the Bloomington Ferry Bridge Stage 5A Cleanup Contract, 1997.
- Cooperative Agreement between the City of Bloomington and Hennepin County for the CSAH 18 from 108th Street to TH494 project, 1995.

- Amendment between the City of Bloomington and Hennepin County for the CSAH 18 construction project, 1996.

**Minnesota Department of Natural Resources**

- Agreement between the DNR, the City of Bloomington, the Lower Minnesota River Watershed District, and the US Fish and Wildlife Service to develop a boat launch/access at Lyndale Avenue to the Minnesota River.

**US Fish and Wildlife Service**

- Memorandum of Understanding between the City of Bloomington and the US Fish and Wildlife Service for the management and development of the Long Meadow Lake Unit (the "I-35W east agreement"), 1997.
- Special Use Permit and Draft Amendment to the Cooperative Agreement for Orchard Springs storm sewer development, 1985.
- Management Agreement to I-35W west within the Minnesota River Valley Wildlife Refuge
- Storm Sewer Outfall for Killebrew and 24th to the Minnesota River Valley

**MnDOT**

- Agreement between MnDOT and the City of Bloomington for the connection of storm sewer systems to existing I-494 storm sewer and TH77 storm sewer systems, 1989.

Figure II-1
Watershed District and Management Organization Boundary Map

**United States Department of the Interior**

**U.S. FISH AND WILDLIFE SERVICE**
Minnesota Valley National Wildlife Refuge
3815 American Blvd. East
Bloomington, MN 55425

Celebrating a Century of Conservation!

IN REPLY REFER TO:

FWS/MNV

June 15, 2004

Mr. Randall Devendorf
Wildlife Biologist
U.S. Army, Corp of Engineers
St. Paul District
190 5th Street East
St. Paul, Minnesota 55101-1638

By letter dated May 10, 2004 we provided comments on the Long Meadow Lake Draft Definite Project Report (DPR) dated January 2004 as related to the potential effects on threatened and endangered species. In addition to our previous concurrence with the Corps determination of no adverse effects on critical habitat for the threatened bald eagle (*Haliaeetus leucocephalus*) we have the following comment.

1. The DPR identifies that the threatened prairie bush-clover (*Lespedeza leptostachya*) is located on the Minnesota Valley National Wildlife Refuge. While it is present on several prairie tracts on the refuge, it is not present in the area affected by the proposed construction of the control structure or in any of the areas being considered for tree plantings.

2. As described in the DPR, we concur that this project is not likely to adversely affect critical habitat for the federally threatened prairie bush-clover. Should the project be modified or new information indicates that listed species may be affected, consultation with the Services' Twin Cities Ecological field Office should be reinitiated (612) 725-3548 extension 210.

The comments have been prepared under the authority of the Endangered Species Act of 1973, (16 USC 1531-1543) as amended.

Sincerely,

Rick Schultz
Refuge Manager

## Novak, Tom MVP - PM-A

**From:** Novak, Tom MVP - PM-A

**Sent:** Tuesday, June 22, 2004 1:27 PM

**To:** 'Mader, Judy'

**Cc:** Scot Johnson (E-mail); Sharonne N. Baylor (E-mail); Wayne Barstad (E-mail); Devendorf, Randall D MVP; Face, Joel J MVP; Wege Gary [USFWS] (E-mail); Warburton Dave [USFWS] (E-mail)

**Subject:** RE: Long Meadow Lake HREP - Draft DPR

Judy, attached are my responses to your comments for the above project. I plan on routing the report/FONSI for the District Engineer's signature by 1 July. If you have any further comments, please let me know.

Thomas Novak
Project Manager
U.S. Army Corps of Engineers, St Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638
Tel: 651.290.5524
Fax: 651.290.5258
Business email: tom.novak@usace.army.mil

-----Original Message-----
**From:** Mader, Judy [mailto:Judy.Mader@state.mn.us]
**Sent:** Monday, March 15, 2004 4:17 PM
**To:** Novak, Tom MVP - PM-A
**Cc:** Scot Johnson (E-mail); Sharonne N. Baylor (E-mail); Wayne Barstad (E-mail); Brownell, Kurt A MVP; Devendorf, Randall; Face, Joel; Machajewski, Paul R MVP; Riggin, Lewis T MVP; Wege Gary [USFWS] (E-mail); Warburton Dave [USFWS] (E-mail)
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Tom:

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acenaphthene, acenaphthylene, endrin, hepatchlor epoxide and toxaphene for all of the samples;
gamma-BHC and dieldrin for sample LM1-B;
all the pesticide/herbicide parameters for samples LM2-T, LM2-B, LM3-T; and
most of the pesticide/herbicide parameters at LM3-B.

If analytical results are not reviewed in depth, then results that come back as nondetect give a false sense of security when the detection limits are actually above effect levels.

The analytical results for:

mercury and zinc were above the MPCA's SQT Level I for sample LM1-T;
mercury was above Ontario Ministry of the Environment's (OME) low effect level (lel) for sample LM2-T;
copper was above OME's lel for sample LM3-B; and
Total Organic Carbon was above OME's lel for samples LM2-T, LM2-B, LM3-T, and LM3-B.

None of these, however, approached the MPCA's SQT Level II or OME's *severe* effect level (sel).

EnChem
The detection limit was above OME's lel for:

Arochlor 1260 for all of the samples;
Arochlor 1016, chlordane (technical) and heptachlor for samples LM-2 Top and LM-2 Bottom; and
4, 4' DDD for sample LM-2 Bottom.

Again, results that come back as nondetect give a false sense of security when the detection limits are actually above effect levels.

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The analytical results for 4, 4' DDD was above OME's lel for sample LM-2 Top, but was well below the sel.

**Miscellaneous comments**
Thank you for printing on both sides of the paper.

Please specify that it is **J**. Mader at the MPCA that receives copies of documents as currently there are three Maders at the Agency.

Errata
Long Meadow Lake is misidentified as being in Dakota County in Section 3.7. The lake is actually in Hennepin County. (Hennepin is misspelled on the first page of Attachment 7.)

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An o is missing from a label on the overhead view on Plate 10 in Attachment 1.

The code for the Reasons column is missing from Feasibility Level Estimates in Attachment 2.

Terminology shifts between Attachment and Appendix.

If you have any questions regarding my comments, please feel free to call or send an e-mail to me.

Judy M.
Minnesota Pollution Control Agency
520 Lafayette Road N.
St. Paul, MN 55155-4194
phone: (651) 296-7315
FAX: (651) 297-8683

-----Original Message-----
**From:** Novak, Tom MVP - PM-A [mailto:tom.novak@mvp02.usace.army.mil]
**Sent:** Monday, January 26, 2004 9:16 AM
**To:** Chris Kane (E-mail); Judy Mader (E-mail); Rick Schultz (E-mail); Scot Johnson (E-mail); Sharonne N. Baylor (E-mail); Wayne Barstad (E-mail); Brownell, Kurt A MVP; Crum, Douglas A MVP; Devendorf, Randall; Dunlop, Aaron D MVP; Face, Joel; Johnson, Brad A MVP; Layman, Kari; Machajewski, Paul R MVP; Riggin, Lewis T MVP; Skupa, Joseph S MVP
**Subject:** Long Meadow Lake HREP - Draft DPR

The above report is back from the printers. I'll will be distributing copies this week.

Thomas Novak
Project Manager
U.S. Army Corps of Engineers, St Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638
Tel: 651.290.5524
Fax: 651.290.5258
Business email: tom.novak@usace.army.mil

Reply responses to: MPCA
Subject: RE: Long Meadow Lake HREP - Draft DPR

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**Response: the first sentence has been added to this section.**

One of the facilities on the Minnesota River -- Richards Asphalt -- does not ship grain from its facility in Savage, MN.
**Response: comment noted.**

Although the Corps of Engineers is still responsible for the 4-foot channel up to River Mile 25.6 at Shakopee, MN, the Corps should state when the last time the channel was maintained/dredged upstream of Savage.
**Response: Judy, not much to add. Per Dan Krumholz, the Corps is only authorized to provide a 4' channel between mile 14.7 and 25.6. Maintenance in this reach involves clearing and snagging. Snagging is very common from 14.7 on down and usually done on an annual basis. No snag removals above 14.7 have been done in the last 15 years. Private interests have done the only dredging above mile 14.7.**

Section 3.2 Water Resources

Again, the Minnesota River drains large portions of west central, southwestern and south central Minnesota.
**Response: See response no. 1 above.**

The Corps should mention that, although there are water quality problems due to the nature of the watershed, several agencies are working to reduce or eliminate those problems.
**Response: Concur.**

Some water quality data does exist for Long Meadow Lake. Between 1975 to 1978, the U.S. Geological Survey (USGS) took samples at four locations. That data is available through the USGS' website on the internet. More current data may be available from the Black Dog Watershed Management Organization (terry.schultz@ci.burnsville.mn.us).
**Response: Will add note regarding the most recent data. Mr. Schultz noted that they do not have any data for Long Meadow Lake.**

Page 17-1 Coordination

It is possible that the reason there was no citizen attendance at the public meeting in Bloomington is the fact that the meeting was held the day after the September 11, 2001 attacks on the World Trade Center and the Pentagon. The Corps should mention this possible explanation in future documents for this project rather than leave the impression that citizens were not interested in the project.

**Response: Will add an explanation.**

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The analytical results for 4, 4' DDD was above OME's lel for sample LM-2 Top, but was well below the sel.
**Response: see attached analysis from Jim Noren. This will be added to Appendix 9 – Sediment analysis.**

Miscellaneous comments

Thank you for printing on both sides of the paper.
**Response: You're welcome**

Please specify that it is J. Mader at the MPCA that receives copies of documents as currently there are three Maders at the Agency.
**Response: will note J. Mader on all correspondence.**

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**Response: Corrected.**

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An o is missing from a label on the overhead view on Plate 10 in Attachment 1.
**Response: Corrected.**

The code for the Reasons column is missing from Feasibility Level Estimates in Attachment 2.
**Response: Added codes 1 and 2 definitions.**

Terminology shifts between Attachment and Appendix.
**Response: Corrected**.

Thomas Novak

## Novak, Tom MVP - PM-A

**From:** Mader, Judy [Judy.Mader@state.mn.us]
**Sent:** Tuesday, June 22, 2004 3:52 PM
**To:** Novak, Tom MVP - PM-A
**Subject:** RE: Long Meadow Lake HREP - Draft DPR

Looks good to me!
-----Original Message-----
**From:** Novak, Tom MVP - PM-A [mailto:tom.novak@mvp02.usace.army.mil]
**Sent:** Tuesday, June 22, 2004 1:27 PM
**To:** 'Mader, Judy'
**Cc:** Scot Johnson (E-mail); Sharonne N. Baylor (E-mail); Wayne Barstad (E-mail); Devendorf, Randall D MVP; Face, Joel J MVP; Wege Gary [USFWS] (E-mail); Warburton Dave [USFWS] (E-mail)
**Subject:** RE: Long Meadow Lake HREP - Draft DPR

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Thomas Novak
Project Manager
U.S. Army Corps of Engineers, St Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638
Tel: 651.290.5524
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Business email: tom.novak@usace.army.mil

-----Original Message-----
**From:** Mader, Judy [mailto:Judy.Mader@state.mn.us]
**Sent:** Monday, March 15, 2004 4:17 PM
**To:** Novak, Tom MVP - PM-A
**Cc:** Scot Johnson (E-mail); Sharonne N. Baylor (E-mail); Wayne Barstad (E-mail); Brownell, Kurt A MVP; Devendorf, Randall; Face, Joel; Machajewski, Paul R MVP; Riggin, Lewis T MVP; Wege Gary [USFWS] (E-mail); Warburton Dave [USFWS] (E-mail)
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## Novak, Tom MVP - PM-A

**From:** Novak, Tom MVP - PM-A
**Sent:** Tuesday, June 22, 2004 1:25 PM
**To:** 'Sharonne_Baylor@fws.gov'
**Cc:** wayne.barstad@dnr.state.mn.us; Richard_Schultz@fws.gov; Chris_Kane@fws.gov; Tom_Kerr@fws.gov; Don_Hultman@fws.gov
**Subject:** RE: Long Meadow Lake; Draft Comments


USFWS.doc


Sediment.pdf


Novak, Tom MVP-PM-A.vcf

Sharonne, see attached responses to your comments on the above product. My plan is to send the final report/FONSI to the DE next week.

Thomas Novak
Project Manager
U.S. Army Corps of Engineers, St Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638
Tel: 651.290.5524
Fax: 651.290.5258
Business email: tom.novak@usace.army.mil

-----Original Message-----
From: Sharonne_Baylor@fws.gov [mailto:Sharonne_Baylor@fws.gov]
Sent: Friday, February 27, 2004 1:18 PM
To: tom.novak@mvp02.usace.army.mil
Cc: wayne.barstad@dnr.state.mn.us; Richard_Schultz@fws.gov; Chris_Kane@fws.gov; Tom_Kerr@fws.gov; Don_Hultman@fws.gov
Subject: Long Meadow Lake; Draft Comments

Tom,

Here are our draft comments to the Long Meadow Lake Draft DPR dated January 2004. Please consider this a draft until you receive a signed letter from the Minnesota Valley NWR. Just let me know if you have any questions or comments. Thanks!

Comments for the DPR

1. Section 6.2.5, Socioeconomic/Recreational: This narrative is the same as the preceding section, 6.2.4, Cultural Resources.

2. Section 6.5.3, Tree Planting: We will finalize the planting plan during the plans and specifications phase of this project. However, please note that we will not include swamp white oak in the planting species list.

3. Attachment 9, Sediment Analysis Data: Include a discussion and explanation of the analysis.

4. Address the secondary outlet culvert under the access road. This culvert will not support construction equipment and will need to be replaced during the construction contract. We would like to consider a slide or sluice gate on a new culvert which would give us flexibility to control the water flow through this area ? not only to prevent back flow into Long Meadow Lake, but also to protect the eagle nesting site and manage the riparian habitat downstream. We envision a simple structure at this location, not a large concrete one like the stoplog structure.

5. Hydraulics Appendix, page 5-2, Figure 1.1: Add proposed channel and structure elevation (210.7) to this profile (or to a new profile showing the selected alternative profile).

6. Pages 3-4 and 3-5, Assessment of Existing Resources: Cultural resources have been appropriately addressed for the water control structure and the dredged material placement. However, discussion and determination for tree planting are not covered. It seems unlikely that tree planting in this floodplain condition would impact historic properties, but the DPR needs to so state. (These situations are addressed on page 9-4.)

7. Include discussion of fish passage issues in the DPR.

8. 36 CFR 800.2(a)(2) identifies the possibility for a lead Federal agency when two or more Federal agencies are involved in a project. Please inform the Regional Director that the Corps of Engineers will be the lead Federal agency for the Section 106 (National Historic Preservation Act) process for this project, including an assurance that the Regional Historic Preservation Officer will be kept advised of compliance steps taken in accordance with 36 CFR Part 800. Include this arrangement for lead Federal agency in the final DPR.

9. We have some concerns about the way NEPA is being handled on this and other projects. We propose to meet with you to discuss these issues.

Comments for the Plans and Specifications

10. Many of our September 26, 2003 Preliminary Draft DPR comments were not addressed in this revised DPR because they were more appropriate to the plans and specifications phase of this project. Please address those comments when we get to the plans and specifications phase of the project.

11. Provide additional bathymetry data for Lower Long Meadow Lake. After analyzing that data, we can fine-tune the channel and structure invert elevations.

12. Ensure the channel design eliminates or minimizes operation and maintenance responsibilities. Also, ensure the construction tolerances for the channel excavation do not allow the channel to be left above the structure invert elevation. Or, the channel elevation could be lowered a bit further to allow for reasonable +/- construction tolerances.

13. Locate the stoplog structure staff gauges where they will be least susceptible to damage by flood debris.

14. Please salvage the existing 54" CMP and return it to the Refuge.

15. We prefer aluminum rather than wood stoplogs in order to eliminate beaver damage and the potential for the boards to warp. We would also like to have some extra stoplogs in case of damage or loss.

Please call me at (507) 494-6207 if you have any questions or comments. Thanks!

Sharonne N. Baylor, P.E.
Environmental Engineer
Upper Mississippi River National Wildlife and Fish Refuge
51 East Fourth Street, Room 101
Winona, MN 55987
Phone: (507) 494-6207
Fax: (507) 452-0851
sharonne_baylor@fws.gov

Responses to USFWS comments to the draft DPR

1. Section 6.2.5, Socioeconomic/Recreational: This narrative is the same as the preceding section, 6.2.4, Cultural Resources.
**Response: Section 6.2.5 has been revised.**

2. Section 6.5.3, Tree Planting: We will finalize the planting plan during the plans and specifications phase of this project. However, please note that we will not include swamp white oak in the planting species list.
**Response: Swamp White Oak has been deleted from the plant list.**

3. Attachment 9, Sediment Analysis Data: Include a discussion and explanation of the analysis.
**Response: Have added a discussion (Jim Noren) per your recommendation (See attached).**

4. Address the secondary outlet culvert under the access road. This culvert will not support construction equipment and will need to be replaced during the construction contract. We would like to consider a slide or sluice gate on a new culvert which would give us flexibility to control the water flow through this area ? not only to prevent back flow into Long Meadow Lake, but also to protect the eagle nesting site and manage the riparian habitat downstream. We envision a simple structure at this location, not a large concrete one like the stoplog structure.
**Response: We agreethat the secondary culvert will need to replaced. The inclusion of a slide or flapgate as part of the design will be evaluated during Plans and Specifications.**

5. Hydraulics Appendix, page 5-2, Figure 1.1: Add proposed channel and structure elevation (210.7) to this profile (or to a new profile showing the selected alternative profile).
**Response: This detail is shown in Attachment 8 - Correspondence. For clarity, this detail will also be included the H&H Appendix.**

6. Pages 3-4 and 3-5, Assessment of Existing Resources: Cultural resources have been appropriately addressed for the water control structure and the dredged material placement. However, discussion and determination for tree planting are not covered. It seems unlikely that tree planting in this floodplain condition would impact historic properties, but the DPR needs to so state. (These situations are addressed on page 9-4.)
**Response: Have included this discussion in 3.6 last paragraph.**

7. Include discussion of fish passage issues in the DPR.
**Response: Have revised 9.2.1 second paragraph to include a sentence related to no adverse affects on fish passage.**

8. 36 CFR 800.2(a)(2) identifies the possibility for a lead Federal agency when two or more Federal agencies are involved in a project. Please inform the Regional Director that the Corps of Engineers will be the lead Federal agency for the Section 106 (National Historic Preservation Act) process for this project, including an assurance that the Regional Historic Preservation Officer will be kept advised of compliance steps taken in accordance with 36 CFR Part 800. Include this arrangement for lead Federal agency in the final DPR.
**Response: Concur. Has been added to section 9.3**

9. We have some concerns about the way NEPA is being handled on this and other projects. We propose to meet with you to discuss these issues.
**Response: A meeting between COE/FWS was held at the Twin Cities Regional Office on March 22, 2004. A memo for record for the meeting outlines proposed changes for future HREP reports, and was sent to the parties involved in the meeting.**

Comments for the Plans and Specifications

10. Many of our September 26, 2003 Preliminary Draft DPR comments were not addressed in this revised DPR because they were more appropriate to the plans and specifications phase of this project. Please address those comments when we get to the plans and specifications phase of the project.

11. Provide additional bathymetry data for Lower Long Meadow Lake. After analyzing that data, we can fine-tune the channel and structure invert elevations.

12. Ensure the channel design eliminates or minimizes operation and maintenance responsibilities. Also, ensure the construction tolerances for the channel excavation do not allow the channel to be left above the structure invert elevation. Or, the channel elevation could be lowered a bit further to allow for reasonable +/- construction tolerances.

13. Locate the stoplog structure staff gauges where they will be least susceptible to damage by flood debris.

14. Please salvage the existing 54" CMP and return it to the Refuge.

15. We prefer aluminum rather than wood stoplogs in order to eliminate beaver damage and the potential for the boards to warp. We would also like to have some extra stoplogs in case of damage or loss.

## Novak, Tom MVP - PM-A

**From:** Novak, Tom MVP - PM-A
**Sent:** Tuesday, June 22, 2004 1:23 PM
**To:** 'Wayne Barstad'
**Cc:** Julie Ekman; Molly Shodeen
**Subject:** RE: Long Meadow Lake Draft Integrated Definite Project Report and Environmental Assessment


Novak, Tom MVP-PM-A.vcf


DNR.doc

Wayne, attached are responses to your comments. Sorry for the delay. I plan on sending the final report/FONSI to the District Engineer in about a week. Let me know if you have any additional concerns/issues.

Thomas Novak
Project Manager
U.S. Army Corps of Engineers, St Paul District
Sibley Square
190 East Fifth Street
St. Paul, MN 55101-1638
Tel: 651.290.5524
Fax: 651.290.5258
Business email: tom.novak@usace.army.mil

-----Original Message-----
From: Wayne Barstad [mailto:wayne.barstad@dnr.state.mn.us]
Sent: Tuesday, March 02, 2004 2:21 PM
To: tom.novak@mvp02.usace.army.mil
Cc: Julie Ekman; Molly Shodeen
Subject: Long Meadow Lake Draft Integrated Definite Project Report and Environmental Assessment

Section 8.1.1

The proposal to use a mechanical dredge plant, launch from near the control structure, and barge materials to the structure appears to be the least impacting approach to cleaning the channel.

Construction of the control structure will require a DNR permit. If the channel excavation is to be done below the ordinary high water level (OHW), it also may need a permit. An OHW for this basin has never been established.

Section 9.2.2

The filling of five acres of wetland to the access road is an action that may require permitting either through the Wetland Conservation Act or the DNR permitting process. Again, this depends on the location of the OHW. Replacement of the outlet structure would likely trigger the need to officially establish an OHW for this basin. In either case, a

1:1 replacement would be required.

If you have any questions about this comments, please feel free to contact Julie Ekman, Area Hydrologist, at 651 772-7919.

Wayne Barstad
Regional Environmental Assessment Ecologist
Central Region
651 772-7940
wayne.barstad@dnr.state.mn.us

Section 8.1.1

The proposal to use a mechanical dredge plant, launch from near the control structure, and barge materials to the structure appears to be the least impacting approach to cleaning the channel.

Construction of the control structure will require a DNR permit. If the channel excavation is to be done below the ordinary high water level (OHW), it also may need a permit. An OHW for this basin has never been established.

**Response: Any required permits will be obtained prior to construction.**

Section 9.2.2

The filling of five acres of wetland to the access road is an action that may require permitting either through the Wetland Conservation Act or the DNR permitting process. Again, this depends on the location of the OHW. Replacement of the outlet structure would likely trigger the need to officially establish an OHW for this basin. In either case, a 1:1 replacement would be required.

**Response: Any required permits will be obtained prior to construction. Section 9.2.2 has been revised to clarify the amount and type of fill required to be placed in wetlands. Temporary fill for a cofferdam could require up to 2.5 hectares of fill and the road raise could require less than 0.2 hectares of permanent fill. The Corps does not concur that mitigation is required for the minor amount of permanent fill needed to enhance over 1500 acres of wetlands.**

# Sediment Analysis Data

## Attachment 9

## 2001 Long Meadow Sediment Sampling

## US Army Corps of Engineers

## St. Paul District

In the February and November of 2001, the St. Paul District surveyed the sediment conditions at Long Meadow Lake. The 2001 surveys consisted of six samples at three locations (top 3' and bottom 3'). Each sample was obtained using a hollow metal pole that was driven into the sediment with a post driver. USACE, St. Paul District employees homogenized each sample in a stainless steel pan, placed them in the laboratory provided container and then stored them on ice immediately following sampling. All samples were repacked with ice and shipped by next day delivery to the laboratory. The survey was first done on February 13th, 2001, but was repeated on November 1st, 2001 due to the initial lab's failure to analyze all the parameters requested.

The February samples were sent to Spectrum Labs, and were analyzed for pesticides, total PCB's, PAH's, metals, and various physical characteristics such as grain size, total organic carbon, nitrogen, ammonia, and total phosphorus. Metals analysis included arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. The November samples were sent to EnChem labs and were analyzed for pesticides, Aroclor PCB's, and the parameters Spectrum failed to analyze: manganese, cyanide, percent solids and total volatile solids.

The results indicate that the sediment in Long Meadow Lake is moderately contaminated for a few parameters, as defined by the Minnesota Pollution Control Agency's Level I sediment quality targets (SQT) and/or the Ministry of Ontario's lowest effects level (lel) sediment standards (Table 1).

Figure 1. Long Meadow Lake Sediment contamination

| Station ID | Sample Date | Lab | Test | Result | Units | SQT Level I | OME (lel) |
|---|---|---|---|---|---|---|---|
| LM-1 BOTTOM | 11/1/01 | EnChem | Manganese | 1100 | mg/kg | | 460 |
| LM-1 BOTTOM | 2/13/01 | Spectrum | Mercury | 0.2 | mg/kg | 0.18 | 0.2 |
| LM-1 TOP | 2/13/01 | Spectrum | Mercury | 0.34 | mg/kg | 0.18 | 0.2 |
| LM-1 TOP | 2/13/01 | Spectrum | Zinc | 160 | mg/kg | 120 | 120 |
| LM-2 BOTTOM | 11/1/01 | EnChem | Manganese | 940 | mg/kg | | 460 |
| LM-2 BOTTOM | 2/13/01 | Spectrum | Mercury | 0.25 | mg/kg | 0.18 | 0.2 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Total Organic Carbon | 4.09 | % | | 1 |
| LM-2 TOP | 11/1/01 | EnChem | 4,4'-DDD | 10 | ug/kg | 4.9 | 8 |
| LM-2 TOP | 11/1/01 | EnChem | Manganese | 820 | mg/kg | | 460 |
| LM-2 TOP | 2/13/01 | Spectrum | Mercury | 0.42 | mg/kg | 0.18 | 0.2 |
| LM-2 TOP | 2/13/2001 | Spectrum | Total Organic Carbon | 4.27 | % | | 1 |
| LM-3 BOTTOM | 2/13/01 | Spectrum | Copper | 17 | mg/kg | 32 | 16 |
| LM-3 BOTTOM | 11/1/01 | EnChem | Manganese | 930 | mg/kg | | 460 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Total Organic Carbon | 1.59 | % | | 1 |
| LM-3 TOP | 11/1/01 | EnChem | Manganese | 920 | mg/kg | | 460 |
| LM-3 TOP | 2/13/2001 | Spectrum | Total Organic Carbon | 2.63 | % | | 1 |

The Level I SQTs and the OME LEL are similar screening tools that are intended to indicate levels of sediment contamination that can be tolerated by the majority of benthic organisms. These low levels differ from the Level II SQTs and the OME SEL, which indicates the level at which pronounced disturbance of the sediment dwelling community can be expected. None of the sediment samples tested had values above the Level II SQTs or the OME SEL.

One caveat, however, in describing the sediment at Long Meadow Lake as moderately contaminated, is the failure to use low enough reporting limits for the analysis of a number of parameters. In Table 2, a list of sediment analyses that used reporting limits higher than either Level I SQTs, Level II SQTs and/or OME LEL values are shown. These high detection levels are problematic because parameters determined as non-detect may be ignored, even though they might contain harmful levels of contamination.

Table 2. Lab analyses that use higher reporting levels (EQL/PQL) than the SQT and OME sediment screening levels.

| Station ID | Sample Date | Lab | Test | Result | Units | EQL/POL | Code | SQT Level I | SQT Level II | OME (lel) |
|---|---|---|---|---|---|---|---|---|---|---|
| LM-2 BOTTOM | 11/1/2001 | EnChem | Chlordane, technical | ND | ug/kg | 8.7 | | 3.2 | 18 | 7 |
| LM-2 BOTTOM | 11/1/2001 | EnChem | Cyanide, total | ND | mg/kg | 1.1 | | | | 0.1 |
| LM-2 BOTTOM | 11/1/2001 | EnChem | Heptachlor | ND | ug/kg | 0.43 | | | | 0.3 |
| LM-2 BOTTOM | 11/1/2001 | EnChem | Aroclor 1260 | ND | ug/kg | 8.7 | | 60 | 680 | 5 |
| LM-2 BOTTOM | 11/1/2001 | EnChem | Aroclor 1016 | ND | ug/kg | 8.7 | | 60 | 680 | 7 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | 4,4'-DDD | ND | ug/kg | 94 | dd,m,L | 4.9 | 28 | 8 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | 4,4'-DDE | ND | ug/kg | 550 | dd,m | 3.2 | 31 | 5 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | 4,4'-DDT | ND | ug/kg | 88 | dd,m | 4.2 | 63 | 7 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | a-BHC | ND | ug/kg | 88 | dd,m | | | 6 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Acenaphthene | ND | ug/kg | 14 | | 6.7 | 89 | |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Acenaphthylene | ND | ug/kg | 92 | | 5.9 | 130 | |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | b-BHC | ND | ug/kg | 52 | dd,m | | | 5 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Chlordane | ND | ug/kg | 250 | dd,m | 3.2 | 18 | 7 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | d-BHC | ND | ug/kg | 120 | dd,m | | | 3 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Dieldrin | ND | ug/kg | 150 | dd,m | 1.9 | 62 | 2 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Endrin | ND | ug/kg | 75 | dd,m | 2.2 | 210 | 3 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | g-BHC (Lindane) | ND | ug/kg | 94 | dd,m | 2.4 | 5 | 3 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Heptachlor | ND | ug/kg | 1400 | dd,m | | | 0.3 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Heptachlor epoxide | ND | ug/kg | 94 | dd,m,L | 2.5 | 16 | 5 |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Toxaphene | ND | ug/kg | 630 | dd,m | 0.1 | 32 | |
| LM-2 BOTTOM | 2/13/2001 | Spectrum | Aldrin | ND | ug/kg | 88 | dd,m | | | 2 |
| LM-2 TOP | 11/1/2001 | EnChem | Chlordane, technical | ND | ug/kg | 9.3 | | 3.2 | 18 | 7 |
| LM-2 TOP | 11/1/2001 | EnChem | Cyanide, total | ND | mg/kg | 1.2 | | | | 0.1 |
| LM-2 TOP | 11/1/2001 | EnChem | Heptachlor | ND | ug/kg | 0.52 | | | | 0.3 |
| LM-2 TOP | 11/1/2001 | EnChem | Aroclor 1260 | ND | ug/kg | 9.3 | | 60 | 680 | 5 |
| LM-2 TOP | 11/1/2001 | EnChem | Aroclor 1016 | ND | ug/kg | 9.3 | | 60 | 680 | 7 |
| LM-2 TOP | 2/13/2001 | Spectrum | 4,4'-DDD | ND | ug/kg | 94 | dd,m,L | 4.9 | 28 | 8 |
| LM-2 TOP | 2/13/2001 | Spectrum | 4,4'-DDE | ND | ug/kg | 550 | dd,m | 3.2 | 31 | 5 |
| LM-2 TOP | 2/13/2001 | Spectrum | 4,4'-DDT | ND | ug/kg | 88 | dd,m | 4.2 | 63 | 7 |
| LM-2 TOP | 2/13/2001 | Spectrum | a-BHC | ND | ug/kg | 88 | dd,m | | | 6 |
| LM-2 TOP | 2/13/2001 | Spectrum | Acenaphthene | ND | ug/kg | 14 | | 6.7 | 89 | |
| LM-2 TOP | 2/13/2001 | Spectrum | Acenaphthylene | ND | ug/kg | 93 | | 5.9 | 130 | |
| LM-2 TOP | 2/13/2001 | Spectrum | b-BHC | ND | ug/kg | 52 | dd,m | | | 5 |
| LM-2 TOP | 2/13/2001 | Spectrum | Chlordane | ND | ug/kg | 250 | dd,m | 3.2 | 18 | 7 |
| LM-2 TOP | 2/13/2001 | Spectrum | d-BHC | ND | ug/kg | 120 | dd,m | | | 3 |
| LM-2 TOP | 2/13/2001 | Spectrum | Dieldrin | ND | ug/kg | 150 | dd,m | 1.9 | 62 | 2 |
| LM-2 TOP | 2/13/2001 | Spectrum | Endrin | ND | ug/kg | 75 | dd,m | 2.2 | 210 | 3 |
| LM-2 TOP | 2/13/2001 | Spectrum | g-BHC (Lindane) | ND | ug/kg | 94 | dd,m | 2.4 | 5 | 3 |
| LM-2 TOP | 2/13/2001 | Spectrum | Heptachlor | ND | ug/kg | 1400 | dd,m | | | 0.3 |
| LM-2 TOP | 2/13/2001 | Spectrum | Heptachlor epoxide | ND | ug/kg | 94 | dd,m,L | 2.5 | 16 | 5 |
| LM-2 TOP | 2/13/2001 | Spectrum | Toxaphene | ND | ug/kg | 630 | dd,m | 0.1 | 32 | |
| LM-2 TOP | 2/13/2001 | Spectrum | Aldrin | ND | ug/kg | 88 | dd,m | | | 2 |

| Station ID | Sample Date | Lab | Test | Result | Units | EQL/POL | Code | SQT Level I | SQT Level II | OME (lel) |
|---|---|---|---|---|---|---|---|---|---|---|
| LM-3 BOTTOM | 11/1/2001 | EnChem | Chlordane, technical | ND | ug/kg | 5.4 | | 3.2 | 18 | 7 |
| LM-3 BOTTOM | 11/1/2001 | EnChem | Cyanide, total | ND | mg/kg | 0.67 | | | | 0.1 |
| LM-3 BOTTOM | 11/1/2001 | EnChem | Aroclor 1260 | ND | ug/kg | 5.4 | | 60 | 680 | 5 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | 4,4'-DDE | ND | ug/kg | 27 | m | 3.2 | 31 | 5 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | 4,4'-DDT | ND | ug/kg | 4.4 | m | 4.2 | 63 | 7 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Acenaphthene | ND | ug/kg | 14 | | 6.7 | 89 | |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Acenaphthylene | ND | ug/kg | 90 | | 5.9 | 130 | |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Chlordane | ND | ug/kg | 13 | m | 3.2 | 18 | 7 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | d-BHC | ND | ug/kg | 5.6 | m | | | 3 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Dieldrin | ND | ug/kg | 7.2 | m | 1.9 | 62 | 2 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Endrin | ND | ug/kg | 3.8 | m | 2.2 | 210 | 3 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | g-BHC (Lindane) | ND | ug/kg | 4.7 | m | 2.4 | 5 | 3 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Heptachlor | ND | ug/kg | 29 | m | | | 0.3 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Heptachlor epoxide | ND | ug/kg | 4.7 | m,L | 2.5 | 16 | 5 |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Toxaphene | ND | ug/kg | 31 | m | 0.1 | 32 | |
| LM-3 BOTTOM | 2/13/2001 | Spectrum | Aldrin | ND | ug/kg | 4.4 | m | | | 2 |
| LM-3 TOP | 11/1/2001 | EnChem | Chlordane, technical | ND | ug/kg | 5.6 | | 3.2 | 18 | 7 |
| LM-3 TOP | 11/1/2001 | EnChem | Cyanide, total | ND | mg/kg | 0.7 | | | | 0.1 |
| LM-3 TOP | 11/1/2001 | EnChem | Aroclor 1260 | ND | ug/kg | 5.6 | | 60 | 680 | 5 |
| LM-3 TOP | 2/13/2001 | Spectrum | 4,4'-DDD | ND | ug/kg | 110 | dd,m,L | 4.9 | 28 | 8 |
| LM-3 TOP | 2/13/2001 | Spectrum | 4,4'-DDE | ND | ug/kg | 590 | dd,m | 3.2 | 31 | 5 |
| LM-3 TOP | 2/13/2001 | Spectrum | 4,4'-DDT | ND | ug/kg | 95 | dd,m | 4.2 | 63 | 7 |
| LM-3 TOP | 2/13/2001 | Spectrum | a-BHC | ND | ug/kg | 95 | dd,m | | | 6 |
| LM-3 TOP | 2/13/2001 | Spectrum | Acenaphthene | ND | ug/kg | 13 | | 6.7 | 89 | |
| LM-3 TOP | 2/13/2001 | Spectrum | Acenaphthylene | ND | ug/kg | 86 | | 5.9 | 130 | |
| LM-3 TOP | 2/13/2001 | Spectrum | b-BHC | ND | ug/kg | 56 | dd,m | | | 5 |
| LM-3 TOP | 2/13/2001 | Spectrum | Chlordane | ND | ug/kg | 270 | dd,m | 3.2 | 18 | 7 |
| LM-3 TOP | 2/13/2001 | Spectrum | d-BHC | ND | ug/kg | 130 | dd,m | | | 3 |
| LM-3 TOP | 2/13/2001 | Spectrum | Dieldrin | ND | ug/kg | 160 | dd,m | 1.9 | 62 | 2 |
| LM-3 TOP | 2/13/2001 | Spectrum | Endrin | ND | ug/kg | 81 | dd,m | 2.2 | 210 | 3 |
| LM-3 TOP | 2/13/2001 | Spectrum | g-BHC (Lindane) | ND | ug/kg | 110 | dd,m | 2.4 | 5 | 3 |
| LM-3 TOP | 2/13/2001 | Spectrum | Heptachlor | ND | ug/kg | 1500 | dd,m | | | 0.3 |
| LM-3 TOP | 2/13/2001 | Spectrum | Heptachlor epoxide | ND | ug/kg | 110 | dd,m,L | 2.5 | 16 | 5 |
| LM-3 TOP | 2/13/2001 | Spectrum | Toxaphene | ND | ug/kg | 680 | dd,m | 0.1 | 32 | |
| LM-3 TOP | 2/13/2001 | Spectrum | Aldrin | ND | ug/kg | 95 | dd,m | | | 2 |

m = MS recovery was low for this compound

l = LCS/LCSD recovery exceeded control limits for these compounds

s = Low surrogate recovery

dd = A dilution was necessary due to sample matrix; therefor, detection limits were raised

ND = Non-detect, below detection limits

Sediment Analysis
Long Meadow Lake
Nov 01

Trip Report for 11/1/01
Sediment Sampling for Long Meadow Lake Outlet Channel

Daryl Weirzbinski and Jim Sentz visited Long meadow Lake and collected 3 sediment cores in the outlet channel. The Cores were in the same locations as those collected the previous winter. Resampling was required due to laboratory loss of the sediment samples prior to completing the analyses. We have discontinued use of the lab (Spectrum) for environmental samples.

The cores taken were LM-1, LM-2, and LM-3. The following table describes the core length and portioning. All cores were divided into top and bottom samples.

| Long Meadow Lake Sediment Core | | | | |
|---|---|---|---|---|
| | Core Depth | Top Composite | Bottom Composite | Approx. Compaction |
| | feet | feet | Feet | |
| LM-1 | 5 | 0-3.5 | 3.5-5 | 50% |
| LM-2 | 5 | 0-4 | 4-5 | 50% |
| LM-3 | 4 | 0-3 | 3-4 | 40% |

Core depth was determined from the sediment-water interface. All cores exhibited significant compaction during the coring and core removal process. The estimated compaction percentage is shown in the table above.

The weather was warm and sunny for November 1 (high 50's). A 5 ft core is the limit in this type of material. One core (LM-1) was extremely hard to retrieve.

Generally material in the top of the cores had significant amounts of decaying vegetation in them. This diminished moving down through the core. The top of LM-1 was grainy and may be due to repair work recently completed after Spring 2001 flooding. The graininess was probably due to sand being introduced during repair of the culvert. Upper sediments were silty clay with very little sand, progressing to mostly all clay at the bottom of the cores. The upper portions of the cores were highly flocculent.

Sampling was accomplished between 0930 and 1300 approximately. The Fish and Wildlife Service provided a boat for the sampling exercise.

A new method of sampling is required for core samples. The current method is very hard work and we were at the limitation of the equipment we had.

Equipment used: 2 inch galvanized metal pipe 10' long with a fence pole pounder. Sediment removed by pushing a plunger through the pipe.

| US Army Corps of Engineers | PROJECT TITLE: | COMPUTED BY: | DATE: 11/1/01 | SHEET: |
|---|---|---|---|---|
| Saint Paul District | SUBJECT TITLE: ENCHEM SAMPLES | CHECKED BY: | DATE: | CONTRACT NO.: |

LM1 - 0-5' 10 AM 11/1/01

0-3.5' Top

3.5-5.0' Bottom

compacted 5' → 2.5'
50%

Top silty sand grains w/ clay

bottom clayey black/dark grey

LM2- 0-5' 11:10 AM

flocculent @ top denser nr 3.5 mark

Top 0- [redacted] 3.5

decayin vegetation

3.5 [redacted] - 5.0

Clayey w/ some debris (plant

denser

LM3- 0-4'

0-3 3-4

Bott

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# - Analytical Report -

Project Name : LONG MEADOW LAKE

Project Number :

Client : US ARMY CORPS OF ENGINEERS

Report Date : 12/17/01

WI DNR LAB ID : 113172950

| Lab Sample No. | Field ID | Collection Date |
|---|---|---|
| 913868-001 | LM-1 TOP | 11/1/01 |
| 913868-002 | LM-1 BOTTOM | 11/1/01 |
| 913868-003 | LM-2 TOP | 11/1/01 |
| 913868-004 | LM-2 BOTTOM | 11/1/01 |
| 913868-005 | LM-3 TOP | 11/1/01 |
| 913868-006 | LM-3 BOTTOM | 11/1/01 |

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample narrative. Release of this final report is authorized by Laboratory management, as is verified by the following signature.

Tod Woltemeyer
Approval Signature

12/18/01
Date

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# - Analytical Report -

Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-1 TOP
Lab Sample Number : 913868-001
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Inorganic Results

| Test | Result | EQL | Units | Code | Analysis Date | Prep Method | Analysis Method |
|---|---|---|---|---|---|---|---|
| Manganese | 460 | 0.29 | mg/Kg | | 11/15/01 | SW846 3051 | SW846 6010B |
| Cyanide, total | < 0.73 | 0.73 | mg/kg | | 11/8/01 | EPA 335.4 | EPA 335.4 |
| Solids, total | 68 | 1.0 | % | | 11/5/01 | EPA 160.3M | EPA 160.3M |
| Solids, total volatile | 3.2 | 1.0 | % | | 11/5/01 | EPA 160.4 | EPA 160.4 |

All soil results are reported on a dry weight basis unless otherwise noted.

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# - Analytical Report -

Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-1 BOTTOM
Lab Sample Number : 913868-002
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Inorganic Results

| Test | Result | EQL | Units | Code | Analysis Date | Prep Method | Analysis Method |
|---|---|---|---|---|---|---|---|
| Manganese | 1100 | 0.27 | mg/Kg | | 11/15/01 | SW846 3051 | SW846 6010B |
| Cyanide, total | < 0.71 | 0.71 | mg/kg | | 11/8/01 | EPA 335.4 | EPA 335.4 |
| Solids, total | 71 | 1.0 | % | | 11/5/01 | EPA 160.3M | EPA 160.3M |
| Solids, total volatile | 2.7 | 1.0 | % | | 11/5/01 | EPA 160.4 | EPA 160.4 |

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# - Analytical Report -

Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-2 TOP
Lab Sample Number : 913868-003
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Inorganic Results

| Test | Result | EQL | Units | Code | Analysis Date | Prep Method | Analysis Method |
|---|---|---|---|---|---|---|---|
| Manganese | 820 | 0.45 | mg/Kg | | 11/15/01 | SW846 3051 | SW846 6010B |
| Cyanide, total | < 1.2 | 1.2 | mg/kg | | 11/8/01 | EPA 335.4 | EPA 335.4 |
| Solids, total | 43 | 1.0 | % | | 11/5/01 | EPA 160.3M | EPA 160.3M |
| Solids, total volatile | 12 | 1.0 | % | | 11/5/01 | EPA 160.4 | EPA 160.4 |

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# - Analytical Report -

**Project Name :** LONG MEADOW LAKE
**Project Number :**
**Field ID :** LM-2 BOTTOM
**Lab Sample Number :** 913868-004
**Lab Project Number :** 913868

**Submitter :** US ARMY CORPS OF ENGINEERS
**Report Date :** 12/18/01
**Collection Date :** 11/1/01
**Matrix Type :** SOIL
**WI DNR LAB ID :** 113172950

## Inorganic Results

| Test | Result | EQL | Units | Code | Analysis Date | Prep Method | Analysis Method |
|---|---|---|---|---|---|---|---|
| Manganese | 940 | 0.41 | mg/Kg | | 11/15/01 | SW846 3051 | SW846 6010B |
| Cyanide, total | < 1.1 | 1.1 | mg/kg | | 11/8/01 | EPA 335.4 | EPA 335.4 |
| Solids, total | 45 | 1.0 | % | | 11/5/01 | EPA 160.3M | EPA 160.3M |
| Solids, total volatile | 12 | 1.0 | % | | 11/5/01 | EPA 160.4 | EPA 160.4 |

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# - Analytical Report -

Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-3 TOP
Lab Sample Number : 913868-005
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Inorganic Results

| Test | Result | EQL | Units | Code | Analysis Date | Prep Method | Analysis Method |
|---|---|---|---|---|---|---|---|
| Manganese | 920 | 0.25 | mg/Kg | | 11/15/01 | SW846 3051 | SW846 6010B |
| Cyanide, total | < 0.70 | 0.70 | mg/kg | | 11/8/01 | EPA 335.4 | EPA 335.4 |
| Solids, total | 73 | 1.0 | % | | 11/5/01 | EPA 160.3M | EPA 160.3M |
| Solids, total volatile | 2.2 | 1.0 | % | | 11/5/01 | EPA 160.4 | EPA 160.4 |

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# - Analytical Report -

Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-3 BOTTOM
Lab Sample Number : 913868-006
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Inorganic Results

| Test | Result | EQL | Units | Code | Analysis Date | Prep Method | Analysis Method |
|---|---|---|---|---|---|---|---|
| Manganese | 930 | 0.25 | mg/Kg | | 11/15/01 | SW846 3051 | SW846 6010B |
| Cyanide, total | < 0.67 | 0.67 | mg/kg | | 11/8/01 | EPA 335.4 | EPA 335.4 |
| Solids, total | 75 | 1.0 | % | | 11/5/01 | EPA 160.3M | EPA 160.3M |
| Solids, total volatile | 1.7 | 1.0 | % | | 11/5/01 | EPA 160.4 | EPA 160.4 |

All soil results are reported on a dry weight basis unless otherwise noted.

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# Analytical Report

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Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-1 TOP
Lab Sample Number : 913868-001
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Semivolatile Organic Results

PCB LIST

Prep Method: SW846 3550 Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| Aroclor 1016 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1221 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1232 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1242 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1248 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1254 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1260 | < 5.8 | 5.8 | ug/kg | | 11/13/01 | SW846 8082 |

SPECIAL PESTICIDE LIST

Prep Method: SW846 3550B Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| 4,4'-DDD | < 0.58 | 0.58 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDE | < 0.58 | 0.58 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDT | < 0.58 | 0.58 | ug/kg | | 12/5/01 | SW846 8081A |
| alpha-BHC | < 1.5 | 1.5 | ug/kg | | 12/5/01 | SW846 8081A |
| beta-BHC | < 1.5 | 1.5 | ug/kg | | 12/5/01 | SW846 8081A |
| Chlordane, technical | < 5.8 | 5.8 | ug/kg | | 12/5/01 | SW846 8081A |
| delta-BHC | < 1.5 | 1.5 | ug/kg | | 12/5/01 | SW846 8081A |
| Dieldrin | < 0.58 | 0.58 | ug/kg | | 12/5/01 | SW846 8081A |
| Endrin | < 0.58 | 0.58 | ug/kg | | 12/5/01 | SW846 8081A |
| gamma-BHC (Lindane) | < 0.29 | 0.29 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor | < 0.29 | 0.29 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor epoxide | < 1.5 | 1.5 | ug/kg | | 12/5/01 | SW846 8081A |
| Oxychlordane | < 2.9 | 2.9 | ug/kg | X | 12/5/01 | SW846 8081A |

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## Analytical Report

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Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-1 BOTTOM
Lab Sample Number : 913868-002
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Semivolatile Organic Results

PCB LIST

Prep Method: SW846 3550 Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| Aroclor 1016 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1221 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1232 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1242 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1248 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1254 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1260 | < 5.7 | 5.7 | ug/kg | | 11/13/01 | SW846 8082 |

SPECIAL PESTICIDE LIST

Prep Method: SW846 3550B Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| 4,4'-DDD | < 0.57 | 0.57 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDE | < 0.57 | 0.57 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDT | < 0.57 | 0.57 | ug/kg | | 12/5/01 | SW846 8081A |
| alpha-BHC | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| beta-BHC | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| Chlordane, technical | < 5.7 | 5.7 | ug/kg | | 12/5/01 | SW846 8081A |
| delta-BHC | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| Dieldrin | < 0.57 | 0.57 | ug/kg | | 12/5/01 | SW846 8081A |
| Endrin | < 0.57 | 0.57 | ug/kg | | 12/5/01 | SW846 8081A |
| gamma-BHC (Lindane) | < 0.29 | 0.29 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor | < 0.29 | 0.29 | ug/kg | S | 12/5/01 | SW846 8081A |
| Heptachlor epoxide | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| Oxychlordane | < 2.9 | 2.9 | ug/kg | X | 12/5/01 | SW846 8081A |

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# Analytical Report

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Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-2 TOP
Lab Sample Number : 913868-003
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Semivolatile Organic Results

PCB LIST

Prep Method: SW846 3550 Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| Aroclor 1016 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1221 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1232 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1242 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1248 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1254 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1260 | < 9.3 | 9.3 | ug/kg | | 11/13/01 | SW846 8082 |

SPECIAL PESTICIDE LIST

Prep Method: SW846 3550B Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| 4,4'-DDD | 10 | 0.93 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDE | 2.8 | 0.93 | ug/kg | P | 12/5/01 | SW846 8081A |
| 4,4'-DDT | 1.6 | 0.93 | ug/kg | | 12/5/01 | SW846 8081A |
| alpha-BHC | < 2.3 | 2.3 | ug/kg | | 12/5/01 | SW846 8081A |
| beta-BHC | < 2.3 | 2.3 | ug/kg | | 12/5/01 | SW846 8081A |
| Chlordane, technical | < 9.3 | 9.3 | ug/kg | | 12/5/01 | SW846 8081A |
| delta-BHC | < 2.3 | 2.3 | ug/kg | | 12/5/01 | SW846 8081A |
| Dieldrin | < 0.93 | 0.93 | ug/kg | | 12/5/01 | SW846 8081A |
| Endrin | < 0.93 | 0.93 | ug/kg | | 12/5/01 | SW846 8081A |
| gamma-BHC (Lindane) | < 0.47 | 0.47 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor | < 0.52 | 0.52 | ug/kg | S | 12/5/01 | SW846 8081A |
| Heptachlor epoxide | < 2.3 | 2.3 | ug/kg | | 12/5/01 | SW846 8081A |
| Oxychlordane | < 4.7 | 4.7 | ug/kg | X | 12/5/01 | SW846 8081A |

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# Analytical Report

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Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-2 BOTTOM
Lab Sample Number : 913868-004
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Semivolatile Organic Results

PCB LIST — Prep Method: SW846 3550 — Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| Aroclor 1016 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1221 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1232 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1242 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1248 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1254 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1260 | < 8.7 | 8.7 | ug/kg | | 11/13/01 | SW846 8082 |

SPECIAL PESTICIDE LIST — Prep Method: SW846 3550B — Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| 4,4'-DDD | < 0.87 | 0.87 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDE | < 0.87 | 0.87 | ug/kg | P | 12/5/01 | SW846 8081A |
| 4,4'-DDT | < 0.87 | 0.87 | ug/kg | | 12/5/01 | SW846 8081A |
| alpha-BHC | < 2.2 | 2.2 | ug/kg | | 12/5/01 | SW846 8081A |
| beta-BHC | < 2.2 | 2.2 | ug/kg | | 12/5/01 | SW846 8081A |
| Chlordane, technical | < 8.7 | 8.7 | ug/kg | | 12/5/01 | SW846 8081A |
| delta-BHC | < 2.2 | 2.2 | ug/kg | | 12/5/01 | SW846 8081A |
| Dieldrin | < 0.87 | 0.87 | ug/kg | | 12/5/01 | SW846 8081A |
| Endrin | < 0.87 | 0.87 | ug/kg | | 12/5/01 | SW846 8081A |
| gamma-BHC (Lindane) | < 0.43 | 0.43 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor | < 0.43 | 0.43 | ug/kg | S | 12/5/01 | SW846 8081A |
| Heptachlor epoxide | < 2.2 | 2.2 | ug/kg | | 12/5/01 | SW846 8081A |
| Oxychlordane | < 4.3 | 4.3 | ug/kg | X | 12/5/01 | SW846 8081A |

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# Analytical Report

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Project Name : LONG MEADOW LAKE
Project Number :
Field ID : LM-3 TOP
Lab Sample Number : 913868-005
Lab Project Number : 913868

Submitter : US ARMY CORPS OF ENGINEERS
Report Date : 12/18/01
Collection Date : 11/1/01
Matrix Type : SOIL
WI DNR LAB ID : 113172950

## Semivolatile Organic Results

PCB LIST — Prep Method: SW846 3550 — Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| Aroclor 1016 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1221 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1232 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1242 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1248 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1254 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1260 | < 5.6 | 5.6 | ug/kg | | 11/13/01 | SW846 8082 |

SPECIAL PESTICIDE LIST — Prep Method: SW846 3550B — Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| 4,4'-DDD | < 0.56 | 0.56 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDE | < 0.56 | 0.56 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDT | < 0.56 | 0.56 | ug/kg | | 12/5/01 | SW846 8081A |
| alpha-BHC | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| beta-BHC | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| Chlordane, technical | < 5.6 | 5.6 | ug/kg | | 12/5/01 | SW846 8081A |
| delta-BHC | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| Dieldrin | < 0.56 | 0.56 | ug/kg | | 12/5/01 | SW846 8081A |
| Endrin | < 0.56 | 0.56 | ug/kg | | 12/5/01 | SW846 8081A |
| gamma-BHC (Lindane) | < 0.28 | 0.28 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor | < 0.28 | 0.28 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor epoxide | < 1.4 | 1.4 | ug/kg | | 12/5/01 | SW846 8081A |
| Oxychlordane | < 2.8 | 2.8 | ug/kg | X | 12/5/01 | SW846 8081A |

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920-469-2436 • Fax: 920-469-8827
800-7-ENCHEM

EN CHEM INC.

# Analytical Report

**Madison Office & Laboratory**
525 Science Drive
Madison, WI 53711
608-232-3300 • Fax: 608-233-0502
888-5-ENCHEM

**Project Name :** LONG MEADOW LAKE
**Project Number :**
**Field ID :** LM-3 BOTTOM
**Lab Sample Number :** 913868-006
**Lab Project Number :** 913868

**Submitter :** US ARMY CORPS OF ENGINEERS
**Report Date :** 12/18/01
**Collection Date :** 11/1/01
**Matrix Type :** SOIL
**WI DNR LAB ID :** 113172950

## Semivolatile Organic Results

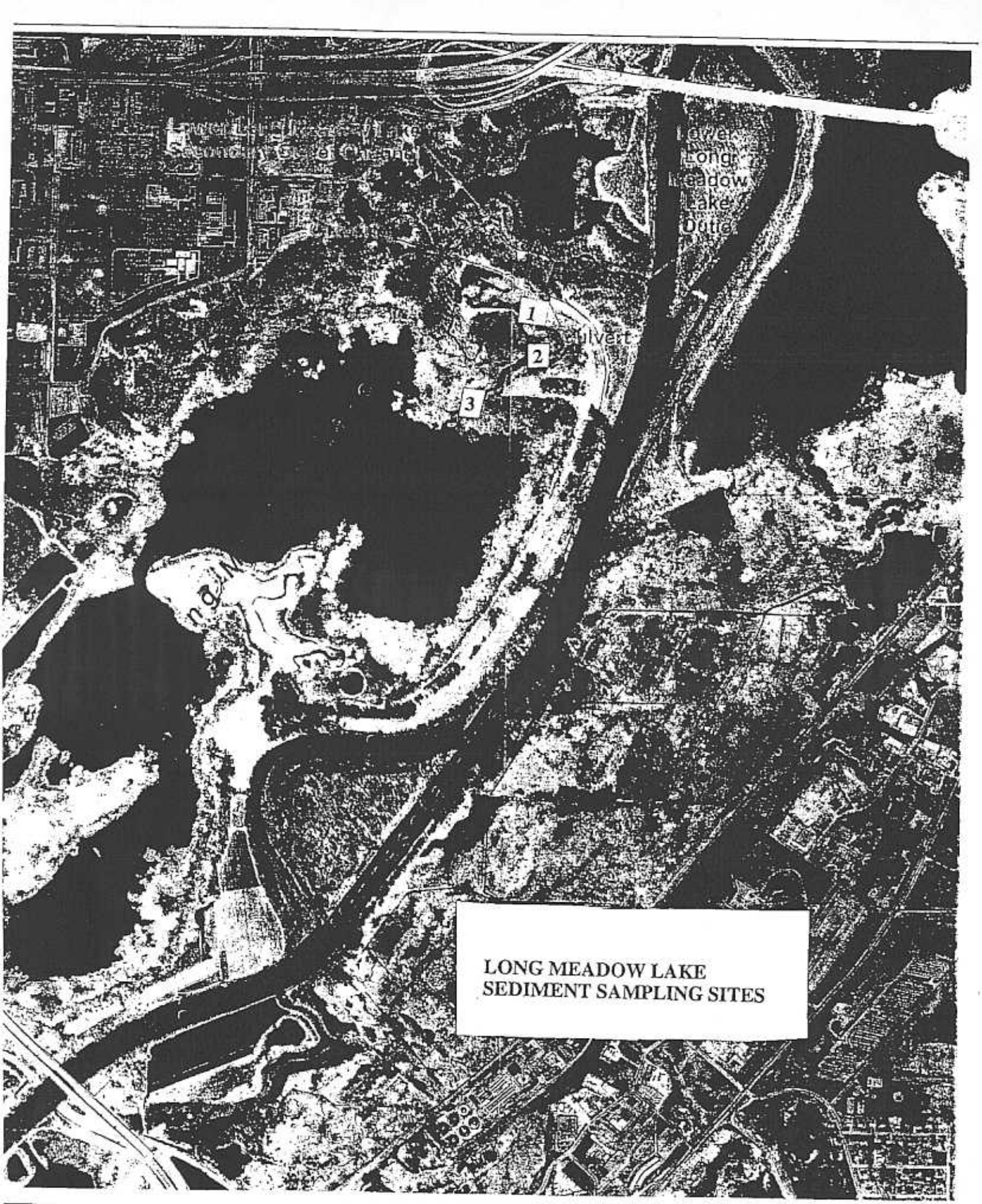
PCB LIST — Prep Method: SW846 3550 — Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| Aroclor 1016 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1221 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1232 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1242 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1248 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1254 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |
| Aroclor 1260 | < 5.4 | 5.4 | ug/kg | | 11/13/01 | SW846 8082 |

SPECIAL PESTICIDE LIST — Prep Method: SW846 3550B — Prep Date: 11/7/01

| Analyte | Result | EQL | Units | Code | Analysis Date | Analysis Method |
|---|---|---|---|---|---|---|
| 4,4'-DDD | < 0.54 | 0.54 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDE | < 0.54 | 0.54 | ug/kg | | 12/5/01 | SW846 8081A |
| 4,4'-DDT | < 0.54 | 0.54 | ug/kg | | 12/5/01 | SW846 8081A |
| alpha-BHC | < 1.3 | 1.3 | ug/kg | | 12/5/01 | SW846 8081A |
| beta-BHC | < 1.3 | 1.3 | ug/kg | | 12/5/01 | SW846 8081A |
| Chlordane, technical | < 5.4 | 5.4 | ug/kg | | 12/5/01 | SW846 8081A |
| delta-BHC | < 1.3 | 1.3 | ug/kg | | 12/5/01 | SW846 8081A |
| Dieldrin | < 0.54 | 0.54 | ug/kg | | 12/5/01 | SW846 8081A |
| Endrin | < 0.54 | 0.54 | ug/kg | | 12/5/01 | SW846 8081A |
| gamma-BHC (Lindane) | < 0.27 | 0.27 | ug/kg | P | 12/5/01 | SW846 8081A |
| Heptachlor | < 0.27 | 0.27 | ug/kg | | 12/5/01 | SW846 8081A |
| Heptachlor epoxide | < 1.3 | 1.3 | ug/kg | | 12/5/01 | SW846 8081A |
| Oxychlordane | < 2.7 | 2.7 | ug/kg | X | 12/5/01 | SW846 8081A |

# LONG MEADOW LAKE
# SEDIMENT ANALYSIS DATA




LONG MEADOW LAKE
SEDIMENT SAMPLING SITES

Sediment Analysis
Long Meadow Lake
Feb 01

2/13/01

LM1-T
LM1-B
> 12:00 - 12:30
0-3' T 3-4.5 B

LM2-T
LM2-B
> 1330
0-5.5
0-4 B
4-5.5

LM3-T
LM3-B
0-3
3-4 B

Grain size top & bottom are switched

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 1 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

| ANALYSIS | UNITS | PQL | Sample No.: 43758.001<br>Sample ID.: LM1-T<br>RESULTS |
|---|---|---|---|
| **PAH 8310** | | | |
| **Date Analyzed: 3/2/01** | | | |
| Acenaphthene | ug/kg | 14 | ND |
| Acenaphthlylene | ug/kg | 90 | ND |
| Anthracene | ug/kg | 4.0 | ND |
| Benzo(a)Anthracene | ug/kg | 3.1 | 4.5 |
| Benzo(a)Pyrene | ug/kg | 4.0 | 5.0 |
| Benzo(b)Fluoranthene | ug/kg | 5.4 | ND |
| Benzo(g,h,i)Perylene | ug/kg | 16 | ND |
| Benzo(k)Fluoranthene | ug/kg | 4.0 | 4.8 |
| Chrysene | ug/kg | 4.0 | 6.4 |
| Dibenzo(a,h)Anthracene | ug/kg | 8.1 | ND |
| Fluoranthene | ug/kg | 11 | ND |
| Fluorene | ug/kg | 6.3 | ND |
| Indeno(1,2,3-cd)Pyrene | ug/kg | 7.2 | ND |
| Naphthalene | ug/kg | 27 | ND |
| Phenanthrene | ug/kg | 6.3 | ND |
| Pyrene | ug/kg | 3.6 | 4.1 |

| Surrogate Recovery | Limits | % Recovery |
|---|---|---|
| Decafluorobiphenyl | 20 - 100 | 53.0% |

ND means Not Detected or below reported PQL
PQL means Practical Quantification
ug/kg means Milligrams Per Kilogram which is equivalent to Parts Per Billion (ppb)

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*LABORATORY ANALYSIS REPORT*

*DATE:* March 29, 2001

*PAGE:* 2 Of 19

*CLIENT:* U.S. Army Corp of Engineers
190 E 5th St.
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*CONTACT:* Jim Sentz

*PROJECT NO.:* 021301-200390
*COLLECTION DATE:* 2/13/2001
*COLLECTED BY:* Client
*RECEIVED DATE:* 2/13/2001
*PROJECT DESCRP.:* Long Meadow Lake

| | | Sample No.: | 43758.001 |
|---|---|---|---|
| | | Sample ID.: | LM1-T |
| ANALYSIS | UNITS | PQL | RESULT |
| Method 8081A[m] | | | |
| Date Extracted: 2/20/01 | | | |
| Date Analyzed: 2/23/01 | | | |
| Aldrin | ug/kg | 3.5 | ND |
| alpha-BHC | ug/kg | 3.5 | ND |
| beta-BHC | ug/kg | 2.1 | ND |
| delta-BHC | ug/kg | 4.5 | ND |
| gamma-BHC | ug/kg | 3.8 | ND |
| 4,4-DDD[L] | ug/kg | 3.8 | ND |
| 4,4-DDE | ug/kg | 22 | ND |
| 4,4-DDT | ug/kg | 3.5 | ND |
| Dieldrin | ug/kg | 5.8 | ND |
| Endosulfan I[L] | ug/kg | 3.8 | ND |
| Endosulfan II[L] | ug/kg | 3.3 | ND |
| Endosulfan sulfate | ug/kg | 2.4 | ND |
| Endrin | ug/kg | 3.8 | ND |
| Endrin aldehyde | ug/kg | 3.0 | ND |
| Heptachlor | ug/kg | 55 | ND |
| Heptachlor epoxide[L] | ug/kg | 3.8 | ND |
| Methoxychlor | ug/kg | 25 | ND |
| Total Chlordane | ug/kg | 10 | ND |
| Toxaphene | ug/kg | 25 | ND |
| Surrogate | | % Recovery | |
| 2,4,5,6-Tetrachloro-m-Xylene | | [s]48.2% | |
| Decachlorobiphenyl | | 73.2% | |

[m]MS recovery was low for this compound.
[L]LCS/LCSD recovery exceeded control limits for these compounds.
[s]Low surrogate recovery.
ND means Not Detected or below reported PQL
PQL means Practical Quantification Limit
ug/kg means Micrograms Per Kilogram which is equivalent to Parts Per Billion (ppb)

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**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.001
**Sample ID.:** LM1-T

| ANALYSIS | UNITS | PQL | RESULT | ANALYSIS DATE |
|---|---|---|---|---|
| Arsenic (200.8) | mg/kg | 3.6 | ND | 2/23/2001 |
| Cadmium (200.8) | mg/kg | 0.41 | ND | 2/23/2001 |
| Chromium (200.8) | mg/kg | 0.78 | 7.2 | 2/23/2001 |
| Copper (200.8) | mg/kg | 1.4 | 10 | 2/23/2001 |
| Lead (200.8) | mg/kg | 0.94 | 5.3 | 2/23/2001 |
| Mercury (200.8) | mg/kg | 0.16 | 0.34 | 2/23/2001 |
| Nickel (200.8) | mg/kg | 1.2 | 10 | 2/23/2001 |
| Nitrogen, Ammonia (350.1) | mg/kg | 1.0 | 11 | 2/15/2001 |
| Zinc (200.8) | mg/kg | 11 | 160 | 2/23/2001 |
| Total Phosphorus (365.2) | mg/kg | 1.0 | 420 | 2/27/2001 |
| Total Organic Carbon (9060) | % | 0.01 | 0.60 | 3/29/2001 |

| Sieve # | Mesh Size | Weight (g) Retained |
|---|---|---|
| 4 | 4.75 mm | 40 |
| 10 | 2.00 mm | 130 |
| 1 | 1.00 mm | 131 |
| 20 | 0.85 mm | 27 |
| 25 | 0.71 mm | 15 |
| 40 | 0.42 mm | 35 |
| 45 | 0.355 mm | 13 |
| 60 | 0.250 mm | 27 |
| 70 | 0.212 mm | 23 |
| 80 | 0.180 mm | 32 |
| 100 | 0.150 mm | 49 |
| 120 | 0.125 mm | 20 |
| 170 | 0.090 mm | 10 |
| 200 | 0.075 mm | 4.0 |

*Effective Size: 0.15 mm*
*Uniformity Coefficiency: 6.7*

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification Limit*
*mg/kg means Milligrams Per Kilogram which is equivalent to Parts Per Million (ppm)*

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*DATE:* March 29, 2001

*CLIENT:* U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

*CONTACT:* Jim Sentz

*PAGE:* 4 Of 19

*PROJECT NO.:* 021301-200390
*COLLECTION DATE:* 2/13/2001
*COLLECTED BY:* Client
*RECEIVED DATE:* 2/13/2001
*PROJECT DESCRP.:* Long Meadow Lake

*Sample No.:* 43758.002
*Sample ID.:* LM1-B

| ANALYSIS | UNITS | PQL | RESULTS |
|---|---|---|---|
| **PAH 8310** | | | |
| **Date Analyzed: 3/02/01** | | | |
| Acenaphthene | ug/kg | 14 | ND |
| Acenaphthlylene | ug/kg | 89 | ND |
| Anthracene | ug/kg | 4.0 | ND |
| Benzo(a)Anthracene | ug/kg | 3.1 | 3.7 |
| Benzo(a)Pyrene | ug/kg | 4.0 | ND |
| Benzo(b)Fluoranthene | ug/kg | 5.3 | ND |
| Benzo(g,h,i)Perylene | ug/kg | 16 | ND |
| Benzo(k)Fluoranthene | ug/kg | 4.0 | ND |
| Chrysene | ug/kg | 4.0 | 4.0 |
| Dibenzo(a,h)Anthracene | ug/kg | 8.0 | ND |
| Fluoranthene | ug/kg | 11 | ND |
| Fluorene | ug/kg | 6.2 | ND |
| Indeno(1,2,3-cd)Pyrene | ug/kg | 7.1 | ND |
| Naphthalene | ug/kg | 27 | ND |
| Phenanthrene | ug/kg | 6.2 | ND |
| Pyrene | ug/kg | 3.6 | 3.6 |

| Surrogate Recovery | Limits | % Recovery |
|---|---|---|
| Decafluorobiphenyl | 20 - 100 | 57.8% |

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification*
*ug/kg means Milligrams Per Kilogram which is equivalent to Parts Per Billion (ppb)*

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 5 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

| | | Sample No.: | 43758.002 |
|---|---|---|---|
| | | Sample ID.: | LMI-B |
| **ANALYSIS** | **UNITS** | **PQL** | **RESULT** |
| **Method 8081A[m]** | | | |
| **Date Extracted: 2/20/01** | | | |
| **Date Analyzed: 2/23/01** | | | |
| Aldrin | ug/kg | 3.4 | ND |
| alpha-BHC | ug/kg | 3.4 | ND |
| beta-BHC | ug/kg | 2.0 | ND |
| delta-BHC | ug/kg | 4.4 | ND |
| gamma-BHC | ug/kg | 3.6 | ND |
| 4,4-DDD[L] | ug/kg | 3.6 | ND |
| 4,4-DDE | ug/kg | 21 | ND |
| 4,4-DDT | ug/kg | 3.4 | ND |
| Dieldrin | ug/kg | 5.6 | ND |
| Endosulfan I[L] | ug/kg | 3.6 | ND |
| Endosulfan II[L] | ug/kg | 3.2 | ND |
| Endosulfan sulfate | ug/kg | 2.3 | ND |
| Endrin | ug/kg | 3.6 | ND |
| Endrin aldehyde | ug/kg | 2.9 | ND |
| Heptachlor | ug/kg | 53 | ND |
| Heptachlor epoxide[L] | ug/kg | 3.6 | ND |
| Methoxychlor | ug/kg | 24 | ND |
| Total Chlordane | ug/kg | 9.6 | ND |
| Toxaphene | ug/kg | 24 | ND |
| **Surrogate** | | **% Recovery** | |
| 2,4,5,6-Tetrachloro-m-Xylene | | [s]29.7% | |
| Decachlorobiphenyl | | [s]48.4% | |

[m]MS recovery was low for this compound.
[L]LCS/LCSD recovery exceeded control limits for these compounds.
[s]Low surrogate recovery.
ND means Not Detected or below reported PQL
PQL means Practical Quantification Limit
ug/kg means Micrograms Per Kilogram which is equivalent to Parts Per Billion (ppb)

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 6 Of 19

**CLIENT:** U.S. Army Corp of Engineers
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**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.002
**Sample ID.:** LM1-B

| ANALYSIS | UNITS | PQL | RESULT | ANALYSIS DATE |
|---|---|---|---|---|
| Arsenic (200.8) | mg/kg | 3.8 | ND | 2/23/2001 |
| Cadmium (200.8) | mg/kg | 0.42 | ND | 2/23/2001 |
| Chromium (200.8) | mg/kg | 0.81 | 6.9 | 2/23/2001 |
| Copper (200.8) | mg/kg | 1.5 | 8.6 | 2/23/2001 |
| Lead (200.8) | mg/kg | 0.98 | 4.3 | 2/23/2001 |
| Mercury (200.8) | mg/kg | 0.17 | 0.20 | 2/23/2001 |
| Nickel (200.8) | mg/kg | 1.3 | 11 | 2/23/2001 |
| Nitrogen, Ammonia (350.1) | mg/kg | 1.0 | 7.5 | 2/15/2001 |
| Zinc (200.8) | mg/kg | 11 | 32 | 2/23/2001 |
| Total Phosphorus (365.2) | mg/kg | 1.0 | 460 | 2/27/2001 |
| Total Organic Carbon (9060) | % | 0.01 | 0.27 | 3/29/2001 |

| Sieve # | Mesh Size | Weight (g) Retained |
|---|---|---|
| 4 | 4.75 mm | 15 |
| 10 | 2.00 mm | 94 |
| 1 | 1.00 mm | 57 |
| 20 | 0.85 mm | 9.0 |
| 25 | 0.71 mm | 5.0 |
| 40 | 0.42 mm | 10 |
| 45 | 0.355 mm | 8.0 |
| 60 | 0.250 mm | 0.0 |
| 70 | 0.212 mm | 11 |
| 80 | 0.180 mm | 0.0 |
| 100 | 0.150 mm | 5.0 |
| 120 | 0.125 mm | 6.0 |
| 170 | 0.090 mm | 25 |
| 200 | 0.075 mm | 35 |

*Effective Size: 0.075 mm*
*Uniformity Coefficiency: 13*

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification Limit*
*mg/kg means Milligrams Per Kilogram which is equivalent to Parts Per Million (ppm)*

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## *LABORATORY ANALYSIS REPORT*

*DATE:* March 29, 2001

*CLIENT:* U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

*CONTACT:* Jim Sentz

*PAGE:* 7 Of 19

*PROJECT NO.:* 021301-200390
*COLLECTION DATE:* 2/13/2001
*COLLECTED BY:* Client
*RECEIVED DATE:* 2/13/2001
*PROJECT DESCRP.:* Long Meadow Lake

*Sample No.:* 43758.003
*Sample ID.:* LM2-T

| ANALYSIS | UNITS | PQL | RESULTS |
|---|---|---|---|
| **PAH 8310** | | | |
| **Date Analyzed: 3/02/01** | | | |
| Acenaphthene | ug/kg | 14 | ND |
| Acenaphthlylene | ug/kg | 93 | ND |
| Anthracene | ug/kg | 4.2 | 4.5 |
| Benzo(a)Anthracene | ug/kg | 3.3 | 4.0 |
| Benzo(a)Pyrene | ug/kg | 4.2 | ND |
| Benzo(b)Fluoranthene | ug/kg | 5.6 | 6.1 |
| Benzo(g,h,i)Perylene | ug/kg | 17 | ND |
| Benzo(k)Fluoranthene | ug/kg | 4.2 | ND |
| Chrysene | ug/kg | 4.2 | ND |
| Dibenzo(a,h)Anthracene | ug/kg | 8.4 | ND |
| Fluoranthene | ug/kg | 12 | ND |
| Fluorene | ug/kg | 6.5 | ND |
| Indeno(1,2,3-cd)Pyrene | ug/kg | 7.4 | ND |
| Naphthalene | ug/kg | 28 | ND |
| Phenanthrene | ug/kg | 6.5 | ND |
| Pyrene | ug/kg | 3.7 | 4.5 |

| Surrogate Recovery | Limits | % Recovery |
|---|---|---|
| Decafluorobiphenyl | 20 - 100 | 35.8% |

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification*
*ug/kg means Milligrams Per Kilogram which is equivalent to Parts Per Billion (ppb)*

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*PAGE:* 8 Of 19

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190 E 5th St.
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*PROJECT NO.:* 021301-200390
*COLLECTION DATE:* 2/13/2001
*COLLECTED BY:* Client
*RECEIVED DATE:* 2/13/2001
*PROJECT DESCRP.:* Long Meadow Lake

*CONTACT:* Jim Sentz

| | | Sample No.: | 43758.003 |
|---|---|---|---|
| | | Sample ID.: | LM2-T |
| **ANALYSIS** | **UNITS** | **PQL** | **RESULT** |
| **Method 8081A[dd][m]** | | | |
| **Date Extracted: 2/20/01** | | | |
| **Date Analyzed: 2/23/01** | | | |
| Aldrin | ug/kg | 88 | ND |
| alpha-BHC | ug/kg | 88 | ND |
| beta-BHC | ug/kg | 52 | ND |
| delta-BHC | ug/kg | 120 | ND |
| gamma-BHC | ug/kg | 94 | ND |
| 4,4-DDD[L] | ug/kg | 94 | ND |
| 4,4-DDE | ug/kg | 550 | ND |
| 4,4-DDT | ug/kg | 88 | ND |
| Dieldrin | ug/kg | 150 | ND |
| Endosulfan I[L] | ug/kg | 94 | ND |
| Endosulfan II[L] | ug/kg | 82 | ND |
| Endosulfan sulfate | ug/kg | 59 | ND |
| Endrin | ug/kg | 94 | ND |
| Endrin aldehyde | ug/kg | 75 | ND |
| Heptachlor | ug/kg | 1400 | ND |
| Heptachlor epoxide[L] | ug/kg | 94 | ND |
| Methoxychlor | ug/kg | 630 | ND |
| Total Chlordane | ug/kg | 250 | ND |
| Toxaphene | ug/kg | 630 | ND |
| **Surrogate** | | **% Recovery** | |
| 2,4,5,6-Tetrachloro-m-Xylene | | diluted out | |
| Decachlorobiphenyl | | diluted out | |

[dd]A dilution was necessary due to sample matrix; therefore, detection limits were raised.
[m]MS recovery was low for this compound.
[L]LCS/LCSD recovery exceeded control limits for these compounds.
ND means Not Detected or below reported PQL
PQL means Practical Quantification Limit
ug/kg means Micrograms Per Kilogram which is equivalent to Parts Per Billion (ppb)

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**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.003
**Sample ID.:** LM2-T

| ANALYSIS | UNITS | PQL | RESULT | ANALYSIS DATE |
|---|---|---|---|---|
| Arsenic (200.8) | mg/kg | 3.7 | ND | 2/23/2001 |
| Cadmium (200.8) | mg/kg | 0.41 | ND | 2/23/2001 |
| Chromium (200.8) | mg/kg | 0.80 | 7.0 | 2/23/2001 |
| Copper (200.8) | mg/kg | 1.4 | 11 | 2/23/2001 |
| Lead (200.8) | mg/kg | 0.96 | 5.3 | 2/23/2001 |
| Mercury (200.8) | mg/kg | 0.16 | 0.42 | 2/23/2001 |
| Nickel (200.8) | mg/kg | 1.3 | 8.7 | 2/23/2001 |
| Nitrogen, Ammonia (350.1) | mg/kg | 1.0 | 25 | 2/15/2001 |
| Zinc (200.8) | mg/kg | 11 | 71 | 2/23/2001 |
| Total Phosphorus (365.2) | mg/kg | 1.0 | 290 | 2/27/2001 |
| Total Organic Carbon (9060) | % | 0.01 | 4.27 | 3/29/2001 |

| Sieve # | Mesh Size | Weight (g) Retained |
|---|---|---|
| 4 | 4.75 mm | 40 |
| 10 | 2.00 mm | 53 |
| 1 | 1.00 mm | 20 |
| 20 | 0.85 mm | 5.0 |
| 25 | 0.71 mm | 0.0 |
| 40 | 0.42 mm | 11 |
| 45 | 0.355 mm | 5.0 |
| 60 | 0.250 mm | 0.0 |
| 70 | 0.212 mm | 5.0 |
| 80 | 0.180 mm | 9.0 |
| 100 | 0.150 mm | 3.0 |
| 120 | 0.125 mm | 0.0 |
| 170 | 0.090 mm | 0.0 |
| 200 | 0.075 mm | 0.0 |

*Effective Size: 2.0 mm*
*Uniformity Coefficiency: 9.4*

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification Limit*
*mg/kg means Milligrams Per Kilogram which is equivalent to Parts Per Million (ppm)*

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 10 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.004
**Sample ID.:** LM2-B

| ANALYSIS | UNITS | PQL | RESULTS |
|---|---|---|---|
| **PAH 8310** | | | |
| **Date Analyzed:** 3/02/01 | | | |
| Acenaphthene | ug/kg | 14 | ND |
| Acenaphthlylene | ug/kg | 92 | ND |
| Anthracene | ug/kg | 4.1 | 5.1 |
| Benzo(a)Anthracene | ug/kg | 3.2 | 5.8 |
| Benzo(a)Pyrene | ug/kg | 4.1 | 5.2 |
| Benzo(b)Fluoranthene | ug/kg | 5.5 | ND |
| Benzo(g,h,i)Perylene | ug/kg | 17 | ND |
| Benzo(k)Fluoranthene | ug/kg | 4.1 | 5.4 |
| Chrysene | ug/kg | 4.1 | 7.8 |
| Dibenzo(a,h)Anthracene | ug/kg | 8.3 | ND |
| Fluoranthene | ug/kg | 11 | ND |
| Fluorene | ug/kg | 6.4 | ND |
| Indeno(1,2,3-cd)Pyrene | ug/kg | 7.4 | ND |
| Naphthalene | ug/kg | 28 | ND |
| Phenanthrene | ug/kg | 6.4 | 6.5 |
| Pyrene | ug/kg | 3.7 | 3.7 |

| Surrogate Recovery | Limits | % Recovery |
|---|---|---|
| Decafluorobiphenyl | 20 - 100 | 24.8% |

ND means Not Detected or below reported PQL
PQL means Practical Quantification
ug/kg means Milligrams Per Kilogram which is equivalent to Parts Per Billion (ppb)

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*LABORATORY ANALYSIS REPORT*

*DATE:* March 29, 2001

*PAGE:* 11 Of 19

*CLIENT:* U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

*CONTACT:* Jim Sentz

*PROJECT NO.:* 021301-200390
*COLLECTION DATE:* 2/13/2001
*COLLECTED BY:* Client
*RECEIVED DATE:* 2/13/2001
*PROJECT DESCRP.:* Long Meadow Lake

| | | Sample No.: | 43758.004 |
|---|---|---|---|
| | | Sample ID.: | LM2-B |
| **ANALYSIS** | **UNITS** | **POL** | **RESULT** |
| **Method 8081A[dd][m]** | | | |
| **Date Extracted: 2/20/01** | | | |
| **Date Analyzed: 2/23/01** | | | |
| Aldrin | ug/kg | 88 | ND |
| alpha-BHC | ug/kg | 88 | ND |
| beta-BHC | ug/kg | 52 | ND |
| delta-BHC | ug/kg | 120 | ND |
| gamma-BHC | ug/kg | 94 | ND |
| 4,4-DDD[L] | ug/kg | 94 | ND |
| 4,4-DDE | ug/kg | 550 | ND |
| 4,4-DDT | ug/kg | 88 | ND |
| Dieldrin | ug/kg | 150 | ND |
| Endosulfan I[L] | ug/kg | 94 | ND |
| Endosulfan II[L] | ug/kg | 82 | ND |
| Endosulfan sulfate | ug/kg | 59 | ND |
| Endrin | ug/kg | 94 | ND |
| Endrin aldehyde | ug/kg | 75 | ND |
| Heptachlor | ug/kg | 1400 | ND |
| Heptachlor epoxide[L] | ug/kg | 94 | ND |
| Methoxychlor | ug/kg | 630 | ND |
| Total Chlordane | ug/kg | 250 | ND |
| Toxaphene | ug/kg | 630 | ND |
| **Surrogate** | | **% Recovery** | |
| 2,4,5,6-Tetrachloro-m-Xylene | | diluted out | |
| Decachlorobiphenyl | | diluted out | |

[dd]A dilution was necessary due to sample matrix; therefore, detection limits were raised.
[m]MS recovery was low for this compound.
[L]LCS/LCSD recovery exceeded control limits for these compounds.
ND means Not Detected or below reported PQL
PQL means Practical Quantification Limit
ug/kg means Micrograms Per Kilogram which is equivalent to Parts Per Billion (ppb)

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz



**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.004
**Sample ID.:** LM2-B

| ANALYSIS | UNITS | PQL | RESULT | ANALYSIS DATE |
|---|---|---|---|---|
| Arsenic (200.8) | mg/kg | 4.0 | ND | 2/23/2001 |
| Cadmium (200.8) | mg/kg | 0.44 | ND | 2/23/2001 |
| Chromium (200.8) | mg/kg | 0.85 | 7.9 | 2/23/2001 |
| Copper (200.8) | mg/kg | 1.5 | 13 | 2/23/2001 |
| Lead (200.8) | mg/kg | 1.0 | 5.6 | 2/23/2001 |
| Mercury (200.8) | mg/kg | 0.18 | 0.25 | 2/23/2001 |
| Nickel (200.8) | mg/kg | 1.3 | 11 | 2/23/2001 |
| Nitrogen, Ammonia (350.1) | mg/kg | 1.0 | 23 | 2/15/2001 |
| Zinc (200.8) | mg/kg | 12 | 40 | 2/23/2001 |
| Total Phosphorus (365.2) | mg/kg | 1.0 | 350 | 2/27/2001 |
| Total Organic Carbon (9060) | % | 0.01 | 4.09 | 3/29/2001 |

| Sieve # | Mesh Size | Weight (g) Retained |
|---|---|---|
| 4 | 4.75 mm | 0.0 |
| 10 | 2.00 mm | 10 |
| 1 | 1.00 mm | 15 |
| 20 | 0.85 mm | 0.0 |
| 25 | 0.71 mm | 0.0 |
| 40 | 0.42 mm | 6.0 |
| 45 | 0.355 mm | 0.0 |
| 60 | 0.250 mm | 0.0 |
| 70 | 0.212 mm | 0.0 |
| 80 | 0.180 mm | 0.0 |
| 100 | 0.150 mm | 2.0 |
| 120 | 0.125 mm | 0.0 |
| 170 | 0.090 mm | 3.0 |
| 200 | 0.075 mm | 3.0 |

*Effective Size: 0.09 mm*
*Uniformity Coefficiency: 11*

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification Limit*
*mg/kg means Milligrams Per Kilogram which is equivalent to Parts Per Million (ppm)*

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*LABORATORY ANALYSIS REPORT*

*DATE:* March 29, 2001

*CLIENT:* U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

*CONTACT:* Jim Sentz

*PAGE:* 13 Of 19

*PROJECT NO.:* 021301-200390
*COLLECTION DATE:* 2/13/2001
*COLLECTED BY:* Client
*RECEIVED DATE:* 2/13/2001
*PROJECT DESCRP.:* Long Meadow Lake

*Sample No.:* 43758.005
*Sample ID.:* LM3-T

| ANALYSIS | UNITS | PQL | RESULTS |
|---|---|---|---|
| **PAH 8310** | | | |
| **Date Analyzed: 3/02/01** | | | |
| Acenaphthene | ug/kg | 13 | ND |
| Acenaphthlylene | ug/kg | 86 | ND |
| Anthracene | ug/kg | 3.9 | 3.9 |
| Benzo(a)Anthracene | ug/kg | 3.0 | 3.7 |
| Benzo(a)Pyrene | ug/kg | 3.9 | ND |
| Benzo(b)Fluoranthene | ug/kg | 5.2 | ND |
| Benzo(g,h,i)Perylene | ug/kg | 15 | ND |
| Benzo(k)Fluoranthene | ug/kg | 3.9 | ND |
| Chrysene | ug/kg | 3.9 | 4.2 |
| Dibenzo(a,h)Anthracene | ug/kg | 7.7 | ND |
| Fluoranthene | ug/kg | 11 | ND |
| Fluorene | ug/kg | 6.0 | ND |
| Indeno(1,2,3-cd)Pyrene | ug/kg | 6.9 | ND |
| Naphthalene | ug/kg | 26 | ND |
| Phenanthrene | ug/kg | 6.0 | ND |
| Pyrene | ug/kg | 3.4 | 4.2 |

| Surrogate Recovery | Limits | % Recovery |
|---|---|---|
| Decafluorobiphenyl | 20 - 100 | 37.7% |

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification*
*ug/kg means Milligrams Per Kilogram which is equivalent to Parts Per Billion (ppb)*

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 14 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

| ANALYSIS | UNITS | Sample No.: / Sample ID.: / PQL | 43758.005 / LM3-T / RESULT |
|---|---|---|---|
| **Method 8081A[(dd)(m)]** | | | |
| **Date Extracted: 2/20/01** | | | |
| **Date Analyzed: 2/23/01** | | | |
| Aldrin | ug/kg | 95 | ND |
| alpha-BHC | ug/kg | 95 | ND |
| beta-BHC | ug/kg | 56 | ND |
| delta-BHC | ug/kg | 130 | ND |
| gamma-BHC | ug/kg | 110 | ND |
| 4,4-DDD[(L)] | ug/kg | 110 | ND |
| 4,4-DDE | ug/kg | 590 | ND |
| 4,4-DDT | ug/kg | 95 | ND |
| Dieldrin | ug/kg | 160 | ND |
| Endosulfan I[(L)] | ug/kg | 110 | ND |
| Endosulfan II[(L)] | ug/kg | 88 | ND |
| Endosulfan sulfate | ug/kg | 63 | ND |
| Endrin | ug/kg | 110 | ND |
| Endrin aldehyde | ug/kg | 81 | ND |
| Heptachlor | ug/kg | 1500 | ND |
| Heptachlor epoxide[(L)] | ug/kg | 110 | ND |
| Methoxychlor | ug/kg | 680 | ND |
| Total Chlordane | ug/kg | 270 | ND |
| Toxaphene | ug/kg | 680 | ND |
| **Surrogate** | | **% Recovery** | |
| 2,4,5,6-Tetrachloro-m-Xylene | | diluted out | |
| Decachlorobiphenyl | | diluted out | |

[(dd)] A dilution was necessary due to sample matrix; therefore, detection limits were raised.
[(m)] MS recovery was low for this compound.
[(L)] LCS/LCSD recovery exceeded control limits for these compounds.
ND means Not Detected or below reported PQL
PQL means Practical Quantification Limit
ug/kg means Micrograms Per Kilogram which is equivalent to Parts Per Billion (ppb)

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**LABORATORY ANALYSIS REPORT**

**DATE:** March 29, 2001

**PAGE:** 15 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.005
**Sample ID.:** LM3-T

| ANALYSIS | UNITS | PQL | RESULT | ANALYSIS DATE |
|---|---|---|---|---|
| Arsenic (200.8) | mg/kg | 3.7 | ND | 2/23/2001 |
| Cadmium (200.8) | mg/kg | 0.41 | ND | 2/23/2001 |
| Chromium (200.8) | mg/kg | 0.80 | 10 | 2/23/2001 |
| Copper (200.8) | mg/kg | 1.4 | 14 | 2/23/2001 |
| Lead (200.8) | mg/kg | 0.96 | 6.7 | 2/23/2001 |
| Mercury (200.8) | mg/kg | 0.16 | 0.17 | 2/23/2001 |
| Nickel (200.8) | mg/kg | 1.3 | 11 | 2/23/2001 |
| Nitrogen, Ammonia (350.1) | mg/kg | 1.0 | 7.3 | 2/15/2001 |
| Zinc (200.8) | mg/kg | 11 | 48 | 2/23/2001 |
| Total Phosphorus (365.2) | mg/kg | 1.0 | 430 | 2/27/2001 |
| Total Organic Carbon (9060) | % | 0.01 | 2.63 | 3/29/2001 |

| Sieve # | Mesh Size | Weight (g) Retained |
|---|---|---|
| 4 | 4.75 mm | 60 |
| 10 | 2.00 mm | 120 |
| 1 | 1.00 mm | 45 |
| 20 | 0.85 mm | 12 |
| 25 | 0.71 mm | 6.0 |
| 40 | 0.42 mm | 18 |
| 45 | 0.355 mm | 7.0 |
| 60 | 0.250 mm | 15 |
| 70 | 0.212 mm | 0.0 |
| 80 | 0.180 mm | 0.0 |
| 100 | 0.150 mm | 0.0 |
| 120 | 0.125 mm | 0.0 |
| 170 | 0.090 mm | 0.0 |
| 200 | 0.075 mm | 6.0 |

*Effective Size: 0.42 mm*
*Uniformity Coefficiency: 4.8*

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification Limit*
*mg/kg means Milligrams Per Kilogram which is equivalent to Parts Per Million (ppm)*

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 16 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.006
**Sample ID.:** LM3-B

| ANALYSIS | UNITS | PQL | RESULTS |
|---|---|---|---|
| **PAH 8310** | | | |
| **Date Analyzed:** 3/02/01 | | | |
| Acenaphthene | ug/kg | 14 | ND |
| Acenaphthlylene | ug/kg | 90 | ND |
| Anthracene | ug/kg | 4.0 | ND |
| Benzo(a)Anthracene | ug/kg | 3.1 | 3.4 |
| Benzo(a)Pyrene | ug/kg | 4.0 | ND |
| Benzo(b)Fluoranthene | ug/kg | 5.4 | ND |
| Benzo(g,h,i)Perylene | ug/kg | 16 | ND |
| Benzo(k)Fluoranthene | ug/kg | 4.0 | ND |
| Chrysene | ug/kg | 4.0 | ND |
| Dibenzo(a,h)Anthracene | ug/kg | 8.1 | ND |
| Fluoranthene | ug/kg | 11 | ND |
| Fluorene | ug/kg | 6.3 | ND |
| Indeno(1,2,3-cd)Pyrene | ug/kg | 7.2 | ND |
| Naphthalene | ug/kg | 27 | ND |
| Phenanthrene | ug/kg | 6.3 | ND |
| Pyrene | ug/kg | 3.6 | 4.2 |

| Surrogate Recovery | Limits | % Recovery |
|---|---|---|
| Decafluorobiphenyl | 20 - 100 | 46.8% |

ND means Not Detected or below reported PQL
PQL means Practical Quantification
ug/kg means Milligrams Per Kilogram which is equivalent to Parts Per Billion (ppb)

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## LABORATORY ANALYSIS REPORT

**DATE:** March 29, 2001

**PAGE:** 17 Of 19

**CLIENT:** U.S. Army Corp of Engineers
190 E 5th St.
St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

| | | Sample No.: | 43758.006 |
|---|---|---|---|
| | | Sample ID.: | LM3-B |
| **ANALYSIS** | **UNITS** | **PQL** | **RESULT** |
| **Method 8081A[m]** | | | |
| **Date Extracted: 2/20/01** | | | |
| **Date Analyzed: 2/23/01** | | | |
| Aldrin | ug/kg | 4.4 | ND |
| alpha-BHC | ug/kg | 4.4 | ND |
| beta-BHC | ug/kg | 2.6 | ND |
| delta-BHC | ug/kg | 5.6 | ND |
| gamma-BHC | ug/kg | 4.7 | ND |
| 4,4-DDD[L] | ug/kg | 4.7 | ND |
| 4,4-DDE | ug/kg | 27 | ND |
| 4,4-DDT | ug/kg | 4.4 | ND |
| Dieldrin | ug/kg | 7.2 | ND |
| Endosulfan I[L] | ug/kg | 4.7 | ND |
| Endosulfan II[L] | ug/kg | 4.1 | ND |
| Endosulfan sulfate | ug/kg | 2.9 | ND |
| Endrin | ug/kg | 4.7 | ND |
| Endrin aldehyde | ug/kg | 3.8 | ND |
| Heptachlor | ug/kg | 29 | ND |
| Heptachlor epoxide[L] | ug/kg | 4.7 | ND |
| Methoxychlor | ug/kg | 31 | ND |
| Total Chlordane | ug/kg | 13 | ND |
| Toxaphene | ug/kg | 31 | ND |
| **Surrogate** | | **% Recovery** | |
| 2,4,5,6-Tetrachloro-m-Xylene | | [s]40.5% | |
| Decachlorobiphenyl | | 81.0% | |

[m]MS recovery was low for this compound.
[L]LCS/LCSD recovery exceeded control limits for these compounds.
[s]Low surrogate recovery.
ND means Not Detected or below reported PQL
PQL means Practical Quantification Limit
ug/kg means Micrograms Per Kilogram which is equivalent to Parts Per Billion (ppb)

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**DATE:** March 29, 2001

**PAGE:** 18 Of 19

**CLIENT:** U.S. Army Corp of Engineers
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St.Paul, MN 55101

**CONTACT:** Jim Sentz

**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

**Sample No.:** 43758.006
**Sample ID.:** LM3-B

| ANALYSIS | UNITS | PQL | RESULT | ANALYSIS DATE |
|---|---|---|---|---|
| Arsenic (200.8) | mg/kg | 4.2 | ND | 2/23/2001 |
| Cadmium (200.8) | mg/kg | 0.46 | ND | 2/23/2001 |
| Chromium (200.8) | mg/kg | 0.89 | 8.5 | 2/23/2001 |
| Copper (200.8) | mg/kg | 1.6 | 17 | 2/23/2001 |
| Lead (200.8) | mg/kg | 1.1 | 8.2 | 2/23/2001 |
| Mercury (200.8) | mg/kg | 0.18 | ND | 2/23/2001 |
| Nickel (200.8) | mg/kg | 1.4 | 15 | 2/23/2001 |
| Nitrogen, Ammonia (350.1) | mg/kg | 1.0 | 5.3 | 2/15/2001 |
| Zinc (200.8) | mg/kg | 13 | 43 | 2/23/2001 |
| Total Phosphorus (365.2) | mg/kg | 1.0 | 500 | 2/27/2001 |
| Total Organic Carbon (9060) | % | 0.01 | 1.59 | 3/29/2001 |

| Sieve # | Mesh Size | Weight (g) Retained |
|---|---|---|
| 4 | 4.75 mm | 85 |
| 10 | 2.00 mm | 84 |
| 1 | 1.00 mm | 32 |
| 20 | 0.85 mm | 7.0 |
| 25 | 0.71 mm | 5.0 |
| 40 | 0.42 mm | 15 |
| 45 | 0.355 mm | 0.0 |
| 60 | 0.250 mm | 0.0 |
| 70 | 0.212 mm | 0.0 |
| 80 | 0.180 mm | 0.0 |
| 100 | 0.150 mm | 0.0 |
| 120 | 0.125 mm | 0.0 |
| 170 | 0.090 mm | 0.0 |
| 200 | 0.075 mm | 5.0 |

*Effective Size: 0.71 mm*
*Uniformity Coefficiency: 2.8*

*ND means Not Detected or below reported PQL*
*PQL means Practical Quantification Limit*
*mg/kg means Milligrams Per Kilogram which is equivalent to Parts Per Million (ppm)*

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**DATE:** March 29, 2001

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**CONTACT:** Jim Sentz



**PROJECT NO.:** 021301-200390
**COLLECTION DATE:** 2/13/2001
**COLLECTED BY:** Client
**RECEIVED DATE:** 2/13/2001
**PROJECT DESCRP.:** Long Meadow Lake

This report has been reviewed by me for technical accuracy and completeness. The analyses were performed using EPA or other approved methodologies and the results were reported on an "as received" basis unless otherwise noted. Organic soil analyses were reported on a dry weight basis. The results reported relate only to the items tested. Please contact me if you have any questions or comments regarding this report. Spectrum Labs, Inc. appreciates the opprotunity to provide this analytical service for you.

Report submitted By,

Gerard Herro
Laboratory Manager

GJH:wmc
43758