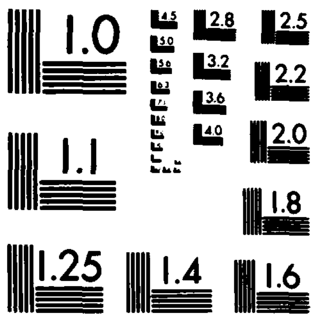
AD-A127 094 GREAT I STUDY OF THE UPPER MISSISSIPPI RIVER TECHNICAL APPENDIXES VOLUME 8 CHANNEL MAINTENANCE PART I NARRATIVE(U) GREAT RIVER ENVIRONMENTAL ACTION TEAM SEP 80 1/

UNCLASSIFIED F/G 13/2 NL




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

# GREAT
# STUDY OF THE
# UPPER MISSISSIPPI RIVER

TECHNICAL APPENDIXES

**VOLUME 8**



## CHANNEL MAINTENANCE

**PART I - NARRATIVE**









The GREAT River

1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

# REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

| | | |
|---|---|---|
| 1. REPORT NUMBER | 2. GOVT ACCESSION NO. AD-A127 094 | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) GREAT I STUDY OF THE UPPER MISSISSIPPI RIVER; Volume 8: Channel Maintenace | | 5. TYPE OF REPORT & PERIOD COVERED |
| | | 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s) Great Environmental Action Team | | 8. CONTRACT OR GRANT NUMBER(s) |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Army Corps of Engineers, St. Paul District 1135 USPO & Custom House, St. Paul, MN | | 12. REPORT DATE September 1980 |
| | | 13. NUMBER OF PAGES |
| 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) | | 15. SECURITY CLASS. (of this report) |
| | | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Volume 8 issues in 5 parts: Part I:narrative; Part II: Pool Plans and Site Descriptions-Minnesota River; St. Croix River, St Anthony Falls, and Pools 1 and 2; Part III: Pools 3 & 4; Part IV: Pools 5, 5A, 6 & 7; Part V: Pools 8, 9, and 10.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Channels (waterways)
Mississippi River
Dredged Material

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The channel maintenance plan is composed of a detailed dredged material placement plan (described in part I) and a set of supporting recommendations for dredging and channel maintenance. Parts II-V detail the channel maintenance plan by specific sites.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

BLANK PAGE

# OUTLINE

GREAT I
SEPTEMBER 1980

VOLUME 1 MAIN REPORT

TECHNICAL APPENDIXES

VOLUME 2
A. FLOODPLAIN MANAGEMENT
B. DREDGED MATERIAL USES
C. DREDGING REQUIREMENTS

VOLUME 3
D. MATERIAL AND EQUIPMENT NEEDS
E. COMMERCIAL TRANSPORTATION

VOLUME 4
F. WATER QUALITY
G. SEDIMENT AND EROSION

VOLUME 5
H. FISH AND WILDLIFE

VOLUME 6
I. RECREATION

VOLUME 7
J. PUBLIC PARTICIPATION
K. PLAN FORMULATION

VOLUME 8
L. CHANNEL MAINTENANCE
PART I - NARRATIVE
PART II - POOL PLANS AND SITE DESCRIPTIONS - MINNESOTA RIVER, ST. CROIX RIVER, ST. ANTHONY FALLS, AND POOLS 1 AND 2
PART III - POOL PLANS AND SITE DESCRIPTIONS - POOLS 3 AND 4
PART IV - POOL PLANS AND SITE DESCRIPTIONS - POOLS 5, 5A, 6, AND 7
PART V - POOL PLANS AND SITE DESCRIPTIONS - POOLS 8, 9, AND 10

VOLUME 9
M. ENVIRONMENTAL IMPACT STATEMENT

(When Data Entered)

## THE CHANNEL MAINTENANCE [illegible]

## PART I

## TABLE OF CONTENTS

## TABLE OF CONTENTS (CONT)

## TABLE OF CONTENTS (CONT)



## TABLES

## [illegible]



## FIGURES

# THE CHANNEL MAINTENANCE APPENDIX

## PART I

## CHAPTER 1

## INTRODUCTION

### THE ROLE OF THE CHANNEL MAINTENANCE PLAN IN THE GREAT STUDY

GREAT was formed to find a better way to manage dredged material placement on the Upper Mississippi River. Several other objectives were identified early in the study, but the climate of public opinion that existed when the study began and events since then have pointed out the overwhelming need for a solution to the problem of the placement of material dredged from the river channel.

With this problem as the primary focus, studies were undertaken, pilot projects proposed, ad hoc task forces formed and charged, data collected and analyzed, and conclusions reached. The results of these activities led to the selection a new set of dredged material placement sites.

The problem with dredged material placement is the harmful impacts on the biological habitat if material (1) covers the biologically active bottom of backwaters, (2) diverts flows through backwater sloughs substantially altering habitat characteristics, (3) inundates areas of open water near the main channel that provide cover and spawning areas for game fish, or (4) erodes from placement sites into adjacent backwaters. Other possible problems with dredged material placement include the placement of large mounds of sand on beaches previously used by boaters for picnicking and camping and the adverse effect dredged material placement may have on flood stages.

The CMP (channel maintenance plan) was designed to solve as many of these problems at individual sites as possible, while maintaining the uses of the river and its resources. Therefore, the function of the CMP in the GREAT I study is the hub around which the other study elements revolve.

All other work either contributed, or is directly related, to the CMP. Without the CMP, the rest of the GREAT I final report becomes a compilation of vaguely related conclusions and recommendations.

The GREAT I members have examined and reexamined the CMP, looking for better alternatives, better data, and better supporting recommendations. The results of their efforts are documented in this appendix. The CMP is not perfect, and better approaches to the problem will probably be developed as more and better information becomes available and as the river and the people who use it continue to change and grow.

But the CMP presented here will work. It will safeguard the river's fish and wildlife resources while providing for maintenance of the navigation channel and meeting the need for water-based recreation of many kinds. Further improvements can and should be incorporated as they are identified. The changing character of the river, changing laws and regulations, expanding knowledge, equipment availability, changing national policies, and funding limitations are a few of the factors that require flexibility in any long-range plan. The intent and objectives of the plan are as important as specific recommendations.

## INFORMATION CONTAINED IN THE CHANNEL MAINTENANCE PLAN

The CMP is composed of two major items - a detailed DMPP (dredged material placement plan) and a set of supporting recommendations for dredging and channel maintenance. The DMPP is described in detail in this volume. The supporting recommendations, described in the GREAT I main report (Volume 1) are also critical elements of the CMP.

### Part I - Narrative

Part I presents the objectives adopted for preparing the river management plan. A table describing the DMPP is included. It contains the critical data decision makers will need. Part I also describes how the DMPP was developed, how future dredging volumes were estimated, and the philosophy behind each pool's DMPP. It concludes with a discussion of several special features of the DMPP and an explanation of how dredging might be done in emergency situations and in the near-term future. General information, such as approximate riprap costs, approximate diking costs, and CMP elements affecting the entire study area, are included in Part I for easy reference.

Parts II, III, IV, and V - Pool Plans and Exhibits

These documents detail the CMP and the information developed by the GREAT I Team in preparing the CMP. The contents are in a pool-by-pool format for easy reference to those data that are site- (or cut-) specific, such as site descriptions, dredging volume estimates, and dredging cost estimates.

## CHAPTER 2

## OBJECTIVES OF THE CHANNEL MAINTENANCE PLAN

Federal laws and regulations require that certain principles and standards be followed in planning for water and related land resources. In Section 103 of the Water Resources Planning Act (Public Law 89-80), the Water Resources Council, an independent executive agency, was charged with developing "Principles and Standards for Planning Water and Related Land Resources." The Principles and Standards were established and published in the Federal Register on 10 September 1973, 13 months before the creation of the GREAT partnership team in October 1974. The purposes of the Principles and Standards are to:

1. ". . . provide the broad policy framework for planning activities and include the conceptual basis for planning."

2. ". . . provide for uniformity and consistency in comparing, measuring, and judging beneficial and adverse effects of alternative plans."

3. ". . . provide more detailed methods for carrying out the various levels of planning activities, including the selection of objectives, the measurement of beneficial and adverse effects, and the comparison of alternative plans for action."

The Principles and Standards required that the GREAT I study consider National Economic Development (NED) and Environmental Quality (EQ) during the formulation of any plan for action and that any plans developed must strive to meet these two objectives:

1. National economic development is enhanced by increasing the value of the Nation's output of goods and services and improving national economic efficiency.

2. Environmental quality is enhanced by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems in the study area and elsewhere in the Nation.

The GREAT I Team developed six specific objectives that any channel maintenance plan should strive to meet:

1. Provide for continued and practical maintenance dredging of the 9-foot navigation channel on the Mississippi, Minnesota, St. Croix, and Black Rivers. Any plan would have to allow the Corps of Engineers to fulfill its congressional mandate to maintain a 9-foot channel for commercial barge traffic.

2. Safeguard the wetland habitat and backwaters of the river from the detrimental effects of dredged material placement. The primary goal through GREAT was to reduce and/or eliminate the adverse effects of placement of dredged material on fish and wildlife habitat and the floodplain.

3. Protect the quality of water in the river from the adverse effects of dredged material placement. Sediments in some reaches of the river are polluted. The CMP seeks to ensure that dredged material placement in these areas and areas of suspected pollution will not aggravate water quality problems.

4. Avoid increasing flood stages. Encroachment on the floodplain has risen steadily with development of the navigation channel. Therefore, floodplain management was a concern.

5. Provide for continued use of the river's main channel border. Banks and islands created by dredged material placement have provided recreat[illegible] boaters with beaching, picnicking, and camping sites. These sites should be maintained as well-designed recreation areas.

6. Establish a beneficial use market for as much dredged material as possible. Highway departments and developers have use for sand, and dredged material can be removed from the floodplains for these users. An attempt was made to place dredged material at sites users could reach.

## CHAPTER 3

## QUICK REFERENCE SUMMARY OF THE CHANNEL MAINTENANCE PLAN

At its most basic level, the GREAT I CMP is a statement of where material from each historic dredging cut should be placed. The reasons for picking these "selected sites," descriptions of the sites, an assessment of the costs and impacts, and an estimate of the volume and frequency of dredging are integral parts of the CMP. The following table briefly summarizes these factors. It is provided as a quick and ready reference and summary of the GREAT I CMP. A more complete assessment or evaluation is provided in the pool-by-pool presentations in Parts II, III, IV, and V of this volume and in the GREAT I Environmental Impact Statement.

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites: Description | | | | | | | | | | Disposal sites: Impacts | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1): Upland | Cover (percent)(1): Wetland | Cover (percent)(1): Open water | Area (Acres) | Ø (ft) | Floodplain location | Conditions on use of site | Habitat alteration: Types 1, 2, and 3 wetland | Habitat alteration: Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered and threatened species | Water quality |
| Minn | 1 | 0.0 - 0.5 | 200 | 12 | 9,800 | 117,500 | 2.18 | 6,500 | Private | 100 | - | - | 1 | 10 | Out | Mech. rehandling with landowners equipment | 0 | 0 | None | All (Mainly) | Unknown | None | None |
| (Mouth of Minn. River) | | | | | | | | | | | | | | | | | | | | | | | |
| Minn | 2 | 4.0 - 4.7 | 200 | 4 | 20,000 | 80,000 | [illegible] | 3,000 | [illegible] | 100 | - | - | 18 | 35 | Floodway | - | 0 | 0 | Enhance | None identified | Unknown | None | Possible runoff |
| (4-mile cut) | | | | | | | | | | | | | | | | | | | | | | | |
| Minn | 3 | 11.2 - 12.8 | 200 | 10 | 38,800 | 387,500 | [illegible]30 | 10,000 | Private | 50 | - | 50 | 65 | 15 | Out | - | - | - | None | None identified | Unknown | None | None |
| (Peterson Bar) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible]06 | 8,000 | Private | 100 | - | - | 24 | 35 | Floodplain | - | - | - | None | None | Unknown | None | None |
| Minn | 4 | 13.2 - 13.5 | 200 | 12 | 2,800 | 33,500 | [illegible]03 | 4,000 | Private | 0 | 100 | - | 7 | 15 | Floodplain | Ind. Dev. may occur | 7 | - | None | None identified | Unknown | None | None |
| (Cargill) | | | | | | | | | | | | | | | | | | | | | | | |
| Minn | 5 | 14.3 - 14.7 | 200 | 16 | 6,300 | 101,500 | [illegible]03 | 7,000 | Private | 0 | 100 | - | 7 | 15 | Floodplain | Ind. Dev. may occur | 7 | - | None | None identified | Unknown | None | None |
| (Savage Bridge) | | | | | | | | | | | | | | | | | | | | | | | |
| St. Croix | 1 | 5.8 - 6.2 | 300 | 16 | 28,800 | 461,000 | SC12 | 1,000 | [illegible] | 100 | - | 0 | 17 | 5 | Floodway | No connection to private island | - | 0 | Enhance | None | Lost | None | None expected |
| (Kinnickinnic Bar) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | SC[illegible] | [illegible],000 | [illegible] | 100 | - | 0 | 9 | 5 | Floodway | No connection | - | 0 | Enhance | None | Lost | None | None expected |
| | | | | | | | SC16 | 33,000 | Minn | - | - | 100 | 3.5 | 15 | Floodway | Erosion control necessary | - | - | Enhance | None | None | None | None expected |
| | | | | | | | SC26 | 34,000 | Wash Co. | 50 | - | 50 | 5 | 10 | Floodway | None | 0 | 0 | Enhance | None | Unknown | None | None |
| | | | | | | | 3.34 | 36,000 | Public | 60 | 40 | 0 | 10 | 25 | Out | Stockpile fill | 0 | 4 | None | 240,000 | Unknown | None | None |
| St. Croix | 2 | 11.5 - 12.2 | 300 | 2 | [illegible] | 44,000 | SC21 | 7,000 | Public | 100 | 0 | 0 | 5 | 10 | Floodway | - | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| (Catfish Bar) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | SC27 | 20,000 | [illegible] | | 100 | | 2 | 20 | Floodway | - | 2 | 0 | Enhance | None identified | Unknown | None | None expected |
| St. Croix | 3 | 16.2 - 17.8 | 300 | 6 | 127,300 | 764,000 | SC01 | 4,000 | Wis. | 90 | 0 | 10 | 7 | Minimal | Floodway | Rec. Enhancement only | 0 | 0 | Enhance | None | Lost | None | None expected |
| (Hudson) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | SC02 | 4,000 | Hudson | 100 | 0 | 0 | 3 | 15 | Floodplain | Ind. dev. may occur | - | - | None | None identified | Unknown | None | None expected |
| | | | | | | | SC18 | 6,000 | | 33 | 0 | 67 | 6 | 5 | Floodway | None | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| | | | | | | | SC03 | 4,000 | Wis. | 100 | 0 | 0 | Minimal | | Floodway | Rec. Enhancement only | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| | | | | | | | SC04 | 4,000 | Wis. | 100 | 0 | 0 | Minimal | | Floodway | Rec. Enhancement only | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| | | | | | | | SC05 | 4,000 | Wis. | 100 | 0 | 0 | Minimal | | Floodway | Rec. Enhancement only | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| | | | | | | | SC06 | 4,000 | Wis. | 100 | 0 | 0 | Minimal | | Floodway | Rec. Enhancement only | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| | | | | | | | SC08 | 4,000 | Wis. | 100 | 0 | 0 | Minimal | | Floodway | Rec. Enhancement only | 0 | 0 | Enhance | None identified | Unknown | None | None expected |
| | | | | | | | SC09 | [illegible],000 | Private | 40 | 60 | 0 | 16 | 20 | Floodway | Ind. Dev. may occur | 16 | 0 | None | None identified | Unknown | None | None expected |

Quick reference summary of channel maintenance plan

| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Wetland | Open water | Area (Acres) | @ (Ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Dredge cuts | | | | Disposal sites: Description | | | | | | | | | | | | | Impacts | | | |
| USAF | 1 | 854.0 - 855.6 | | 26 | 13,600 | 352,500 | [illegible]02 | 15,000 | Mpls. | 100 | 0 | 0 | 3 | 20 | Out | Removal before seasonal high water | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Broadway - Plymouth Ave) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible]03 | 5,000 | Private | 100 | 0 | 0 | 7 | 20 | Out | Stockpile fill | 0 | 0 | None | All-land owners | Lost | None | None expected |
| USAF | 2 | 855.[illegible] - 856.[illegible] | | 22 | 32,100 | 206,500 | [illegible]02 | 4,000 | Mpls. | 100 | 0 | 0 | 3 | 20 | Out | Removal before seasonal high water | 0 | 0 | None | All-city of Mpls | None | None | None expected |
| (Lowry Ave) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible]03 | 10,000 | Private | 100 | 0 | 0 | 7 | 20 | Out | Stockpile fill | 0 | 0 | None | All-land owners | Lost | None | None expected |
| USAF | 3 | 856.8 - 857.7 | | 14 | 31,800 | 446,000 | [illegible]02 | 1,000 | Mpls. | 100 | 0 | 0 | [illegible] | 20 | Out | Removal before seasonal high water | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Soo Line R. R. Bridge) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible]03 | 12,000 | Private | 100 | 0 | 0 | 7 | 20 | Out | Stockpile fill | 0 | 0 | None | All-land owners | Lost | None | None expected |
| 1 | 1 | 847.7 - 848.[illegible] | | 12 | [illegible],000 | 287,500 | 1.01 | 25,000 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (L. L/D 1) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 848.5 - 848.9 | | 4 | 8,300 | 65,500 | 1.01 | 20,000 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (St. Paul Daymark) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 3 | 848.9 - 849.9 | | 22 | 17,800 | 391,500 | 1.01 | 1[illegible],000 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Below Lake Street) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 4 | 849.9 - 850.5 | | 20 | 28,400 | 569,000 | 1.01 | 12,000 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Above Lake Street) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | [illegible] | 850.7 - 851.[illegible] | | 18 | 2[illegible],200 | 489,000 | 1.01 | 9,300 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Below Franklin Ave) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 6 | 851.7 - 852.4 | | 22 | 26,800 | 589,000 | 1.01 | 4,000 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Above Franklin Ave) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | [illegible] | 852.[illegible] - 853.[illegible] | | 36 | 17,800 | 642,500 | 1.01 | 2,000 | Mpls. | 100 | 0 | 0 | 3.5 | 25 | Out | Must be removed annually | 0 | 0 | None | All-city of Mpls. | None | None | None expected |
| (Below St. Anthony) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | [illegible] | 81[illegible] - 815.9 | | 4 | 10,400 | 41,500 | 2.30 | 4,000 | Federal | 0 | 100 | 0 | 3.5 | 10 | Floodway | Removal to maintain capacity | 3.5 | 0 | Enhance with shaping, etc. | 2,420,000 | Unknown | None | Difficult to achieve 7-day retention time |
| (Upper Approach L/D 2) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2 | 819.0 - 819.8 | | 4 | 60,[illegible]00 | 240,[illegible]00 | 2.35 | 7,000 | Private | 100 | 0 | 0 | 25 | 25 | Out | - | 0 | 0 | Enhance | 240,000 | Unknown | None | None if retention time is maintained |
| ([illegible] Bend Lower Light) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 3 | [illegible] - [illegible] | | [illegible] | [illegible]3,900 | 455,500 | 2.35 | 4,000 | Private | 100 | 0 | 0 | 25 | 25 | Out | - | 0 | 0 | Enhance | 240,000 | Unknown | None | None if retention time is maintained |
| (Boulanger Bend) | | | | | | | | | | | | | | | | | | | | | | | |

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites: Description | | | | | | | | | Disposal sites: Impacts | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Cover (percent)(1) | | | Area | | | | Habitat alteration | | | | | | |
| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2085) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2085) | Site No. | Approximate distance from cut (feet) | Ownership | Upland | Wetland | Open water | (Acres) | (ft) | Floodplain location | Conditions on use of site | Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2085) | Cultural resources | Endangered (and threatened) species | Water quality |
| [illegible] | 4 | [illegible] - [illegible] | | [illegible] | [illegible] | [illegible] | 2.10 | [illegible],000 | So. St. Paul | 100 | 0 | 0 | 25 | 25 | Out | Unloading device necessary | 0 | 0 | None | 1,900,000 | Uknown | None | Loss of settling basin for industrial site runoff |
| (Pine Bend) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 5 | [illegible] - [illegible] | | 4 | [illegible],200 | 282,000 | [illegible] | [illegible],000 | So. St. Paul | 100 | 0 | 0 | 25 | 25 | Out | Unloading device necessary | 0 | 0 | None | 1,900,000 | Unknown | None | Loss of settling basin for industrial site runoff |
| ([illegible] Island) | | | | | | | | | | | | | | | | | | | | | | | |
| [illegible] | 6 | [illegible] - [illegible] | | 4 | [illegible],200 | [illegible],500 | 2.10 | [illegible],000 | So. St. Paul | 100 | 0 | 0 | 25 | 25 | Out | Unloading device necessary | 0 | 0 | None | 1,900,000 | Unknown | None | Loss of settling basin for industrial site runoff |
| 2 | [illegible] | 836.6 - [illegible] | | [illegible] | [illegible],700 | 2,028,000 | 2.14*(1) | 6,000 | MAC* | 0 | 100 | 0 | 110 | 10 | Floodplain | Use only as part of construction of runway extension | 0 | 110 | None | All material on site | Unknown | None | Loss of filtering effect of wetland on overland runoff |
| (St. Paul Barge Terminal) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 2.15 | 6,000 | St. Paul Port Auth. | 00 | 0 | 0 | 5.5 | 10 | Out | Owner may limit use to one dredging | 0 | 0 | None | 1,900,000 | Unknown | None | None if retention time is maintained |
| | | | | | | | 2.13 | 8,000 | MAC | 0 | 100 | 0 | 18 | 10 | Floodplain | Stabilize material on site | 18 | 0 | None | 1,900,000 | Unknown | None | Loss of filtering effect of wetland on overland runoff |
| | | | | | | | 2.40 | 1,500 | Minnesota | 0 | 0 | 100 | 28 | 30 | Floodway | Sheet piling required | 0 | 0 | None | 3,233,000 | Unknown | None | None expected if sheet piling is used |
| | | | | | | | 2.02 | 4,000 | St. Paul/ B.N.R.R. | 100 | 0 | 0 | 69 | 20 | Out | | 0 | 0 | None | 200,000 | Unknown | None | None if retention time is maintained |
| 2 | 8 | 838.4 - 839.7 | | 16 | 12,400 | 199,000 | 2.16 | 7,000 | St. Paul | 100 | 0 | 0 | 3.4 | 25 | Floodplain | Removal required to retain capacity | 0 | 0 | None | 200,000 | Unknown | None | None if retention time is maintained |
| (Harriet Island) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 9 | 840.9 - 841.4 | | 30 | 11,900 | 356,500 | 2.17 | 5,000 | N.S.P. | 100 | 0 | 0 | 7 | 20 | Floodplain | Removal required to retain capacity | 0 | 0 | None | 200,000 | Unknown | None | None if retention time is maintained |
| (Smith Ave. Bridge) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 10 | 847.7 - 848.4 | | 18 | 3,300 | 60,000 | 2.18 | [illegible],000 | Shiely Co. | 100 | 0 | 0 | (2) | (2) | Out | Mech. rehandling w/landowners equipment | 0 | 0 | None | All-Landowners | Unknown | None | None |
| (L.A. to L/D 1) | | | | | | | | | | | | | | | | | | | | | | | |

(1) Site 2.14 is not endorsed for use by GREAT I.

(2) Landowner has offered to unload barges and stockpile material on the site with his own equipment.

Quick reference summary of channel maintenance plan

| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2029) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2029) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Wetland | Open water | Area (Acres) | @ (ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2029) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dredge cuts | | | | | | | Disposal sites: Description | | | | | | | | | | Impacts | | | | | | |
| | | [illegible] | | | [illegible] | [illegible],500 | [illegible].09 | [illegible],000 | Private | [illegible] | 100 | [illegible] | 35 | 25 | [illegible] | - | 35 | - | None | 258,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | [illegible] | | - | [illegible] | [illegible],500 | [illegible] | [illegible] | Private | [illegible] | 100 | [illegible] | 35 | 25 | [illegible] | - | 35 | - | None | 258,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | [illegible] | | - | [illegible] | [illegible],000 | [illegible] | [illegible] | Private | [illegible] | [illegible] | [illegible] | 35 | 25 | [illegible] | - | 35 | - | None | 258,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | [illegible] | | | [illegible] | [illegible],000 | [illegible] | [illegible],000 | Private | [illegible] | [illegible] | [illegible] | 11 | [illegible] | Effective flow area of tributary | - | 33 | - | None | 254,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | | | | | | [illegible] | [illegible],000 | Private | 0 | 100 | | | 25 | [illegible] | - | [illegible] | - | None | [illegible]58,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | | | | | | [illegible] | [illegible],000 | Public | 60 | 40 | [illegible] | 10 | 25 | [illegible] | - | | 4 | Facility Enhancement | 240,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | | | | | | [illegible] | [illegible],000 | Private | 100 | [illegible] | 0 | 11 | [illegible] | Floodway | - | | 0 | Enhance | [illegible],420,000 | Unknown | None | No effect if adequate retention |
| | | [illegible] | | | [illegible] | 500,000 | [illegible] | 5,000 | Private | [illegible] | 100 | [illegible] | [illegible] | 10 | Effective flow area of tributary | - | 33 | 0 | None | 254,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | | | | | | 3.09 | 45,000 | Private | 0 | 100 | 0 | 37 | 25 | [illegible] | - | 35 | 0 | None | 258,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | | | | | | 3.34 | 35,000 | Public | 60 | 40 | 0 | 10 | 25 | Out | - | | 4 | Facility Enhancement | 240,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |
| | | | | | | | 3.46 | 25,000 | Private | 100 | 0 | 0 | 11 | | [illegible] | - | 0 | 0 | Enhance | 2,429,000 | Unknown | None | Some loss of overland runoff filtration. No other effect if adequate retention time is maintained |

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites: Description | | | | | | | | | | Disposal sites: Impacts | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Cover (percent)(1) Wetland | Cover (percent)(1) Open water | Area (Acres) | Area Ø (ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Habitat alteration Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
| 3 | 6 | 809.5 - 809.8 | 300 | 4 | 36,800 | 147,000 | 3.27 | 7,500 | Private | 0 | 100 | 0 | 31 | 10 | Effective flow area of tributary | - | 31 | 0 | None | 254,000 | Unknown | None | Some loss of overland runoff filtration. No other if adequate retention time is maintained |
| (Pine Coulee) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 3.09 | 50,000 | Private | 0 | 100 | 0 | 35 | 25 | Out | - | 35 | 0 | None | 258,000 | Unknown | None | Some loss of overland runoff filtration. No other if adequate retention time is maintained |
| | | | | | | | 3.34 | 25,000 | Public | 60 | 40 | 0 | 10 | 25 | Out | - | 0 | 4 | Facility Enhancement | 240,000 | Unknown | None | Some loss of overland runoff filtration. No other if adequate retention time is maintained |
| | | | | | | | 3.36(1) | 14,000 | Private | 100 | 0 | 0 | 11 | 12 | Floodway | - | 0 | 0 | Enhance | 2,420,000 | Unknown | None | Some loss of overland runoff filtration. No other if adequate retention time is maintained |
| 3 | 7 | 810.3 - 811.7 | 450 | 12 | 26,800 | 322,000 | 3.34 | 6,000 | Public | 60 | 40 | 0 | 10 | 15 | Out | - | 0 | 4 | Facility Enhancement | - | Unknown | None | Some loss of overland runoff filtration. No other if adequate retention time is maintained |
| (Prescott) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 3.46 | 15,000 | Private | 100 | 0 | 0 | 11 | 12 | Floodway | - | 0 | 0 | Enhance | 2,420,000 | Unknown | None | No effect if adequate retention time is maintained |
| 3 | 8 | 813.0 - 813.5 | 300 | 4 | 3,000 | 12,000 | 3.46 | 1,000 | Private | 100 | 0 | 0 | 11 | 12 | Floodway | - | 0 | 0 | Enhance | 2,420,000 | Unknown | None | No effect if adequate retention time is maintained |
| (Vermillion) | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 9 | 814.9 - 815.2 | 300 | 6 | 10,200 | 61,500 | 3.47 | 3,000 | Hastings | 100 | 0 | 0 | 1.5 | 12 | Floodway | - | 0 | 0 | Enhance | 2,420,000 | Unknown | None | None expected |
| | | | | | | | Lake Rebecca | 3,000 | Public | 100 | 0 | 0 | (2) | (2) | Floodplain | Stockpile site only | 0 | 0 | Some Adverse | 2,420,000 | Unknown | None | None expected |
| | | | | | | | 3.42 | 2,000 | Private | 0 | 50 | 50 | 8.5 | 5 | Floodway | - | 4 | 0 | Enhance | - | Unknown | None | Short-term violation of turbidity and suspended solid standards |
| 4 | 1 | 753.5 - 754.6 | 400 | 16 | 14,700 | 235,000 | 4.02 | 4,000 | Federal | 0 | 0 | 100 | 10.3 | 30 | Floodway | - | 0 | 0 | Enhance | 1,982,000 | Unknown | Possibly a mussel | None expected |
| (Beef Slough) | | | | | | | 4.20 | 30,000 | Private | 100 | 0 | 0 | 6.4 | 20 | Floodway | - | 0 | 0 | Enhance | 85,000 | Unknown | None | None expected |

(1) Land owner has offered to unload barges and stock pile material on the site with his own equipment

(2) Depends on beneficial use removed by Hastings

Quick reference summary of channel maintenance plan

| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1984-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1984-2025) | Site No | Approximate distance from cut (feet) | Ownership | Cover percent (1) Upland | Cover percent (1) Wetland | Cover percent (1) Open water | Area Acres | Area @ (ft) | Flood plain location | Conditions on use of site | Habitat alteration Types 1, 2 and 3 wetland | Habitat alteration Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1984-2025) | Cultural resources | Endangered and threatened species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | [illegible] | | [illegible] | | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | Unknown | Possible [illegible] | None expected |
| | | | | | | | [illegible] | | [illegible] | | | | | | | | [illegible] | | [illegible] | [illegible] | Unknown | None | None expected |
| | | | | | | | [illegible] | | [illegible] | | | | | | | | | | [illegible] | [illegible] | Unknown | Possible [illegible] | None expected |
| | | | | | | | [illegible] | | [illegible] | | | | [illegible] | | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | Unknown | None | None expected |
| | | | | | | | | | [illegible] | | | | | | [illegible] | [illegible] | [illegible] | | [illegible] | | Unknown | None | None expected |
| | | | | | | | | | | | | | | | [illegible] | | | [illegible] | None | [illegible] | Unknown | No | None expected |
| | | | | | | | | | | | | | [illegible] | | | [illegible] | | | None | [illegible] | Unknown | None | None expected |
| | | | | | | | | | [illegible] | | | | [illegible] | | [illegible] | | | [illegible] | [illegible] | [illegible] | Unknown | None | None expected |
| | | | | | | | [illegible] | | [illegible] | | | | [illegible] | | [illegible] | | | | None | [illegible] | Unknown | None | None expected |
| | | | | | | | | | [illegible] | | | | | | [illegible] | [illegible] | | | [illegible] | | [illegible] | None | None expected |
| | | | | | [illegible] | | [illegible] | | [illegible] | | | | [illegible] | | [illegible] | | | | None | [illegible] | Unknown | None | None expected |
| | | | | | | | | | [illegible] | | | | [illegible] | [illegible] | [illegible] | | | | None | | [illegible] | None | [illegible] water quality [illegible] |
| | | | | | | | [illegible] | | [illegible] | | | | [illegible] | | [illegible] | | | | None | [illegible] | [illegible] | None | None expected |
| | | [illegible] | [illegible] | | | [illegible] | | | | | | | [illegible] | | [illegible] | [illegible] | | [illegible] | None | [illegible] | Unknown | None | None expected |
| | | | | | | | | | | | | | [illegible] | | Floodway | | [illegible] | [illegible] | [illegible] | [illegible] material [illegible] site | Unknown | None | [illegible] |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | Floodway | - | [illegible] | | [illegible] | [illegible] | Unknown | None | None expected |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | Floodplain | [illegible] | | [illegible] | None | [illegible] | Unknown | None | None expected |
| | | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] Red Wing | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Floodway | [illegible] coordination with Red Wing Harbor Commission | [illegible] | [illegible] | None | [illegible] | Unknown | None | None expected |
| | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | | [illegible] | | Floodway | [illegible] coordination with Red Wing Harbor Commission | [illegible] | [illegible] | None | [illegible] | None | None | None expected |
| | [illegible] | [illegible] | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Floodway | - | [illegible] | [illegible] | [illegible] | [illegible] | Unknown | None | [illegible] |
| | [illegible] | [illegible] | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Floodway | [illegible] coordination with Red Wing Harbor Commission | [illegible] | [illegible] | None | [illegible] | Unknown | None | None expected |

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites: Description | | | | | | | | | | Disposal sites: Impacts | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2085) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2085) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1): Upland | Cover (percent)(1): Wetland | Cover (percent)(1): Open water | Area (Acres) | Area (ft) | Floodplain location | Conditions on use of site | Habitat alteration: Types 1, 2, and 3 wetland | Habitat alteration: Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2085) | Cultural resources | Endangered (and threatened) species | Water quality |
| 5 | 1 | 741.2 - 741.6 | 300 | 6 | 22,800 | 136,500 | 5.30 | 12,000 | U.M.R. F.W.R. | 0 | 100 | 0 | 76 | 15 | Floodway | Specific details to be resolved | 0 | 76 | Enhance | All-on Site | Unknown | None | Short-term violation of turbidity and suspended solids standards |
| | (Mt. Vernon Light) | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 2 | 742.7 - 743.8 | 400 | 12 | 27,700 | 332,000 | 5.30 | 7,500 | U.M.R. F.W.R. | 0 | 100 | 0 | 76 | 15 | Floodway | Specific details to be resolved | 0 | 76 | Enhance | All-on Site | Unknown | None | Short-term violation of turbidity and suspended solids standards |
| | (Sommerfield Island) | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 3 | 744.0 - 744.7 | 300 | 24 | 21,700 | 520,000 | 5.30 | 3,000 | U.M.R. F.W.R. | 0 | 100 | 0 | 76 | 15 | Floodway | Specific details to be resolved | 0 | 76 | Enhance | All-on Site | Unknown | None | Short-term violation of turbidity and suspended solids standards |
| | (Lower Zumbro) | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 4 | 744.8 - 746.0 | 500 | 26 | 25,800 | 671,000 | 5.30 | 5,000 | U.M.R. F.W.R. | 0 | 100 | 0 | 76 | 15 | Floodway | Specific details to be resolved | 0 | 76 | Enhance | All-on Site | Unknown | None | Short-term violation of turbidity and suspended solids standards |
| | (Fisher Island) | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 5 | 746.0 - 746.9 | 400 | 26 | 14,700 | 381,500 | 5.26A | 25,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Floodway | Detailed Economic & Environmental comparison of 4 selected sites to be completed before use. (Preferential order may change) | 15 | 0 | None | 1,664,000 | Unknown | Bald Eagle Roost | None expected, may lose settling effect of wetland during flood conditions |
| | (Below West Newton) | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 5.24 | 8,000 | Private | 100 | 0 | 0 | 36 | 25 | Out | See 5.26A | 0 | 0 | None | 41,000 | Unknown | None | None expected |
| | | | | | | | 5.26 | 25,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Out | See 5.26A | 15 | 0 | None | 1,664,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| | | | | | | | 5.28 | 12,000 | Private | 100 | 0 | 0 | 15 | 25 | Out | See 5.26A | 0 | 0 | None | 1,674,000 | Unknown | None | None expected |
| 5 | 6 | 747.2 - 748.2 | [illegible]00 | 14 | 39,800 | 557,000 | 5.26A | 21,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Floodway | Detailed Economic & Environmental comparison of 4 selected sites to be completed before use (Preferential order may change) | 15 | 0 | None | 1,664,000 | Unknown | Bald Eagle Roost | None expected, may lose settling effect of wetland during flood conditions |
| | (West Newton) | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 5.24 | 14,000 | Private | 100 | 0 | 0 | 36 | 25 | Out | See 5.26A | 0 | 0 | None | 41,000 | Unknown | None | None expected |
| | | | | | | | 5.26 | 21,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Out | See 5.26A | 15 | 0 | None | 1,664,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| | | | | | | | 5.28 | 8,000 | Private | 100 | 0 | 0 | 15 | 25 | Out | See 5.26A | 0 | 0 | None | 1,674,000 | Unknown | None | None expected |
| 5 | 7 | 748.6 - 749.6 | 350 | 10 | 35,800 | 358,000 | 5.26A | 14,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Floodway | Detailed Economic & Environmental comparison of 4 selected sites to be completed before use (Preferential order may change) | 15 | 0 | None | 1,664,000 | Unknown | Bald Eagle Roost | None expected, may lose settling effect of wetland during flood conditions |
| | (Mule Bend) | | | | | | | | | | | | | | | | | | | | | | |

Quick reference summary of channel maintenance plan

| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Cover (percent)(1) Wetland | Cover (percent)(1) Open water | Area (Acres) | Area # (ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Habitat alteration Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 5.24 | 10,000 | Private | 100 | 0 | 0 | 36 | 25 | Out | See 5.26A | 0 | 0 | None | 41,000 | Unknown | None | None expected |
| | | | | | | | 5.26 | 20,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Out | See 5.26A | 15 | 0 | None | 1,664,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| | | | | | | | 5.28 | 15,000 | Private | 100 | 0 | 0 | 15 | 5 | Out | See 5.26A | 0 | 0 | None | 1,674,000 | Unknown | None | None expected |
| 5 | 4 | 752.6 - 752.8 | 300 | 12 | 8,800 | 105,000 | 5.26A | 7,000 | Dairyland Power | 0 | 100 | 0 | 15 | 5 | Floodway | Detailed Economic & Environmental comparison of 4 selected sites to be completed before use (Preferential order may change) | .5 | 0 | None | 1,664,000 | Unknown | Bald Eagle Roost | None expected, may lose settling effect of wetland during flood conditions |
| | | | | | | | 5.24 | 13,000 | Private | 100 | 0 | 0 | 36 | 25 | Out | See 5.26A | 0 | 0 | None | 41,000 | Unknown | None | None expected |
| | | | | | | | 5.26 | 7,000 | Dairyland Power | 0 | 100 | 0 | 15 | 25 | Out | See 5.26A | 15 | 0 | None | 1,664,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| | | | | | | | 5.28 | 10,000 | Private | 100 | 0 | 0 | 15 | 25 | Out | See 5.26A | 15 | 0 | None | 1,674,000 | Unknown | None | None expected |
| 5A | 1 | 728.5 - 729.5 | 300 | 10 | 5,200 | 351,500 | 5A.32 | 15,000 | City of Fountain City | 0 | 100 | 0 | 34 | 25 | Floodfringe | Retain vegetative buffer strip | 5 | 29 | Limited | 1,540,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| (Upper Approach L/D 5A) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 5A.25 | 15,000 | Private | 0 | 100 | 0 | 6 | 25 | Floodway | Removal required to maintain capacity | 5 | 0 | Enhance with treatment | [illegible] | Unknown | None | None expected |
| 5A | 2 | 730.0 - 730.4 | 450 | 14 | 19,800 | [illegible]76,000 | 5A.32 | 9,000 | City of Fountain City | 0 | 100 | 0 | 34 | 25 | Floodfringe | Retain vegetative buffer strip | 5 | 29 | Limited | 1,540,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| ([illegible] Bend) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 5A.25 | 9,000 | Private | 0 | 100 | 0 | 6 | 25 | Floodway | Removal required to maintain capacity | 5 | 0 | Enhance with treatment | 1540,000 | Unknown | None | None expected |
| 5A | 3 | [illegible] | 550 | 15 | 12,900 | 361,000 | 5A.32 | 4,000 | City of Fountain City | 0 | 100 | 0 | 34 | 25 | Floodfringe | Retain vegetative buffer strip | 5 | 29 | Limited | 1,540,000 | Unknown | None | None expected, may lose settling effect of wetland during flood conditions |
| (Betsy Slough) | | | | | | | | | | | | | | | | | | | | | | | |
| 5A | 4 | [illegible] | 300 | 12 | 34,008 | [illegible] | 5A.25 | 9,000 | Private | 0 | 100 | 0 | 6 | 25 | Floodway | Removal required to maintain capacity | 5 | 0 | Enhance with treatment | 1,540,000 | Unknown | None | None expected |
| (Fountain City) | | | | | | | | | | | | | | | | | | | | | | | |
| 5A | 5 | 736.0 - [illegible] | 300 | 20 | 36,200 | 724,000 | 5A.23 | 18,000 | Private | 0 | 100 | 0 | 7 | [illegible] | Floodway | Close coordination with Minn. DNR for boat access point | 7 | 0 | Enhance with treatment | 60,000 | Unknown | None | None expected |
| (Island 58) | | | | | | | | | | | | | | | | | | | | | | | |

Quick reference summary of channel maintenance plan

| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Wetland | Open water | Area (Acres) | @ (ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 5A.36 | 20,000 | Federal | 50 | 50 | 0 | 2 | 25 | Floodway | Lock and Dam Dev. | 1 | 0 | Minimal | 60,000 | Unknown | None | None expected |
| 5A | 6 | [illegible] - 738.[illegible] | 300 | 2 | [illegible]4,800 | 49,500 | 5A.23 | 2,000 | Private | 0 | 100 | 0 | 7 | 25 | Floodway | Close coordination with Minn. DNR for boat access point. | 7 | 0 | Enhance with treatment | 60,000 | Unknown | None | None expected |
| | | (L.A. L/D 5) | | | | | | | | | | | | | | | | | | | | | |
| 6 | 1 | 720.0 - 721.0 | 300 | 12 | 22,700 | 272,500 | 6.17 | 19,000 | Winona Port Authority | 0 | 100 | 0 | 21 | 25 | Out | Ind. Div. May occur | 0 | 21 | None | 2,920,000 | Unknown | None | None expected, may lose settling effect of wetlands during flood conditions |
| | | (Homer Point) | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 6.11 | 3,000 | Private | 90 | 10 | 0 | 11 | 15 | Floodway | Removal before seasonal high water | 1 | 0 | Enhance | 920,000 | Unknown | None | None exp. |
| 6 | 2 | 721.4 - 722.3 | 300 | 6 | 13,300 | 80,000 | 6.17 | 9,000 | Winona Port Authority | 0 | 100 | 0 | 21 | 25 | Out* | Ind. Dev. May occur | 0 | 21 | None | 2,920,000 | Unknown | None | None expected, may lose settling effect of wetlands during flood conditions |
| | | (Gravel Point) | | | | | | | | | | | | | | | | | | | | | |
| 6 | 3 | 722.5 - 723.4 | 300 | 12 | 36,[illegible] | [illegible] | 6.[illegible] | 4,000 | Winona Port Authority | 0 | 100 | 0 | 21 | 25 | Out* | Ind. Dev. May Occur | 0 | 21 | None | 2,920,000 | Unknown | None | None expected, may lose settling effect of wetlands during flood conditions |
| | | (Below Winona R.R. Bridge) | | | | | | | | | | | | | | | | | | | | | |
| 6 | 4 | 723.9 - 724.2 | 300 | 4 | 31,400 | [illegible] | 6.19 | 3,000 | City of Winona | 100 | 0 | 0 | 2.5 | 15 | Out* | Removal required to retain capacity | 0 | 0 | None | 920,000 | Unknown | None | None expected |
| | | (Above Winona R.R. Bridge) | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 6.20 | 3,000 | City of Winona | 100 | 0 | 0 | 2.5 | 15 | Out* | Removal Required to retain capacity | 0 | 0 | None | 920,000 | Unknown | None | None expected |
| | | | | | | | 6.17 | 6,000 | Winona Port Authority | 0 | 100 | 0 | 21 | 25 | Out* | Ind. Dev. may occur | 0 | 21 | None | 2,920,000 | Unknown | None | None expected, may lose settling effect of wetlands during flood conditions |
| 6 | 5 | 726.0 - 726.5 | 450 | 12 | 4,130 | 97,500 | 6.27 | 2,000 | City of Winona | 100 | 0 | 0 | .5 | 15 | Floodway | Removal before seasonal high water | 0 | 0 | Enhance | 920,000 | Unknown | None | None expected |
| | | (Island 71) | | | | | | | | | | | | | | | | | | | | | |
| 6 | 6 | 727.[illegible] - 728.1 | 300 | 16 | 8,100 | 129,500 | 6.27 | 10,000 | City of Winona | 100 | 0 | 0 | .5 | 15 | Floodway | Removal before seasonal high water | 0 | 0 | Enhance | 920,000 | Unknown | None | None expected |
| | | (L.A. L/D 5A) | | | | | | | | | | | | | | | | | | | | | |
| 7 | 1 | 703.5 - 703.7 | 300 | 4 | 35,400 | 141,500 | 7.20 | 4,000 | Federal | 100 | 0 | 0 | 1.7 | 20 | Floodplain | Removal Required to retain capacity | 0 | 0 | None | 100,000 | Unknown | Possible Bald Eagle Roost | None expected |
| | | (Upper Approach L/D 7) | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 7.01 | 13,000 | Private | 100 | 0 | 0 | 1.2 | 15 | Out | Limited capacity, may have to be removed during dredging | 0 | 0 | None | 109,900 | Unknown | None | None expected |
| 7 | 2 | 704.3 - 705.3 | 300 | 10 | 35,800 | [illegible] | 7.20 | 14,000 | Federal | 100 | 0 | 0 | 1.7 | 20 | Floodplain | Removal required to retain capacity | 0 | 0 | None | 100,000 | Unknown | Possible Bald Eagle Roost | None expected |
| | | (Head of Dresbach Cut) | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 7.01 | [illegible],000 | Private | 100 | 0 | 0 | 1.2 | 1[illegible] | Out | Limited capacity, may have to be removed during dredging | 0 | 0 | None | 109,900 | Unknown | None | None expected |
| | | | | | | | 7.06 | [illegible] | F[illegible] | | 100 | 0 | 21 | 10 | Out | - | 7 | 14 | Enhance with tr[illegible] | 1,216,000 | Unknown | None | None expected, may lose settling effect of wetland during |

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Description | | | | | | | | | | | | Impacts | | | | |
| | | | | | | | | | | Cover (percent)(1) | | | Area | | | | Habitat alteration | | | | | | |
| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Upland | Wetland | Open water | Acres | @ (ft) | Floodplain location | Conditions on use of site | Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
| | | | | | | | [illegible] | [illegible],000 | State of Minnesota | [illegible] | [illegible] | 0 | [illegible] | [illegible] | Floodway | [illegible] | | [illegible] | Enhance | [illegible] | Unknown | [illegible] | None expected |
| | | | | | | | [illegible] | [illegible] | City of [illegible] | [illegible] | 0 | [illegible] | [illegible] | [illegible] | [illegible] | Mechanical unloading required | [illegible] | [illegible] | Enhance with [illegible] | [illegible] | Unknown | None | None expected |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | 4,800 | [illegible] | [illegible] | [illegible] | Federal | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Enhance with [illegible] | [illegible] | Unknown | None | None expected, [illegible] settling effect of wetland during [illegible] flows |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | 24,[illegible] | [illegible] | [illegible] | [illegible] | Federal | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance with [illegible] | [illegible] | [illegible] | None | None expected, [illegible] some settling effect of wetland during flood flows |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | 21,[illegible] | [illegible] | [illegible] | [illegible] | Federal | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance with [illegible] | [illegible] | Unknown | None | None expected, [illegible] settling effect of wetland during [illegible] flows |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | 20,[illegible] | [illegible] | [illegible] | 1,000 | State of Minnesota | [illegible] | 85 | 0 | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance | [illegible] | Unknown | [illegible] | None expected |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | [illegible] | [illegible] | [illegible] | 1,000 | Federal | 0 | 100 | 0 | [illegible] | [illegible] | [illegible] | | | [illegible] | Enhance with [illegible] | [illegible] | [illegible] | None | None expected, [illegible] settling effect [illegible] wetland during [illegible] flows |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | [illegible] | [illegible] | [illegible] | 7,000 | Private | 100 | 0 | 0 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | None | [illegible] | None with [illegible] | None | None expected |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible],000 | Private | 100 | [illegible] | 0 | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | None | [illegible] | [illegible] with [illegible] | [illegible] | None expected |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | [illegible] | [illegible],300 | [illegible] | [illegible] | Federal (with leases and subleases) | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | | [illegible] | Enhance with [illegible] | [illegible] | Unknown | [illegible] | None expected |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Federal (with leases and subleases) | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Enhance with [illegible] | [illegible] | [illegible] | None | [illegible] |
| Head of [illegible] Channel | | | | | | | | | | | | | | | | | | | | | | | |
| [illegible] | [illegible] | 646.[illegible] - 648.[illegible] | 300 | [illegible] | 28,800 | 633,300 | [illegible] | 8,000 | Federal (with leases and subleases) | [illegible] | 60 | 0 | [illegible] | [illegible] | Floodway | | | | Enhance with [illegible] | 633,000 | Unknown | None | None expected |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible],300 | [illegible] | [illegible] | [illegible],000 | City of [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Mechanical unloading required | | [illegible] | Enhance with [illegible] | [illegible] | Unknown | None | None expected |

Quick reference summary of channel maintenance plan

| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Wetland | Open water | Area (Acres) | @ (ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | [illegible] | 691.4 - 691.8 | 300 | 6 | 35,400 | [illegible] | 8.06 | 25,000 | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| (Picayune Island) | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 8 | 692.2 - 693.3 | 500 | [illegible] | 28,400 | 113,500 | 8.06 | 18,000 | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| (Root River) | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 9 | 694.3 - 695.0 | 400 | 8 | 21,400 | 171,000 | 8.06 | 10,000 | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| (Sand Slough) | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 10 | 699.6 - 700.4 | 300 | 10 | 25,000 | 280,000 | 8.28 | 2,000 | Private | 0 | 100 | [illegible] | 4 | 5 | Floodway | Limited capacity, fill around building foundations | [illegible] | 0 | Enhance | 626,000 | Unknown | None | Temporary violation of state turbidity suspended solids & anti-degradation standards |
| (LaCrosse R.R. Bridge) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 8.06 | 20,000 | City of LaCrosse | 100 | 0 | [illegible] | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| [illegible] | [illegible] | [illegible] | 300 | [illegible] | 26,[illegible] | [illegible] | [illegible] | [illegible] | Private | 100 | 0 | [illegible] | [illegible] | [illegible] | Floodplain | Material must be removed to retain capacity | 0 | 0 | None | 126,000 | Unknown | None | None |
| [illegible] | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Floodplain | | [illegible] | 0 | None | [illegible] | Adverse | None | None |
| [illegible] | | [illegible] | | | [illegible] | [illegible] | [illegible] | [illegible] | Private | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | Material must be removed to retain capacity | | 0 | None | 126,000 | Unknown | Adjacent | None |
| [illegible] | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | [illegible] | Federal | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | | [illegible] | [illegible] | Enhance | 821,000 | Unknown | Unknown | Moderate |
| [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Federal | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | | Enhance | 821,330 | Unknown | Unknown | Moderate |
| [illegible] | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | [illegible] | Private | [illegible] | 0 | | [illegible] | [illegible] | [illegible] | Material must be removed to retain capacity | | | None | 126,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | Unknown | 100 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance | 55,000 | None | None | None expected |
| | | | | | | | [illegible] | [illegible] | State of Iowa | [illegible] | 100 | [illegible] | [illegible] | | [illegible] | | [illegible] | [illegible] | None | [illegible] | Unknown | None | Minor |

[illegible]

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Description | | | | | | | | | | Impacts | | | | | | |
| | | | | | | | | | | Cover (percent)(1) | | | Area | | | | Habitat alteration | | | | | | |
| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged 1986-2025 | Average volume per dredging (cubic yards) | Total volume dredged 1986-2025 | Site No | Approximate distance from cut (feet) | Ownership | Upland | Wetland | Open water | Acres | @ (ft) | Floodplain location | Conditions on use of site | Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | None | 30,000 to 256,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance with treatment | [illegible] | Unknown | None | None |
| | | | | | | | | | [illegible] | | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | None | [illegible] | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Enhance with treatment | [illegible] | Unknown | None | None |
| | | | | | | | [illegible] | | [illegible] | | [illegible] | | | | [illegible] | | [illegible] | [illegible] | Enhance | 256,000 | Unknown | None | Minor |
| | | | | | | | [illegible] | [illegible] | [illegible] | | | [illegible] | | [illegible] | Floodway | | [illegible] | [illegible] | Enhance | [illegible] | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | | [illegible] | Floodway | Material must be removed [illegible] | [illegible] | [illegible] | None | 80,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | | Floodway | | [illegible] | [illegible] | Enhance | [illegible] | Unknown | None | Minor |
| | | | | | | | [illegible] | [illegible] | [illegible] | | [illegible] | | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance | 256,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance with treatment | [illegible] | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | | | [illegible] | [illegible] | Material must be removed [illegible] | [illegible] | [illegible] | - | 180,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | | [illegible] | [illegible] | | | [illegible] | Enhance | 256,000 | Unknown | None | Minor |
| | | | | | | | [illegible] | [illegible] | [illegible] | | | | [illegible] | [illegible] | Floodway | | [illegible] | [illegible] | Enhance | 256,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | | [illegible] | | | [illegible] | Enhance with treatment | [illegible] | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | | | [illegible] | Floodway | Material must be removed [illegible] | [illegible] | [illegible] | - | 180,000 | Unknown | None | None |
| | | | | | | | [illegible] | | Private | [illegible] | [illegible] | [illegible] | | | Floodway | | [illegible] | [illegible] | Enhance | 256,000 | Unknown | None | Minor |
| | | | | | | | [illegible] | [illegible] | [illegible] | | [illegible] | | | [illegible] | Floodway | | [illegible] | [illegible] | Enhance | 256,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | Enhance with treatment | 1,38_,000 | Unknown | None | None |

## Quick reference summary of channel maintenance plan

| Pool | Cut No. | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1): Upland | Wetland | Open water | Area (Acres) | Area @ (Ft) | Floodplain location | Conditions on use of site | Habitat alteration: Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Dredge cuts** | | | | **Disposal sites – Description** | | | | | | | | | | | | **Impacts** | | | | |
| 8 | [illegible] | [illegible] | 300 | 6 | [illegible] | [illegible] | 8.06 | 25,000 | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| (Pettibone Island) | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | [illegible] | [illegible] | 300 | [illegible] | 28,500 | [illegible] | 8.06 | 28,000 | City of LaCrosse | [illegible] | [illegible] | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| (Black River) | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | [illegible] | [illegible] | 400 | 8 | [illegible] | 171,000 | 8.06 | [illegible] | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| (Sand Slough) | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | [illegible] | [illegible] | [illegible] | 10 | 28,000 | 280,500 | 8.28 | [illegible] | Private | 0 | 100 | 0 | [illegible] | 5 | Floodway | Limited capacity, fill around building foundations | [illegible] | [illegible] | Enhance | 624,000 | Unknown | None | Temporary violation of state turbidity suspended solids & anti-degradation standards |
| (LaCrosse R.R. Bridge) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 8.06 | 20,000 | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | Mechanical unloading required | 0 | 0 | Enhance with treatment | 2,082,500 | Unknown | None | None expected |
| 9 | 1 | 653.8 - 654.8 | 300 | 2 | 26,000 | 52,000 | [illegible] | 29,000 | Private | 100 | 0 | 0 | 1 | 10 | Floodplain | Material must be removed to retain capacity | 0 | 0 | None | 126,000 | Unknown | None | None |
| (Above Crooked Slough) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | 15,000 | | 50 | 50 | 0 | 9 | 10 | Floodplain | | 5 | 0 | None | 132,000 | Adverse | None | None |
| 9 | 2 | 660.3 - 660.8 | [illegible] | 2 | [illegible] | [illegible] | [illegible] | 2,000 | Private | 100 | 0 | 0 | 1 | 10 | Floodplain | Material must be removed to retain capacity | 0 | 0 | None | 126,000 | Unknown | Adjacent | None |
| (Above [illegible]) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 9.26 | 18,000 | Federal | 0 | 0 | 100 | 22 | [illegible] | Floodway | - | 0 | 0 | Enhance | 821,000 | Unknown | Unknown | Moderate |
| 9 | 3 | 661.4 - 663.0 | 400 | [illegible] | [illegible] | [illegible] | 9.26 | [illegible] | Federal | 0 | 0 | 100 | 22 | 2 | Floodway | - | 0 | 0 | Enhance | 821,000 | Unknown | Unknown | Moderate |
| (Lansing Upper Light) | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | 20,000 | Private | 100 | 0 | 0 | 1 | 10 | Floodplain | Material must be removed to retain capacity | 0 | [illegible] | None | 126,000 | Unknown | None | None |
| | | | | | | | [illegible] | [illegible] | Unknown | 100 | 0 | 0 | [illegible] | 10 | Floodplain (of Clear Creek) | - | 0 | 0 | Enhance | 55,000 | None | None | None expected |
| | | | | | | | 9.28* | [illegible] | State of Iowa | 0 | 100 | 0 | 33 | | Floodway (Village Creek) | - | 0 | 0 | None | * | Unknown | None | Minor |

* Site 9.28 is not endorsed for use by GREAT I.

Quick reference summary of channel maintenance plan

| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Cover (percent)(1) Upland | Wetland | Open water | Area (Acres) | Ø (ft) | Floodplain location | Conditions on use of site | Habitat alteration Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Dredge cuts** | | | | | **Disposal sites — Description** | | | | | | | | | | **Impacts** | | | | | | |
| 9 | 10 | 678.7 - 679.2 | 300 | 4 | 23,400 | 93,500 | 9.15 | 4,000 | Public | 100 | 0 | 0 | 1 | 20 | Floodway | Material must be removed as it is delivered | 0 | 0 | None | 180,000 | Unknown | None | None |
| | (Lower Approach L.D. 8) | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 9.11 | | Private | 10 | 90 | 0 | 5 | 5 | Floodway | - | 5 | 0 | Enhance | 256,000 | Unknown | None | Minor |
| | | | | | | | 9.33 | 36,000 | Private | 0 | 100 | 0 | 13 | 20 | Floodway | - | 13 | 0 | Enhance | 256,000 | Unknown | None | None |
| | | | | | | | 8.06 | 95,[illegible] | City of LaCrosse | 100 | 0 | 0 | 44 | 35 | Out | - | 0 | 0 | Enhance with treatment | 1,982,000 | Unknown | None | None |
| 10 | 1 | 615.[illegible] - 616.0 | 350 | 2 | 26,800 | 53,500 | 10.02 | 4,300 | City of Guttenberg | 100 | 0 | 0 | 6 | 15 | Out | - | 0 | 0 | None | 12,000 | Unknown | None | None |
| | (Upper Approach L/D 10) | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 10.03 | 15,000 | [illegible] | 100 | 0 | 0 | 10 | 15 | Out | - | 0 | 0 | None | 12,000 | Unknown | None | None |
| 10 | 2 | 618.3 - 619.2 | 500 | 8 | 25,400 | 207,000 | 10.04 | 6,000 | Private | 0 | 100 | 0 | 8 | 25 | Floodplain | - | 0 | 8 | None | None | None | None | Minor |
| | (McMillan Island) | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 3 | 627.3 - 628.0 | 400 | 12 | 10,300 | 123,000 | 10.01 | 3,000 | State of Wisconsin Private (B.N.R.R.) | 100 | 0 | 0 | 8 | 60 | Out | - | 0 | 0 | None | 62,000 | Unknown | None | None |
| | (Wyalusing) | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 4 | 628.4 - 629.3 | 400 | - | 8,400 | 17,[illegible] | 10.01 | 6,000 | State of Wisconsin/ Private (B.N.R.R.) | 100 | 0 | 0 | 8 | 60 | Out | - | 0 | 0 | None | 62,000 | Unknown | None | None |
| | (Wyalusing Bend Light) | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 5 | 633.2 - 637.[illegible] | 300 | 2 | 32,800 | 6[illegible],500 | 10.[illegible] | 15,300 | | 0 | 100 | 0 | 4.5 | 17 | Floodway of Bloody Run Creek | Riprap creek edge | 4.5 | 0 | None | 170,000 | Unknown | None | None |
| | (McGregor) | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 6 | 633.[illegible] - 635.8 | 300 | - | 70,800 | 1[illegible],500 | No site selected, GREAT questions need for dredging citing low frequency and total volume, limited traffic volume, access now provided at downstream end of East Channel and the presence of the Higgin's Eye mussel in the channel. | | | | | | | | | | | | | | | | |
| | (East Channel) | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 7 | 642.7 - 643.3 | 400 | - | 40,800 | 163,000 | 10.40 | 2,000 | Private | 100 | 0 | 0 | 26 | 25 | Floodplain | - | 0 | 0 | None | 300,000 | Unknown | None | None |
| | (Mississippi Gardens) | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 8 | 643.[illegible] - 644.[illegible] | 300 | 15 | [illegible] | 477,000 | 10.30 | 2,000 | Private | 100 | 0 | 0 | 26 | 25 | Floodplain | - | 0 | 0 | None | 300,000 | Unknown | None | None |
| | (Jackson Island) | | | | | | | | | | | | | | | | | | | | | | |

Quick reference summary of channel maintenance plan

| Dredge cuts | | | | | | | Disposal sites | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Description | | | | | | | | | | Impacts | | | | | | |
| | | | | | | | | | | Cover (percent)(1) | | | Area | | | | Habitat alteration | | | | | | |
| Pool | Cut No | River mile | Recommended width (feet) | Number of times dredged (1986-2025) | Average volume per dredging (cubic yards) | Total volume dredged (1986-2025) | Site No. | Approximate distance from cut (feet) | Ownership | Upland | Wetland | Open water | Acres | @ (ft) | Flood-plain location | Conditions on use of site | Types 1, 2, and 3 wetland | Types 4 and 5 wetland | Recreation activities | Possible removal for beneficial use (1986-2025) | Cultural resources | Endangered (and threatened) species | Water quality |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Unknown | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Remove before high water or stabilization of material on site | [illegible] | | [illegible] | 300,000 | Unknown | None | Moderate |
| [illegible] | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | [illegible] | Private | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | - | [illegible] | 0 | None | [illegible] | Unknown | None | None |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Private | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | Remove before high water or stabilization of material on site | 2 | 0 | None | [illegible],000 | Unknown | None | Minor |
| | Lower Apron [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | [illegible] | | Private | [illegible] | [illegible] | [illegible] | [illegible] | - | [illegible] | - | 0 | 0 | None | 300,000 | Unknown | None | None |

# CHAPTER 4

# CHANNEL MAINTENANCE PLAN DEVELOPMENT

The channel maintenance plan presented in this appendix is the result of three phases of development: initial compilation, review by the Plan Formulation Work Group (from an interdisciplinary perspective), and review by the GREAT I Team (from an interagency perspective).

## INITIAL COMPILATION

Early in the study, on-site information was gathered for as many potential placement sites as possible. The data gathered included location, ownership, most likely area available, road access, type of shoreward access, type of riverward access, ground cover, and adjacent land use features. This information is on file in the St. Paul Field Office of the U.S. Fish and Wildlife Service.

A task force from the PFWG (Plan Formulation Work Group) was assigned develop a first-cut dredged material placement plan. The task force was composed of one representative each from the Corps of Engineers, Fish and Wildlife Service, and the Minnesota and Wisconsin Departments of Natural Resources. The task force assembled information on potential sites from several sources (including the on-site information described above), prepared working estimates of projected dredging volumes, and identified major gaps in information about the more promising candidate sites (see sample Matrix B on page 24).

Two iterations of plan formulation were carried out by the task force before presenting a first-cut selected plan to the PFWG. The first was an attempt to place sites for each cut into the following categories (see sample Matrix B on page 24).

| | |
|---|---|
| Regional placement | Habitat enhancement |
| Centralized placement | Most probable future without GREAT |
| Selective placement[1] | Beneficial use |
| Removal from floodplain | |

(1) Not to be confused with the selected plan.

Matrix A - List of potential placement sites

Pool 5A Sheet 1 of 2

| Site description | | | | Site acreage required for each placement alternative (with and without 100-percent containment)(1) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1976-1985 | | 1986-2025 | | | | | | | | | | | | | | [illegible] | |
| | | | | Most probable future without GREAT | | Most probable future without GREAT | | Selective placement | | Regional placement | | Beneficial use | | Centralized placement | | Habitat enhancement | | Removal from the floodplain | | Interim | |
| Site | Area (acres) | River mile | Bank (R or L) | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC |
| 1 | 6 | 728.3 | R | | | | | | | | | | | | 10.3 | | | | | | |
| 2 | 44 | 728.5 | R | | | | | | | | | | | | 5.2 | | | | | | |
| 3 | 6 | 728.5 | L | | | | | | | | | | | | | | | | | 26/ 8.6 | 26/ 1.6 |
| 4 | 8.3 | 728.6 -729.8 | L | 15/ 20.7 | 15/ 6.3 | 15/ 33.8 | 15/ 21.6 | 20/ 20.3 | 20/ 12.9 | | | | | | | | | | | | |
| 5 | 2.6 | 729.4 | L | | | | | | | | | | | | | | | | | See 5A3 | |
| 6 | 3.5 | 729.4 | L | | | | | | | | | | | | | | | | | | |
| 7 | 4 | 729.6 | L | | | | | | | | | | | | | | | | | | |
| 8 | | 729.6 -731 | L | 20/ 8.8 | 20/ 2.4 | 20/ 16.2 | 20/ 2.2 | To 5A.25 | | | | | | | | | | | | | |
| 9 | | 730.2 -730.8 | R | | | | | | | | | | | | | | | | | | |
| 10 | 15.5 | 731.4 | L | | | | | | | 26.5 | 17.7 | 18.8 | 13.4 | | | | | | | 18.2 | 3.6 |
| 11 | | 730.8 | R | | | | | | | | | | | | | | | | | | |
| 12 | 0.7 | 732.6 | L | | | | | | | | | | | | | | | | | | |
| 13 | | 733.5 -734.2 | R | | | | | | | | | | | | | | | | | | |
| 14 | | 733.5 -735.0 | L | 20/ 18.8 | 20/ 8.8 | 20/ 38.6 | 20/ 30.1 | 25/ 24.7 | 25/ 19.3 | | | | | | | | | | | | |
| 15 | | 734.5 -735.0 | R | | | | | | | | | | | | | | | | | | |
| 16 | 37 | 735 | L | | | | | | | | | | | | | | | | | | |
| 17 | 10 | 735.1 | L | | | | | | | | | | | | | | | | | | |

Matrix A - List of potential placement sites

Pool 5A Sheet 2 of 2

| Site description | | | | Site acreage required for each placement alternative (with and without 100-percent containment)(1) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1976-1985 | | 1980-2025 | | | | | | | | | | | | | | 1980-[illegible] | |
| | | | | Most probable future without GREAT | | Most probable future without GREAT | | Selective placement | | Regional placement | | Beneficial use | | Centralized placement | | Habitat enhancement | | Removal from the floodplain | | Interim | |
| Site | Area (acres) | River mile | Bank (R or L) | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC | 100% | NC |
| 18 | | 735.3 -735.7 | R | | | | | | | | | | | | | | | | | | |
| 19 | 3 | 735.8 | L | | | | | | | 5 | 3 | NA(1) | 3 | | | | | | 6 | | |
| 20 | 18 | 736 | L | | | | | | | 24 | 18 | NA(1) | 30.9 | | | | | | 34 | | |
| 21 | 12.2 | 736.1 | L | | | | | | | 16 | 10.2 | NA(1) | 12.2 | | | | | | 24 | 19.3 | 5 |
| 22 | 4.5 | 737.5 | L | | | | | | | | | | | | | | | | | | |
| 23 | 3 | 737.6 | R | 15/ 9.4 | 15/ 0.7 | 15/ 9.2 | 15/ 2.4 | 15/ 7.3 | 15/ 1.9 | | | | | | | | | | | | |
| 24 | | 737.7 | R | | | | | | | | | | | | | | | | | | |
| 25 | 5.5 | 731.6 | L | 20/ 11.8 | 20/ 4.5 | 20/ 21.6 | 20/ 22.9 | 25/ 29.1 | 25/ 20.8 | 9.4 | 6.7 | NA(1) | 7.3 | | | | | | | 5.5 | 2.3 |
| 26 | 1.0 | 732.0 | L | | | | | | | | | | | | | | | | | | |
| 27 | 4.5 | 731.9 | L | | | | | | | 9.4 | 6.7 | NA(1) | 5.5 | | | | | | | | |
| 28 | 4.7 | 733.8 | L | | | | | | | | | | | | | | | | | | |
| 29 | 5.6 | 737.0 | R | | | | | | | | | | | | | | | | | | |
| 30 | | 733.6 | L | | | | | | | | | | | | | | | | | | |
| 31 | | 737.6 -737.9 | L | | | | | | | | | | | | | | | | | | |
| 32 | | 732 | L | | | | | | | | | | | | | | | | | | |
| 33 | 3 | 732.2 | L | | | | | | | | | | | | | | | | | 10.7 | 2.2 |
| 34 | 1.5 | 733.4 | L | 15/ 19.2 | 15/ 6.6 | 15/ 33.4 | 15/ 22.7 | 20/ 7.0 | 20/ 13.6 | | | | | | | | | | | | |

Matrix B - Alternative disposal sites by placement alternative

Pool 5A Sheet 1 of 3

| Dredging cut | River mile | MPEW/OC (1975-1985) | | | MPEW/OC (1986-2025) | | | Selective placement (1975-1985) | | | Selective placement (1986-2025) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) |
| Upper approach lock and dam 5A (Derrickbarge Hauser) | 728.5 to 729.5 | 5A.4 | 153.5 | - | 5A.4 | 522.5 | 15 | 5A.4 | 137.5 | - | 5A.4 | 417.6 | 20 |
| Wilds Bend (Dredge Thompson) | 730.0 to 730.8 | 5A.8 | 76.0 | - | 5A.8 | 372.0 | 20 | 5A.8 | 49.0 | - | 5A.25 | 296.3 | 25 |
| Head of Betsy Slough | 731.0 to 732.0 | 5A.25 | 145.5 | - | 5A.25 | 496.3 | 20 | 5A.25 | 149.0 | - | 5A.25 | 540.3 | 25 |
| Fountain City | 733.4 to 733.9 | 5A.34 | 160.5 | - | 5A.34 | 549.3 | 15 | 5A.34 | 144.0 | - | 5A.34 | 438.3 | 20 |
| Island 58 | 734.0 to 735.2 | 5A.14 | 285.0 | - | 5A.14 | 971.8 | 20 | 5A.14 | 255.0 | - | 5A.14 | 775.3 | 25 |
| Lower approach lock and dam 5 | 737.7 to 738.1 | 5A.23 | 17.0 | - | 5A.23 | 57.8 | 15 | 5A.23 | 15.5 | - | 5A.23 | 46.3 | 15 |
| Wilds Bend (Derrickbarge Hauser) | 730.0 to 730.8 | 5A.25 | 32.7 | - | 5A.25 | 302.5 | 25 | 5A.25 | 49.0 | - | 5A.25 | 296.3 | 25 |

**Matrix B - Alternative disposal sites by placement alternative** Pool 5A Sheet 2 of 3

| Dredging cut | River mile | Regional placement | | | Beneficial use | | | Centralized placement | | | Habitat enhancement | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) |
| Upper approach lock and dam 5A (Derrick-barge Hauser) | 728.5 to 729.5 | 5A.10 | 713.9 (with Wilds Bend) | 25 | 5A.21 | 417.6 | 25 | 5A.1 | 417.6 | 25 | | | |
| Wilds Bend (Dredge Thompson) | 730.0 to 730.8 | 5A.10 | | | 5A.25 | 296.3 | 25 | 5A.2 | 2,096.5 (Wilds Bend through Lower approach) | 25 | 5A.35 | | |
| Head of Betsy Slough | 731.0 to 732.0 | 5A.25 and 5A.27 | 540.3 | 25 | 5A.10 | 540.3 | 25 | 5A.2 | | | | | |
| Fountain City | 733.4 to 733.9 | 5A.21 | 1,259.9 (Fountain City through Lower approach) | 25 | 5A.20 | 438.3 | 25 | 5A.2 | | | | | |
| Island 58 | 734.0 to 735.2 | 5A.20 | | | 5A.19<br>5A.20<br>5A.21<br>5A.27 | 775.3 | 25 | 5A.2 | | | | | |
| Lower approach lock and dam 5 | 737.7 to 738.1 | 5A.19 | | | 5A.27 | 46.3 | 25 | 5A.2 | | | | | |

**Matrix B - Alternative disposal sites by placement alternative**

Pool 5A Sheet 3 of 3

| Dredging cut | River mile | Remove from floodplain | | | Interim (1981-1985) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) | Site | Volume (1,000 cy) | Height (feet) |
| Upper approach lock and dam 5A (Derrick-barge Hauser) | 728.5 to 729.5 | 5A.19 | 713.9 | 25 | 5A.10 | 68.75 | 20 | | | | | | |
| Wilds Bend (Dredge Thompson) | 730.0 to 730.8 | 5A.19 | | | 5A.10 | 49.0 | 20 | | | | | | |
| Head of Betsy Slough | 731.0 to 732.0 | 5A.20 | 978.6 | 25 | 5A.25<br>5A.27 | 74.5 | 20 | | | | | | |
| Fountain City | 733.4 to 733.9 | 5A.20 | | | 5A.33 | 72.0 | 20 | | | | | | |
| Island 58 | 734.0 to 735.2 | 5A.21 | 821.6 | 25 | 5A.21 | 127.5 | 20 | | | | | | |
| Lower approach lock and dam 5 | 737.7 to 738.1 | 5A.21 | | | 5A.21 | 31.0 | 20 | | | | | | |

After seeing how the candidate sites could be included or modified to achieve the objectives implied by these categories, the task force prepared four comprehensive plans for dredged material placement for further consideration:

1. Most Probable Future Without GREAT (MPFW/OG): A calculated guess as to which dredged material placement sites would be used in the future complying with existing State and Federal regulations.

2. Removal from Floodplain (RFFP): A plan to achieve total removal of material from the floodplain either through direct placement out of the 100-year floodplain (assumed to be 1965 high water) or by removal by others for beneficial uses.(1)

3. National Economic Development (NED): An attempt to satisfy the NED objectives specified in the Principles and Standards. This plan would generally involve placing material at the least cost possible or at sites benefiting commerce.

4. Environmental Quality (EQ): A plan that strives to satisfy the EQ objectives given in the Principles and Standards. This would generally mean placing the highest priority on habitat and water quality protection in selecting dredged material placement sites and methods.

As an aid to analysis, a display of some of the known impacts at placement sites (with emphasis on the sites included in the NED and EQ plans) was prepared. (See sample Matrix C on page 28.)

From this information and a continual flow of new information from the functional work groups about the sites considered most seriously, the task force drafted a first-cut, selected dredged material placement plan. This plan completed the creative work assigned to the Channel Maintenance Plan Task Force. This phase took 4 months of continuous work by the task group. The results of its activities are recorded in the minutes of the Plan Formulation Work Group which are on file in the offices of each GREAT I Team member agency.

---

(1) No removal for beneficial use was presumed unless a documented desire for material was in-hand.

## Matrix C - Tabulation of NED and EQ features (1)

| DREDGE CUT | PLACEMENT CATEGORY |
|---|---|
| [illegible] | [illegible] |

EVALUATION OF MATERIAL PLACEMENT SITES

POOL 5A

SHEET 1 OF 1

ST PAUL DISTRICT CORPS OF ENGINEERS

PLATE

(1) Including attempts to collect placement sites into NED and EQ oriented plans.

## INTERDISCIPLINARY REVIEW

The Plan Formulation Work Group undertook the first of two major reviews of the Channel Maintenance Plan developed by the task group. At the time, it was more correctly called a dredged material placement plan because it was concerned almost exclusively with placement of the material and not with the channel or factors affecting its maintenance. Studies by the DRWG (Dredging Requirements Work Group), CTWG (Commercial Transportation Work Group), SEWG (Sediment and Erosion Work Group), and MENWG (Material and Equipment Needs Work Group) which would affect this aspect of the CMP had not been completed, and, at best, only preliminary findings were available.

Dredged material placement sites for each cut were considered, voted on, and approved, with each member of the Plan Formulation Work Group approving or rejecting sites or proposing conditions on the use of a site based on the perspective of his work group and its representative disciplines. No objection to a site was considered unless a substitute site was provided, or appropriate conditions detailed by the objecting faction. Approval was by consensus. If no agreement to change the task force's suggestion could be reached, the task force plan would stand and pass on to the next review by the GREAT voting membership.

In this way, the dredged material placement plan was approved and recommended by the Plan Formulation Work Group. It was called the selected plan and displayed in the draft Channel Maintenance Appendix (dated September 1979). This plan was circulated for public and agency review from September 1979 to March 1980.

## INTERAGENCY REVIEW

The GREAT I Team met in April 1980 to consider all comments received on the selected plan and approve a channel maintenance plan. Studies had been completed which altered assumptions made about maintenance of the channel. Items such as safety near structures, rate of shoal development, tributary erosion control, navigational maneuverability needs, and hydraulic effects of changes in underwater structures were considered, and adjustments were made in estimated dredging volumes generally increasing the estimated volumes.

The Team followed a complex but very effective procedure in approving a channel maintenance plan. For lack of a better term, the process was called "consensus/caucus". Pools were examined individually. Motions to approve or change aspects of the plan within each pool were made. If a second agency wished to support the motion with a slight change, it would offer a "friendly amendment" which could be accepted or rejected by the originator of the motion. Through a series of these friendly amendments, many of the conflicts or concerns of the agencies could be resolved. When no more amendments appeared forthcoming, the meeting moderator would ask for objections. If no objections were voiced, the motion passed by consensus.

The motion failed if objections were expressed, but it was not necessarily lost. A second round of amendments and changes to the motion aimed at removing the stated objections followed. This procedure could be repeated several times until all objections were resolved. If it appeared that an objection(s) could not be resolved, any member of the team could ask for a "caucus." At this point, the Team would recess into caucus (the Federal agency and the State representatives would meet in two separate groups). Votes on the motion would be taken in each group, and the results of the vote reported when the Team reconvened. If the majority of both caucuses voted for the motion, the motion passed; if not, the motion failed. This process served to allow all concerns to be aired and forced consideration of those concerns by other members of the Team.

The CMP presented in this appendix is the result of the GREAT I Team's action. It has been approved through this process and is recommended by the Team for immediate implementation.

# CHAPTER 5

## DREDGING VOLUME PROJECTIONS

The first step in preparing the CMP and determining which detrimental effects of dredging could be mitigated, ameliorated, or hopefully avoided was to determine what volume of material had to be dealt with. If the volume was small and decreasing, a little care added to past practices might be sufficient. If the impacts were significant and the volumes were increasing, a totally different solution would have to be found. In every case, the degree of impact (economic, social, and environmental) would be a function of the volume of material dredged.

The DRWG prepared a working estimate of projected dredging volumes early in the plan formulation process as a beginning for site selection and plan evaluation.

### EVALUATION PROCESSES

A number of assumptions were made about dredging trends and effects of new techniques and channel modifications on those trends. The assumptions (discussed later in this chapter) were checked, verified, and modified during the study through field testing in the maintenance dredging program, mathematical model studies, physical model research, and consultation through the CTWG with licensed pilots working on the river. The final dredging volume projections for each cut are given in Parts II, III, IV, and V of this appendix.

### PROJECTION AND BASE PERIOD TIME FRAMES

The Team determined that a maintenance dredging plan would be established through the year 2025. Factors affecting maintenance dredging quantities would be considered in three time frames:

1. <u>Present - 1985 (short term)</u>. - This period could be affected by GREAT coordination but existing equipment capabilities would limit alternatives until GREAT findings and recommendations could be implemented.

2. 1986-2000 (midterm). - The lower cost and more easily implemented GREAT I findings and recommendations could be implemented and the channel maintenance program would take advantage of research results.

3. 2001-2025 (long term). - Higher cost recommendations and proposals which require further study could be programmed to be effective during this period.

## HISTORICAL VOLUMES

To allow projections related to historic dredging, a base period encompassing a representative hydrologic cycle was required. Records in late 1930's and early 1940's were discarded because the channel was established during this period and dredging requirements were above normal. Record flooding for the Mississippi River occurred in 1952, 1965, and 1969. The last 30 years of record were affected by the extreme high-flow years when compared with the total hydrologic record. Therefore, the 1955-1974 period was selected because it includes the high flows of 1965 and 1969 and also encompasses the low-flow periods on both sides of the high water as a balancing effect. It also represents the most current condition of use and channel and wing dam system. During this period, dredging to a depth of 13 feet was standard with the exception of 1965 and 1974, and advance maintenance dredging was practiced.

In summary, the 1955-1974 period was considered to be the most representative period available and would be conservatively high because of advance channel maintenance practices. Average annual dredging quantities were computed for each historic dredge cut during that period.

## MANAGEMENT ALTERNATIVES

Two types of projected dredging volumes were needed to develop and evaluate alternative dredged material placement plans. To evaluate the environmental and economic impacts of any alternative, a without GREAT plan to use as a base line was needed. A with GREAT set of dredging volumes was also required to develop a recommended plan for dredged material placement. The following two projections were developed:

1. Most Probable Future Without GREAT (MPFW/OG). - This projection of dredging volumes assumed GREAT I had not existed. Changes in volumes and placement methods would result from political, economic, and technological influences exclusive of GREAT I. Some of the same results of the GREAT dredging research would eventually be implemented. In some instances, even more stringent restraints on dredging may have been imposed because constructive dialogue between agencies may not have occurred.

2. Most Probable Future With GREAT (MPFWG). - This projection of dredging volumes assumed that the findings and recommendations of GREAT will be implemented.

## FACTORS AFFECTING DREDGING VOLUMES

### Depth of Dredging

Reduced-depth dredging began as a pilot project during the 1975 channel maintenance season. In 1975, dredging was done to an average depth of 12 feet instead of the standard 13 feet. Initially, dredging quantities were reduced 28.2 percent. In 1976 and 1977, with average dredging depths of 12 and 11.7 feet, respectively, dredging quantities were reduced 27.9 and 35 percent, respectively. The Corps hesitated to recommend direct application of these data because: (1) flows were unrepresentatively low during this period and (2) the reduction might be temporary if more frequent dredging becomes necessary (dredging less on each occurrence but dredging more frequently, without a substantial change in total quantity dredged).

To better understand the long-range potential of reduced-depth dredging, studies of sediment transport and accumulation were done at Colorado State University for GREAT I. These studies show a potential to maintain a navigable depth with significant reductions in volumes at several locations (see Dredging Requirements Work Group Appendix and supporting documents). The study concluded that, at those sites where reduced-depth dredging is suitable, dredging volumes can be reduced 25 percent.

Therefore, to estimate future volumes, adjustments were averaged over all cuts with 15 of the 25 percent occurring in the period 1986-2000 and the remaining 10 percent occurring in 2000-2025. Implementation of reduced-depth dredging practices is expected for each specific cut as detailed studies of shoaling rates at that cut are completed.

For the MPFW/OG, it was assumed that similar studies would be done in time, but the impetus to conduct the studies and implement the findings would not be as strong. Therefore, the first 15 percent of the possible 25-percent reduction would not occur until 1986-2000; any further reduction would occur after 2000.

At a number of sites, the ability of a vessel to maneuver is more important than at other sites, particularly at approaches or near rigid structures. A vessel's ability to maneuver is hampered as the water becomes shallower and is severely hampered at depths less than 3 feet below keel. At these sites, no reduction for reduced depths is calculated and reduced-depth dredging is not recommended. The following table lists these cuts.

Dredging sites where reduced-depth dredging is not recommended because of adjacent rigid structures

| Pool | Cut No. | Name |
|---|---|---|
| USAF | 1 | Above and below Broadway and Plymouth Avenue Bridge |
| | 2 | Above and below Lowry Avenue Bridge |
| | 3 | Below Minneapolis, St. Paul, and Sault Ste. Marie Railroad Bridge |
| 1 | 1 | Upper approach to locks and dam 1 |
| | 4 | Above Lake Street Bridge |
| | 6 | Above Franklin Avenue Bridge |
| | 7 | Below Lower St. Anthony Falls lock and dam |
| 2 | 1 | Above locks and dam 2 |
| | 8 | St. Paul-Harriet Island |
| | 9 | Above and below Smith Avenue Bridge |
| | 10 | Lower approach to locks and dam 1 |
| 3 | 9 | Lower approach to locks and dam 2 |
| 5 | 8 | Lower approach to lock and dam 4 |
| 5A | 1 | Upper approach to lock and dam 5A |
| | 6 | Lower approach to lock and dam 5 |
| 6 | 3 | Below Winona railroad bridge |
| | 4 | Above Winona railroad bridge |
| | 5 | Island 71 |
| | 6 | Lower approach to lock and dam 5A |
| 7 | 1 | Upper approach to lock and dam 7 |
| | 7 | Lower approach to lock and dam 6 |
| 8 | 10 | Above and below La Crosse railroad bridge |
| 9 | 10 | Lower approach to lock and dam 8 |
| 10 | 1 | Upper approach to lock and dam 10 |
| | 6 | East Channel |
| | 10 | Lower approach to lock and dam 9 |
| Minn. | 5 | Savage Bridge |
| St. Croix | 3 | Hudson |

Width of Channel at Bends

One of the subjects addressed by the CTWG was width constriction at bends as an impediment to safe navigation of barge tows. In a related effort, the DRWG was investigating ways to minimize dredging quantities and had identified bend width reduction as a possible way to greatly reduce dredging quantities. With the dual purpose of obtaining an insight into these two areas, the CTWG conducted a survey of 10 experienced towboat pilots. Procedures used for the survey are discussed in the CTWG and DRWG Appendixes. As a result of the survey, 17 reductions and 9 increases in dredging widths were recommended (see the following table).

These recommendations were made by the most experienced operators and may not provide a safe channel for the average pilot. Therefore, bend widths or channel alignments should not be changed without first obtaining input from a cross section of licensed towboat operators and the towing industry; for example, the Upper Mississippi Waterways Association and American Waterways Operators. Their knowledge of the river and its many operational characteristics cannot be ignored and is better than any intuitive decisions made by persons less familiar with barge and towing technology.

Possible bend width changes

| Area | River mile | Channel width (feet) | | |
|---|---|---|---|---|
| | | Present(1) | Change | Suggested |
| **Increased width** | | | | |
| Grey Cloud Slough | 827.3-828.0 | 400 | +50 | 450 |
| Boulanger Bend | 820.3-821.5 | 450 | +50 | 500 |
| Truesdale Slough | 808.2-808.8 | 350 | +50 | 400 |
| Four Mile Island | 807.2-807.8 | 450 | +50 | 500 |
| Head of Lake Pepin | 785.2-785.6 | 450 | +50 | 500 |
| Reads Landing | 762.4-763.3 | 450 | +50 | 500 |
| Below Reads Landing | 761.5-762.5 | 450 | +50 | 500 |
| Mule Bend | 747.8-748.8 | 450 | +50 | 500 |
| Betsy Slough Bend | 731.0-731.7 | 450 | +50 | 500 |
| **Reduced width** | | | | |
| Boulanger Bend Lower Light | 818.4-820.3 | 450 | -50 | 400 |
| Below Wind Creek | 800.0-800.7 | 500 | -50 | 450 |
| Crats Island | 758.0-759.5 | 500 | -50 | 450 |
| Below West Newton | 746.4-746.9 | 500 | -50 | 450 |
| Winters Landing | 708.0-709.0 | 500 | -100 | 400 |
| Broken Arrow | 695.8-696.8 | 500 | -50 | 450 |
| Sand Slough | 694.4-695.2 | 600 | -100 | 500 |
| Brownsville | 689.7-690.2 | 500 | -50 | 450 |
| Island 125 | 677.2-678.2 | 500 | -50 | 450 |
| Bad Axe Bend | 674.0-675.0 | 600 | -150 | 450 |
| Lansing Upper Light | 663.8-665.0 | 600 | -100 | 500 |
| Below Lansing | 600.3-661.0 | 600 | -100 | 500 |
| Gordons Bay | 645.5-643.5 | 600 | -50 | 550 |
| Mississippi Gardens | 642.5-643.5 | 550 | -50 | 500 |
| Wyalusing Bend | 628.6-629.3 | 600 | -100 | 500 |
| Wyalusing | 627.2-628.0 | 600 | -100 | 500 |
| Ferry Slough | 615.6-616.3 | 600 | -150 | 450 |

(1) After dredging.

In the acts authorizing the 9-foot navigation project, Congress left river bend widths to be determined by the Corps of Engineers. Procedures for mathematically determining optimum widths are being developed and tested by the Office of the Chief of Engineers. A discussion of findings of this effort is included in appendix A of the Dredging Requirements Work Group Appendix. That appendix also contains a table of historic and suggested width information for each bend on the Mississippi River from river mile 615.1 to river mile 846.7. This information was provided to the pilots during the survey mentioned above.

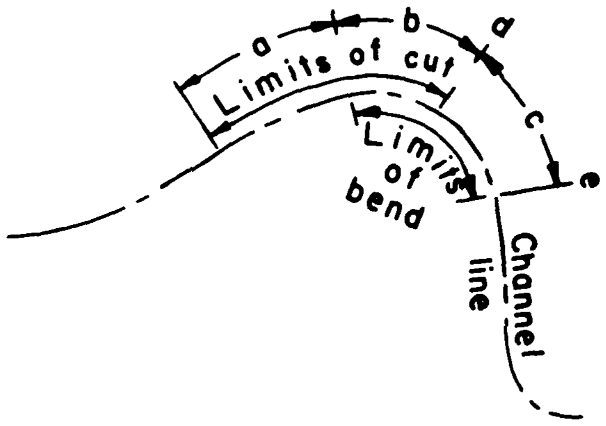
The change in dredging quantity was calculated for each bend by adjusting by 75 percent for a 150-foot modification, 56 percent for a 100-foot modification, and 31 percent for a 50-foot modification.

For the MPFW/OG condition, the GREAT I Team recognized that navigation of a vessel in restricted channels requires a great deal of skill under a wide variety of conditions such as river currents, shoaling, changing water depths, wind, visibility, recreational traffic that is not always cognizant of the "Rules of the Road," and vessel maneuvering characteristics. While the most skillful pilot can handle most of these conditions without difficulty, the river navigation system will eventually be managed to accommodate all levels of expertise.

As adjustments are made, the GREAT I Team assumed that the bends where increases were suggested would be widened, but the possibility of reducing widths would probably not surface. Therefore, for computing dredging volumes for the MPFW/OG, increased bend width factors were included but decreased bend width factors were not.

Not all the bends identified in appendix A of the Dredging Requirements Work Group Appendix coincide with dredge cuts; in fact very few of them do and some have never been dredged. As stated above, the Dredging Requirements Work Group computations include a 75-percent reduction in dredging volume for a 150-foot modification in bend width, a 56-percent reduction for a 100-foot modification, and a 31-percent reduction for a 50-foot modification. This gross percentage change in dredging volumes would only be valid wher the limits of the bend and the cut coincide. Adjustments were needed to change this figure into a working factor that can be applied in computing projected dredging volumes.

In one case, bend width reduction, the adjustment is straightforward. The percentage reduction in dredging volumes described above would affect only that part of the dredge cut that is in the limits of the bend. As shown in the following figure, this proportion of the cut is b/(a + b). To determine the factor that bend width reduction reduces the dredging volume, multiply this ratio for each bend and cut by the appropriate gross percentage change.




# ADJUSTMENTS FOR BEND WIDTHS

SCHEMATIC OF RIVER BEND FOR CALCULATING DREDGING VOLUME
CHANGES AT BENDS

The other case where bend width is increased requires a slightly more complex analysis. As the width of the channel is increased within the limits of the bend, additional dredging is required beyond the limits of the cut to obtain this wider width. Rather than examine each cut's historic shoaling pattern, it is assumed to be a linear relationship of full increase at point "d" to no increase at point "e" (see the above figure). The proportion of the cut changed is then (b + 1/2 c)/(a + b). This ratio is multiplied by the appropriate gross percentage change to determine the factor for increasing dredging volumes. Where the limits of the cut totally contain the limits of the bend, the gross percentage change is multiplied by the ratio of the length of the bend to the length of the cut. The actual adjustments in dredging volumes are shown in the following table.

Site-specific dredging volume adjustments for changes in widths at bends

| Pool | Cut | Cut name | River mile | Bend name | River mile | Width change (feet) | Adjustment (percent) Gross | Net |
|---|---|---|---|---|---|---|---|---|
| 2 | 5 | Grey Cloud Slough | 827.5 - 828.3 | Grey Cloud Slough | 827.3 - 828.0 | +50 | +31 | +29 |
| 2 | 3 | Boulanger Bend | 820.8 - 821.4 | Boulanger Bend | 820.3 - 821.5 | +50 | +31 | +46 |
| 2 | 2 | Boulanger Bend Lower Light | 819.0 - 819.8 | Boulanger Bend Lower Light | 818.4 - 820.3 | -50 | -31 | -15 |
| 3 | 5 | Four Mile Island Truesdale Slough | 807.0 - 808.6 | Truesdale Slough | 808.2 - 808.8 | +50 | +31 | +21[(1)] |
| 3 | 5 | Four Mile Island Truesdale Slough | 807.0 - 808.6 | Four Mile Island | 807.2 - 807.8 | +50 | +31 | +21[(1)] |
| 3 | 1 | Below Diamond Bluff | 798.9 - 800.5 | Below Wind Creek | 800.0 - 800.7 | -50 | -31 | -10 |
| 4 | 6 | Wacouta Point | 783.3 - 785.5 | Head of Lake Pepin | 785.2 - 785.6 | +50 | +31 | +16 |
| 4 | 5 | Read's Landing | 761.8 - 763.8 | Below Read's Landing[(2)] | 761.5 - 762.5 | +50 | +31 | +20 |
| 4 | 5 | Read's Landing | 761.8 - 763.8 | Read's Landing[(2)] | 762.4 - 763.3 | +50 | +31 | +22 |
| 4 | 4 | Above Crats Island | 758.5 - 759.5 | Crats Island | 758.0 - 759.5 | -50 | -31 | -31 |
| 5 | 7 | Mule Bend | 748.6 - 749.6 | Mule Bend | 747.8 - 748.8 | +50 | +31 | +31 |
| 5 | 5 | Below West Newton | 746.0 - 746.8 | Below West Newton | 746.4 - 746.9 | -50 | -31 | -25 |
| 5A | 3 | Head of Betsy Slough | 731.0 - 732.2 | Betsy Slough Bend | 731.0 - 731.7 | +50 | +31 | +25 |
| 7 | 4 | Winters Landing | 707.9 - 709.3 | Winters Landing | 708.0 - 709.0 | -100 | -56 | -40 |
| 8 | 9 | Sand Slough | 694.3 - 695.0 | Sand Slough | 694.4 - 695.2 | -100 | -56 | -48 |
| 8 | 6 | Above Brownsville | 689.9 - 690.8 | Brownsville | 689.7 - 690.2 | -50 | -31 | -10 |
| 9 | 9 | Island 126 | 677.4 - 678.3 | Island 126 | 677.2 - 678.2 | -50 | -31 | -28 |
| 9 | 3 | Lansing Upper Light | 663.8 - 665.0 | Lansing Upper Light | 663.8 - 665.0 | -100 | -56 | -56 |
| 9 | 2 | Above Atchafalaya | 660.3 - 660.8 | Below Lansing | 660.3 - 661.0 | -100 | -56 | -56 |
| 10 | 9 | Hay Point | 646.0 - 646.6 | Gordons Bay | 645.4 - 646.1 | -50 | -31 | -5 |
| 10 | 7 | Mississippi Gardens | 642.7 - 643.3 | Mississippi Gardens | 642.5 - 643.5 | -50 | -31 | -31 |
| 10 | 4 | Wyalusing Bend | 628.9 - 629.3 | Wyalusing Bend | 628.6 - 629.3 | -100 | -56 | -56 |
| 10 | 3 | Wyalusing | 627.3 - 628.0 | Wyalusing | 627.2 - 628.0 | -100 | -56 | -56 |
| 10 | 1 | Upper Approach L/D 10 | 615.1 - 616.0 | Ferry Slough | 615.6 - 616.3 | -150 | -75 | -33 |

(1) Total adjustment for cut 5 in pool 3 (Four Mile Island - Truesdale Slough) is 42 percent.
(2) Total adjustment for cut 5 in pool 4 (Read's Landing) is 42 percent.

Modification of Side Channel Openings

Channel maintenance dredging is required along the Mississippi River at many locations where substantial main channel flow enters backwater areas through side channels. Lower flows in both the main channel and side channel result in accumulation of sediment (shoaling). Shoaling in the main channel is removed by dredging. As shoaling occurs in the side channel, the cross-sectional area becomes smaller resulting in higher velocities until the system becomes balanced. GREAT has recommended opening several side channels which may increase shoaling and dredging in the main channel.

The St. Paul District has authority to reestablish side channel openings that have been directly affected by dredged material placement. A limited program has been initiated and is projected to continue until 1985. The number and magnitude of the sites are small. Therefore, a token increase in dredging requirements of 1 percent was estimated in the short-term without GREAT.

On the basis of research and recommendations of GREAT, more side channels are being opened than would have been programmed without GREAT. The impact is not viewed as significant, but it was an increase. An increase in dredging requirements of 2 percent was projected for the 1977 to 1985 period. It is anticipated that management actions after 1985 would increase flow loss into the backwaters. Thus, a 2-percent increase was projected for the midterm (1986-2000).

GREAT I is also recommending closure of some side channel openings. These closures would increase flow velocity and, hence, sediment transport in the main channel adjacent to the closures. At these cuts, a net decrease of 5 percent is applied during the time period that the action is most likely to occur. A list of these cuts is in the following table.

Dredge cuts adjacent to side channel closures(1)

| Pool | Cut No. | Name |
|---|---|---|
| 2 | 4 | Pine Bend Foot Light |
| 5 | 3 | Lower Zumbro |
| | 4 | Fisher Island |
| | 5 | Below West Newton |

(1) Dredging volume decreased as a result of increased flow velocity in the main channel.

Placement Site Maintenance

Current dredging practices and equipment limitations result in some placement of dredged material in the floodplain. During high flows, some of this material may erode back into the river system. The volume of material which is eroded and the portion of the material that is subsequently dredged have not been determined. An estimate in the pool 5 (Weaver Bottoms) area indicated about 16 percent of the material dredged historically could not be accounted for in placement areas. This loss occurred over a 40-year period and is not apparent to the casual observer. Other areas are subject to varying conditions and this one reach estimate should not be applied to the entire system.

Restraining material on land with berms would reduce this impact when compared to open water placement. A 1-percent reduction was applied to both plans based on current berming practices compared with those during the 1956-1977 period.

Wing Dam System Maintenance and Modification

Modification or repair of the wing dam system has the potential of dictating where shoaling occurs. Wing dam designs might be improved at desired sites to increase the river velocity and sediment transport through critical locations where dredging and material placement are undesirable. Removal or modification of the existing wing dams could reduce the river velocity and sediment deposition at other sites where dredging and material placement are more advantageous. This could reduce dredged material transport cost to reach desired placement sites or reduce the overall amount of dredging required.

Colorado State University conducted intensive research on this factor in pool 4. These study findings are summarized in the Dredging Requirements Work Group Appendix. Preliminary results indicated that a dike field in a problem area would cause erosion of the channel bottom by restricting the effective width of the channel. A potential 1- to 2-foot increase in channel depth was projected. Because the historical average face of the dredging cut is 3 feet, a significant reduction in dredging quantity would be feasible.

The Corps reviewed existing records and alerted its field crews to note evidence of wing dam and closing dam deterioration. The wing dam pattern and/or alignment was briefly reviewed to identify sites with obvious design review requirements. Wing dams or closing dams showing significant evidence of deterioration are listed in the following table. The Dredging Requirements Work Group also identified areas where modifications to channel control structures might reduce dredging requirements. These areas are listed in the table on page 44.

Wing dams or closing dams showing significant evidence of deterioration

| Pool | Mile | Bank | Description |
|---|---|---|---|
| 4 | 759.2 | Right | Dam 2 |
| 4 | 756.8 | Left | Dams 56 and 57 |
| 5 | 750.0 | Right | Closing dam 4 |
| 5 | 746.6 | Left | Roebucks Cut |
| 5 | 745.7 | Left | Closing dam 41 |
| 5A | 736.5 | Right | Dams 1 and 74 |
| 5A | 732.0 | Right | Closing dam 60 |
| 6 | 728.0 | Left | Wing dam 87 |
| 6 | 724.3 | Left | Wing dams 64-67 |
| 7 | 711.6 | Left | Closing dam 8 |
| 7 | 706.8 | Right | Dams 42 and 36 |
| 7 | 705.2 | Left | Dam 72 |
| 8 | 688.3 | Left | Wing dams |
| 9 | 666.9 | Left | Closing dam 6 |

| Wing dam system modification areas suggested for further investigation | | |
|---|---|---|
| River mile | Name | Suggested modification |
| 745.5 | Below West Newton | Add one or two wing dams along the right bank, across the channel from wing dam 55, and below the existing wing dam on the right bank. |
| 730.4 - 732.0 | Betsy Slough, Wilds Bend | In this reach, remove or shorten wing dam 66 (mile 732.0, left bank), add two wing dams on the left bank at approximate river miles 731.4 and 731.2, shorten wing dam 88 (mile 730.4 - 730.7, left bank), and add one wing dam on the right bank at river mile 730.8. |
| 713.0 - 713.5 | Above Richmond Island | The existing wing dams along both banks should be extended. |
| 706.7 - 709.0 | Dakota, Minnesota, and Winters Landing | Shorten wing dams 18 and 30 (mile 709.1 - 709.2, left bank), and extend wing dam 19 (mile 708.3, left bank) downstream toward the wing dam identified as "Mound of Riprap" Top El. 652.0" (mile 707.9, left bank). Shorten wing dams 42 and 43 (mile 706.8 - 706.9, right bank). Wing dams, right bank (mile 708 - 709) appear to be ineffective because a deep channel runs through the field. |
| 690.5 | Above Brownsville | At this site, shorten wing dam 65 (left bank) and lengthen wing dam 33 (right bank) |
| 664.6 - 774.7 | Lansing Upper Light | Remove or shorten wing dam 13 (mile 664.7, left bank), and add a wing dam on the right bank (approximate mile 664.7). |

From research findings and field observations, the Channel Maintenance Task Force concluded that the rehabilitation of 12 to 15 sites in the next 50 years could reduce dredging volumes 15 percent over the system. Whether all of these specific actions could be justified and implemented is questionable. Therefore, reductions for wing dam system maintenance and modification were limited to 9 percent for the MPFWG and 6 percent for the MPFW/OG.

## Bank Protection (Mississippi River)

The Upper Mississippi River channel has relatively stable banks and main channel bank erosion is not considered a significant contribution to sediments requiring dredging. Recognizing that main channel bank erosion does contribute sediment, the Corps of Engineers and Colorado State agreed on a 1-percent reduction in dredging volumes if the erosion was stopped. It is recognized that riprap bank protection is valuable as fisheries habitat and, in extreme cases, is necessary to retain channel alignment for reasonable navigation. The Plan Formulation Work Group felt 1 percent was conservative and increased the projected reduction to 2 percent. This reduction was posted in an earlier time frame for the MPFWG condition than for the MPFW/OG.

Tributary Sediment Supply

A sediment trap with a capacity for 313,800 cubic yards was dredged on the Chippewa River in May 1965. The trap was dredged to catch sediment before it reached the Mississippi River. An area of 780,000 square feet was deepened from approximately 9 to 20 feet. The site was 2,400 to 4,000 feet upstream of the Chippewa River confluence with the Mississippi River channel. Monitoring of the sediment trap showed the area had filled by the fall of 1966. Initial reaction was unfavorable because of the short life of the trap. However, dredging was not required at Reads Landing in 1966 and 1967 under normal flow conditions. Dredging requirements in lower pool 4 in 1967 dipped 95,000 cubic yards below average annual requirements.

The DRWG conducted several studies of lower pool 4 and the confluence of the Chippewa River. These studies are documented in the DRWG Appendix and supporting documents. From these studies it was concluded that a maximum reduction of 50 percent of the sediment supply coming from the Chippewa River would potentially reduce dredging requirements by 50 percent immediately below the Chippewa-Mississippi River confluence. Furthermore, the effect of this reduction would move downstream on the Mississippi River at about 1 mile per year. The overall effect of this reduction would also subside as one proceeds downstream with no measurable benefit below lock and dam 5. The following table shows the reduction computed for each cut in lower pool 4 and pool 5 resulting from potential actions on the Chippewa River.

Site-specific dredging volume reductions from erosion protection on the Chippewa River

| Pool | Cut | Name | Reduction (percent) 1986-2000 | 2000-2025 |
|---|---|---|---|---|
| 4 | 5 | Reads Landing | 50 | 50 |
| | 4 | Above Crats Island | 37 | 50 |
| | 3 | Above Teepeeota Point | 33 | 50 |
| | 2 | Grand Encampment | 30 | 50 |
| | 1 | Beef Slough | 20 | 50 |
| 5 | 8 | Lower Approach L/D 4 | 0 | 25 |
| | 7 | Mule Bend | 0 | 25 |
| | 6 | West Newton | 0 | 25 |
| | 5 | Below West Newton | 0 | 25 |
| | 4 | Fisher Island | 0 | 25 |
| | 3 | Lower Zumbro | 0 | 25 |
| | 2 | Sommerfield Island | 0 | 25 |
| | 1 | | 0 | 25 |

GREAT did not include in the CMP the dredging required in the Chippewa River to create and maintain this sediment trap. This dredging was omitted because of the uncertainty of the sediment trap as a channel maintenance feature. Other less costly measures may be taken in the Chippewa River which will provide the sediment reduction desired, or it may be possible that no placement site for material from such a trap will be acceptable. If the sediment trap approach is implemented, an additional dredging site should be added to the CMP.

The dredging volume reduction for sites immediately affected by the Chippewa River were modified because of the potential impact of a sediment reduction project in the Chippewa River. These dredging volume reductions are projected to be 34 to 37 percent (see the following table). The Team believes a total reduction estimate of 84 to 87 percent for a shoal such as Read's Landing was unrealistic. Therefore, rather than adding the 50-percent reduction for the Chippewa River sediment reduction to the other reduction factors, the Team agreed to assume a total reduction of 50 percent for Read's Landing and lesser reductions for dredging farther downstream.

## GENERAL DREDGING REDUCTIONS

The changes in dredging volumes for each cut were computed as described in the previous section. The following table summarizes the general adjustments applied to all cuts in the GREAT I study area. As noted, many of the adjustments used in computing an estimate of dredging volumes are site-specific. A tabulation of these calculations for each cut is shown in table 2 of Parts II, III, IV, and V of this appendix.

General dredging volume adjustments[1]

| Time period | Factor | Percent change: With GREAT | Percent change: Without GREAT |
|---|---|---|---|
| 1975-1985 | Depth of dredging | -15[2] | [2] |
| | Width at bends[3] | (site specific) | (site specific) |
| | Modification to side channel openings | +2[4] | +1 |
| | Wing dam maintenance and modification | -3 | -2 |
| | Placement site maintenance | -1 | -1 |
| | Bank protection | -2 | - |
| | Typical adjustment for 1975-1985 period | -19 | -2 |
| 1986-2000 | Depth of dredging (additional) | -10[2] | -10 |
| | Modification to side channel openings (additional) | +2[4] | - |
| | Wing dam maintenance and modification (additional) | -3 | -2 |
| | Bank protection (additional) | - | -2 |
| | Siltation of backwaters | -3 | -3 |
| | Tributary sediment supply | (site specific)[5] | (site specific)[5] |
| | Typical additional adjustment for 1986-2000 period | -15 | -17 |
| | Total adjustment from 1975 | -34 | -19 |
| 2001-2025 | Depth of dredging (additional) | -[2] | -15 |
| | Wing dam maintenance and modification (additional) | -3 | -2 |
| | Typical additional adjustment for 2001-2025 period | -3 | -17 |
| | Total adjustment from 1975 | -37 | -36 |

(1) Factors to be applied to average annual dredging volumes.

(2) No reduction at approaches to rigid structures such as locks, bridges, piers, and other structures which pose potential safety hazards.

(3) Both increases and decreases in volume from the table on page 40 will be applied to the with GREAT volume computations. Only increases in volume will be applied to the without GREAT volume computations.

(4) A decrease of 5 percent is used at those cuts where GREAT is recommending side channel closures adjacent to cuts, thus reducing the effective flow area and increasing flow velocities and sediment transport capability. This factor is applied during and following the time period that GREAT expects the side channel alteration to occur.

(5) The Chippewa River is the only tributary in the GREAT I area on which treatment to reduce sediment transport is expected. Studies documented in the Dredging Requirements Work Group Appendix show this reduction will affect only lower pool 4 and pool 5.

The following two tables summarize the estimates of dredging volumes for the with and without GREAT conditions. These adjustments would reduce some of the major dredging cuts from high problem areas to areas of moderate concern; others would remain significant issues.

Comparison of dredging volumes (1986-2025)

| Pool | Total volume dredged (1,000 cubic yards) | | Average volume dredged per job (cubic yards) | |
|---|---|---|---|---|
| | With GREAT | Without GREAT | With GREAT | Without GREAT |
| USAF | 1,505 | 1,630 | 24,300 | 26,300 |
| Pool 1 | 3,034 | 3,309 | 22,000 | 24,000 |
| Pool 2 | 4,136 | 4,623 | 32,800 | 36,700 |
| Pool 3 | 2,734 | 3,052 | 36,000 | 40,200 |
| Pool 4 (U) | 1,455 | 1,595 | 42,800 | 46,900 |
| Pool 4 (L) | 4,794 | 7,110 | 42,100 | 62,400 |
| Pool 5 | 3,062 | 4,683 | 23,600 | 36,000 |
| Pool 5A | 2,370 | 2,592 | 32,900 | 36,000 |
| Pool 6 | 1,184 | 1,290 | 17,900 | 19,600 |
| Pool 7 | 2,172 | 2,528 | 31,000 | 36,100 |
| Pool 8 | 3,679 | 4,318 | 35,400 | 41,500 |
| Pool 9 | 2,322 | 3,405 | 27,000 | 39,600 |
| Pool 10 | 1,528 | 2,008 | 28,300 | 37,200 |
| Minn. | 720 | 786 | 13,300 | 14,600 |
| St. Croix | 1,269 | 1,385 | 52,900 | 57,700 |
| Total | 35,964 | 44,314 | | |
| Average per job | | | 30,800 | 36,900 |

Dredging volume summary (in cubic yards)

| Item | USAF | | Pool 1 | | Pool 2 | | Pool 3 | |
|---|---|---|---|---|---|---|---|---|
| | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Without GREAT |
| 1955-1974 | | | | | | | | |
| Average annual dredging volume | - | 50,700 (1) | - | 107,500 | - | 153,100 | - | 101,300 |
| Total volume dredged | - | 1,064,700 (2) | - | 2,150,000 | - | 3,062,000 | - | 2,026,000 |
| Estimated number of dredging jobs | - | 33 (2) | - | 69 | - | 63 | - | 38 |
| Dredging volume per job | - | 32,300 (2) | - | 31,200 | - | 48,600 | - | 53,300 |
| 1986-2025 | | | | | | | | |
| Estimated volume to be dredged (1986-2000) | 577,500 | 693,000 | 1,169,000 | 1,411,500 | 1,596,000 | 1,990,500 | 1,056,000 | 1,314,000 |
| Estimated volume to be dredged (2001-2025) | 927,500 | 937,500 | 1,865,000 | 1,897,500 | 2,540,000 | 2,632,500 | 1,677,500 | 1,737,500 |
| Total estimated volume to be dredged | 1,505,000 | 1,630,500 | 3,034,000 | 3,309,000 | 4,136,000 | 4,623,000 | 2,733,500 | 3,051,500 |
| Estimated number of dredging jobs | 62 | 62 | 138 | 138 | 126 | 126 | 76 | 76 |
| Dredging volume per job | 24,300 | 26,300 | 22,000 | 24,000 | 32,800 | 36,700 | 36,000 | 40,200 |

Dredging volume summary (in cubic yards)(cont)

| Item | Upper pool 4 | | Lower pool 4 | | Pool 5 | | Pool 5A | |
|---|---|---|---|---|---|---|---|---|
| | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Without GREAT | With [illegible] | [illegible] |
| 1955-1974 | | | | | | | | |
| Average annual dredging volume | - | 55,200 | - | 219,200 | - | 162,500 | - | 86,200 |
| Total volume dredged | - | 1,104,000 | - | 4,184,000 | - | 3,250,000 | - | 1,724,000 |
| Estimated number of dredging jobs | - | 17 | - | 56 | - | 65 | - | 36 |
| Dredging volume per job | - | 64,900 | - | 74,700 | - | 50,000 | - | 47,900 |
| 1986-2025 | | | | | | | | |
| Estimated volume to be dredged (1986-2000) | 562,500 | 688,500 | 1,854,000 | 3,070,500 | 1,471,500 | 2,020,500 | 915,000 | 1,114,500 |
| Estimated volume to be dredged (2001-2025) | 892,500 | 906,500 | 2,940,000 | 4,040,000 | 1,590,000 | 2,662,500 | 1,455,000 | 1,477,500 |
| Total estimated volume to be dredged | 1,455,000 | 1,595,000 | 4,794,000 | 7,110,500 | 3,061,500 | 4,683,000 | 2,370,000 | 2,592,000 |
| Estimated number of dredging jobs | 34 | 34 | 114 | 114 | 130 | 130 | 72 | 72 |
| Dredging volume per job | 42,800 | 46,900 | 42,100 | 62,400 | 23,600 | 36,000 | 32,900 | 36,000 |

Dredging volume summary (in cubic yards) (cont)

| Item | Pool 6 | | Pool 7 | | Pool 8 | | Pool 9 | |
|---|---|---|---|---|---|---|---|---|
| | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Without GREAT |
| 1955-1974 | | | | | | | | |
| Average annual dredging volume | - | 41,800 | - | 95,500 | - | 152,000 | - | 120,500 |
| Total volume dredged | - | 820,000 | - | 1,910,000 | - | 3,040,000 | - | 2,410,000 |
| Estimated number of dredging jobs | - | 33 | - | 35 | - | 52 | - | 43 |
| Dredging volume per job | - | 24,800 | - | 54,600 | - | 58,500 | - | 56,000 |
| 1986-2025 | | | | | | | | |
| Estimated volume to be dredged (1986-2000) | 454,500 | 550,500 | 840,000 | 1,173,000 | 1,419,000 | 1,863,000 | 897,000 | 1,470,000 |
| Estimated volume to be dredged (2001-2025) | 730,000 | 740,000 | 1,332,500 | 1,355,000 | 2,260,000 | 2,455,000 | 1,425,000 | 1,935,000 |
| Total estimated volume to be dredged | 1,184,500 | 1,290,500 | 2,172,500 | 2,528,000 | 3,679,000 | 4,318,000 | 2,322,000 | 3,405,000 |
| Estimated number of dredging jobs | 66 | 66 | 70 | 70 | 104 | 104 | 86 | 86 |
| Dredging volume per job | 17,900 | 19,600 | 31,000 | 36,100 | 35,400 | 41,500 | 27,000 | 39,600 |

Dredging volume summary (in cubic yards) (cont)

| Item | Pool 10 | | Minnesota River | | St. Croix River | | GREAT I study area | |
|---|---|---|---|---|---|---|---|---|
| | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Without GREAT | With GREAT | Wit… GRE… |
| 1955-1974 | | | | | | | | |
| Average annual dredging volume | - | 70,000 | - | 27,500(3) | - | 45,500 | - | 1,488,500 |
| Total volume dredged | - | 1,400,000 | - | 577,500(2) | | 955,500 | - | 29,678,000 |
| Estimated number of dredging jobs | - | 27 | - | 28(2) | - | 13 | - | 608 |
| Dredging volume per job | - | 51,900 | - | 20,600(2) | - | 73,500 | - | 48,800 |
| 1986-2025 | | | | | | | | |
| Estimated volume to be dredged (1986-2000) | 591,000 | 865,500 | 277,500 | 339,000 | 489,000 | 592,500 | 14,170,000 | 19,150,000 |
| Estimated volume to be dredged (2001-2025) | 937.500 | 1,142,500 | 442,500 | 447,500 | 780,000 | 792,500 | 21,790,000 | 25,160,000 |
| Total estimated volume to be dredged | 1,528,500 | 2,008,000 | 720,000 | 786,500 | 1,269,000 | 1,385,000 | 35,960,000 | 44,310,000 |
| Estimated number of dredging jobs | 54 | 54 | 54 | 54 | 24 | 24 | 1,210 | 1,210 |
| Dredging volume per job | 28,300 | 37,200 | 13,300 | 14,600 | 52,900 | 57,700 | 29,700 | 36,600 |

(1) 1964-1977.
(2) Interpolated to 1955-1974
(3) 1967-1977

# CHAPTER 6

# POOL DISCUSSIONS

## INTRODUCTION

This chapter provides brief narrative descriptions of the CMP recommended for each pool. These descriptions are intended to make the CMP more understandable to those not familiar with every dredge cut and placement site in the GREAT I area. Placement sites are referred to by the numbering system used in the CMP. The sites are shown on the maps of each pool located in Chapter VII of the main report. More detailed CMP maps are located in Parts II through V of this volume.

## ST. ANTHONY FALLS POOL

The navigation project above St. Anthony Falls was completed in the mid-1960's. One of the requirements for completing the project construction was an agreement with the city of Minneapolis, Minnesota, to sponsor the project. The city is obligated to provide lands needed for the project, its operation, and its maintenance.

The Channel Maintenance Plan Task Force (CMPTF) discussed the material placement possibilities with representatives of Minneapolis, evaluated these possibilities, and, with knowledge of the city's riverfront development plans, prepared a recommended plan.

Site U.01 in the Upper Harbor[1] has been used for material placement, but the city plans to develop the site for riverfront public use and will provide an alternative site. The proposed site is U.02 which is also in an industrial area. The third site the CMPTF considered was U.03, a privately owned sand and gravel stockpile site. The landowner is willing to take the material and has a use for it. The GREAT I Team did not take specific action in recommending this site. In both cases, the material would be removed for beneficial use.

---

(1) Commonly used name for the Upper St. Anthony Falls Pool.

The GREAT I Team added a condition on the use of site U.02 - the material must be removed before the next seasonal high water. This condition should not cause a hardship because Minneapolis uses the material for sanding icy streets in the winter.

POOL 1

In pool 1, Minneapolis is not required to provide placement sites. In recent years the city has requested and received most of the dredged material from pool 1. The Corps has been dredging with a clamshell dredge and barging the material to the Minneapolis Coal Dock (site 1.01). The CMPTF recommended that this plan be continued with some occasional shoreline placement to renew the existing beaches and provide some more variety of habitat in the gorge area. No other sites in the pool have capacity to handle the volumes dredged.

The GREAT I Team expanded on the selected plan and will allow, during emergency conditions, the use of historical placement sites with the condition that the material be removed to site 1.01 before the next seasonal high water.

MINNESOTA RIVER

This portion of the 9-foot channel project was not included until the mid-1960's. Before that, companies with terminals on the Minnesota River, primarily Cargill, Inc., maintained a navigation channel. In 1967 and 1968, the original construction dredging was done under contract with a 16-inch hydraulic cutterhead suction dredge. Major items of the dredging work were (1) Two-Mile Cutoff, (2) Four-Mile Cutoff, (3) Six-Mile Cutoff, and (4) Petersons Bar. The three oxbow cutoffs were dredged, and closing dams were built at the upstream ends of the old channels. At Petersons Bar, the flow of the river was diverted from the right to left side (facing downstream) of a rock outcrop in the riverbed.

The Lower Minnesota River Watershed District is the local sponsor for the Minnesota River project. As such, it has certain responsibilities for maintenance of the channel. These responsibilities include providing the land areas needed for dredged material placement.

Immediately after construction, the watershed district set about to fulfill this responsibility. With no record of historic dredging on this new, deeper, and straighter channel, it was assumed that dredging could occur at any place along the 14.7 miles of channel, most dredging would be done with hydraulic dredges having a range of about three-fourths mile, and larger sites would be needed in the upper reaches of the project. Under these assumptions, the watershed district bought land or easements at roughly 1 1/2- to 2-mile intervals along the channel. With approximately 10 years of records, GREAT has been able to make better estimates of expected dredging requirements.

All of the sites originally purchased for placement are still available except for restrictions imposed by floodplain ordinances. A few sites now lie within the boundaries of the Minnesota Valley National Wildlife Refuge but these sites will be replaced by the Fish and Wildlife Service if they are taken for the refuge development.

The consulting engineer for the watershed district worked with the CMPTF in identifying potential placement sites, evaluating those sites, selecting placement sites for the various plans, and recommending sites for the selected plan.

J. L. Shiely Sand and Gravel Company assured GREAT in a letter dated June 28, 1977 (see the following page), that material dredged at several sites near the mouth of the Minnesota River would be accepted at Shiely's Lexington Avenue storage yard on the Mississippi River (site 2.18 - RM 843.3) if the material was delivered to the conveyor system at the base of the bluff. The yard is part of its Twin Cities operation and is normally a distribution point for sand and gravel mined on Grey Cloud Island (RM 825). Gravel and quarried limestone are loaded on barges at Grey Cloud Island and transported to any of several riverside yards. The barges are unloaded by clamshell. The gravel and limestone are stockpiled and trucked to the customer.

At the Lexington Avenue storage yard, the stockpile sites are on top of the river bluff. Two sets of railroad tracks are at the bottom of the bluff between the yard and the river. A conveyor system moves the material from the riverbank to the stockpile.

J. L. SHIELY COMPANY

1101 SNELLING AVENUE NORTH SAINT PAUL, MINNESOTA 55108

TELEPHONE: 646-8601

June 28, 1977



Mr. Carl Schenk, Planner
Mississippi River Corridor
Metropolitan Council
300 Metro Square Bldg.
7th. St. & Robert St.
St. Paul, MN 55101

Dear Mr. Schenk:

Harold Rehfeld of the City of Lilydale referred your letter regarding dredge spoil disposal sites to me. We have a tract of land on the west bank of the Mississippi immediately upstream from the I-35E Lexington Avenue Bridge. This tract has been quarried and from time to time parts of the property have been refilled. For certain locations along the river this site might have use as a dredge spoil disposal site. We have the capability of unloading barges if the material is relatively dry and granular.

If you need further information feel free to contact me.

Very truly yours,

J. L. Shiely, III
Vice President-Operations

JLS,III.d
cc: Harold Rehfeld

For the dredging operations, the dredging plant would bring loaded barges to the unloading site. Shiely would unload the barges and store the material on the stockpile site for its own use.

Cut 2, Four-Mile Cutoff, has only been dredged once in the history of maintenance on the Minnesota River (in 1969). The dredging was to correct dimensions from the original construction dredging. The channel has remained stable. The GREAT Team does not believe that this site will require dredging in the future. If the site needs dredging, site MN.28, the site used during construction, was selected for placement of the dredged material.

The Lower Minnesota River Watershed District originally purchased MN.07 to serve Cut 3 - Peterson's Bar. Title has been transferred to Bloomington, Minnesota, and the site is included in the Lower Minnesota River National Wildlife Refuge and Recreation Area.

The main factors influencing the choice of MN.30 as the primary site and MN.06 as a secondary site are described in the following table. As in cut 1 (site 2.18), the selected site is subject to the wishes of the landowner. Therefore, even though the selected site is large enough to hold all the material, a secondary site is shown. The first step toward using MN.30 is to get the permission of and a long-range agreement with the landowner. This step is the responsibility of the Lower Minnesota River Watershed District. Some dikes or berms may have to be placed in the quarry floor to keep the dredging separate from any quarrying that might be going on, and any slurry water must be handled if the material is delivered by pipeline.

Factors in site selection on the Minnesota River

| Factor | MN.30 | MN.06 | MN.07 | MN.13 |
|---|---|---|---|---|
| For | Out of the floodplain. Beneficial use as quarry backfill or landfill cover. Landowner willing to accept material. No containment structure needed. | Potentially out of the floodplain. Potential for beneficial use. Landowner willing to accept material. No containment structure needed. No pumping of slurry water required. Possibly within reach of hydraulic dredge. | Adjacent to cut. Previously used site. | Out of floodplain. Beneficial use as quarry backfill. Landowner willing to accept material. No containment structure needed. |
| Against | Just beyond reach of most hydraulic dredges. Return water must be pumped. Privately owned. | Quality habitat, even though temporary, for upland game would be lost. | In floodway. Material must be removed by truck. Poor road access. Adverse impacts on Minnesota River Trail. Containment dikes needed. | Beyond reach of most hydraulic dredges. Return water must be pumped. Privately owned. Farther from the river than MN.30. |

The GREAT I Team suggests that, to use this site, every effort be made to dredge only the lower end of the cut and dredge directly, with hydraulic dredge, to site MN.30. If this is not possible, a mechanical dredge plant placing material on shore opposite MN.07 or at the salt dock just above I-35 and trucking to MN.30 would be the recommended method.

Cuts 4 and 5 together form the most difficult dredge material placement problem on the Minnesota River. Locks and dam 2 influence water levels to just upstream of the project. This effect slows water flow and decreases the river's sediment transport abilities drastically in the first 2 or 3 miles - the areas of cuts 4 and 5. The watershed of the Minnesota River is different from most of the other tributaries to the Upper Mississippi River in the GREAT I area. The upland areas are overwhelmingly agricultural, and not as many areas of stream bank erosion are present. Those areas that do erode yield a much higher proportion of silt and fine sand particles than the other tributaries, including the Mississippi River above Minneapolis. Therefore, material dredged from the Minnesota River cannot be used for some of the beneficial uses of other dredged material (for example, street sandings). Thus, the potential market is limited.

The entire left bank of the river is in the floodway; most of the right bank is zoned industrial with a high potential for development. In 1975 and 1976, the Twin Cities Level B Study spent considerable time discussing potential placement sites with all the landowners in the area and the watershed district. These discussions have continued with the watershed district taking an active role. Assuming that it would be possible to reach all potential sites between the river and the Chicago and Northwestern Railway tracks, few sites were identified which would best fit into the landowners' development plans and provide access for removal. Possible means of reaching the site with dredge line were explored. Overall, site MN.03 provided the best combination of:

1. Access from the dredge.
2. Access for removal.
3. Negligible habitat impacts.
4. Negligible flood effects.
5. Suitability to landowners' plans.
6. Negligible cultural impacts.

The site is a grassy meadow. It is bordered on two sides by railroad sidings which connect the Chicago and Northwestern lines on the south and the Minneapolis, Northfield and Southern Railway tracks on the west (across County Road 31). Vehicle access to the site is off County Road 31. Overland access to cut 4 is not difficult; only a channelized portion of the Credit River outlet would have to be spanned.

Access to the upstream end of cut 5 is considerably more difficult. The Minneapolis, Northfield and Southern Railway track is on a rock fill for abo 2,000 feet south from the bridge and earthen fill the remainder of the way to where it crosses over Highway 13 in Savage. No culverts or breaks are in this fill. To reach MN.03, the pipeline must either cross under the track at the river, or a connection through the embankment must be built.

MN.14 is closer to cut 5 than MN.03 but the problems of crossing the Chicago and Northwestern Railway tracks, frontage roads, and the four-lane divided roadbed of Highway 13 make it less attractive.

Maintenance of the channel on the Minnesota River depends on cooperation among the Corps, the Lower Minnesota River Watershed District, permitting agencies, and the local landowners. Fortunately, the volumes to be dredged apparently are not unreasonably large and throughout a season the channel has remained quite stable, which is to say that sedimentation rates are more closely related to spring runoff than summer storms. It would be desirable to study sediment transport with the objective of reducing total dredging volumes. However, the expected volumes, based on the short history of the project, do not appear to warrant a high priority for such study.

POOL 2

The most difficult dredged material placement problems occur in downtown St. Paul (cuts 7, 8, and 9). The area near the river is so developmentally volatile that it is very difficult to find a site that will stay relatively unchanged for even 10 years. On the other hand, some construction which could use the material is usually imminent or being planned.

The GREAT I Team selected a plan that would:

1. Provide a site(s) that would seem to have some longevity and be available for removal to other sites, construction projects, or other uses.

2. Illustrate that some work being contemplated now should use dredged material and recommend that it be used in these specific areas.

The second most difficult area to select sites for is the area immediately below the Pig's Eye Metropolitan Sewage Treatment Plant (cuts 4, 5, and 6). These cuts have much higher levels of contamination than other cuts in the pool.(1) Therefore, more care in choosing sites is needed to protect the backwater areas and main channel waters from the dangers of resuspended contaminants. Each site examined was assumed to be diked with potential total containment of dredged slurry.

At cut 1, the GREAT I Team selected a site near the lock approach adjacent to the lock structure where the material would be used as fill.

For cuts 2 and 3, the two candidate sites were sites 2.35 and 2.24. Site 2.35 was selected primarily because it was in an area that could be easily diked if needed for pipeline placement. Site 2.24 is part of the Spring Lake rehabilitation proposal by the Twin Cities Metropolitan Council and C. F. Industries.

The proposal for altering the head of Spring Lake is one of the special features of the GREAT I CMP described in Chapter 12 of this appendix. Under this proposal, some channels into Spring Lake would be blocked and an extension of the natural levee would be constructed. The actions would reduce erosion at the head of Spring Lake and prevent encroachment of land areas, by sedimentation, into the lake. In addition, the dredging required at Pine Bend Foot Light might be significantly reduced.

The Spring Lake proposal was being developed when the CMP was assembled. The GREAT I Team saw several problems with the proposal which would have to be solved before it could be considered. Therefore, another site was selected for all the material. If these problems are resolved, several of which have been addressed in Chapter 12, site 2.24 should be the selected site.

---

(1) All cuts in pool 2 showed a level of contamination high enough that the GREAT I Team recommended diking and 7-day retention of slurry water. Percolation of water through dikes and the underlying soil was factored into all sizing and cost computations. The material would be available for beneficial use and there is road access to the site but it is doubtful that any material would be removed. The native soil at the closest developing area is very easily shaped and is excellent for fill and building material.

Some of the concerns involve hydrology, water quality, fish and wildlife management, institutional concerns, and economics (e.g., what are the effects on flood flows and dredging volumes, is the natural spring water feeding Spring Lake of sufficiently high quality and quantity to affect the lake's condition, can a suitable fishery be developed and maintained, is there broad support from both private and public interests for the project, and can cost savings be realized in maintaining the navigation project, respectively).

With the acceptance of the project at site 2.24, material from cut 4 would be diverted, as needed, from site 2.10 to 2.24 and material from cuts 2 and 3 would be diverted, again as needed, from site 2.35 to 2.24.

Site 2.10 was selected for cuts 4, 5, and 6 because, of the several sites considered, it best met several criteria. It provided enough area to construct a diked retention area, removed material from the floodplain, made material available to Dakota County (the county had shown a need for 1,700,000 cubic yards), and showed little potential for groundwater pollution.

The St. Paul Barge Terminal (cut 7) is the highest total volume dredging site in the St. Paul District with a total expected volume of 2,028,000 cubic yards to be dredged in the 40-year study period. In recent years, this material was placed on shore near Holman Field (site 2.15). The area bounded by the shore, the St. Paul flood control levee, access roads to the Holman Field terminal building, and the seaplane dock (the limits of site 2.15) is, for all practical purposes, filled to the same height as, or higher than, the levee. The shoreline, including that facing the seaplane dock, has now bee riprapped. Thus, site 2.15 is no longer a candidate for a long-term site as described at the beginning of this discussion. A more complete discussion of all sites recommended for this cut and the obstacles to implementation of each are discussed in Chapter 12, Special Features of the CMP.

POOL 3

Three cuts in pool 3 have significantly lower dredging volumes and frequencies than the other cuts. For these three, GREAT I chose placement sites that would have reasonably few negative impacts.

Every effort was made to accommodate the needs expressed by the city of Hastings. The primary site for cut 9 is a temporary stockpile site, site 3.47, along a city street. Site 3.46 was recommended, though not always as the primary site, for cuts 4 through 8. It is a stockpile site near the downtown area having moderate land access. In addition, the GREAT I Team recognized plans under way by the Corps of Engineers and the city of Hastings to develop Lake Rebecca Park by making material available for park development if any fill is needed.

The Minnesota shoreline between Hastings and lock 3 is inaccessible by land. Sturgeon Lake and North Lake are backwater marshes that are beginning to show the same symptoms as the Weaver Bottoms. The Wisconsin shoreline between Prescott and Diamond Bluff plunges directly to the main channel water surface from the top of the bluff broken only by the roadbed of the Burlington Northern railroad tracks.

Goodhue and Dakota Counties, Minnesota, and the city of Hastings have expressed a need for large amounts of material. Even though portions of the material would be used adjacent to pool 3, the lack of access sites precludes meeting any of the counties' needs with pool 3 dredged material. Hastings may be able to justify bringing material in from near Prescott.

Prescott, Oak Grove Township, and Diamond Bluff, Wisconsin, all showed a need for moderate volumes of material. GREAT I sees these communities satisfying their needs from nearby sites with access (sites 3.34, 3.27, and 3.09, respectively).

Site 3.09 was chosen for cuts 1, 2, and 3 because of its larger potential volume; the volumes dredged approximately equal the capacity of the site.

Sites for cuts 4, 5, and 6 are difficult to choose. Those sites immediately available are marginal at best either because of capacity limits, negative impacts, or difficult access. This, plus the nature of the tributaries associated with those shoals, led to the recommendation for sediment entrapment structures on intermittent streams in Wisconsin.

Site 3.34 does not have capacity for all the material from cut 7 in the configuration planned for the site. The beach on the St. Croix River side of Point Douglas is the most heavily used beach area with land access on the St. Croix River. Parking is extremely limited and a very dangerous traffic condition exists on every summer weekend. Attempts have been made to discourage its use in the past, because of this traffic condition, without success. Rather than discourage its use, those in authority have opted to try to make the area as safe as possible, and steps have been taken to plan and design a safe recreation area encompassing most of the peninsula. Site 3.34 can serve either as a parking lot to support the beach area or as a stockpile area for material to be used elsewhere.

The largest single problem to be faced while dredging pool 3, according to to the CMP, is moving dredged material from the loaded barges to placement site 3.09. Almost, without exception, the easiest and least detrimental means of moving the material is in a pipeline. The distances from the closest mooring place to the placement site is beyond practical movement mechanically (by end loader, dozer, etc.) and the material is not easily moved by conveyor belt. If the material can be bottom dumped from the barges and dredged inland with a pipeline dredge, the problem is difficult but not insurmountable. If this cannot be done, the costs of dredging will increase substantially to cover specialized equipment which unloads the material as slurry directly from the barge, dries the material sufficiently to be handled by conveyor, or substantially increases the reach of hydraulic dredges.

## ST. CROIX RIVER

The portion of the lower St. Croix River which includes the 9-foot navigation project has been declared a National Scenic Riverway. The documents and management governing this scenic riverway recognize the importance of maintaining the channel in harmony with the intense recreation use. The following quotation from the Lower St. Croix National Scenic Riverway Master Plan dated February 1976 exemplifies the basic philosophy from which GREAT I worked to develop plans for the lower St. Croix River:

> "A spoil disposal plan should be developed so that dredge spoil material from the 9-foot channel would be used to supplement existing beach areas or to establish additional recreational sites outside the floodway."

Beyond the scope of the National Scenic Riverway are many conflicts in use and planned use on the St. Croix River. The Minnesota-Wisconsin Boundary Area Commission was established as a Governor-appointed citizen bistate review commission to help deal with these conflicts, needs, and pressures.

In developing plans for the St. Croix River, the CMPTF carefully reviewed all potential sites with the executive director of the Commission before selecting any sites and reviewed all plans with them before recommending a selected plan.

The primary factor in selecting sites was providing safe areas for boaters to use the placement sites. GREAT I felt that once the sand was placed, there was no doubt that it would be used. The channel maintenance plan must therefore protect the boating public as much as possible by placing the material in safe places. The lists of sites show the order of preference for using the sites.

At the higher volume cuts, sites that showed any potential for beneficial use removal while still having any sufficient on-site capacity without removal were recommended after needs for beaches were satisfied.

At the sites at Kinnickinnic Bar, questions of land ownership and State park development must be answered before placing material. (See Chapter 7 for further discussion of these concerns.)

POOL 4

Although Pool 4 is divided by Lake Pepin into lower and upper sections, the pool is dealt with as a single unit here. Cuts 1-5 are located in the lower section and cuts 6-11 are located in the upper section.

The selected material placement sites for cuts 1, 2, and 3 are identical. In fact, the three cuts function as a unit as far as placement operations are concerned. All rely heavily on beneficial use by four identified markets in Wisconsin. Cuts 4 and 5 are also tied together but to a much smaller extent. They place some reliance on the Wabasha Gravel Pit and beneficial use in and around Wabasha.

To fully understand the relationship of cuts 1, 2, and 3 with placement at the small-boat harbor (site 4.02), a "budget" of material used and stored must be shown.

Four markets were identified in the Marketing Study (see Dredged Material Uses Work Group Appendix). These markets are the Wisconsin Department of Transportation (61,000 cubic yards), Buffalo County (1,500,000 cubic yards), Alma Village (400,000 cubic yards), and Alma Township (20,000 cubic yards). The Task Force split the Buffalo County requests between pool 4 (730,000 cubic yards) and pool 5 (770,000 cubic yards).

Lower pool 4 material budget (cuts 1, 2, and 3 to site 4.02)

| Item | Amount (cubic yards) |
|---|---|
| **Demands and capacities** | |
| Buffalo County | 730,000 |
| Village of Alma | 400,000 |
| Wisconsin Department of Transportation | 61,000 |
| Township of Alma | 20,000 |
| On-site capacity (4.02) | 367,000 |
| Total capacity | 1,578,000 |
| **Dredging volumes** | |
| Cut 1 - Beef Slough | 235,000 |
| Cut 2 - Grand Encampment | 522,500 |
| Cut 3 - Above Teepeeota Point | 972,000 |
| Total volume dredged | 1,729,500 |
| Excess volume dredged | 151,500 (9 percent) |

Use of site 4.02 depends on the establishment of a bulkhead line.[1] The request which begins this process under Wisconsin law must come from a local governmental unit, in this case either the city of Alma or Buffalo County.

Cuts 4 and 5 are immediately downstream of the Chippewa River. This reach of river has been the subject of the most intensive and broad-based studies within the GREAT I effort. There are references to this problem area in practically every report and document prepared by GREAT I. In particular, refer to Chapter 12 of this appendix and the Dredging Requirements, Material and Equipment Needs, and Fish and Wildlife Work Group Appendixes.

(1) Wisconsin Statutes Section 30.11 authorizes the Department of Natural Resources to permit placement of material in navigable waters only if it is placed behind a bulkhead line. A bulkhead line is a surveyed line which describes the limits of a fill and can only be used to regularize a shoreline. A bulkhead line cannot be used to create land for the riparian owner.

The two overriding considerations which arose in preparing the plan for upper pool 4 were the nature of material at cut 6 (Wacouta Point) and the requests for material and a potential industrial harbor development in Red Wing, Minnesota.

Dredging at Wacouta Point requires unusual handling compared to other cuts along the river because of the high level of PCB contamination in the sediment. A thorough discussion of the problems at Wacouta Point is in the Dredging Seminar Proceedings. Sites 4.37 and 4.38, both gravel pits, were chosen because the material would be least likely to cause further contamination of the river and would have the least overall environmental impacts. High costs of building containment areas ruled out many of the sites which at first glance seem preferable. Site 4.48 is a temporary stockpile and/or rehandling site. Site 4.57 was selected as the primary placement site for cuts 7, 8, 9, and 11 because of the site's accessibility and the fact that it has already been greatly disturbed by landfill operations. Site 4.57 in Red Wing has been a productive wetland in the past but very little habitat value remains since the city used it for a landfill.

The following material budget for site 4.57 shows how the material is to be distributed. The CMPTF discussed all of the several sites around Red Wing's upper harbor with local officials before deciding on site 4.57. This provided the best compromise between the city's desire for fill at several locations and the logistics of bringing the material to the site from the dredge.

Dredged material budget, site 4.57
(Fill for industrial harbor and beneficial use removal)

| Item | Quantity (cubic yards) |
|---|---|
| Beneficial use demands and capacity | |
| City of Red Wing | 180,000 |
| Goodhue County | 160,000 |
| On-site capacity | 605,000 |
| Total demand and capacity | 945,000 |
| Dredging volumes | |
| Cut 7 - Below Red Wing highway bridge | 395,500 |
| Cut 8 - Above Red Wing highway bridge | 85,500 |
| Cut 9 - Cannon River | 427,500 |
| Cut 11 - Above Trenton | 93,500 |
| Total dredging volume | 1,002,000 |
| Excess dredging volume (1) | 57,000 |

(1) To be placed in secondary placement sites for cut 7 (4.47 and 4.54).

Material from cut 11 at Trenton, Wisconsin, is to be placed at site 4.63, a private floodplain forest area that has been developed for recreation use. The Red Wing Wildlife League would be responsible for further development of the placement site once the material is delivered.

POOL 5

The recommended plan for dredging and material placement in pool 5 is a classic example of "regional placement" as described in the 9-foot Navigation Channel Environmental Impact Statement. One of several large placement sites will be used for material from all cuts in the upper half of the pool. The specific site to be used will either be an agricultural field on the Minnesota side, a pasture area north of Buffalo, or a site adjacent to the Alma power plant rail loop. If the material is placed at either of the Wisconsin sites, Buffalo County will take large volumes of the material for beneficial use.

Dredging in the remainder of the pool is adjacent to and between Weaver Bottoms and Belvidere Slough. The recommendations of the "Phase I Study of the Weaver-Belvidere area, Upper Mississippi River" led to the selection of sites for this portion of the pool.

Weaver Bottoms has been a major concern of the GREAT I Team since early in the study. The Weaver-Belvidere study suggested several specific actions involving blocking side channels and constructing islands within the Weaver Bottoms area. These are identified collectively as site 5.30. By recommending site 5.30, GREAT I implies that all placement will be according to recommendations of the Phase I Study of the Weaver-Belvidere area (or subsequent studies of the same area done after the GREAT study is completed). The Weaver Bottoms channel closures without island construction would only provide the dredging capacity needed for approximately 5 years. If islands are not to be built in the Weaver Bottoms area, alternative placement sites for the lower four cuts will need to be developed for the period 1990 to 2025. For a more complete summary of the Weaver Bottoms area see chapter 12.

Five markets for dredged material were identified in the Marketing Study (Dredged Material Uses Work Group Appendix) for material dredged in pool 5 and placed on the Wisconsin shore. Buffalo County's stated need of 1,500,000 cubic yards was arbitrarily split between pools 4 and 5 with 770,000 cubic yards assigned to a placement site in upper pool 5.

Upper pool 5 material needs

| Item | Quantity (cubic yards) |
|---|---|
| Buffalo County | 770,000 |
| Wisconsin Department of Transportation | 131,000 |
| Buffalo County | 12,000 |
| Belvidere Township | 20,000 |
| Cochrane Village | 10,000 |
| Total | 943,000 |

In addition to these identified needs for material, Dairyland Power has recently expressed interest in using material either dredged near the Alma Power Plant or delivered to a site with access near the plant.

POOL 5A

No overriding scheme or concept has emerged from the planning process for pool 5A. Early attempts were made to accommodate a potential habitat enhancement project at site 5A.35 using dredged material to build islands in Pollander Lake. Further assessment of the concept by the Fish and Wildlife Work Group showed a preference for using material from the immediate area to build the islands.

In most cases, attempts were made to balance the benefits of removing the material from the floodplain and providing for beneficial use near Fountain City with the benefits of not limiting the choice of equipment and keeping costs low.

POOL 6

All the expected dredging in pool 6 is within 3 miles of Winona; the largest volumes are downstream of town. Winona is a medium-sized city located on a bottomland terrace with little room for growth without spreading onto the river bluff. The local economy has in the immediate past been largely based on the three colleges in town. Recently, a locally based manufacturing and commercial economy has been developing and expanding into areas near the river and along railroads on the downstream side of town. The local flood protection project being built by the Corps of Engineers will remove this area from the floodplain.

This development has generated a desire for fill material for building sites and other uses. Site 6.17 is an area suggested by the city (Winona Port Authority) as desirable for the next development in the industrial park area. This site is reasonably near the main channel and can be reached from shore using hydraulic dredges. Sites 6.27 and 6.19/6.20 are also in the city [illegible] material would be stockpiled for use in other areas.

With these demands for material in the Winona area, GREAT I felt that every reasonable attempt should be made to satisfy this demand while taking advantage of the proximity of most of the dredging to the city. In addition, one of the institutional problems encountered elsewhere on the river is avoided here. That is, "can the material be made available to private parties without compensation?" At the time the CMP was assembled, site 6.17 was owned by the Winona Port Authority, a public body which could accept the material with no difficulty under current regulations.

POOL 7

Pool 7 is probably the most difficult pool in the GREAT I area to select placement sites for. The channel through the pool stays very close to the bluff line on the Minnesota side. In fact, for almost the entire length of the pool, there is only enough room for the railroad tracks and the highway along this bank. Any low or level areas are built up with single-family and vacation homes. The Wisconsin shore is dominated by Lake Onalaska and the Black River bottoms both of which effectively block any access to placement for beneficial use. The entire bottomland except for Brice Prairie is in the La Crosse District of the Upper Mississippi River Wild Life and Fish Refuge, perhaps the most valuable and productive unit in the refuge. With these constraints, the selection of placement sites is determined not by which site fits the criteria and objectives the best, but by which site fails the least.

The market study identified several moderate demands on the Minnesota side; however, because of the scarcity of placement sites, these demands could not be satisfied within pool 7. Much the same is true of the Wisconsin side with one notable exception. Site 7.06 at lock 6 would serve the two identified users in Wisconsin. The Corps of Engineers needs 1,000,000 cubic yards of fill to be used on site near lock 6, and Trempealeau County needs 216,000 cubic yards which would be taken from site 7.06. This volume can practically be met with dredging from cuts 6 and 7 only.

Site 7.04 was once considered as a major site for the pool. Two major drawbacks of the site prompted closer examination. First, it is subject to erosion into the Black River Bottoms. Second, the paved road from Trempealeau would have to be extended an additional mile or more to ensure access for the beneficial users identified.

Late in the study, site 7.05 on the Minnesota bank near lock and dam 6 became available because of a change in ownership. The Minnesota Department of Natural Resources purchased the fish pond area in 1980 to develop a boat access and parking area. Fill material will be required for this development.

POOL 8

The primary placement site for cuts in upper pool 8 (and a portion of pools 7 and 9) is 8.06. The beneficial use demand identified in the La Crosse area was a major reason for selecting this site. During the study, the Wisconsin Department of Transportation expressed interest in using dredged material for fill on a construction project in La Crosse (Lang Drive). The large amount of material involved helped generate interest in providing a beneficial use stock-pile site for material in or near La Crosse. The city-owned landfill on Isle La Plume (site 8.06) appeared the most attractive because it provided the best combination of barge and truck access. However, GREAT I was reluctant to include the imminent construction of Lang Drive as a long-term market feeling that, by the time site 8.06 was operational as a permanent placement site, the construction would have been completed. Therefore, use of any material on Lang Drive is not included in beneficial use demand estimates.

In the lower reaches of pool 8, the Team chose sites which provided for hydraulic dredging of several high-volume cuts and also provided for beneficial use of material dredged. Material from cuts 1 and 2 is recommended to be placed at site 8.22 just outside of Stoddard and material from cuts 3, 4, and 5 is to be placed at site 8.30 near Brownsville. Several acres of type 3 and 4 wetlands will be lost in use of site 8.30. However, the Team judged that the need for a hydraulic placement site for the three Brownsville cuts and the beneficial use potential at the site justified this loss.

The primary reasons for recommending that some of the material from pool 9 be barged past sites 8.22 and 8.30 to Isle La Plume were that:

1. Site 8.22 would be very difficult to reach by barge.

2. Site 8.30 will have a very close capacity budget with material being delivered from cuts 3, 4, and 5 of pool 8.

3. Once material is loaded on a barge, the cost to move barges additional distances is not expensive compared with loading and unloading costs.

Pool 8 material needs, 1985-2025 (1977 estimate)

| Site | User | Quantity (cubic yards) |
|---|---|---|
| 8.06 | City of La Crosse | 700,000 |
| | Wisconsin Department of Transportation | 192,000 |
| | La Crosse County | 1,000,000 |
| | On-site capacity | 2,500,000 |
| | Total | 4,392,000 |
| 8.22 | Vernon County | 220,000 |
| | Bergen Township | 50,000 |
| | Stoddard City | 6,000 |
| | On-site capacity | 2,400,000 |
| | Total | 2,676,000 |
| 8.30 | Brownsville | 50,000 |
| | Hokah Township | 20,000 |
| | Houston Township | 300,000 |
| | On-site capacity | 2,500,000 |
| | Total | 2,870,000 |

POOL 9

Throughout the pool, two approaches to material placement evolved from the CMPTF's deliberations. For cuts 1-6, the predominant theme was to strive for the best balance for each cut. For the remainder of the cuts (7-10), regional placement near Genoa, Wisconsin, was selected.

Three markets were identified in or near Genoa. Site 9.40 is the only site considered by the CMPTF to have acceptable access to serve these markets and was the preferred site for cuts 7-10.

The CMP calls for the excess material to be barged to site 8.06 (Isle La Plume). If additional requests for material develop, this need for long distance transportation may be eliminated.

For cut 6, head of Battle Island, sites 9.11 and 9.33 present an opportunity to place dredged material from this moderately large volume cut in a pair of nearby sites with moderate adverse effects. Site 9.11 is easier to reach with hydraulic equipment. Therefore, it is the preferred site.

Gradation analysis of the material from cuts 5 and 4, De Soto and Indian Camp Light, show fine to medium sand with only traces of silt, making the material very suitable for a large number of beneficial uses. Site 9.07 in De Soto has access for removal. Three markets have been identified and the site is recommended as part of the selected plan for cuts 4 and 5. Access and site development problems still need to be worked out for this site.

Planning for placement of material from cuts 3 and 4, Lansing Upper Light and Indian Camp Light, is difficult for several reasons. They have been high-volume, high-frequency dredging sites. Few potential placement sites are out of the floodplain because the edge of the floodplain is at the toe of the bluff for all practical purposes; the low population in the immediate area does not generate the large beneficial uses found elsewhere; and the floodplain is an extremely rich habitat area harboring endangered species and commercially harvested fish, clams, and furbearers.

In formulating the placement plans for these two cuts, the CMPTF first tried to accommodate the beneficial uses that had been identified in De Soto and Lansing. Although the CMP calls for material from cut 4 to go to De Soto and cut 3 to Lansing, GREAT I would support flexibility where the dredging and a waiting user do not follow the plan's specifications exactly. One such case might be if both Crawford County in Wisconsin and Allamakee County in Iowa were planning to use dredged material from a current dredging season for sanding ice-covered roads the following winter and dredging was imminent at Lansing Upper Light only. It would be prudent and within the intent of the CMP for some of the material to be placed at site 9.07 in De Soto as well as a site in Lansing even though the CMP states that Lansing is the recommended selected placement site for dredging at Lansing Upper Light. The CMP does call for the material from cut 4 to go to De Soto (site 9.07) and beyond(site 8.06), while material from cut 3 goes to Lansing (site 9.26, etc.).

The demand for material at and the on-site capacity of site 9.07 are not large enough to handle all the material from cut 4 let alone cut 5. The material from cut 5 should go to the site which would cause the least amount of problems for placement from cut 4. Material from cut 4 should go to site 9.07 because the techniques of unloading barges are more suitable to site 9.07 than pipeline placement. The CMP implies through the site specific recreation enhancement recommendations that material barged past these enhancement sites could be used at these sites. For example, it would be within the intent of the CMP that if one dredging operation at Indian Camp Light exceeded the available capacity at site 9.07 by a reasonably small amount, say 5,000 cubic yards, that rather than move that material to site 8.06 it may be more desirable to distribute that 5,000 cubic yards along the riverbanks at the recommended enhancement sites 9.18, 9.19, 9.20, and 9.39.

Several possible placement sites in and around Lansing were identified evaluated. None of these sites have capacity for all material from cuts 1, 2, and 3. In fact, only site 9.47 has enough capacity with beneficial use requests to handle material from the smallest volume cut (cut 2).

GREAT I concluded that the minimum overall impact and the greatest cost savings could be achieved by recommending a group of sites and putting a priority on the order in which sites should be considered. For cut 2 (above Atchafalaya), the dredging volumes are so small that all material is to be placed at site 9.47 and at least 25,000-cubic-yard capacity (one dredging job) should be reserved at that site. For cuts 1 and 3, the order in which the sites should be considered is site 9.26 (adjacent to marina in Lansing), site 9.47 (area near substation about 2 miles east of Lansing), and site 9.03 (city of Parkland near the downtown Lansing area). Site 9.28 (the Village Creek marina site in Lansing) is recommended for use only if all objections to the project by the U.S. Fish and Wildlife Service are resolved.

POOL 10

The cuts in pool 10 seem to fall into five groups of two and the reason for dredging at each group seems to be based on a riverine hydraulic factor. Three of these groups are just downstream from a significant tributary and the other two are at sudden expansions in cross-sectional area allowing velocities to slow and carrying capacity to decrease. In four of these five groups, the same factor causing the need for dredging also supplies upland areas where material placement sites can be located with minimal to moderate impacts.

Leitner Hollow, Sioux Coulee, and the Wisconsin River are the three tributaries seemingly tied to cuts 9-10, 7-8, and 3-4, respectively. Sandbar areas formed downstream from the confluence of these streams, and perhaps aided by past dredgings, provide placement areas adjacent to or near the cuts. The CMP for the most part takes advantage of these opportunities. At cut 9, the available capacity at sites 10.16 and 10.40, with beneficial use, is short of the expected dredged volume.

Site 10.04 on McMillan Island is preferred over site 10.18 for dredged material from cut 2 because 10.18 is well used by recreationists and significant additions of material would drastically affect this use. Site 10.04 is an abandoned gravel pit with standing water which may be considered a hazard by many people. Both sites are within easy reach of pipeline equipment.

In the immediate area of Prairie du Chien, the river divides and navigable channels are maintained on both sides of Island 172. This increase in cross-sectional area and flow conditions at the head of Island 172 contribute significantly to the need for dredging in the East Channel.

The city of Prairie du Chien and several other bodies have expressed an interest in using material in or near Prairie du Chien. The CMPTF initially chose site 10.09 in Prairie du Chien as a good dredged material placement site for cut 6. However, the GREAT I Team recognizes significant controversy regarding future dredging of the East Channel at Prairie du Chien. Factors involved in this controversy include concentrations of endangered mussel species (Lampsilis Higginsi) located in the historic dredge cut, recognition of cultural resource values at prospective dredged material placement sites, low frequency use of the channel for bulk commodity movement by barges, active litigation involving barging facility expansion, and anticipated commercial navigation use and facility requirements to the year 2025. The GREAT I Team believes decisions regarding future use and dredging in the East Channel are beyond the scope of GREAT I and must ultimately be addressed by higher authorities (perhaps Congress). On this basis, the GREAT I Team chooses to make no recommendations on this issue.

MORE DETAILS

For a more detailed description and analysis of placement sites and pool plans, examine Parts II through V of this volume. These detailed sections include cost estimates, ecological impacts, and alternative analysis of all placement sites and plans recommended. Parts II through V immediate follow this narrative section of the CMP.

# CHAPTER 7

## TEAM ACTIONS ON SELECTED PLAN

The GREAT I Team met in April 1980 to consider all comments received on the selected plan developed by the CMPTF and Plan Formulation Work Group and approve a channel maintenance plan. Studies had been completed which altered earlier assumptions made about maintenance of the channel. Items such as safety near structures, rate of shoal development, tributary erosion control, navigational maneuverability needs, and hydraulic effects of changes in underwater structures were considered, and adjustments were made in estimated dredging volumes. Work group members and the staffs of member agencies had closely examined the sites being seriously considered along with possible alternatives and mitigating measures. Newer information on material transport equipment was now available, and Public Law 95-269 had been passed requiring that a large portion of channel maintenance dredging be made available to private contractors.

The process used by the Team to consider these factors is outlined in Chapter 4 - Channel Maintenance Plan Development. The following is a record of the Team's actions.

### UPPER ST. ANTHONY FALLS POOL

Motion by Wisconsin: "Material placed at U.02 be removed by the City of Minneapolis before the next seasonal high water" be added as a condition on use of site U.02.

No objection - motion passed.

Motion by Department of Transportation: The city of Minneapolis be urged to locate a site within reach of cut No. 3 (below Soo Line Railroad Bridge) to allow for dredging with pipeline dredge.

No objection - motion passed.

Note: The city of Minneapolis is the local sponsor for the navigation project above the St. Anthony Falls locks and is required by memorandum of agreement to furnish all lands needed for maintenance of the project.

POOL 1

Motion by Corps of Engineers: The Corps of Engineers should purchase fee title or easement for site 1.01 to ensure continued use of the site for material placement.

No objection - motion passed.

Motion by Minnesota: "Material placed at site 1.01 within the identified floodway should be removed before the next seasonal high water" be added as a condition on use of site 1.01.

No objection - motion passed.

Motion by Department of Transportation: During emergency dredging, use of historical material placement sites is acceptable, with the condition that the material be removed to site 1.01 before the next seasonal high water.

No objection - motion passed.

POOL 2

Motion by Department of Interior: Approve selected plan sites for cuts 1-6.

No objection - motion passes.

Motion by Department of the Interior: For cut 7, delete selected plan sites (2.14, 2.15, 2.13, 2.02) and substitute sites 2.30, 2.35, 2.02, 2.13 in preferential order, citing loss of types 3 and 4 wetlands.

Corps of Engineers suggests adding very specific condition on use of site 2.14 - that it only be used if the runway extension project is approved and then only as part of the construction of the runway.

Motion withdrawn pending attachment of condition on use of site 2.14.

No objection to adding condition.

Motion by Department of the Interior: Approve selected plan sites for cut 7 and add site 2.40[(1)] in preference before site 2.02 and after site 2.13. Site 2.40 is to be along the right bank of the river behind a proposed retaining structure (similar to sheet pile). Use of this site would result in reduced dredging volumes (part of area now dredged would become part of disposal site) and use of material for development either through removal or on-site construction.

Note: Use of this site would result in a narrower turning basin and may require participation by local sponsor.

No objection - motion passed.

MINNESOTA RIVER

Motion by Minnesota: Approve site 2.18 for use at cut 1, deleting consideration of MN.27.

No objection - motion passed.

---

(1) Site referred to as 2.40 is the sheet-pile basin built along the inside of the bend at cut 7. See special features of the GREAT I CMP.

Motion by Minnesota: Approve selected plan sites for cuts 2, 3, 4, and 5.

No objection - motion passed.

POOL 3

Motion by Minnesota: Eliminate consideration of site 3.43 citing objection to open-water material placement. Single purpose is beach nourishment and apparent capacity with beneficial use demand at site 3.09.

No objection - motion passed.

Motion by Wisconsin: Add two conditions on use of site 3.09 for cut 1:

1. All material barged and rehandled in the water must be rehandled in an enclosed basin with inland transport by pipeline dredge (for example the Dubuque).

2. An NPDES (National Pollutant Discharge Elimination System) permit is required for any return water.

Department of the Interior requests motion be tabled - motion tabled.

Motion by Wisconsin: For cut 4, substitute site 3.27 for site 3.21, citing position of site in the floodplain and types 3 and 4 wetlands.

Objection - Corps of Engineers - insufficient volume at site 3.27.

Motion by Wisconsin: For cut 4, delete site 3.21 with all material to go to site 3.44.

Substitute motion made from floor to delete site 3.44 from consideration without approving or deleting site 3.21.

No objection - substitute motion passed.

Statement by Minnesota: Site 3.46 has been identified as being in the floodway (preliminary finding) in the Hastings Flood Insurance Study. State suggests that the condition for removal before seasonal high water be considered for this site.

Motion by Wisconsin: A package for the entire pool be approved as follows:

| Cut | Sites (in preferential order) |
|---|---|
| 1 | 3.09 |
| 2 | 3.09 |
| 3 | 3.09 |
| 4 | 3.27, 3.09, 3.34, 3.46 |
| 5 | 3.27, 3.09, 3.34, 3.46 |
| 6 | 3.27, 3.09, 3.34, 3.46 |
| 7 | 3.34, 3.46 |
| 8 | 3.46, 3.34 |
| 9 | 3.46 |

with three conditions:

1. Minnesota's statement about site 3.46 be included.
2. An enclosed rehandling area be used for in-water rehandling with site 3.34.
3. At site 3.27, the intermittent stream be diverted, an enclosed rehandling area be used, and a WPDES (Wisconsin Pollutant Discharge Elimination System) permit be obtained for any return water.

The chair ruled to consider cuts 4, 5, and 6 independently.

Objection to approving cuts 4, 5, and 6:

Corps of Engineers - permit requirement on site 3.27 citing insufficient area to provide settling needed to meet WPDES criteria.

Department of Transportation - citing higher cost of using the sites in the order shown.

Motion to amend the motion by the Department of the Interior:

For cut 3, site 3.10 needs to be designated as a rehandling site if needed.

No objection - motion to amend passes.

Motion to amend the motion by the Department of the Interior: Corps of Engineers and Wisconsin determine, on a site-by-site basis, whether an enclosed rehandling site is needed (intent of motion is to provide policy guidance for remainder of channel maintenance plan implementation).

Motion to amend the motion tabled.

Motion to amend the motion by the Department of Transportation:

For cut 6, substitute site 3.30 for sites 3.27, 3.09, 3.34, 3.46, citing reduced costs.

Many objections - motion to amend fails.

Motion by Department of the Interior: To remove cuts 4, 5, and 6 from motion on the floor and approve, in preferential order, sites 3.27, 3.09, 3.34, and 3.46 with the following two conditions:

1. Negotiations will take place between the State of Wisconsin and Corps of Engineers regarding the use of sites 3.27 and 3.09. Talks will address the need for enclosed containment, size of site, and terms of WPDES permit.
2. Site 3.46 will be used only to the level of removal before seasonal high water.

Objections: Department of Transportation - excessive costs.
Corps of Engineers - condition results in nonapproval, with part of the approval occurring in the future.

Caucus called: State results - passed motion unanimously.
Federal results - passed by majority.

Motion passed.

Motion by Minnesota: Approve selected plan sites for cuts 7 and 8 and approve sites for cut 9 (in preferential order, a site on right bank in municipal park along lock access road as a stockpile site for use by the city of Hastings (3.47), a site in Lake Rebecca Park, and site 3.42).

Corps of Engineers requests amending motion to delete Lake Rebecca as an alternative, citing that present development plans for the park have excess of material.

Minnesota declines change.

Department of the Interior requests amending motion adding condition on use of site 3.42; it will be used only if further sediment analysis shows material is unpolluted and is of physical character of in situ material at site 3.42.

Minnesota accepts change.

No objection - motion passed.

ST. CROIX RIVER

Motion by Corps of Engineers: Approve in preferential order, sites SC.12, SC.13, SC.15, SC.16, SC.26T (an island to be built in shallow water a distance off beach at Point Douglas), and site 3.34 for cut 1.

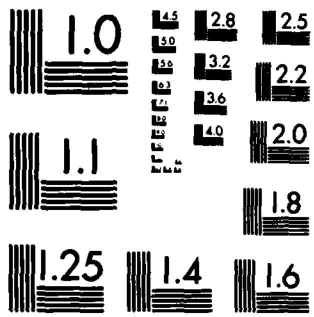
Motion by Wisconsin to amend the motion - Delete site SC.15, citing land ownership concerns at a privately owned island. Amendment not accepted by Corps of Engineers.

Motion amended by Corps of Engineers: Add condition on sites SC.12, SC.13, and SC.15 that dredged material placement will not connect to privately owned island.

Wisconsin objects to sites SC.12 and SC.13, citing location in the floodplain.

AD-A127 094 GREAT I STUDY OF THE UPPER MISSISSIPPI RIVER TECHNICAL APPENDIXES VOLUME 8 CHANNEL MAINTENANCE PART I NARRATIVE(U) GREAT RIVER ENVIRONMENTAL ACTION TEAM SEP 80 2/4

UNCLASSIFIED F/G 13/2 NL


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

Caucus called: Federal result - approve unanimously.
State result - majority approve.

Motion passed. Wisconsin is recorded as the dissenting vote.

Motion by Department of the Interior: Approve site SC.21 for use from cut 2.

Motion by Minnesota to amend the motion: add site SC.27 (in Afton State Par at river mile 8.2) as a secondary site. Amendment accepted.

No objection - motion passed.

Motion by Wisconsin: Approve, in preferential order, sites SC.22, SC.24, an SC.25 for cut 3.

Motion by Minnesota to amend motion: Delete site SC.25. Amendment accepted

Corps of Engineers objects, citing preference for list provided by Lower St. Croix Management Commission Technical Committee. Motion failed.

Motion by Corps of Engineers: Approve, in preferential order, sites SC.01, SC.22, SC.18, SC.03, SC.04, SC.05, SC.06, SC.28T, and SC.24 for cut 3. This is the Lower St. Croix Management Commission Technical Committee list deleting site SC.25 and adding the condition on sites SC.01, SC.03, SC.04, SC.05, SC.06, and SC.28T that material placement shall be for recreational enhancement only.
No objection - motion passed.

POOL 4

Motion by Wisconsin: For cut 1, eliminate site 4.69, citing loss of habitat and open water. Add the following conditions on site 4.04:

1. Complete removal before seasonal high water.
2. All material barged and rehandled in the water must be rehandled in an enclosed basin with inland transport by pipeline dredge.
3. A WPDES permit is required for return water flow.

Minnesota moved to amend the motion separating site 4.69 from the motion and deleting it from the plan.

No objection - motion to amend passed.

Department of the Interior moved to table the motion until later discussion on the pool.

No objection - motion tabled.

Motion by Department of Transportation: Approve site 4.10 for cut 2, citing loss of habitat at site 4.04 and cost savings.

Wisconsin moved to table the motion, citing possibility of reaching resolution at site 4.04, opportunity to accommodate beneficial use at Alma, and potential loss of habitat at site 4.10.

No objection - motion tabled.

Motion by Wisconsin: For cut 3, substitute, in preferential order, sites 4.18, 4.20, and 4.25 for selected plan.

Minnesota objected citing apparent lack of fully developed concept for using these sites. Motion failed.

Motion by Corps of Engineers: Delay consideration of cuts 1-4 until Team members have opportunity to reflect on the potential sites and the interrelationships of the cuts and sites in this reach of the river.

No objection - motion passed.

Motion by Minnesota: Approve site 4.24 for use at cut 5, recognizing Corps of Engineers investigation of technical feasibility of using the site.

No objection - motion passed.

Motion by Wisconsin: Approve selected plan for cut 6.

No objection - motion passed.

Motion by Minnesota: Approve cut 7 with deletion of site 4.49 from consideration, citing objection to open-water placement (beach nourishment) and destruction of aquatic habitat.

Wisconsin suggests that no beach nourishment be allowed at site 4.49, and that sites 4.54 and 4.57 require special handling and close coordination with Red Wing Harbor Commission.

Amendment accepted.

No objection - motion passed.

Motion by Minnesota: Approve selected plan sites for cuts 8, 9, and 10 with condition on site 4.57 approved before.

No objection - motion passed.

Motion by Department of the Interior: Approve site 4.02 (including the area between the marina access road and railroad tracks) for cuts 1, 2, and 3 with the condition that a bulkhead line be established before use. By Wisconsin law, the request for bulkhead line must begin with local government (in this case, the city of Alma).

Motion by Wisconsin to amend the motion: Site 4.20 be approved as the secondary site for cuts 1, 2, and 3. Amendment accepted.

No objection - motion passed.

Motion by Department of the Interior: Approve sites 4.25 and 4.24, in that order, for cut 4, with sites 4.20, 4.18, or 4.19 to be used as rehandling sites. Some material may be left at sites 4.19 and 4.20 permanently.

No objection - motion passed.

Motion by Department of Transportation: For cut 11, substitute site 4.67 for site 4.57, citing proximity to site, relatively low volumes, and cost savings.

Department of the Interior objects - site is roosting area for bald eagles.

Corps of Engineers objects - probable increase in cost to comply with State and Federal standards.

Motion failed.

Motion by Wisconsin: Eliminate site 4.29 from consideration at cut 5, with site 4.25 being substituted as a secondary site.

No objection - motion passed.

POOL 5

Motion by Wisconsin: Approve sites 5.28, 5.24, and 5.26 in preferential order for all cuts in the pool with the condition on site 5.26 that it be the preferred site if studies under way by Dairyland Power show that it has a beneficial use market or need for the material.

Department of Transportation objects - prefers sites 5.30 and 5.03.

Corps of Engineers objects - limitation on types of equipment and difficult access to the site.

Minnesota objects - site 5.24 is near scientific natural area, aesthetic impacts, and no access.

Motion failed.

Motion by Department of the Interior: Approve site 5.30 for cuts 1, 2, 3, and 4 and site 5.24 for cuts 5, 6, 7, and 8, with the condition that an environmental study be done on placement on the scientific area. If site 5.24 is not acceptable, 5.28 is approved for use.

In response to discussion, the Department of the Interior split the motion into two independent motions and added a condition to site 5.30 that an EIS (environmental impact statement) be prepared and calculation of required flood easement be done before use. The motion was tabled on cuts 5, 6, 7, and 8.

Corps of Engineers objects to conditions, citing a questionable need for the EIS as part of the Channel Maintenance Plan and the implication that the Corps of Engineers is responsible for EIS preparation. The Department of Transportation objects to deletion of site 5.03 for cut 1, citing increased cost and limit on choice of equipment.

Motion failed.

Motion by Minnesota: Approve site 5.30 for cuts 2, 3, and 4 unconditionally.

Wisconsin objects, citing uncertainty of need for EIS and floodplain studies.

Motion failed.

Motion by Wisconsin: Because of difficulties in reaching consensus on many portions of the Channel Maintenance Plan, attach the following statement to the Channel Maintenance Plan with the intention that some restrictions and conditions that are not presently clear or well defined are superseded by this statement:

"Specific details of the GREAT recommended Channel Maintenance Plan, including material placement site design, should be developed between the Corps of Engineers and the appropriate Federal, State, and local authorities to achieve compliance with laws and policies."

No objection - motion passed.

Motion by Department of the Interior as substitute for tabled motion: Approve, in preferential order, sites 5.24, 5.26, and 5.28 for cuts 5, 6, 7, and 8, with the condition that economic, environmental, and beneficial use studies on sites 5.24 and 5.26 be completed before use. Material should be placed at site 5.28 if study findings are not in favor of use as a placement site.

Objection by Minnesota, Department of Transportation, and Corps of Engineers.

Caucus called: State results - majority in favor.
Federal results - majority opposed - proposed to make a new motion.

Motion by Federal caucus: Approve, in preferential order, sites 5.24, 5.26T (a portion of site 5.26 suitable for temporary stockpile only and in proximity to rail loop for possible loading of rail cars) and site 5.28 for cuts 5, 6, 7, and 8, with condition that economic and environmental studies on all three be completed before use.

Motion by Minnesota to amend the motion: Change list of sites and preferential order to sites 5.26T, 5.24, 5.26, and 5.28 and studies to include all four sites.

No objection - motion passed.

Motion by Department of Transportation: Approve, in preferential order, sites 5.03 and 5.30 for cut 1 and site 5.30 for cuts 2, 3, and 4.

Department of the Interior and Minnesota object, citing Minnesota riparian rights law which would result in private ownership of site 5.03 as soon as connection to land was made.

Motion failed.

Motion by Department of Transportation: Approve site 5.30 for cuts 1,2, 3, and 4.

No objection - motion passed.

Motion by Minnesota: Remove consideration of site 5A.35, citing majority support in the Fish and Wildlife Work Group for material used to build habitat enhancement features to be taken from the immediate area.

Motion by Wisconsin to amend the motion - substitute motion to approve site 5A.25 for all cuts in the pool with site 5A.22 as secondary site. Minnesota cautioned that ownership of site 5A.22 may be in question. Wisconsin amended its own motion (in response to general discussion): For cut 6, approve site 5A.22 as primary site with site 5A.23 as secondary. Minnesota suggested an amendment to the motion: Approve, in preferential order, sites 6.17, 5A.25, and 5A.22 for cuts 1, 2, and 3.

Objection by Corps of Engineers - belief that better sites are available.
Objection by Department of Transportation - excessive costs and limitation on choice of equipment.

Motion failed.

Motion by Department of the Interior: Approve selected plan for entire pool substituting, in preferential order, sites 5A.32 and 5A.25 for 5A.35 for cuts 1 and 2.

Department of Transportation objects, citing high costs and limit on choice of equipment.

Motion by Department of Transportation: Approve site 5A.04 for cut 1 and site 5A.08 for cut 2.

Department of Interior objected, citing belief that better sites were available.
Wisconsin objected, citing loss of habitat and potential secondary erosion.

Caucus called: State results - majority approved.
Federal results - majority against.

Motion failed.

Motion by Corps of Engineers on behalf of Federal caucus: Approve selected plan with substitution of site 5A.04 for cut 1 and site 5A.32 for cuts 2 and 3, with site 5A.35 as secondary site for cuts 1 and 2 if details of enhancement project are developed.

Many objections - motion failed.

Motion by Wisconsin: Approve, in preferential order, sites 5A.32 and 5A.25 for cuts 1 and 2, and approve selected plan sites for cuts 3, 4, 5, and 6.

Minnesota objects only to cut 5, citing uncertain location, boundaries, and ownership. It may be an area now being acquired as part of a wildlife management area.

Motion by Wisconsin: Approve, in preferential order, sites 5A.32 and 5A.25 for cuts 1 and 2 and approve selected plan sites for cuts 3, 4, and 6.

No objection - motion passed.

Motion by Minnesota: Approve, in preferential order, sites 5A.23 and 5A.36 (adjacent to lock structure near control house) for cut 5.

No objection - motion passed.

POOL 6

Motion by Wisconsin: Approve selected plan for cuts 1, 2, 3, 4, 5, and 6. Delete site 6.11 from consideration at cuts 2 and 3, and add the condition that material be removed from sites 6.11 and 6.27 before the next seasonal high water.

No objection - motion passed.

POOL 7

Motion by Wisconsin: Approve site 7.01 for cut 1, including a proposal to excavate and shape the site to provide needed capacity.

Motion by Corps of Engineers to amend the motion by substituting approval, in preferential order, of sites 7.20T (area immediately upstream of the lock on the right bank) and 7.01 for cut 1.

No objection - motion passed.

Motion by Wisconsin: Approve, in preferential order, sites 7.20T, 7.01, 8.06, and 6.17 for cuts 2, 3, 4, 5, 6, and 7, citing general opposition to open-water placement at site 7.06 and open-water placement, creation of stagnant area behind site, and floodplain impacts at site 7.12.

Corps of Engineers and Department of Transportation object, citing increased costs.

Motion failed.

Motion by Department of the Interior: Approve site 7.06 for cuts 5, 6, 7, and 8.

Wisconsin objects, citing open-water placement.
Department of Transportation objects for cuts 5 and 6 only, citing increased costs.

Motion failed.

Motion by Corps of Engineers: Approve, in preferential order, sites 7.20T, 7.01, 7.06 for cut 2; site 7.06 for cuts 3, 4, 5, and 7; and site 7.04 for cut 6.

The chair separated the voting on the motion into three portions:

For cut 2, Wisconsin objects, citing open-water placement.
For cuts 3, 4, 5, and 7, Wisconsin objects, citing open-water placement.
For cut 6, Wisconsin and Department of the Interior object, citing possible secondary movement into Lake Onalaska and lack of access for beneficial use.

Motion by Wisconsin: Approve, in preferential order, sites 7.20T, 7.01, 7.06, 7.05, and 8.06 for cut 2; site 7.06 for cuts 3, 4, 5, and 7; and site 7.05 for cut 6.

No objection - motion passed.

POOL 8

Motion by Wisconsin: Approve selected plan for all cuts with substitution of site 8.30T (the upland portion of site 8.30) for site 8.30 and the condition on site 8.22 that identified cultural resource site be avoided.

No objection - motion passed.

Motion by Wisconsin: Approve selected plan for cuts 9 and 10.

Resolution from Houston County brought into discussion. GREAT's site 8.07 is apparently not the one referred to in the resolution.

No objection - motion passed.

POOL 9

Motion by Wisconsin: Substitute site 10.40 for 10.17 for cut 1.

Many objections - motion failed.

Motion by Iowa: Approval of selected plan for all of pool 9.

Motion by Wisconsin to amend motion: Substitute, in preferential order, sites 9.47 and 9.41 for site 10.17; substitute site 9.07 for site 9.08 citing realty company's recently built office on site 9.08; and substitute, in preferential order, sites 9.15 and 9.11 for site 9.40.

Amendment not accepted by Iowa - brought to vote.

Many objections - motion failed.

Motion by Department of the Interior: Substitute for motion on the floor approval of the following sites for the corresponding cuts (sites shown in preferential order):

Cut 1 - Sites 9.47 and 9.41
Cut 2 - Site 9.47
Cut 3 - Sites 9.26, 9.47, 9.03, and 9.28
Cut 4 - Sites 9.07 and 8.06
Cut 5 - Sites 9.07 and 8.06
Cut 6 - Sites 9.11 and 9.33
Cuts 7, 8, 9, and 10 - Sites 9.15, 9.11, 9.33, and 8.06.

Corps of Engineers objects, citing perceived difficulty in permission to use site 9.47.

Motion by Department of Transportation: Approve sites in previous motion for cuts 3, 4, 5, and 6, with sites 9.11 and 9.33 enlarged as needed to hold material.

No objection - motion passed.

Motion by Wisconsin: Approve, in preferential order, sites 9.15, 9.11, 9.33, and 8.06 for cuts 7, 8, 9, and 10, with sites 9.11 and 9.33 enlarged as needed to hold material.

Motion to table motion made by Department of Transportation.

Motion tabled.

Motion by Department of Transportation: Approve site 9.34 either left of channel or right of channel for cut 1.

Objections by Department of the Interior and Wisconsin, citing wetlands affected, secondary erosion potential, and lack of beneficial use possibility.

Motion failed.

Motion by Iowa: Approve, in preferential order, sites 9.47, 9.41, and 9.35 for cut 1.

Department of Transportation objects, citing high costs and limit on type of equipment.
Wisconsin objects, citing reference to Higgen's eye clam in the area of site 9.35.

Motion by Corps of Engineers: Approve, in preferential order, sites 9.47 and 9.41 for cut 1.

Department of Transportation objects, citing unreasonable costs.

Department of the Interior requests caucus.

Caucus results: State result - unanimous support.
Federal result - majority support.

Motion passed.

Motion by Department of the Interior: Approve, in preferential order, sites 9.47 and 9.26 for cut 2; site 9.26 is necessary to ensure needed capacity for cut 2 dredging.

No objection - motion passed.

Motion by Wisconsin on cuts 7, 8, 9, and 10 is brought from the table. Department of the Interior notes that the fish hatchery has expressed willingness to remove material as needed from site 9.15 for its own use.

No objection - motion passed.

POOL 10

Motion by Iowa: Approve selected plan for all cuts in the pool.

Department of Transportation notes site 10.33 was approved by Plan Formulation Work Group subject to approval as a lockage waiting area.

Motion by Wisconsin to amend motion: Delete site 10.33 from consideration. Accepted by Iowa.

Motion by Department of the Interior to amend motion: Substitute site 10.04 for site 10.33. Accepted by Iowa.

Objection by Corps of Engineers - small amount of dredging and setting up pipeline are not worthwhile. The Corps prefers site 10.02 with rehandling.

Motion failed.

Motion by Wisconsin: Approve, in preferential order, sites 10.02 and 10.03 for cut 1.

No objection - motion passed.

Motion by Corps of Engineers: Approve selected plan for cut 3, adding site 10.24 as secondary site for cut 4 for use as a rehandling site for use of site 10.01.

Corps of Engineers amends motion in response to discussion: deleting site 10.24 as a secondary site on cuts 3 and 4 and adding condition that site 10.24 is to be used as the rehandling site with mechanical dredging equipment.

No objection - motion passed.

Motion by Wisconsin: Approve site 10.04 for cut 2.

No objection - motion passed.

Motion by Wisconsin: Approve, in preferential order, sites 10.01 and 10.40 for cuts 5 and 6.

Objection by Department of Transportation - high costs cited.

Objection by Corps of Engineers citing limit on choice of equipment and other reasons.

Motion by Department of the Interior: Approve, in preferential order, sites 10.09 and 10.41T (an area south of Bloody Run Creek and west of Highway 18) for cut 5.

Objection by Wisconsin, citing National Historic Registry status of St. Feriole Island.

Motion by Iowa: Approve, in preferential order, sites 10.41T and 10.09 for cut 5, citing city of Prairie du Chien's land use plans identifying site 10.09 as a possible industrial site.

No objection - motion passed.

Motion to delete site 10.09 as secondary site for cut 5 by Wisconsin approved.

Motion by Department of Transportation: Approve site 10.09 for cut 6.

Objection by Wisconsin, citing high clamming activity in east channel, evidence of Higgen's eye clam in the cut, and low dredging volume.

Department of Transportation called for caucus.

Caucus results: State - against motion.
Federal - for motion by majority.

Motion failed.

Motion by Wisconsin: GREAT should not identify site for cut 6, citing the following rationale:

The GREAT I Team recognizes significant controversy regarding future use of the East Channel of the Mississippi River at Prairie du Chien, Wisconsin (R.M. 633.0 - 636.0L). Elements of this controversy include concentrations of endangered mussel species (Lampsilis Higginsi) located in the historic dredge cut, recognition of cultural resource values at prospective dredged material placement locations, present low frequency use of the channel for bulk commodity movement by barges, active litigation involving barging facility expansion, and anticipated commercial navigation use and facility requirements to the year 2025. The GREAT I Team believes decisions regarding future use and dredging in the East Channel are beyond the scope of GREAT I and must ultimately be addressed by higher authorities (perhaps Congress). On this basis, the GREAT I Team chooses to make no recommendations on this issue.

No objection - motion passed.

Motion by Wisconsin: Approve site 10.40 for cuts 7, 8, 9, and 10.

Motion by Department of Transportation to amend the motion: Consider each cut separately.

For cut 7: no objection - motion passed.
For cut 8: no objection - motion passed.
For cut 9: Corps of Engineers objects, citing possibility of mitigating impacts at sites 10.23 and 10.16.
Department of Transportation objects, citing capacity of site 10.23 to hold all material.

Motion by Department of Transportation: Approve site 10.23 for cut 9.
Department of the Interior and Wisconsin object, citing loss of wetland and secondary erosion potential into Gordon's Bay.

Department of Transportation calls for caucus.

Caucus results: State rejects unanimously.
Federal approve by majority.

Motion failed.

Motion by Wisconsin: Approve site 10.17 for cuts 9 and 10 with removal before seasonal high water. All excess material to go to site 10.40.

Corps of Engineers objects, citing limit on choice of equipment. Department of Transportation objects, citing insufficient capacity at site 10.17; hence, de facto approval of site 10.40 as a primary site which is too costly.

Motion failed.

Motion by Wisconsin: Approve site 10.17 for cut 9 with removal before seasonal high water. All excess material to go to site 10.40.

Corps of Engineers and Department of Transportation object, citing same reasons as for previous motion.

Motion by Corps of Engineers: Approve, in preferential order, sites 10.16 and 10.40 for cut 9 with removal from site 10.16 before high water as beneficial use demand develops with on-site stabilization of remaining material. Approve, in preferential order, sites 10.17 and 10.40 for cut 10 with the same conditions on site 10.17.

No objection - motion passed.

## COST COMPUTATIONS AND COMPARISONS

### INTRODUCTION

Past assumptions have been that the dredging and placement practices required to minimize adverse environmental impacts would probably exceed costs of "present practices" or the manner of dredging before GREAT. The questions have been: "How much more?" and "Is it worth it?"

As in other substantive issues that brought about the formation of GREAT, the study process has clarified information needs, resulted in study/analysis efforts, and developed recommendations to provide the information for improved decision making in the future.

Costs shown in this appendix are still being refined. However, they are accurate enough to provide usable relative costs for different sites for a particular piece of dredging equipment. The cost figures are not accurate enough to compare costs for different dredging equipment types for a particular site.

Quantitative cost estimates were not always available when the Team had to make decisions on the CMP. In these cases, qualitative cost elements, such as distance from cut to placement site and amount of preparatory work required, were considered with other factors in selecting the placement plan.

### COST COMPUTATIONS

In Parts II, III, IV, and V of this appendix, costs are shown for dredging each cut and delivering the dredged material to the recommended placement site. These costs are shown for seven different dredging plants. An example of the display is shown in the following table. The GREAT I Team felt it was most productive to provide a cost estimate to take material to one site versus another by several types of dredging equipment. In that way, the CMP would provide a reasonable choice of placement sites while retaining flexibility of equipment choice. With this approach, it is easy to look at cuts individually or in small groups and reach some conclusions as to equipment choices. However, it is difficult to look at all 105 dredge cuts and make an equipment choice suitable for the entire study area.

Example of format for Channel Maintenance Plan costs per dredging job(1)

Hay Point

| | Types of dredges | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pipeline | | | Mechanical | | | | |
| | | | | Backhoe | | Clamshell | | |
| Placement site 10.16<br>Pool 10 - Cut 9 | 20-inch | 16-inch | 12-inch | 350 HP | 700 HP | 350 HP | 700 HP | Remarks |
| Basic dredging operation | $169,000* | $189,000* | $179,000* | $110,000* | $121,000* | $140,000* | $138,000* | Freq. 25 percent |
| Berming costs | 5,000* | 7,000* | 8,000* | - | - | - | - | Volume = 27,200 cubic yards |
| Diking costs | 7,000 | 7,000 | 5,000 | - | - | - | - | |
| Riprapping costs | 191,000 | 191,000 | 191,000 | 191,000 | 191,000 | 191,000 | 191,000 | |
| Seasonal removal | 65,000* | 65,000* | 65,000* | 65,000* | 65,000* | 65,000* | 65,000* | |
| Special construction | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Land acquisition | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total of GREAT recommended actions | 239,000 | 261,000 | 252,000 | 175,000 | 186,000 | 205,000 | 203,000 | |
| Average annual costs | 59,800 | 65,300 | 63,000 | 43,800 | 46,500 | 51,300 | 50,800 | |

* GREAT recommended actions

(1) See Parts II-V of Volume 8 for full set of Channel Maintenance Plan costs.

The GREAT I Team deliberately chose not to recommend that a specific type of dredge be acquired by the Corps. Instead, the Team recommended that a certain variety of equipment be available - either privately or publicly owned - to take advantage of individual operating characteristics to suit individual sites.

COST COMPARISONS

The data given in the following table attempt to describe the cost of the CMP by adding the average annual costs of dredging each cut into the first priority placement site. This was calculated using an average cost for all hydraulic dredging methods for distances less than 6,000 feet between cut and placement site, and an average cost of all mechanical dredging methods for distances greater than 6,000 feet between cut and placement site. This information is valuable only as an indication of the general scope of the cost of the plan. GREAT's goal was to develop a sound channel maintenance plan using a multidisciplinary approach with secondary consideration for the cost of implementation. To obtain a more precise estimate of the cost of implementing the CMP, several assumptions must be made. These assumptions are the type (or types) of equipment that will be used, what percentage of the work is likely to be done by contract plant, what makes up the dredge plant (e.g., number and size of barges and towboats), what percentage of a worst case year is the plant to be sized for, and in what order would cuts be dredged in a particular year. With these assumptions made, a total cost per year to support the dredging plant and contract work can be calculated.

The GREAT I Team felt that the responsibility for a more detailed analysis properly rests with the Corps and did not proceed beyond the work described in this appendix and the main report. Therefore, costs were a comparative factor, not a determining factor when selecting placement sites for the DMPP.

Estimated average annual costs for the GREAT I Channel Maintenance Plan(1)

| Pool | Dredge cut | Place-ment site | Dredging cost | Frequency (percent) | Job longevity (years) | Average annual cost |
|---|---|---|---|---|---|---|
| **Minnesota River** | | | | | | |
| MN | 1 | 2.18 | $55,000 | 30 | 3.3 | $16,500 |
| MN | 2 | MN.28 | 58,000 | 10 | 10 | 8,800 |
| MN | 3 | MN.30 | 238,000 | 25 | 4 | 59,500 |
| MN | 4 | MN.03 | 30,000 | 30 | 3.3 | 9,000 |
| MN | 5 | MN.03 | 55,000 | 40 | 2.5 | 22,000 |
| Total for Minnesota River pool | | | | | | 115,800 |
| **St. Croix River** | | | | | | |
| SC | 1 | SC.12 | 116,000 | 40 | 2.5 | 46,400 |
| SC | 2 | SC.21 | 94,000 | 5 | 20.0 | 4,700 |
| SC | 3 | SC.01 | 466,000 | 15 | 6.7 | 69,900 |
| Total for St. Croix River pool | | | | | | 121,000 |
| **Upper St. Anthony Falls pool** | | | | | | |
| U | 1 | U.02 | 78,000 | 65 | 1.5 | 50,700 |
| U | 2 | U.02 | 134,000 | 55 | 1.8 | 73,700 |
| U | 3 | U.02 | 130,000 | 35 | 2.9 | 45,500 |
| Total for Upper St. Anthony Falls pool | | | | | | 169,900 |
| **Pool 1** | | | | | | |
| 1 | 1 | 1.01 | 122,000 | 30 | 3.3 | 36,600 |
| 1 | 2 | 1.01 | 369,000 | 20 | 5 | 73,800 |
| 1 | 3 | 1.01 | 99,000 | 55 | 1.8 | 54,500 |
| 1 | 4 | 1.01 | 139,000 | 50 | 2 | 69,500 |
| 1 | 5 | 1.01 | 134,000 | 45 | 2.2 | 60,300 |
| 1 | 6 | 1.01 | 114,000 | 55 | 1.8 | 62,700 |
| 1 | 7 | 1.01 | 80,000 | 90 | 1.1 | 72,000 |
| Total for pool 1 | | | | | | 429,400 |

Estimated average annual costs for the GREAT I Channel Maintenance Plan[1] (Cont)

| Pool | Dredge cut | Place-ment site | Dredging cost | Frequency (percent) | Job longevity (years) | Average annual cost |
|---|---|---|---|---|---|---|
| Pool 2 | | | | | | |
| 2 | 1 | 2.30 | $53,000 | 10 | 10 | $5,300 |
| 2 | 2 | 2.35 | 224,000 | 10 | 10 | 22,400 |
| 2 | 3 | 2.35 | 448,000 | 10 | 10 | 44,800 |
| 2 | 4 | 2.10 | 196,000 | 40 | 2.5 | 78,400 |
| 2 | 5 | 2.10 | 172,000 | 20 | 5 | 34,400 |
| 2 | 6 | 2.10 | 60,000 | 20 | 5 | 12,000 |
| 2 | 7 | 2.02 | 312,000 | 60 | 1.7 | 187,200 |
| 2 | 8 | 2.16 | 72,000 | 40 | 2.5 | 28,800 |
| 2 | 9 | 2.37 | 61,000 | 75 | 1.3 | 45,800 |
| Total for pool 2 | | | | | | 459,100 |
| Pool 3 | | | | | | |
| 3 | 1 | 3.09 | 170,000 | 25 | 4 | 42,500 |
| 3 | 2 | 3.09 | 148,000 | 20 | 5 | 29,600 |
| 3 | 3 | 3.09 | 252,000 | 20 | 5 | 50,400 |
| 3 | 4 | 3.27 | 162,000 | 30 | 3.3 | 49,100 |
| 3 | 5 | 3.27 | 187,000 | 30 | 3.3 | 56,700 |
| 3 | 6 | 3.27 | 141,000 | 10 | 10 | 14,100 |
| 3 | 7 | 3.46 | 127,000 | 30 | 3.3 | 38,500 |
| 3 | 8 | 3.46 | 25,000 | 10 | 10 | 2,500 |
| 3 | 9 | 3.47T | 50,000 | 15 | 6.7 | 7,500 |
| Total for pool 3 | | | | | | 290,900 |
| Pool 4 | | | | | | |
| 4 | 1 | 4.02 | 58,000 | 40 | 2.5 | 23,200 |
| 4 | 2 | 4.02 | 165,000 | 35 | 2.9 | 56,900 |
| 4 | 3 | 4.02 | 144,000 | 75 | 1.3 | 110,800 |
| 4 | 4 | 4.25 | 118,000 | 70 | 1.4 | 84,300 |
| 4 | 5 | 4.24 | 1,161,000 | 65 | 1.5 | 774,000 |
| 4 | 6 | 4.37 | 437,000 | 10 | 10 | 43,700 |
| 4 | 7 | 4.49 | 150,000 | 25 | 4 | 37,500 |
| 4 | 8 | 4.57 | 87,000 | 10 | 10 | 8,700 |
| 4 | 9 | 4.57 | 221,000 | 20 | 5 | 44,200 |
| 4 | 10 | 4.63 | 169,000 | 10 | 10 | 16,900 |
| 4 | 11 | 4.57 | 88,300 | 10 | 10 | 8,800 |
| Total for pool 4 | | | | | | 1,209,000 |
| Pool 5 | | | | | | |
| 5 | 1 | 5.30 | 91,000 | 15 | 2.7 | 33,700 |
| 5 | 2 | 5.30 | 119,000 | 30 | 3.3 | 36,100 |
| 5 | 3 | 5.30 | 79,000 | 60 | 1.7 | 46,500 |
| 5 | 4 | 5.30 | 97,000 | 65 | 1.5 | 64,700 |
| 5 | 5 | 5.26T | 68,000 | 65 | 1.5 | 45,300 |
| 5 | 6 | 5.26T | 173,000 | 35 | 2.9 | 59,700 |
| 5 | 7 | 5.26T | 154,000 | 25 | 4 | 38,500 |
| 5 | 8 | 5.26T | 36,000 | 30 | 3.3 | 10,900 |
| Total for pool 5 | | | | | | 335,400 |

Estimated average annual costs for the GREAT I Channel Maintenance Plan[1] (Cont)

| Pool | Dredge cut | Placement site | Dredging cost | Frequency (percent) | Job longevity (years) | Average annual cost |
|---|---|---|---|---|---|---|
| **Pool 5A** | | | | | | |
| 5A | 1 | 5A.32 | $194,000 | 25 | 4 | $48,500 |
| 5A | 2 | 5A.32 | 86,000 | 35 | 2.9 | 29,600 |
| 5A | 3 | 5A.32 | 117,000 | 35 | 2.9 | 40,300 |
| 5A | 4 | 5A.25 | 135,000 | 30 | 3.3 | 40,900 |
| 5A | 5 | 5A.23 | 155,000 | 50 | 2 | 77,500 |
| 5A | 6 | 5A.23 | 86,000 | 5 | 20 | 4,300 |
| Total for pool 5A | | | | | | 241,100 |
| **Pool 6** | | | | | | |
| 6 | 1 | 6.17 | 147,000 | 30 | 3.3 | 44,500 |
| 6 | 2 | 6.17 | 52,000 | 15 | 6.7 | 7,800 |
| 6 | 3 | 6.17 | 184,000 | 30 | 3.3 | 55,800 |
| 6 | 4 | 6.19 | 123,000 | 20 | 5 | 24,600 |
| 6 | 5 | 6.27 | 32,000 | 30 | 3.3 | 9,700 |
| 6 | 6 | 6.27 | 37,000 | 40 | 2.5 | 14,800 |
| Total for pool 6 | | | | | | 157,200 |
| **Pool 7** | | | | | | |
| 7 | 1 | 7.20T | 112,000 | 10 | 10 | 11,200 |
| 7 | 2 | 7.20T | 143,000 | 25 | 4 | 35,800 |
| 7 | 3 | 7.06 | 111,000 | 45 | 2.2 | 50,500 |
| 7 | 4 | 7.06 | 145,000 | 40 | 2.5 | 58,000 |
| 7 | 5 | 7.06 | 97,000 | 10 | 10 | 9,700 |
| 7 | 6 | 7.05 | 183,000 | 35 | 2.9 | 63,100 |
| 7 | 7 | 7.06 | 58,000 | 10 | 10 | 5,800 |
| Total for pool 7 | | | | | | 234,100 |
| **Pool 8** | | | | | | |
| 8 | 1 | 8.22 | 92,000 | 5 | 20 | 4,600 |
| 8 | 2 | 8.22 | 90,000 | 5 | 20 | 4,500 |
| 8 | 3 | 8.30T | 167,000 | 15 | 6.7 | 24,900 |
| 8 | 4 | 8.30T | 185,000 | 50 | 2 | 92,500 |
| 8 | 5 | 8.30T | 115,000 | 55 | 1.9 | 60,500 |
| 8 | 6 | 8.06 | 207,000 | 60 | 1.7 | 121,800 |
| 8 | 7 | 8.06 | 169,000 | 15 | 6.7 | 25,200 |
| 8 | 8 | 8.06 | 130,000 | 10 | 10 | 13,000 |
| 8 | 9 | 8.06 | 96,000 | 20 | 5 | 19,200 |
| 8 | 10 | 8.28 | 102,000 | 25 | 4 | 25,500 |
| Total for pool 8 | | | | | | 391,700 |
| **Pool 9** | | | | | | |
| 9 | 1 | 9.47 | 138,000 | 5 | 20 | 6,900 |
| 9 | 2 | 9.47 | 99,000 | 5 | 20 | 4,900 |
| 9 | 3 | 9.26 | 83,000 | 60 | 1.7 | 48,800 |
| 9 | 4 | 9.07 | 218,000 | 25 | 4 | 54,500 |
| 9 | 5 | 9.07 | 188,000 | 5 | 20 | 9,400 |
| 9 | 6 | 9.11 | 120,000 | 30 | 3.3 | 36,400 |
| 9 | 7 | 9.15 | 37,000 | 5 | 20 | 1,900 |
| 9 | 8 | 9.15 | 91,000 | 45 | 2.2 | 41,400 |
| 9 | 9 | 9.15 | 120,000 | 25 | 4 | 30,000 |
| 9 | 10 | 9.15 | 92,000 | 10 | 10 | 9,200 |
| Total for pool 9 | | | | | | 243,400 |

Estimated average annual costs for the GREAT I Channel Maintenance Plan[1] (Cont)

| Pool | Dredge cut | Placement site | Dredging cost | Frequency (percent) | Job longevity (years) | Average annual cost |
|---|---|---|---|---|---|---|
| Pool 10 | | | | | | |
| 10 | 1 | 10.02 | $170,000 | 5 | 20 | $8,500 |
| 10 | 2 | 10.04 | 113,000 | 20 | 5 | 22,600 |
| 10 | 3 | 10.01 | 56,000 | 30 | 3.3 | 17,000 |
| 10 | 4 | 10.01 | 51,000 | 5 | 20 | 2,600 |
| 10 | 5 | 10.41T | 132,000 | 5 | 20 | 6,600 |
| 10 | 6 | No site selected | | | | |
| 10 | 7 | 10.40 | 162,000 | 10 | 10 | 16,200 |
| 10 | 8 | 10.40 | 205,000 | 25 | 4 | 51,300 |
| 10 | 9 | 10.16 | 110,000 | 25 | 4 | 27,500 |
| 10 | 10 | 10.17 | 29,000 | 5 | 20 | 1,500 |
| Total for pool 10 | | | | | | 153,800 |
| Total | | | | | | 4,551,800 |

(1) Only primary sites are shown. All costs are estimated as if preparing a Government estimate for a dredging contract. Included are mobilization costs to and from Fountain City for each job. Price levels are 1978 averages. See section on "Cost Comparisons" for a discussion on the accuracy of these cost estimates.

## CHAPTER 9

## PROCEDURE FOR ESTIMATING EROSION PROTECTION COSTS AT MATERIAL PLACEMENT SITES

Generally, GREAT I agreed with the philosophy that material should be removed from the floodplain to eliminate impacts on wildlife habitat from direct placement and secondary movement. However, the GREAT I recommended channel maintenance plan recognizes that funding limitations and other considerations will prevent removal of all material from the floodplain. In many cases where material is to be left in the floodplain, it should be stabilized to prevent secondary movement. In some cases, riprap is the desired means of stabilization. In other cases, careful placement of the material, shaping of slopes, vegetative buffer zones, or revegetation can accomplish the same results.

Riprap reduces the value of the area for recreation. It also makes it much more difficult to restore a site to near natural conditions if in the future the site is no longer needed. Riprap placed below the waterline is desirable for fish habitat.

Cost estimates of riprap called for in the Dredged Material Placement Plan (DMPP) were developed by adapting standard design procedures for riprap used by the Corps of Engineers into a general form which could be used for any site. The final cost estimates shown in the table on page 116 provide for riprap designed to protect placement sites up to a 5-year flood stage. The cost estimates may vary as a result of site-specific design specifications.

Cost estimates were based, in part, on the following design criteria:

1. Riprap thickness for the placement sites would be 12 or 18 inches depending on the site location. On "straight" river stretches, on the inside of bends, and in backwaters, 12-inches of riprap would be used. On the outside of bends, 18 inches of riprap would be used.

2. Riprap placed below water (low control pool elevation) would be 50 percent thicker than riprap placed above water.

3. All riprap would have a bedding or base layer to support it. This gravel bedding would be one-half the thickness of the riprap blanket it supports.

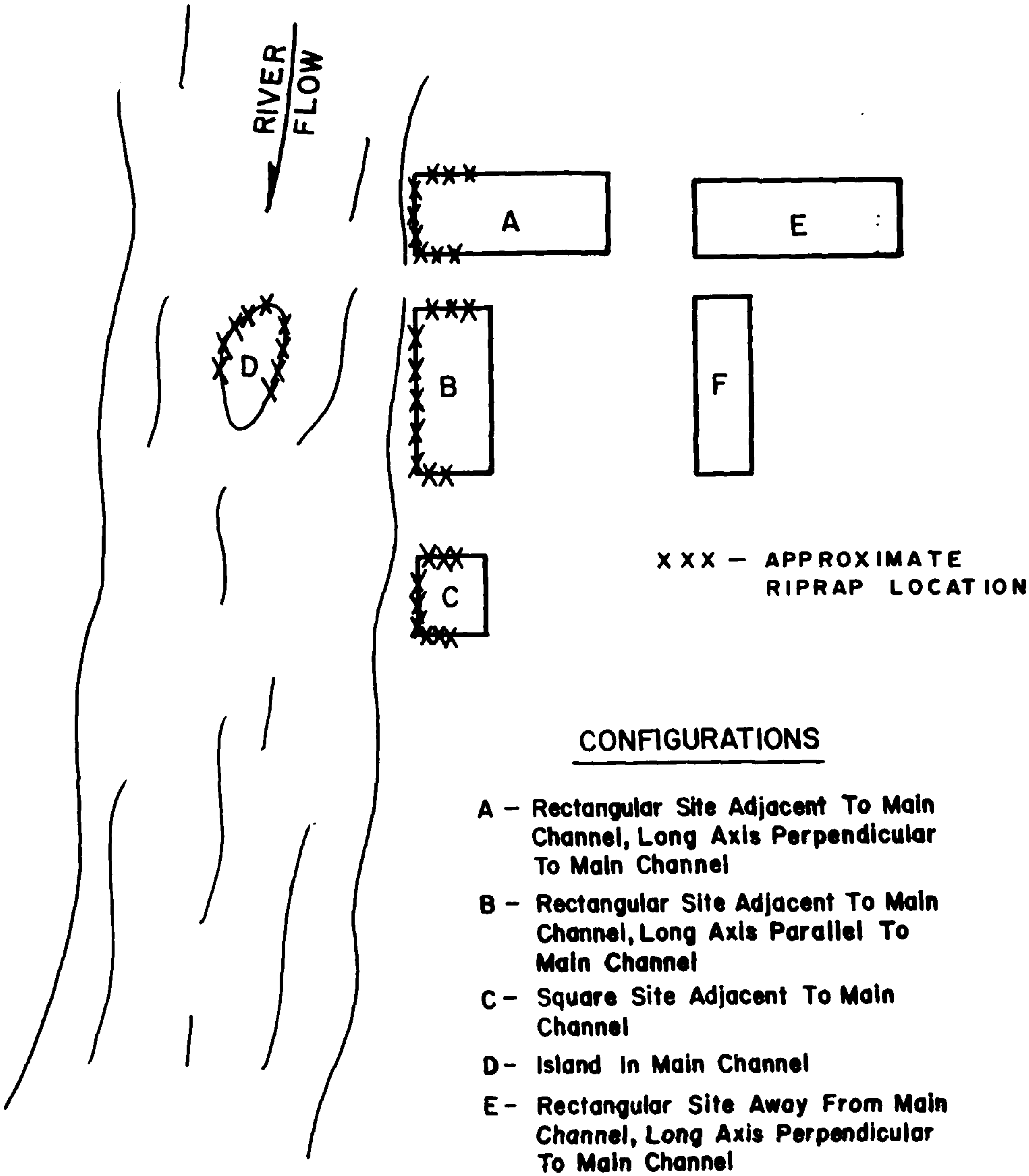
4. Riprap slope ratios would be 4 (horizontal) to 1 (vertical).

5. The structures would be built of graded rock.

6. The structures would meet Corps construction standards.

Using these basic criteria, general riprap costs were calculated for necessary placement sites assuming that the sites would fit one of six configurations (see the following figure). The configuration of the site would determine how much and what type of riprap would be needed to protect a dredged material placement site from erosion. Configurations "E" and "F" represent sites off the main channel. These sites are less subject to erosion than configurations "A" through "D". Therefore, no riprap costs were calculated for placement sites fitting configurations "E" or "F" unless the sites were in or on open water where they would be subject to erosion caused by boat wakes or wind.

Riprap cost estimates were further refined according to four general designs or typical cross sections of the riprap blanket constructed. The figure on page 113 shows the designs used to calculate the costs. Design I would be used in backwater areas to protect against erosion from boat wakes. Design II would be used on sites in the floodplain on stable land. Design III would be used for sites directly on the riverbank, and Design IV would be used for sites on riverbanks already showing erosion problems. The riprap structures were designed to protect against 5-year flood stages.




## CONFIGURATIONS

A – Rectangular Site Adjacent To Main Channel, Long Axis Perpendicular To Main Channel

B – Rectangular Site Adjacent To Main Channel, Long Axis Parallel To Main Channel

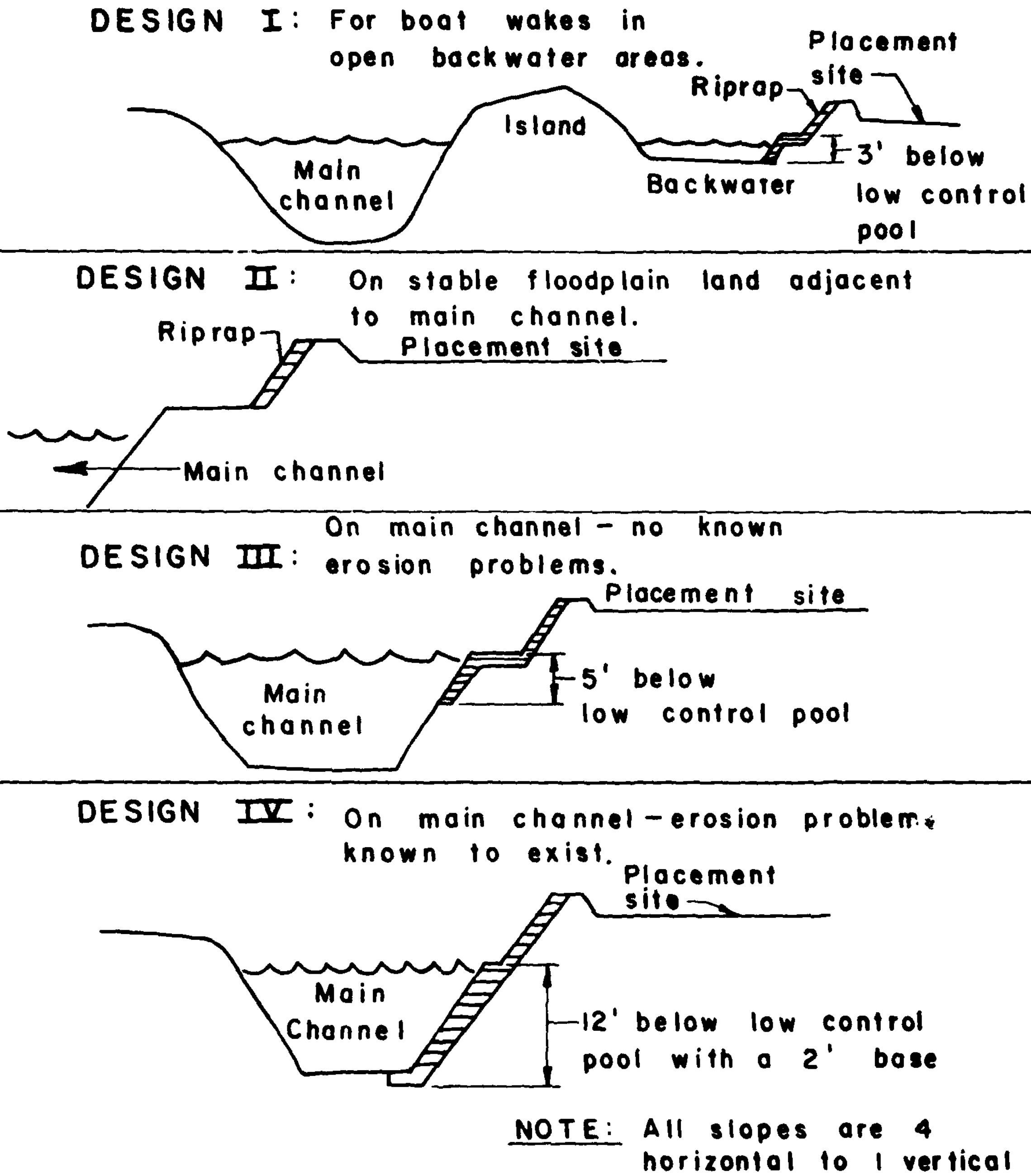
C – Square Site Adjacent To Main Channel

D – Island In Main Channel

E – Rectangular Site Away From Main Channel, Long Axis Perpendicular To Main Channel

F – Rectangular Site Away From Main Channel, Long Axis Parallel To Main Channel

TYPICAL PLACEMENT SITE CONFIGURATIONS USED TO CALCULATE RIPRAP COST




**TYPICAL CROSS-SECTIONAL DESIGNS USED TO CALCULATE RIPRAP COST**

The table on page 116 displays cost estimates for riprap protection. Each combination of site configuration and typical cross section is shown for both a location on the outside of a river bend (requiring 18-inch layers of riprap) and areas other than the outside of a bend (requiring 12-inch layers of riprap). The drawings from the figures on pages 112 and 113 are duplicated on the table. The perimeter shown in the table is the total distance around the placement site. The length of this perimeter, which is presumed to be riprapped, is in the proportion shown on the site configuration. To determine the difference in elevation from low control pool to 5-year flood elevation for a particular site, refer to the detailed site description in Parts II-V of this appendix.

By following a step-by-step procedure using the following table, the approximate cost of riprapping a site (average 1978 dollars) can easily be found:

Step 1: Determine which of the four site configurations (shown at the top of each section) most closely resembles the site in question. Turn to the first section of the table with that configuration shown.

Step 2: Determine which of the four typical cross sections (shown under the site configuration) most closely resembles the site in question. Turn to the first section of the table with that cross section.

Step 3: Determine if the site is on the outside of a main channel bend (subject to direct erosion from current) or in some other location. Turn to the page with the appropriate statement shown between the two graphic illustrations. This is the page on which you will find the dollar value desired.

Step 4: Determine how far above the low control pool elevation the riprap should extend. Find the column heading with this value. The table heading refers to a 5-year flood elevation. GREAT I used this point for estimating the amount of riprap needed.

Step 5: Go down this column to the value opposite the perimeter of the site in question. This figure is the estimate of the cost of riprapping the site.

By comparing charts or columns, you will be able to interpolate values for particular situations which may not fit the tables exactly.

The illustration for the site configuration shows the ratio between riprapped and unriprapped perimeter used on each section of the table.

```
  Q             S
  Q             S
  Q             S
  Q             S
  Q             OCXXXXXXXXXXXX          APPROXIMATE
  Q             C           X
  Q             C           X           RIPRAP
  Q             OCXXXXXXXXXXXX
G Q G           S                       COSTS
 QQQ            S
  Q             S
                S       SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                                 XXXXX
                                X
                               O -----5 YEAR
                   FLOWING    C
              XXXX  BACKWATER C
 - - - - - - -X    X- - - - - -C --------LOW CONTROL POOL
   MAIN       X     X         C  3 FEET
             X       XXXXXXXXO ----------
   CHANNEL   X
            X
           X
 XXXXXXXXX              TYPICAL CROSS SECTION
```

LEGEND
- O - RIPRAP IN PLACE
- S - SHORE LINE
- Q - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 3458. | $ 4522. | $ 5586. | $ 6650. | $ 7714. | $ 8778. | $ 9842. |
| 1000. | $ 6916. | $ 9044. | $ 11172. | $ 13300. | $ 15428. | $ 17556. | $ 19684. |
| 1500. | $ 10374. | $ 13566. | $ 16758. | $ 19950. | $ 23142. | $ 26334. | $ 29526. |
| 2000. | $ 13832. | $ 18088. | $ 22344. | $ 26600. | $ 30856. | $ 35112. | $ 39368. |
| 2500. | $ 17290. | $ 22610. | $ 27930. | $ 33250. | $ 38570. | $ 43890. | $ 49210. |
| 3000. | $ 20748. | $ 27132. | $ 33516. | $ 39900. | $ 46284. | $ 52668. | $ 59052. |
| 3500. | $ 24206. | $ 31654. | $ 39102. | $ 46550. | $ 53998. | $ 61446. | $ 68894. |
| 4000. | $ 27664. | $ 36176. | $ 44688. | $ 53200. | $ 61712. | $ 70224. | $ 78736. |
| 4500. | $ 31122. | $ 40698. | $ 50274. | $ 59850. | $ 69426. | $ 79002. | $ 88578. |
| 5000. | $ 34580. | $ 45220. | $ 55860. | $ 66500. | $ 77140. | $ 87780. | $ 98420. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 38038. | $ 49742. | $ 61446. | $ 73150. | $ 84854. | $ 96558. | $ 108262. |
| 6000. | $ 41496. | $ 54264. | $ 67032. | $ 79800. | $ 92568. | $ 105336. | $ 118104. |
| 6500. | $ 44954. | $ 58786. | $ 72618. | $ 86450. | $ 100282. | $ 114114. | $ 127946. |
| 7000. | $ 48412. | $ 63308. | $ 78204. | $ 93100. | $ 107996. | $ 122892. | $ 137788. |
| 7500. | $ 51870. | $ 67830. | $ 83790. | $ 99750. | $ 115710. | $ 131670. | $ 147630. |
| 8000. | $ 55328. | $ 72352. | $ 89376. | $ 106400. | $ 123424. | $ 140448. | $ 157472. |
| 8500. | $ 58786. | $ 76874. | $ 94962. | $ 113050. | $ 131138. | $ 149226. | $ 167314. |
| 9000. | $ 62244. | $ 81396. | $ 100548. | $ 119700. | $ 138852. | $ 158004. | $ 177156. |
| 9500. | $ 65702. | $ 85918. | $ 106134. | $ 126350. | $ 146566. | $ 166782. | $ 186998. |
| 10000. | $ 69160. | $ 90440. | $ 111720. | $ 133000. | $ 154280. | $ 175560. | $ 196840. |
| 10500. | $ 72618. | $ 94962. | $ 117306. | $ 139650. | $ 161994. | $ 184338. | $ 206682. |
| 11000. | $ 76076. | $ 99484. | $ 122892. | $ 146300. | $ 169708. | $ 193116. | $ 216524. |
| 11500. | $ 79534. | $ 104006. | $ 128478. | $ 152950. | $ 177422. | $ 201894. | $ 226366. |
| 12000. | $ 82992. | $ 108528. | $ 134064. | $ 159600. | $ 185136. | $ 210672. | $ 236208. |
| 12500. | $ 86450. | $ 113050. | $ 139650. | $ 166250. | $ 192850. | $ 219450. | $ 246050. |
| 13000. | $ 89908. | $ 117572. | $ 145236. | $ 172900. | $ 200564. | $ 228228. | $ 255892. |
| 13500. | $ 93366. | $ 122094. | $ 150822. | $ 179550. | $ 208278. | $ 237006. | $ 265734. |
| 14000. | $ 96824. | $ 126616. | $ 156408. | $ 186200. | $ 215992. | $ 245784. | $ 275576. |
| 14500. | $ 100282. | $ 131138. | $ 161994. | $ 192850. | $ 223706. | $ 254562. | $ 285418. |
| 15000. | $ 103740. | $ 135660. | $ 167580. | $ 199500. | $ 231420. | $ 263340. | $ 295260. |
| 15500. | $ 107198. | $ 140182. | $ 173166. | $ 206150. | $ 239134. | $ 272118. | $ 305102. |
| 16000. | $ 110656. | $ 144704. | $ 178752. | $ 212800. | $ 246848. | $ 280896. | $ 314944. |
| 16500. | $ 114114. | $ 149226. | $ 184338. | $ 219450. | $ 254562. | $ 289674. | $ 324786. |
| 17000. | $ 117572. | $ 153748. | $ 189924. | $ 226100. | $ 262276. | $ 298452. | $ 334628. |
| 17500. | $ 121030. | $ 158270. | $ 195510. | $ 232750. | $ 269990. | $ 307230. | $ 344470. |
| 18000. | $ 124488. | $ 162792. | $ 201096. | $ 239400. | $ 277704. | $ 316008. | $ 354312. |
| 18500. | $ 127946. | $ 167314. | $ 206682. | $ 246050. | $ 285418. | $ 324786. | $ 364154. |
| 19000. | $ 131404. | $ 171836. | $ 212268. | $ 252700. | $ 293132. | $ 333564. | $ 373996. |
| 19500. | $ 134862. | $ 176358. | $ 217854. | $ 259350. | $ 300846. | $ 342342. | $ 383838. |
| 20000. | $ 138320. | $ 180880. | $ 223440. | $ 266000. | $ 308560. | $ 351120. | $ 393680. |
| 20500. | $ 141778. | $ 185402. | $ 229026. | $ 272650. | $ 316274. | $ 359898. | $ 403522. |
| 21000. | $ 145236. | $ 189924. | $ 234612. | $ 279300. | $ 323988. | $ 368676. | $ 413364. |
| 21500. | $ 148694. | $ 194446. | $ 240198. | $ 285950. | $ 331702. | $ 377454. | $ 423206. |
| 22000. | $ 152152. | $ 198968. | $ 245784. | $ 292600. | $ 339416. | $ 386232. | $ 433048. |
| 22500. | $ 155610. | $ 203490. | $ 251370. | $ 299250. | $ 347130. | $ 395010. | $ 442890. |

```
     Q              S
     Q              S
     Q              S
     Q              S
     Q              SOOXXXXXXXXXXXX                   APPROXIMATE
     Q              SO            X
     Q              SO            X                   RIPRAP
     Q              SOOXXXXXXXXXXXX
   Q Q Q            S                                 COSTS
    QQQ             S
     Q              S
                    S       SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                                   XXXXX
                                  X
                                 O -----5 YEAR
                       FLOWING  O
                XXXX  BACKWATER O
- - - - - - - -X    X- - - - - -O ---------LOW CONTROL POOL
  MAIN        X    X           O  3 FEET
             X      XXXXXXXXO ----------
  CHANNEL   X
           X
          X
XXXXXXXXX               TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 2311. | $ 3023. | $ 3734. | $ 4445. | $ 5156. | $ 5867. | $ 6579. |
| 1000. | $ 4623. | $ 6045. | $ 7468. | $ 8890. | $ 10312. | $ 11735. | $ 13157. |
| 1500. | $ 6934. | $ 9068. | $ 11201. | $ 13335. | $ 15469. | $ 17602. | $ 19736. |
| 2000. | $ 9246. | $ 12090. | $ 14935. | $ 17780. | $ 20625. | $ 23470. | $ 26314. |
| 2500. | $ 11557. | $ 15113. | $ 18669. | $ 22225. | $ 25781. | $ 29337. | $ 32893. |
| 3000. | $ 13868. | $ 18136. | $ 22403. | $ 26670. | $ 30937. | $ 35204. | $ 39472. |
| 3500. | $ 16180. | $ 21158. | $ 26137. | $ 31115. | $ 36093. | $ 41072. | $ 46050. |
| 4000. | $ 18491. | $ 24181. | $ 29870. | $ 35560. | $ 41250. | $ 46939. | $ 52629. |
| 4500. | $ 20803. | $ 27203. | $ 33604. | $ 40005. | $ 46406. | $ 52807. | $ 59207. |
| 5000. | $ 23114. | $ 30226. | $ 37338. | $ 44450. | $ 51562. | $ 58674. | $ 65786. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 25425. | $ 33249. | $ 41072. | $ 48895. | $ 56718. | $ 64541. | $ 72365. |
| 6000. | $ 27737. | $ 36271. | $ 44806. | $ 53340. | $ 61874. | $ 70409. | $ 78943. |
| 6500. | $ 30048. | $ 39294. | $ 48539. | $ 57785. | $ 67031. | $ 76276. | $ 85522. |
| 7000. | $ 32360. | $ 42316. | $ 52273. | $ 62230. | $ 72187. | $ 82144. | $ 92100. |
| 7500. | $ 34671. | $ 45339. | $ 56007. | $ 66675. | $ 77343. | $ 88011. | $ 98679. |
| 8000. | $ 36982. | $ 48362. | $ 59741. | $ 71120. | $ 82499. | $ 93878. | $ 105258. |
| 8500. | $ 39294. | $ 51384. | $ 63475. | $ 75565. | $ 87655. | $ 99746. | $ 111836. |
| 9000. | $ 41605. | $ 54407. | $ 67208. | $ 80010. | $ 92812. | $ 105613. | $ 118415. |
| 9500. | $ 43917. | $ 57429. | $ 70942. | $ 84455. | $ 97968. | $ 111481. | $ 124993. |
| 10000. | $ 46228. | $ 60452. | $ 74676. | $ 88900. | $ 103124. | $ 117348. | $ 131572. |
| 10500. | $ 48539. | $ 63475. | $ 78410. | $ 93345. | $ 108280. | $ 123215. | $ 138151. |
| 11000. | $ 50851. | $ 66497. | $ 82144. | $ 97790. | $ 113436. | $ 129083. | $ 144729. |
| 11500. | $ 53162. | $ 69520. | $ 85877. | $ 102235. | $ 118593. | $ 134950. | $ 151308. |
| 12000. | $ 55474. | $ 72542. | $ 89611. | $ 106680. | $ 123749. | $ 140818. | $ 157886. |
| 12500. | $ 57785. | $ 75565. | $ 93345. | $ 111125. | $ 128905. | $ 146685. | $ 164465. |
| 13000. | $ 60096. | $ 78588. | $ 97079. | $ 115570. | $ 134061. | $ 152552. | $ 171044. |
| 13500. | $ 62408. | $ 81610. | $ 100813. | $ 120015. | $ 139217. | $ 158420. | $ 177622. |
| 14000. | $ 64719. | $ 84633. | $ 104546. | $ 124460. | $ 144374. | $ 164287. | $ 184201. |
| 14500. | $ 67031. | $ 87655. | $ 108280. | $ 128905. | $ 149530. | $ 170155. | $ 190779. |
| 15000. | $ 69342. | $ 90678. | $ 112014. | $ 133350. | $ 154686. | $ 176022. | $ 197358. |
| 15500. | $ 71653. | $ 93701. | $ 115748. | $ 137795. | $ 159842. | $ 181889. | $ 203937. |
| 16000. | $ 73965. | $ 96723. | $ 119482. | $ 142240. | $ 164998. | $ 187757. | $ 210515. |
| 16500. | $ 76276. | $ 99746. | $ 123215. | $ 146685. | $ 170155. | $ 193624. | $ 217094. |
| 17000. | $ 78588. | $ 102768. | $ 126949. | $ 151130. | $ 175311. | $ 199492. | $ 223672. |
| 17500. | $ 80899. | $ 105791. | $ 130683. | $ 155575. | $ 180467. | $ 205359. | $ 230251. |
| 18000. | $ 83210. | $ 108814. | $ 134417. | $ 160020. | $ 185623. | $ 211226. | $ 236830. |
| 18500. | $ 85522. | $ 111836. | $ 138151. | $ 164465. | $ 190779. | $ 217094. | $ 243408. |
| 19000. | $ 87833. | $ 114859. | $ 141884. | $ 168910. | $ 195936. | $ 222961. | $ 249987. |
| 19500. | $ 90145. | $ 117881. | $ 145618. | $ 173355. | $ 201092. | $ 228829. | $ 256565. |
| 20000. | $ 92456. | $ 120904. | $ 149352. | $ 177800. | $ 206248. | $ 234696. | $ 263144. |
| 20500. | $ 94767. | $ 123927. | $ 153086. | $ 182245. | $ 211404. | $ 240563. | $ 269723. |
| 21000. | $ 97079. | $ 126949. | $ 156820. | $ 186690. | $ 216560. | $ 246431. | $ 276301. |
| 21500. | $ 99390. | $ 129972. | $ 160553. | $ 191135. | $ 221717. | $ 252298. | $ 282880. |
| 22000. | $ 101702. | $ 132994. | $ 164287. | $ 195580. | $ 226873. | $ 258166. | $ 289458. |
| 22500. | $ 104013. | $ 136017. | $ 168021. | $ 200025. | $ 232029. | $ 264033. | $ 296037. |

```
  O                    S
  O                    S
  O                    S
  O                    S
  O                    OOXXXXXXXXXXXX
  O                    O            X
  O                    O            X
  O                    OOXXXXXXXXXXXX
O O O                  S
 OOO                   S
  O                    S
                       S         SITE CONFIGURATION
```

APPROXIMATE

RIPRAP

COSTS

OUTSIDE OF BENDS

```
                            XXXXX
                           X
                          O -----5 YEAR
                         O
                        O
- - - - - - - -XXXO --------LOW CONTROL POOL
   MAIN        X
              X
  CHANNEL    X
            X
           X
XXXXXXXXX          TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 1064. | $ 2128. | $ 3192. | $ 4256. | $ 5320. | $ 6384. | $ 7448. |
| 1000. | $ 2128. | $ 4256. | $ 6384. | $ 8512. | $ 10640. | $ 12768. | $ 14896. |
| 1500. | $ 3192. | $ 6384. | $ 9576. | $ 12768. | $ 15960. | $ 19152. | $ 22344. |
| 2000. | $ 4256. | $ 8512. | $ 12768. | $ 17024. | $ 21280. | $ 25536. | $ 29792. |
| 2500. | $ 5320. | $ 10640. | $ 15960. | $ 21280. | $ 26600. | $ 31920. | $ 37240. |
| 3000. | $ 6384. | $ 12768. | $ 19152. | $ 25536. | $ 31920. | $ 38304. | $ 44688. |
| 3500. | $ 7448. | $ 14896. | $ 22344. | $ 29792. | $ 37240. | $ 44688. | $ 52136. |
| 4000. | $ 8512. | $ 17024. | $ 25536. | $ 34048. | $ 42560. | $ 51072. | $ 59584. |
| 4500. | $ 9576. | $ 19152. | $ 28728. | $ 38304. | $ 47880. | $ 57456. | $ 67032. |
| 5000. | $ 10640. | $ 21280. | $ 31920. | $ 42560. | $ 53200. | $ 63840. | $ 74480. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 11704. | $ 23408. | $ 35112. | $ 46816. | $ 58520. | $ 70224. | $ 81928. |
| 6000. | $ 12768. | $ 25536. | $ 38304. | $ 51072. | $ 63840. | $ 76608. | $ 89376. |
| 6500. | $ 13832. | $ 27664. | $ 41496. | $ 55328. | $ 69160. | $ 82992. | $ 96824. |
| 7000. | $ 14896. | $ 29792. | $ 44688. | $ 59584. | $ 74480. | $ 89376. | $ 104272. |
| 7500. | $ 15960. | $ 31920. | $ 47880. | $ 63840. | $ 79800. | $ 95760. | $ 111720. |
| 8000. | $ 17024. | $ 34048. | $ 51072. | $ 68096. | $ 85120. | $ 102144. | $ 119168. |
| 8500. | $ 18088. | $ 36176. | $ 54264. | $ 72352. | $ 90440. | $ 108528. | $ 126616. |
| 9000. | $ 19152. | $ 38304. | $ 57456. | $ 76608. | $ 95760. | $ 114912. | $ 134064. |
| 9500. | $ 20216. | $ 40432. | $ 60648. | $ 80864. | $ 101080. | $ 121296. | $ 141512. |
| 10000. | $ 21280. | $ 42560. | $ 63840. | $ 85120. | $ 106400. | $ 127680. | $ 148960. |
| 10500. | $ 22344. | $ 44688. | $ 67032. | $ 89376. | $ 111720. | $ 134064. | $ 156408. |
| 11000. | $ 23408. | $ 46816. | $ 70224. | $ 93632. | $ 117040. | $ 140448. | $ 163856. |
| 11500. | $ 24472. | $ 48944. | $ 73416. | $ 97888. | $ 122360. | $ 146832. | $ 171304. |
| 12000. | $ 25536. | $ 51072. | $ 76608. | $ 102144. | $ 127680. | $ 153216. | $ 178752. |
| 12500. | $ 26600. | $ 53200. | $ 79800. | $ 106400. | $ 133000. | $ 159600. | $ 186200. |
| 13000. | $ 27664. | $ 55328. | $ 82992. | $ 110656. | $ 138320. | $ 165984. | $ 193648. |
| 13500. | $ 28728. | $ 57456. | $ 86184. | $ 114912. | $ 143640. | $ 172368. | $ 201096. |
| 14000. | $ 29792. | $ 59584. | $ 89376. | $ 119168. | $ 148960. | $ 178752. | $ 208544. |
| 14500. | $ 30856. | $ 61712. | $ 92568. | $ 123424. | $ 154280. | $ 185136. | $ 215992. |
| 15000. | $ 31920. | $ 63840. | $ 95760. | $ 127680. | $ 159600. | $ 191520. | $ 223440. |
| 15500. | $ 32984. | $ 65968. | $ 98952. | $ 131936. | $ 164920. | $ 197904. | $ 230888. |
| 16000. | $ 34048. | $ 68096. | $ 102144. | $ 136192. | $ 170240. | $ 204288. | $ 238336. |
| 16500. | $ 35112. | $ 70224. | $ 105336. | $ 140448. | $ 175560. | $ 210672. | $ 245784. |
| 17000. | $ 36176. | $ 72352. | $ 108528. | $ 144704. | $ 180880. | $ 217056. | $ 253232. |
| 17500. | $ 37240. | $ 74480. | $ 111720. | $ 148960. | $ 186200. | $ 223440. | $ 260680. |
| 18000. | $ 38304. | $ 76608. | $ 114912. | $ 153216. | $ 191520. | $ 229824. | $ 268128. |
| 18500. | $ 39368. | $ 78736. | $ 118104. | $ 157472. | $ 196840. | $ 236208. | $ 275576. |
| 19000. | $ 40432. | $ 80864. | $ 121296. | $ 161728. | $ 202160. | $ 242592. | $ 283024. |
| 19500. | $ 41496. | $ 82992. | $ 124488. | $ 165984. | $ 207480. | $ 248976. | $ 290472. |
| 20000. | $ 42560. | $ 85120. | $ 127680. | $ 170240. | $ 212800. | $ 255360. | $ 297920. |
| 20500. | $ 43624. | $ 87248. | $ 130872. | $ 174496. | $ 218120. | $ 261744. | $ 305368. |
| 21000. | $ 44688. | $ 89376. | $ 134064. | $ 178752. | $ 223440. | $ 268128. | $ 312816. |
| 21500. | $ 45752. | $ 91504. | $ 137256. | $ 183008. | $ 228760. | $ 274512. | $ 320264. |
| 22000. | $ 46816. | $ 93632. | $ 140448. | $ 187264. | $ 234080. | $ 280896. | $ 327712. |
| 22500. | $ 47880. | $ 95760. | $ 143640. | $ 191520. | $ 239400. | $ 287280. | $ 335160. |

```
    O              S
    O              S
    O              S
    O              S
    O              OOXXXXXXXXXXXX          APPROXIMATE
    O              O            X
    O              O            X          RIPRAP
    O              OOXXXXXXXXXXXX
  S O S            S                       COSTS
   OOO             S
    O              S
                   S      SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                      XXXXX
                     X
                    O -----5 YEAR
                   O
                  O
- - - - - - -XXXO --------LOW CONTROL POOL
  MAIN       X
            X
 CHANNEL   X
          X
         X
XXXXXXXX        TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
O - DIRECTION OF FLOW

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 711. | $ 1422. | $ 2134. | $ 2845. | $ 3556. | $ 4267. | $ 4978. |
| 1000. | $ 1422. | $ 2845. | $ 4267. | $ 5690. | $ 7112. | $ 8534. | $ 9957. |
| 1500. | $ 2134. | $ 4267. | $ 6401. | $ 8534. | $ 10668. | $ 12802. | $ 14935. |
| 2000. | $ 2845. | $ 5690. | $ 8534. | $ 11379. | $ 14224. | $ 17069. | $ 19914. |
| 2500. | $ 3556. | $ 7112. | $ 10668. | $ 14224. | $ 17780. | $ 21336. | $ 24892. |
| 3000. | $ 4267. | $ 8534. | $ 12802. | $ 17069. | $ 21336. | $ 25603. | $ 29870. |
| 3500. | $ 4978. | $ 9957. | $ 14935. | $ 19914. | $ 24892. | $ 29870. | $ 34849. |
| 4000. | $ 5690. | $ 11379. | $ 17069. | $ 22758. | $ 28448. | $ 34138. | $ 39827. |
| 4500. | $ 6401. | $ 12802. | $ 19202. | $ 25603. | $ 32004. | $ 38405. | $ 44806. |
| 5000. | $ 7112. | $ 14224. | $ 21336. | $ 28448. | $ 35560. | $ 42672. | $ 49784. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 7823. | $ 15646. | $ 23470. | $ 31293. | $ 39116. | $ 46939. | $ 54762. |
| 6000. | $ 8534. | $ 17069. | $ 25603. | $ 34138. | $ 42672. | $ 51206. | $ 59741. |
| 6500. | $ 9246. | $ 18491. | $ 27737. | $ 36982. | $ 46228. | $ 55474. | $ 64719. |
| 7000. | $ 9957. | $ 19914. | $ 29870. | $ 39827. | $ 49784. | $ 59741. | $ 69698. |
| 7500. | $ 10668. | $ 21336. | $ 32004. | $ 42672. | $ 53340. | $ 64008. | $ 74676. |
| 8000. | $ 11379. | $ 22758. | $ 34138. | $ 45517. | $ 56896. | $ 68275. | $ 79654. |
| 8500. | $ 12090. | $ 24181. | $ 36271. | $ 48362. | $ 60452. | $ 72542. | $ 84633. |
| 9000. | $ 12802. | $ 25603. | $ 38405. | $ 51206. | $ 64008. | $ 76810. | $ 89611. |
| 9500. | $ 13513. | $ 27026. | $ 40538. | $ 54051. | $ 67564. | $ 81077. | $ 94590. |
| 10000. | $ 14224. | $ 28448. | $ 42672. | $ 56896. | $ 71120. | $ 85344. | $ 99568. |
| 10500. | $ 14935. | $ 29870. | $ 44806. | $ 59741. | $ 74676. | $ 89611. | $ 104546. |
| 11000. | $ 15646. | $ 31293. | $ 46939. | $ 62586. | $ 78232. | $ 93878. | $ 109525. |
| 11500. | $ 16358. | $ 32715. | $ 49073. | $ 65430. | $ 81788. | $ 98146. | $ 114503. |
| 12000. | $ 17069. | $ 34138. | $ 51206. | $ 68275. | $ 85344. | $ 102413. | $ 119482. |
| 12500. | $ 17780. | $ 35560. | $ 53340. | $ 71120. | $ 88900. | $ 106680. | $ 124460. |
| 13000. | $ 18491. | $ 36982. | $ 55474. | $ 73965. | $ 92456. | $ 110947. | $ 129438. |
| 13500. | $ 19202. | $ 38405. | $ 57607. | $ 76810. | $ 96012. | $ 115214. | $ 134417. |
| 14000. | $ 19914. | $ 39827. | $ 59741. | $ 79654. | $ 99568. | $ 119482. | $ 139395. |
| 14500. | $ 20625. | $ 41250. | $ 61874. | $ 82499. | $ 103124. | $ 123749. | $ 144374. |
| 15000. | $ 21336. | $ 42672. | $ 64008. | $ 85344. | $ 106680. | $ 128016. | $ 149352. |
| 15500. | $ 22047. | $ 44094. | $ 66142. | $ 88189. | $ 110236. | $ 132283. | $ 154330. |
| 16000. | $ 22758. | $ 45517. | $ 68275. | $ 91034. | $ 113792. | $ 136550. | $ 159309. |
| 16500. | $ 23470. | $ 46939. | $ 70409. | $ 93878. | $ 117348. | $ 140818. | $ 164287. |
| 17000. | $ 24181. | $ 48362. | $ 72542. | $ 96723. | $ 120904. | $ 145085. | $ 169266. |
| 17500. | $ 24892. | $ 49784. | $ 74676. | $ 99568. | $ 124460. | $ 149352. | $ 174244. |
| 18000. | $ 25603. | $ 51206. | $ 76810. | $ 102413. | $ 128016. | $ 153619. | $ 179222. |
| 18500. | $ 26314. | $ 52629. | $ 78943. | $ 105258. | $ 131572. | $ 157886. | $ 184201. |
| 19000. | $ 27026. | $ 54051. | $ 81077. | $ 108102. | $ 135128. | $ 162154. | $ 189179. |
| 19500. | $ 27737. | $ 55474. | $ 83210. | $ 110947. | $ 138684. | $ 166421. | $ 194158. |
| 20000. | $ 28448. | $ 56896. | $ 85344. | $ 113792. | $ 142240. | $ 170688. | $ 199136. |
| 20500. | $ 29159. | $ 58318. | $ 87478. | $ 116637. | $ 145796. | $ 174955. | $ 204114. |
| 21000. | $ 29870. | $ 59741. | $ 89611. | $ 119482. | $ 149352. | $ 179222. | $ 209093. |
| 21500. | $ 30582. | $ 61163. | $ 91745. | $ 122326. | $ 152908. | $ 183490. | $ 214071. |
| 22000. | $ 31293. | $ 62586. | $ 93878. | $ 125171. | $ 156464. | $ 187757. | $ 219050. |
| 22500. | $ 32004. | $ 64008. | $ 96012. | $ 128016. | $ 160020. | $ 192024. | $ 224028. |

APPROXIMATE

RIPRAP

COSTS

```
  Q              S
  Q              S
  Q              S
  Q              S
  Q              OOXXXXXXXXXXXX
  Q              OC           X
  Q              OC           X
  Q              OOXXXXXXXXXXXX
 Q Q Q           S
  QQQ            S
   Q             S
                 S
                 S      SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                      XXXXX
                     X
                    C -----5 YEAR
                   C
                  C
 - - - - - - - - C---------LOW CONTROL POOL
   MAIN       C    5 FEET
             C
  CHANNEL   C -----------
           X
          X
XXXXXXXXX          TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 5054. | $ 6118. | $ 7182. | $ 8246. | $ 9310. | $ 10374. | $ 11438. |
| 1000. | $ 10108. | $ 12236. | $ 14364. | $ 16492. | $ 18620. | $ 20748. | $ 22876. |
| 1500. | $ 15162. | $ 18354. | $ 21546. | $ 24738. | $ 27930. | $ 31122. | $ 34314. |
| 2000. | $ 20216. | $ 24472. | $ 28728. | $ 32984. | $ 37240. | $ 41496. | $ 45752. |
| 2500. | $ 25270. | $ 30590. | $ 35910. | $ 41230. | $ 46550. | $ 51870. | $ 57190. |
| 3000. | $ 30324. | $ 36708. | $ 43092. | $ 49476. | $ 55860. | $ 62244. | $ 68628. |
| 3500. | $ 35378. | $ 42826. | $ 50274. | $ 57722. | $ 65170. | $ 72618. | $ 80066. |
| 4000. | $ 40432. | $ 48944. | $ 57456. | $ 65968. | $ 74480. | $ 82992. | $ 91504. |
| 4500. | $ 45486. | $ 55062. | $ 64638. | $ 74214. | $ 83790. | $ 93366. | $ 102942. |
| 5000. | $ 50540. | $ 61180. | $ 71820. | $ 82460. | $ 93100. | $ 103740. | $ 114380. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 55554. | $ 67298. | $ 79002. | $ 90706. | $ 102410. | $ 114114. | $ 125818. |
| 6000. | $ 60648. | $ 73416. | $ 86184. | $ 98952. | $ 111720. | $ 124488. | $ 137256. |
| 6500. | $ 65702. | $ 79534. | $ 93366. | $ 107198. | $ 121030. | $ 134862. | $ 148694. |
| 7000. | $ 70756. | $ 85652. | $ 100548. | $ 115444. | $ 130340. | $ 145236. | $ 160132. |
| 7500. | $ 75810. | $ 91770. | $ 107730. | $ 123690. | $ 139650. | $ 155610. | $ 171570. |
| 8000. | $ 80864. | $ 97888. | $ 114912. | $ 131936. | $ 148960. | $ 165984. | $ 183008. |
| 8500. | $ 85918. | $ 104006. | $ 122094. | $ 140182. | $ 158270. | $ 176358. | $ 194446. |
| 9000. | $ 90972. | $ 110124. | $ 129276. | $ 148428. | $ 167580. | $ 186732. | $ 205884. |
| 9500. | $ 96026. | $ 116242. | $ 136458. | $ 156674. | $ 176890. | $ 197106. | $ 217322. |
| 10000. | $ 101080. | $ 122360. | $ 143640. | $ 164920. | $ 186200. | $ 207480. | $ 228760. |
| 10500. | $ 106134. | $ 128478. | $ 150822. | $ 173166. | $ 195510. | $ 217854. | $ 240198. |
| 11000. | $ 111188. | $ 134596. | $ 158004. | $ 181412. | $ 204820. | $ 228228. | $ 251636. |
| 11500. | $ 116242. | $ 140714. | $ 165186. | $ 189658. | $ 214130. | $ 238602. | $ 263074. |
| 12000. | $ 121296. | $ 146832. | $ 172368. | $ 197904. | $ 223440. | $ 248976. | $ 274512. |
| 12500. | $ 126350. | $ 152950. | $ 179550. | $ 206150. | $ 232750. | $ 259350. | $ 285950. |
| 13000. | $ 131404. | $ 159068. | $ 186732. | $ 214396. | $ 242060. | $ 269724. | $ 297388. |
| 13500. | $ 136458. | $ 165186. | $ 193914. | $ 222642. | $ 251370. | $ 280098. | $ 308826. |
| 14000. | $ 141512. | $ 171304. | $ 201096. | $ 230888. | $ 260680. | $ 290472. | $ 320264. |
| 14500. | $ 146566. | $ 177422. | $ 208278. | $ 239134. | $ 269990. | $ 300846. | $ 331702. |
| 15000. | $ 151620. | $ 183540. | $ 215460. | $ 247380. | $ 279300. | $ 311220. | $ 343140. |
| 15500. | $ 156674. | $ 189658. | $ 222642. | $ 255626. | $ 288610. | $ 321594. | $ 354578. |
| 16000. | $ 161728. | $ 195776. | $ 229824. | $ 263872. | $ 297920. | $ 331968. | $ 366016. |
| 16500. | $ 166782. | $ 201894. | $ 237006. | $ 272118. | $ 307230. | $ 342342. | $ 377454. |
| 17000. | $ 171836. | $ 208012. | $ 244188. | $ 280364. | $ 316540. | $ 352716. | $ 388892. |
| 17500. | $ 176890. | $ 214130. | $ 251370. | $ 288610. | $ 325850. | $ 363090. | $ 400330. |
| 18000. | $ 181944. | $ 220248. | $ 258552. | $ 296856. | $ 335160. | $ 373464. | $ 411768. |
| 18500. | $ 186998. | $ 226366. | $ 265734. | $ 305102. | $ 344470. | $ 383838. | $ 423206. |
| 19000. | $ 192052. | $ 232484. | $ 272916. | $ 313348. | $ 353780. | $ 394212. | $ 434644. |
| 19500. | $ 197106. | $ 238602. | $ 280098. | $ 321594. | $ 363090. | $ 404586. | $ 446082. |
| 20000. | $ 202160. | $ 244720. | $ 287280. | $ 329840. | $ 372400. | $ 414960. | $ 457520. |
| 20500. | $ 207214. | $ 250838. | $ 294462. | $ 338086. | $ 381710. | $ 425334. | $ 468958. |
| 21000. | $ 212268. | $ 256956. | $ 301644. | $ 346332. | $ 391020. | $ 435708. | $ 480396. |
| 21500. | $ 217322. | 263074. | $ 308826. | $ 354578. | $ 400330. | $ 446082. | $ 491834. |
| 22000. | $ 222376. | 269192. | $ 316008. | $ 362824. | $ 409640. | $ 456456. | $ 503272. |
| 22500. | $ 227430. | 75310. | $ 323190. | $ 371070. | $ 418950. | $ 466830. | $ 514710. |

```
                    S
     O              S
     O              S
     O              S
     O              SCXXXXXXXXXXXX          APPROXIMATE
     O              SC           X
     O              SC           X          RIPRAP
     O              SCXXXXXXXXXXXX
   O O O            S                       COSTS
    OOO             S
     O              S
                    S      SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                XXXXX
               X
              C -----5 YEAR
             C
            C
 - - - - - - C--------LOW CONTROL POOL
   MAIN     C    4 FEET
           C
  CHANNEL C -----------
         X
        X
XXXXXXXXX          TYPICAL CROSS SECTION
```

LEGEND
- O - RIPRAP IN PLACE
- S - SHORE LINE
- O - DIRECTION OF FLOW

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 3378. | $ 4089. | $ 4801. | $ 5512. | $ 6223. | $ 6934. | $ 7645. |
| 1000. | $ 6756. | $ 8179. | $ 9601. | $ 11024. | $ 12446. | $ 13868. | $ 15291. |
| 1500. | $ 10135. | $ 12268. | $ 14402. | $ 16535. | $ 18669. | $ 20803. | $ 22936. |
| 2000. | $ 13513. | $ 16358. | $ 19202. | $ 22047. | $ 24892. | $ 27737. | $ 30582. |
| 2500. | $ 16891. | $ 20447. | $ 24003. | $ 27559. | $ 31115. | $ 34671. | $ 38227. |
| 3000. | $ 20269. | $ 24536. | $ 28804. | $ 33071. | $ 37338. | $ 41605. | $ 45872. |
| 3500. | $ 23647. | $ 28626. | $ 33604. | $ 38583. | $ 43561. | $ 48539. | $ 53518. |
| 4000. | $ 27026. | $ 32715. | $ 38405. | $ 44094. | $ 49784. | $ 55474. | $ 61163. |
| 4500. | $ 30404. | $ 36805. | $ 43205. | $ 49606. | $ 56007. | $ 62408. | $ 68809. |
| 5000. | $ 33782. | $ 40894. | $ 48006. | $ 55118. | $ 62230. | $ 69342. | $ 76454. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 37160. | $ 44983. | $ 52807. | $ 60630. | $ 68453. | $ 76276. | $ 84099. |
| 6000. | $ 40538. | $ 49073. | $ 57607. | $ 66142. | $ 74676. | $ 83210. | $ 91745. |
| 6500. | $ 43917. | $ 53162. | $ 62408. | $ 71653. | $ 80899. | $ 90145. | $ 99390. |
| 7000. | $ 47295. | $ 57252. | $ 67208. | $ 77165. | $ 87122. | $ 97079. | $ 107036. |
| 7500. | $ 50673. | $ 61341. | $ 72009. | $ 82677. | $ 93345. | $ 104013. | $ 114681. |
| 8000. | $ 54051. | $ 65430. | $ 76810. | $ 88189. | $ 99568. | $ 110947. | $ 122326. |
| 8500. | $ 57429. | $ 69520. | $ 81610. | $ 93701. | $ 105791. | $ 117881. | $ 129972. |
| 9000. | $ 60808. | $ 73609. | $ 86411. | $ 99212. | $ 112014. | $ 124816. | $ 137617. |
| 9500. | $ 64186. | $ 77699. | $ 91211. | $ 104724. | $ 118237. | $ 131750. | $ 145263. |
| 10000. | $ 67564. | $ 81788. | $ 96012. | $ 110236. | $ 124460. | $ 138684. | $ 152908. |
| 10500. | $ 70942. | $ 85877. | $ 100813. | $ 115748. | $ 130683. | $ 145618. | $ 160553. |
| 11000. | $ 74320. | $ 89967. | $ 105613. | $ 121260. | $ 136906. | $ 152552. | $ 168199. |
| 11500. | $ 77699. | $ 94056. | $ 110414. | $ 126771. | $ 143129. | $ 159487. | $ 175844. |
| 12000. | $ 81077. | $ 98146. | $ 115214. | $ 132283. | $ 149352. | $ 166421. | $ 183490. |
| 12500. | $ 84455. | $ 102235. | $ 120015. | $ 137795. | $ 155575. | $ 173355. | $ 191135. |
| 13000. | $ 87833. | $ 106324. | $ 124816. | $ 143307. | $ 161798. | $ 180289. | $ 198780. |
| 13500. | $ 91211. | $ 110414. | $ 129616. | $ 148819. | $ 168021. | $ 187223. | $ 206426. |
| 14000. | $ 94590. | $ 114503. | $ 134417. | $ 154330. | $ 174244. | $ 194158. | $ 214071. |
| 14500. | $ 97968. | $ 118593. | $ 139217. | $ 159842. | $ 180467. | $ 201092. | $ 221717. |
| 15000. | $ 101346. | $ 122682. | $ 144018. | $ 165354. | $ 186690. | $ 208026. | $ 229362. |
| 15500. | $ 104724. | $ 126771. | $ 148819. | $ 170866. | $ 192913. | $ 214960. | $ 237007. |
| 16000. | $ 108102. | $ 130861. | $ 153619. | $ 176378. | $ 199136. | $ 221894. | $ 244653. |
| 16500. | $ 111481. | $ 134950. | $ 158420. | $ 181889. | $ 205359. | $ 228829. | $ 252298. |
| 17000. | $ 114859. | $ 139040. | $ 163220. | $ 187401. | $ 211582. | $ 235763. | $ 259944. |
| 17500. | $ 118237. | $ 143129. | $ 168021. | $ 192913. | $ 217805. | $ 242697. | $ 267589. |
| 18000. | $ 121615. | $ 147218. | $ 172822. | $ 198425. | $ 224028. | $ 249631. | $ 275234. |
| 18500. | $ 124993. | $ 151308. | $ 177622. | $ 203937. | $ 230251. | $ 256565. | $ 282880. |
| 19000. | $ 128372. | $ 155397. | $ 182423. | $ 209448. | $ 236474. | $ 263500. | $ 290525. |
| 19500. | $ 131750. | $ 159487. | $ 187223. | $ 214960. | $ 242697. | $ 270434. | $ 298171. |
| 20000. | $ 135128. | $ 163576. | $ 192024. | $ 220472. | $ 248920. | $ 277368. | $ 305816. |
| 20500. | $ 138506. | $ 167665. | $ 196825. | $ 225984. | $ 255143. | $ 284302. | $ 313461. |
| 21000. | $ 141884. | $ 171755. | $ 201625. | $ 231496. | $ 261366. | $ 291236. | $ 321107. |
| 21500. | $ 145263. | $ 175844. | $ 206426. | $ 237007. | $ 267589. | $ 298171. | $ 328752. |
| 22000. | $ 148641. | $ 179934. | $ 211226. | $ 242519. | $ 273812. | $ 305105. | $ 336398. |
| 22500. | $ 152019. | $ 184023. | $ 216027. | $ 248031. | $ 280035. | $ 312039. | $ 344043. |

```
                 S
   O             S
   O             S
   O             S
   O             SOXXXXXXXXXXXX
   O             SO           X
   O             SO           X
   O             SOXXXXXXXXXXXX
 O O O           S
  OOO            S
   O             S
                 S        SITE CONFIGURATION
```

APPROXIMATE

RIPRAP

COSTS

OUTSIDE OF BENDS

```
                     XXXXX
                    X
                   O -----5 YEAR
                  O
                 O
  - - - - - - - O--------LOW CONTROL POOL
    MAIN       O
              O
   CHANNEL   O      12 FEET
            O
           O
XXXXXXXOO -------------

                TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
O - DIRECTION OF FLOW

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 11035. | $ 12103. | $ 13167. | $ 14231. | $ 15295. | $ 16359. | $ 17423. |
| 1000. | $ 22070. | $ 24206. | $ 26334. | $ 28462. | $ 30590. | $ 32718. | $ 34846. |
| 1500. | $ 33117. | $ 36309. | $ 39501. | $ 42693. | $ 45885. | $ 49077. | $ 52269. |
| 2000. | $ 44156. | $ 48412. | $ 52668. | $ 56924. | $ 61180. | $ 65436. | $ 69692. |
| 2500. | $ 55195. | $ 60515. | $ 65835. | $ 71155. | $ 76475. | $ 81795. | $ 87115. |
| 3000. | $ 66234. | $ 72618. | $ 79002. | $ 85386. | $ 91770. | $ 98154. | $ 104538. |
| 3500. | $ 77273. | $ 84721. | $ 92169. | $ 99617. | $ 107065. | $ 114513. | $ 121961. |
| 4000. | $ 88312. | $ 96824. | $ 105336. | $ 113848. | $ 122360. | $ 130872. | $ 139384. |
| 4500. | $ 99351. | $ 108927. | $ 118503. | $ 128079. | $ 137655. | $ 147231. | $ 156807. |
| 5000. | $ 110390. | $ 121030. | $ 131670. | $ 142310. | $ 152950. | $ 163590. | $ 174230. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 121429. | $ 133133. | $ 144837. | $ 156541. | $ 168245. | $ 179949. | $ 191653. |
| 6000. | $ 132468. | $ 145236. | $ 158004. | $ 170772. | $ 183540. | $ 196308. | $ 209076. |
| 6500. | $ 143507. | $ 157339. | $ 171171. | $ 185003. | $ 198835. | $ 212667. | $ 226499. |
| 7000. | $ 154546. | $ 169442. | $ 184338. | $ 199234. | $ 214130. | $ 229026. | $ 243922. |
| 7500. | $ 165585. | $ 181545. | $ 197505. | $ 213465. | $ 229425. | $ 245385. | $ 261345. |
| 8000. | $ 176624. | $ 193648. | $ 210672. | $ 227696. | $ 244720. | $ 261744. | $ 278768. |
| 8500. | $ 187663. | $ 205751. | $ 223839. | $ 241927. | $ 260015. | $ 278103. | $ 296191. |
| 9000. | $ 198702. | $ 217854. | $ 237006. | $ 256158. | $ 275310. | $ 294462. | $ 313614. |
| 9500. | $ 209741. | $ 229957. | $ 250173. | $ 270389. | $ 290605. | $ 310821. | $ 331037. |
| 10000. | $ 220780. | $ 242060. | $ 263340. | $ 284620. | $ 305900. | $ 327180. | $ 348460. |
| 10500. | $ 231819. | $ 254163. | $ 276507. | $ 298851. | $ 321195. | $ 343539. | $ 365883. |
| 11000. | $ 242858. | $ 266266. | $ 289674. | $ 313082. | $ 336490. | $ 359898. | $ 383306. |
| 11500. | $ 253897. | $ 278369. | $ 302841. | $ 327313. | $ 351785. | $ 376257. | $ 400729. |
| 12000. | $ 264936. | $ 290472. | $ 316008. | $ 341544. | $ 367080. | $ 392616. | $ 418152. |
| 12500. | $ 275975. | $ 302575. | $ 329175. | $ 355775. | $ 382375. | $ 408975. | $ 435575. |
| 13000. | $ 287014. | $ 314678. | $ 342342. | $ 370006. | $ 397670. | $ 425334. | $ 452998. |
| 13500. | $ 298053. | $ 326781. | $ 355509. | $ 384237. | $ 412965. | $ 441693. | $ 470421. |
| 14000. | $ 309092. | $ 338884. | $ 368676. | $ 398468. | $ 428260. | $ 458052. | $ 487844. |
| 14500. | $ 320131. | $ 350987. | $ 381843. | $ 412699. | $ 443555. | $ 474411. | $ 505267. |
| 15000. | $ 331170. | $ 363090. | $ 395010. | $ 426930. | $ 458850. | $ 490770. | $ 522690. |
| 15500. | $ 342209. | $ 375193. | $ 408177. | $ 441161. | $ 474145. | $ 507129. | $ 540113. |
| 16000. | $ 353248. | $ 387296. | $ 421344. | $ 455392. | $ 489440. | $ 523488. | $ 557536. |
| 16500. | $ 364287. | $ 399399. | $ 434511. | $ 469623. | $ 504735. | $ 539847. | $ 574959. |
| 17000. | $ 375326. | $ 411502. | $ 447678. | $ 483854. | $ 520030. | $ 556206. | $ 592382. |
| 17500. | $ 386365. | $ 423605. | $ 460845. | $ 498085. | $ 535325. | $ 572565. | $ 609805. |
| 18000. | $ 397404. | $ 435708. | $ 474012. | $ 512316. | $ 550620. | $ 588924. | $ 627228. |
| 18500. | $ 408443. | $ 447811. | $ 487179. | $ 526547. | $ 565915. | $ 605283. | $ 644651. |
| 19000. | $ 419482. | $ 459914. | $ 500346. | $ 540778. | $ 581210. | $ 621642. | $ 662074. |
| 19500. | $ 430521. | $ 472017. | $ 513513. | $ 555009. | $ 596505. | $ 638001. | $ 679497. |
| 20000. | $ 441560. | $ 484120. | $ 526680. | $ 569240. | $ 611800. | $ 654360. | $ 696920. |
| 20500. | $ 452599. | $ 496223. | $ 539847. | $ 583471. | $ 627095. | $ 670719. | $ 714343. |
| 21000. | $ 463638. | $ 508326. | $ 553014. | $ 597702. | $ 642390. | $ 687078. | $ 731766. |
| 21500. | $ 474677. | $ 520429. | $ 566181. | $ 611933. | $ 657685. | $ 703437. | $ 749189. |
| 22000. | $ 485716. | $ 532532. | $ 579348. | $ 626164. | $ 672980. | $ 719796. | $ 766612. |
| 22500. | $ 496755. | $ 544635. | $ 592515. | $ 640395. | $ 688275. | $ 736155. | $ 784035. |

```
 Q              S
 Q              S
 Q              S
 Q              OCXXXXXXXXXXX
 Q              C           X
 Q              C           X
 Q              OCXXXXXXXXXXX
Q Q Q           S
 QQQ            S
  Q             S
                S      SITE CONFIGURATION
```

APPROXIMATE

RIPRAP

COSTS

OTHER THAN OUTSIDE OF BENDS

```
                  XXXXX
                 X
                C -----5 YEAR
               C
              C
- - - - - - - C--------LOW CONTROL POOL
  MAIN       C
            C
  CHANNEL  C      12 FEET
          C
         C
XXXXXXXOC -------------

              TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 7375. | $ 8090. | $ 8801. | $ 9512. | $ 10224. | $ 10935. | $ 11646. |
| 1000. | $ 14757. | $ 16180. | $ 17602. | $ 19025. | $ 20447. | $ 21869. | $ 23292. |
| 1500. | $ 22136. | $ 24270. | $ 26403. | $ 28537. | $ 30671. | $ 32804. | $ 34938. |
| 2000. | $ 29515. | $ 32360. | $ 35204. | $ 38049. | $ 40894. | $ 43739. | $ 46584. |
| 2500. | $ 36894. | $ 40450. | $ 44006. | $ 47562. | $ 51118. | $ 54674. | $ 58230. |
| 3000. | $ 44272. | $ 48539. | $ 52807. | $ 57074. | $ 61341. | $ 65608. | $ 69875. |
| 3500. | $ 51651. | $ 56629. | $ 61608. | $ 66586. | $ 71565. | $ 76543. | $ 81521. |
| 4000. | $ 59030. | $ 64719. | $ 70409. | $ 76098. | $ 81788. | $ 87478. | $ 93167. |
| 4500. | $ 66408. | $ 72809. | $ 79210. | $ 85611. | $ 92012. | $ 98412. | $ 104813. |
| 5000. | $ 73787. | $ 80899. | $ 88011. | $ 95123. | $ 102235. | $ 109347. | $ 116459. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 81166. | $ 88989. | $ 96812. | $ 104635. | $ 112459. | $ 120282. | $ 128105. |
| 6000. | $ 88544. | $ 97079. | $ 105613. | $ 114148. | $ 122682. | $ 131216. | $ 139751. |
| 6500. | $ 95923. | $ 105169. | $ 114414. | $ 123660. | $ 132906. | $ 142151. | $ 151397. |
| 7000. | $ 103302. | $ 113259. | $ 123215. | $ 133172. | $ 143129. | $ 153086. | $ 163043. |
| 7500. | $ 110681. | $ 121349. | $ 132017. | $ 142685. | $ 153353. | $ 164021. | $ 174689. |
| 8000. | $ 118059. | $ 129438. | $ 140818. | $ 152197. | $ 163576. | $ 174955. | $ 186334. |
| 8500. | $ 125438. | $ 137528. | $ 149619. | $ 161709. | $ 173800. | $ 185890. | $ 197980. |
| 9000. | $ 132817. | $ 145618. | $ 158420. | $ 171221. | $ 184023. | $ 196825. | $ 209626. |
| 9500. | $ 140195. | $ 153708. | $ 167221. | $ 180734. | $ 194247. | $ 207759. | $ 221272. |
| 10000. | $ 147574. | $ 161798. | $ 176022. | $ 190246. | $ 204470. | $ 218694. | $ 232918. |
| 10500. | $ 154953. | $ 169888. | $ 184823. | $ 199758. | $ 214694. | $ 229629. | $ 244564. |
| 11000. | $ 162331. | $ 177978. | $ 193624. | $ 209271. | $ 224917. | $ 240563. | $ 256210. |
| 11500. | $ 169710. | $ 186068. | $ 202425. | $ 218783. | $ 235141. | $ 251498. | $ 267856. |
| 12000. | $ 177089. | $ 194158. | $ 211226. | $ 228295. | $ 245364. | $ 262433. | $ 279502. |
| 12500. | $ 184468. | $ 202248. | $ 220028. | $ 237808. | $ 255588. | $ 273368. | $ 291148. |
| 13000. | $ 191846. | $ 210337. | $ 228829. | $ 247320. | $ 265811. | $ 284302. | $ 302793. |
| 13500. | $ 199225. | $ 218427. | $ 237630. | $ 256832. | $ 276035. | $ 295237. | $ 314439. |
| 14000. | $ 206604. | $ 226517. | $ 246431. | $ 266344. | $ 286258. | $ 306172. | $ 326085. |
| 14500. | $ 213982. | $ 234607. | $ 255232. | $ 275857. | $ 296482. | $ 317106. | $ 337731. |
| 15000. | $ 221361. | $ 242697. | $ 264033. | $ 285369. | $ 306705. | $ 328041. | $ 349377. |
| 15500. | $ 228740. | $ 250787. | $ 272834. | $ 294881. | $ 316929. | $ 338976. | $ 361023. |
| 16000. | $ 236118. | $ 258877. | $ 281635. | $ 304394. | $ 327152. | $ 349910. | $ 372669. |
| 16500. | $ 243497. | $ 266967. | $ 290436. | $ 313906. | $ 337376. | $ 360845. | $ 384315. |
| 17000. | $ 250876. | $ 275057. | $ 299237. | $ 323418. | $ 347599. | $ 371780. | $ 395961. |
| 17500. | $ 258255. | $ 283147. | $ 308039. | $ 332931. | $ 357823. | $ 382715. | $ 407607. |
| 18000. | $ 265633. | $ 291236. | $ 316840. | $ 342443. | $ 368046. | $ 393649. | $ 419252. |
| 18500. | $ 273012. | $ 299326. | $ 325641. | $ 351955. | $ 378270. | $ 404584. | $ 430898. |
| 19000. | $ 280391. | $ 307416. | $ 334442. | $ 361467. | $ 388493. | $ 415519. | $ 442544. |
| 19500. | $ 287769. | $ 315506. | $ 343243. | $ 370980. | $ 398717. | $ 426453. | $ 454190. |
| 20000. | $ 295148. | $ 323596. | $ 352044. | $ 380492. | $ 408940. | $ 437388. | $ 465836. |
| 20500. | $ 302527. | $ 331686. | $ 360845. | $ 390004. | $ 419164. | $ 448323. | $ 477482. |
| 21000. | $ 309905. | $ 339776. | $ 369646. | $ 399517. | $ 429387. | $ 459257. | $ 489128. |
| 21500. | $ 317284. | $ 347866. | $ 378447. | $ 409029. | $ 439611. | $ 470192. | $ 500774. |
| 22000. | $ 324663. | $ 355956. | $ 387248. | $ 418541. | $ 449834. | $ 481127. | $ 512420. |
| 22500. | $ 332042. | $ 364046. | $ 396050. | $ 428054. | $ 460058. | $ 492062. | $ 524066. |

```
   O          S
   O          S
   O          OOOOXX
   O          O    X          APPROXIMATE
   O          O    X
   O          O    X          RIPRAP
   O          O    X
   O          O    X
 O O O        O    X          COSTS
  OOO         OOXXXX
   O          S
              S      SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                                XXXXX
                               X
                              O -----5 YEAR
                  FLOWING    O
             XXXX  BACKWATER O
- - - - - - - -X   X- - - - - -O --------LOW CONTROL POOL
 MAIN          X    X         O  3 FEET
              X      XXXXXXXXO ----------
 CHANNEL     X
            X
           X
XXXXXXXXX             TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 8645. | $ 11305. | $ 13965. | $ 16625. | $ 19285. | $ 21945. | $ 24605. |
| 1000. | $ 17290. | $ 22610. | $ 27930. | $ 33250. | $ 38570. | $ 43890. | $ 49210. |
| 1500. | $ 25935. | $ 33915. | $ 41895. | $ 49875. | $ 57855. | $ 65835. | $ 73815. |
| 2000. | $ 34580. | $ 45220. | $ 55860. | $ 66500. | $ 77140. | $ 87780. | $ 98420. |
| 2500. | $ 43225. | $ 56525. | $ 69825. | $ 83125. | $ 96425. | $ 109725. | $ 123025. |
| 3000. | $ 51870. | $ 67830. | $ 83790. | $ 99750. | $ 115710. | $ 131670. | $ 147630. |
| 3500. | $ 60515. | $ 79135. | $ 97755. | $ 116375. | $ 134995. | $ 153615. | $ 172235. |
| 4000. | $ 69160. | $ 90440. | $ 111720. | $ 133000. | $ 154280. | $ 175560. | $ 196840. |
| 4500. | $ 77805. | $ 101745. | $ 125685. | $ 149625. | $ 173565. | $ 197505. | $ 221445. |
| 5000. | $ 86450. | $ 113050. | $ 139650. | $ 166250. | $ 192850. | $ 219450. | $ 246050. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 95095. | $ 120355. | $ 153615. | $ 182875. | $ 212135. | $ 241395. | $ 270655. |
| 6000. | $ 103740. | $ 131660. | $ 167580. | $ 199500. | $ 231420. | $ 263340. | $ 295260. |
| 6500. | $ 112385. | $ 146965. | $ 181545. | $ 216125. | $ 250705. | $ 285285. | $ 319865. |
| 7000. | $ 121030. | $ 158270. | $ 195510. | $ 232750. | $ 269990. | $ 307230. | $ 344470. |
| 7500. | $ 129675. | $ 169575. | $ 209475. | $ 249375. | $ 289275. | $ 329175. | $ 369075. |
| 8000. | $ 138320. | $ 180880. | $ 223440. | $ 266000. | $ 308560. | $ 351120. | $ 393680. |
| 8500. | $ 146965. | $ 192185. | $ 237405. | $ 282625. | $ 327845. | $ 373065. | $ 418285. |
| 9000. | $ 155610. | $ 203490. | $ 251370. | $ 299250. | $ 347130. | $ 395010. | $ 442890. |
| 9500. | $ 164255. | $ 214795. | $ 265335. | $ 315875. | $ 366415. | $ 416955. | $ 467495. |
| 10000. | $ 172900. | $ 226100. | $ 279300. | $ 332500. | $ 385700. | $ 438900. | $ 492100. |
| 10500. | $ 181545. | $ 237405. | $ 293265. | $ 349125. | $ 404985. | $ 460845. | $ 516705. |
| 11000. | $ 190190. | $ 248710. | $ 307230. | $ 365750. | $ 424270. | $ 482790. | $ 541310. |
| 11500. | $ 198835. | $ 260015. | $ 321195. | $ 382375. | $ 443555. | $ 504735. | $ 565915. |
| 12000. | $ 207480. | $ 271320. | $ 335160. | $ 399000. | $ 462840. | $ 526680. | $ 590520. |
| 12500. | $ 216125. | $ 282625. | $ 349125. | $ 415625. | $ 482125. | $ 548625. | $ 615125. |
| 13000. | $ 224770. | $ 293930. | $ 363090. | $ 432250. | $ 501410. | $ 570570. | $ 639730. |
| 13500. | $ 233415. | $ 305235. | $ 377055. | $ 448875. | $ 520695. | $ 592515. | $ 664335. |
| 14000. | $ 242060. | $ 316540. | $ 391020. | $ 465500. | $ 539980. | $ 614460. | $ 688940. |
| 14500. | $ 250705. | $ 327845. | $ 404985. | $ 482125. | $ 559265. | $ 636405. | $ 713545. |
| 15000. | $ 259350. | $ 339150. | $ 418950. | $ 498750. | $ 578550. | $ 658350. | $ 738150. |
| 15500. | $ 267995. | $ 350455. | $ 432915. | $ 515375. | $ 597835. | $ 680295. | $ 762755. |
| 16000. | $ 276640. | $ 361760. | $ 446880. | $ 532000. | $ 617120. | $ 702240. | $ 787360. |
| 16500. | $ 285285. | $ 373065. | $ 460845. | $ 548625. | $ 636405. | $ 724185. | $ 811965. |
| 17000. | $ 293930. | $ 384370. | $ 474810. | $ 565250. | $ 655690. | $ 746130. | $ 836570. |
| 17500. | $ 302575. | $ 395675. | $ 488775. | $ 581875. | $ 674975. | $ 768075. | $ 861175. |
| 18000. | $ 311220. | $ 406980. | $ 502740. | $ 598500. | $ 694260. | $ 790020. | $ 885780. |
| 18500. | $ 319865. | $ 418285. | $ 516705. | $ 615125. | $ 713545. | $ 811965. | $ 910385. |
| 19000. | $ 328510. | $ 429590. | $ 530670. | $ 631750. | $ 732830. | $ 833910. | $ 934990. |
| 19500. | $ 337155. | $ 440895. | $ 544635. | $ 648375. | $ 752115. | $ 855855. | $ 959595. |
| 20000. | $ 345800. | $ 452200. | $ 558600. | $ 665000. | $ 771400. | $ 877800. | $ 984200. |
| 20500. | $ 354445. | $ 463505. | $ 572565. | $ 681625. | $ 790685. | $ 899745. | $1008805. |
| 21000. | $ 363090. | $ 474810. | $ 586530. | $ 698250. | $ 809970. | $ 921690. | $1033410. |
| 21500. | $ 371735. | $ 486115. | $ 600495. | $ 714875. | $ 829255. | $ 943635. | $1058015. |
| 22000. | $ 380380. | $ 497420. | $ 614460. | $ 731500. | $ 848540. | $ 965580. | $1082620. |
| 22500. | $ 389025. | $ 508725. | $ 628425. | $ 748125. | $ 867825. | $ 987525. | $1107225. |

APPROXIMATE

RIPRAP

COSTS

```
             S
   Q         S
   Q         OOOOXX
   Q         O    X
   Q         O    X
   Q         O    X
   Q         O    X
   Q         O    X
 Q Q Q       O    X
  QQQ        OOXXXX
   Q         S
             S
```

SITE CONFIGURATION

OTHER THAN OUTSIDE OF BENDS

```
                                   XXXXX
                                  X
                                 O -----5 YEAR
                 FLOWING        O
            XXXX  BACKWATER   O
- - - - - - -X    X- - - - - -O --------LOW CONTROL POOL
  MAIN       X     X          O  3 FEET
              X     XXXXXXXXO ----------
  CHANNEL    X
            X
           X
XXXXXXXXX
```

TYPICAL CROSS SECTION

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 5779. | $ 7557. | $ 9335. | $ 11113. | $ 12891. | $ 14669. | $ 16447. |
| 1000. | $ 11557. | $ 15113. | $ 18669. | $ 22225. | $ 25781. | $ 29337. | $ 32893. |
| 1500. | $ 17336. | $ 22670. | $ 28004. | $ 33338. | $ 38672. | $ 44006. | $ 49340. |
| 2000. | $ 23114. | $ 30226. | $ 37338. | $ 44450. | $ 51562. | $ 58674. | $ 65786. |
| 2500. | $ 28893. | $ 37783. | $ 46673. | $ 55563. | $ 64453. | $ 73343. | $ 82233. |
| 3000. | $ 34671. | $ 45339. | $ 56007. | $ 66675. | $ 77343. | $ 88011. | $ 98679. |
| 3500. | $ 40450. | $ 52896. | $ 65342. | $ 77788. | $ 90234. | $ 102680. | $ 115126. |
| 4000. | $ 46228. | $ 60452. | $ 74676. | $ 88900. | $ 103124. | $ 117348. | $ 131572. |
| 4500. | $ 52007. | $ 68009. | $ 84011. | $ 100013. | $ 116015. | $ 132017. | $ 148019. |
| 5000. | $ 57785. | $ 75565. | $ 93345. | $ 111125. | $ 128905. | $ 146685. | $ 164465. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 63564. | $ 83122. | $ 102680. | $ 122238. | $ 141796. | $ 161354. | $ 180912. |
| 6000. | $ 69342. | $ 90678. | $ 112014. | $ 133350. | $ 154686. | $ 176022. | $ 197358. |
| 6500. | $ 75121. | $ 98235. | $ 121349. | $ 144463. | $ 167577. | $ 190691. | $ 213805. |
| 7000. | $ 80899. | $ 105791. | $ 130683. | $ 155575. | $ 180467. | $ 205359. | $ 230251. |
| 7500. | $ 86678. | $ 113348. | $ 140018. | $ 166688. | $ 193358. | $ 220028. | $ 246698. |
| | | | | | | | |
| 8000. | $ 92456. | $ 120904. | $ 149352. | $ 177800. | $ 206248. | $ 234696. | $ 263144. |
| 8500. | $ 98235. | $ 128461. | $ 158687. | $ 188913. | $ 219139. | $ 249365. | $ 279591. |
| 9000. | $ 104013. | $ 136017. | $ 168021. | $ 200025. | $ 232029. | $ 264033. | $ 296037. |
| 9500. | $ 109792. | $ 143574. | $ 177356. | $ 211138. | $ 244920. | $ 278702. | $ 312484. |
| 10000. | $ 115570. | $ 151130. | $ 186690. | $ 222250. | $ 257810. | $ 293370. | $ 328930. |
| | | | | | | | |
| 10500. | $ 121349. | $ 158687. | $ 196025. | $ 233363. | $ 270701. | $ 308039. | $ 345377. |
| 11000. | $ 127127. | $ 166243. | $ 205359. | $ 244475. | $ 283591. | $ 322707. | $ 361823. |
| 11500. | $ 132906. | $ 173800. | $ 214694. | $ 255588. | $ 296482. | $ 337376. | $ 378270. |
| 12000. | $ 138684. | $ 181356. | $ 224028. | $ 266700. | $ 309372. | $ 352044. | $ 394716. |
| 12500. | $ 144463. | $ 188913. | $ 233363. | $ 277813. | $ 322263. | $ 366713. | $ 411163. |
| | | | | | | | |
| 13000. | $ 150241. | $ 196469. | $ 242697. | $ 288925. | $ 335153. | $ 381381. | $ 427609. |
| 13500. | $ 156020. | $ 204026. | $ 252032. | $ 300038. | $ 348044. | $ 396050. | $ 444056. |
| 14000. | $ 161798. | $ 211582. | $ 261366. | $ 311150. | $ 360934. | $ 410718. | $ 460502. |
| 14500. | $ 167577. | $ 219139. | $ 270701. | $ 322263. | $ 373825. | $ 425387. | $ 476949. |
| 15000. | $ 173355. | $ 226695. | $ 280035. | $ 333375. | $ 386715. | $ 440055. | $ 493395. |
| | | | | | | | |
| 15500. | $ 179134. | $ 234252. | $ 289370. | $ 344488. | $ 399606. | $ 454724. | $ 509842. |
| 16000. | $ 184912. | $ 241808. | $ 298704. | $ 355600. | $ 412496. | $ 469392. | $ 526288. |
| 16500. | $ 190691. | $ 249365. | $ 308039. | $ 366713. | $ 425387. | $ 484061. | $ 542735. |
| 17000. | $ 196469. | $ 256921. | $ 317373. | $ 377825. | $ 438277. | $ 498729. | $ 559181. |
| 17500. | $ 202248. | $ 264478. | $ 326708. | $ 388938. | $ 451168. | $ 513398. | $ 575628. |
| | | | | | | | |
| 18000. | $ 208026. | $ 272034. | $ 336042. | $ 400050. | $ 464058. | $ 528066. | $ 592074. |
| 18500. | $ 213805. | $ 279591. | $ 345377. | $ 411163. | $ 476949. | $ 542735. | $ 608521. |
| 19000. | $ 219583. | $ 287147. | $ 354711. | $ 422275. | $ 489839. | $ 557403. | $ 624967. |
| 19500. | $ 225362. | $ 294704. | $ 364046. | $ 433388. | $ 502730. | $ 572072. | $ 641414. |
| 20000. | $ 231140. | $ 302260. | $ 373380. | $ 444500. | $ 515620. | $ 586740. | $ 657860. |
| | | | | | | | |
| 20500. | $ 236919. | $ 309817. | $ 382715. | $ 455613. | $ 528511. | $ 601409. | $ 674307. |
| 21000. | $ 242697. | $ 317373. | $ 392049. | $ 466725. | $ 541401. | $ 616077. | $ 690753. |
| 21500. | $ 248476. | $ 324930. | $ 401384. | $ 477838. | $ 554292. | $ 630746. | $ 707200. |
| 22000. | $ 254254. | $ 332486. | $ 410718. | $ 488950. | $ 567182. | $ 645414. | $ 723646. |
| 22500. | $ 260033. | $ 340043. | $ 420053. | $ 500063. | $ 580073. | $ 660083. | $ 740093. |

```
                      S
   Q                  S
   Q                  OOOOXX
   Q                  O    X
   Q                  O    X          APPROXIMATE
   Q                  O    X
   Q                  O    X          RIPRAP
   Q                  O    X
 Q Q Q                O    X          COSTS
  QQQ                 OOXXXX
   Q                  S
                      S      SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                         XXXXX
                        X
                       O -----5 YEAR
                      O
                     O
 - - - - - - - -XXXO ---------LOW CONTROL POOL
   MAIN          X
                X
   CHANNEL     X
              X
             X
XXXXXXXXX        TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER

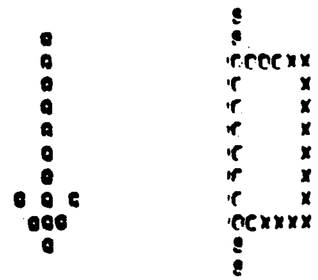
DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 2660. | $ 5320. | $ 7980. | $ 10640. | $ 13300. | $ 15960. | $ 18620. |
| 1000. | $ 5320. | $ 10640. | $ 15960. | $ 21280. | $ 26600. | $ 31920. | $ 37240. |
| 1500. | $ 7980. | $ 15960. | $ 23940. | $ 31920. | $ 39900. | $ 47880. | $ 55860. |
| 2000. | $ 10640. | $ 21280. | $ 31920. | $ 42560. | $ 53200. | $ 63840. | $ 74480. |
| 2500. | $ 13300. | $ 26600. | $ 39900. | $ 53200. | $ 66500. | $ 79800. | $ 93100. |
| 3000. | $ 15960. | $ 31920. | $ 47880. | $ 63840. | $ 79800. | $ 95760. | $ 111720. |
| 3500. | $ 18620. | $ 37240. | $ 55860. | $ 74480. | $ 93100. | $ 111720. | $ 130340. |
| 4000. | $ 21280. | $ 42560. | $ 63840. | $ 85120. | $ 106400. | $ 127680. | $ 148960. |
| 4500. | $ 23940. | $ 47880. | $ 71820. | $ 95760. | $ 119700. | $ 143640. | $ 167580. |
| 5000. | $ 26600. | $ 53200. | $ 79800. | $ 106400. | $ 133000. | $ 159600. | $ 186200. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

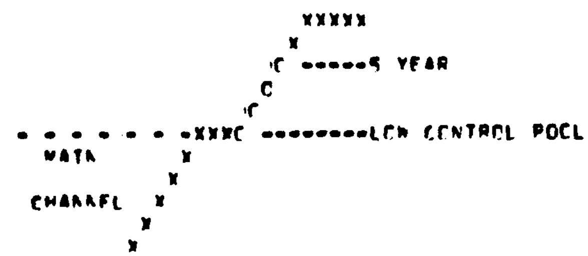
| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 29260. | $ 58520. | $ 87780. | $ 117040. | $ 146300. | $ 175560. | $ 204820. |
| 6000. | $ 31920. | $ 63840. | $ 95760. | $ 127680. | $ 159600. | $ 191520. | $ 223440. |
| 6500. | $ 34580. | $ 69160. | $ 103740. | $ 138320. | $ 172900. | $ 207480. | $ 242060. |
| 7000. | $ 37240. | $ 74480. | $ 111720. | $ 148960. | $ 186200. | $ 223440. | $ 260680. |
| 7500. | $ 39900. | $ 79800. | $ 119700. | $ 159600. | $ 199500. | $ 239400. | $ 279300. |
| 8000. | $ 42560. | $ 85120. | $ 127680. | $ 170240. | $ 212800. | $ 255360. | $ 297920. |
| 8500. | $ 45220. | $ 90440. | $ 135660. | $ 180880. | $ 226100. | $ 271320. | $ 316540. |
| 9000. | $ 47880. | $ 95760. | $ 143640. | $ 191520. | $ 239400. | $ 287280. | $ 335160. |
| 9500. | $ 50540. | $ 101080. | $ 151620. | $ 202160. | $ 252700. | $ 303240. | $ 353780. |
| 10000. | $ 53200. | $ 106400. | $ 159600. | $ 212800. | $ 266000. | $ 319200. | $ 372400. |
| 10500. | $ 55860. | $ 111720. | $ 167580. | $ 223440. | $ 279300. | $ 335160. | $ 391020. |
| 11000. | $ 58520. | $ 117040. | $ 175560. | $ 234080. | $ 292600. | $ 351120. | $ 409640. |
| 11500. | $ 61180. | $ 122360. | $ 183540. | $ 244720. | $ 305900. | $ 367080. | $ 428260. |
| 12000. | $ 63840. | $ 127680. | $ 191520. | $ 255360. | $ 319200. | $ 383040. | $ 446880. |
| 12500. | $ 66500. | $ 133000. | $ 199500. | $ 266000. | $ 332500. | $ 399000. | $ 465500. |
| 13000. | $ 69160. | $ 138320. | $ 207480. | $ 276640. | $ 345800. | $ 414960. | $ 484120. |
| 13500. | $ 71820. | $ 143640. | $ 215460. | $ 287280. | $ 359100. | $ 430920. | $ 502740. |
| 14000. | $ 74480. | $ 148960. | $ 223440. | $ 297920. | $ 372400. | $ 446880. | $ 521360. |
| 14500. | $ 77140. | $ 154280. | $ 231420. | $ 308560. | $ 385700. | $ 462840. | $ 539980. |
| 15000. | $ 79800. | $ 159600. | $ 239400. | $ 319200. | $ 399000. | $ 478800. | $ 558600. |
| 15500. | $ 82460. | $ 164920. | $ 247380. | $ 329840. | $ 412300. | $ 494760. | $ 577220. |
| 16000. | $ 85120. | $ 170240. | $ 255360. | $ 340480. | $ 425600. | $ 510720. | $ 595840. |
| 16500. | $ 87780. | $ 175560. | $ 263340. | $ 351120. | $ 438900. | $ 526680. | $ 614460. |
| 17000. | $ 90440. | $ 180880. | $ 271320. | $ 361760. | $ 452200. | $ 542640. | $ 633080. |
| 17500. | $ 93100. | $ 186200. | $ 279300. | $ 372400. | $ 465500. | $ 558600. | $ 651700. |
| 18000. | $ 95760. | $ 191520. | $ 287280. | $ 383040. | $ 478800. | $ 574560. | $ 670320. |
| 18500. | $ 98420. | $ 196840. | $ 295260. | $ 393680. | $ 492100. | $ 590520. | $ 688940. |
| 19000. | $ 101080. | $ 202160. | $ 303240. | $ 404320. | $ 505400. | $ 606480. | $ 707560. |
| 19500. | $ 103740. | $ 207480. | $ 311220. | $ 414960. | $ 518700. | $ 622440. | $ 726180. |
| 20000. | $ 106400. | $ 212800. | $ 319200. | $ 425600. | $ 532000. | $ 638400. | $ 744800. |
| 20500. | $ 109060. | $ 218120. | $ 327180. | $ 436240. | $ 545300. | $ 654360. | $ 763420. |
| 21000. | $ 111720. | $ 223440. | $ 335160. | $ 446880. | $ 558600. | $ 670320. | $ 782040. |
| 21500. | $ 114380. | $ 228760. | $ 343140. | $ 457520. | $ 571900. | $ 686280. | $ 800660. |
| 22000. | $ 117040. | $ 234080. | $ 351120. | $ 468160. | $ 585200. | $ 702240. | $ 819280. |
| 22500. | $ 119700. | $ 239400. | $ 359100. | $ 478800. | $ 598500. | $ 718200. | $ 837900. |



SITE CONFIGURATION

# APPROXIMATE RIPRAP COSTS

OTHER THAN OUTSIDE OF BENDS




TYPICAL CROSS SECTION

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 1778. | $ 3556. | $ 5334. | $ 7112. | $ 8890. | $ 10668. | $ 12446. |
| 1000. | $ 3556. | $ 7112. | $ 10668. | $ 14224. | $ 17780. | $ 21336. | $ 24892. |
| 1500. | $ 5334. | $ 10668. | $ 16002. | $ 21336. | $ 26670. | $ 32004. | $ 37338. |
| 2000. | $ 7112. | $ 14224. | $ 21336. | $ 28448. | $ 35560. | $ 42672. | $ 49784. |
| 2500. | $ 8890. | $ 17780. | $ 26670. | $ 35560. | $ 44450. | $ 53340. | $ 62230. |
| 3000. | $ 10668. | $ 21336. | $ 32004. | $ 42672. | $ 53340. | $ 64008. | $ 74676. |
| 3500. | $ 12446. | $ 24892. | $ 37338. | $ 49784. | $ 62230. | $ 74676. | $ 87122. |
| 4000. | $ 14224. | $ 28448. | $ 42672. | $ 56896. | $ 71120. | $ 85344. | $ 99568. |
| 4500. | $ 16002. | $ 32004. | $ 48006. | $ 64008. | $ 80010. | $ 96012. | $ 112014. |
| 5000. | $ 17780. | $ 35560. | $ 53340. | $ 71120. | $ 88900. | $ 106680. | $ 124460. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 19558. | $ 39116. | $ 58674. | $ 78232. | $ 97790. | $ 117348. | $ 136906. |
| 6000. | $ 21336. | $ 42672. | $ 64008. | $ 85344. | $ 106680. | $ 128016. | $ 149352. |
| 6500. | $ 23114. | $ 46228. | $ 69342. | $ 92456. | $ 115570. | $ 138684. | $ 161798. |
| 7000. | $ 24892. | $ 49784. | $ 74676. | $ 99568. | $ 124460. | $ 149352. | $ 174244. |
| 7500. | $ 26670. | $ 53340. | $ 80010. | $ 106680. | $ 133350. | $ 160020. | $ 186690. |
| 8000. | $ 28448. | $ 56896. | $ 85344. | $ 113792. | $ 142240. | $ 170688. | $ 199136. |
| 8500. | $ 30226. | $ 60452. | $ 90678. | $ 120904. | $ 151130. | $ 181356. | $ 211582. |
| 9000. | $ 32004. | $ 64008. | $ 96012. | $ 128016. | $ 160020. | $ 192024. | $ 224028. |
| 9500. | $ 33782. | $ 67564. | $ 101346. | $ 135128. | $ 168910. | $ 202692. | $ 236474. |
| 10000. | $ 35560. | $ 71120. | $ 106680. | $ 142240. | $ 177800. | $ 213360. | $ 248920. |
| 10500. | $ 37338. | $ 74676. | $ 112014. | $ 149352. | $ 186690. | $ 224028. | $ 261366. |
| 11000. | $ 39116. | $ 78232. | $ 117348. | $ 156464. | $ 195580. | $ 234696. | $ 273812. |
| 11500. | $ 40894. | $ 81788. | $ 122682. | $ 163576. | $ 204470. | $ 245364. | $ 286258. |
| 12000. | $ 42672. | $ 85344. | $ 128016. | $ 170688. | $ 213360. | $ 256032. | $ 298704. |
| 12500. | $ 44450. | $ 88900. | $ 133350. | $ 177800. | $ 222250. | $ 266700. | $ 311150. |
| 13000. | $ 46228. | $ 92456. | $ 138684. | $ 184912. | $ 231140. | $ 277368. | $ 323596. |
| 13500. | $ 48006. | $ 96012. | $ 144018. | $ 192024. | $ 240030. | $ 288036. | $ 336042. |
| 14000. | $ 49784. | $ 99568. | $ 149352. | $ 199136. | $ 248920. | $ 298704. | $ 348488. |
| 14500. | $ 51562. | $ 103124. | $ 154686. | $ 206248. | $ 257810. | $ 309372. | $ 360934. |
| 15000. | $ 53340. | $ 106680. | $ 160020. | $ 213360. | $ 266700. | $ 320040. | $ 373380. |
| 15500. | $ 55118. | $ 110236. | $ 165354. | $ 220472. | $ 275590. | $ 330708. | $ 385826. |
| 16000. | $ 56896. | $ 113792. | $ 170688. | $ 227584. | $ 284480. | $ 341376. | $ 398272. |
| 16500. | $ 58674. | $ 117348. | $ 176022. | $ 234696. | $ 293370. | $ 352044. | $ 410718. |
| 17000. | $ 60452. | $ 120904. | $ 181356. | $ 241808. | $ 302260. | $ 362712. | $ 423164. |
| 17500. | $ 62230. | $ 124460. | $ 186690. | $ 248920. | $ 311150. | $ 373380. | $ 435610. |
| 18000. | $ 64008. | $ 128016. | $ 192024. | $ 256032. | $ 320040. | $ 384048. | $ 448056. |
| 18500. | $ 65786. | $ 131572. | $ 197358. | $ 263144. | $ 328930. | $ 394716. | $ 460502. |
| 19000. | $ 67564. | $ 135128. | $ 202692. | $ 270256. | $ 337820. | $ 405384. | $ 472948. |
| 19500. | $ 69342. | $ 138684. | $ 208026. | $ 277368. | $ 346710. | $ 416052. | $ 485394. |
| 20000. | $ 71120. | $ 142240. | $ 213360. | $ 284480. | $ 355600. | $ 426720. | $ 497840. |
| 20500. | $ 72898. | $ 145796. | $ 218694. | $ 291592. | $ 364490. | $ 437388. | $ 510286. |
| 21000. | $ 74676. | $ 149352. | $ 224028. | $ 298704. | $ 373380. | $ 448056. | $ 522732. |
| 21500. | $ 76454. | $ 152908. | $ 229362. | $ 305816. | $ 382270. | $ 458724. | $ 535178. |
| 22000. | $ 78232. | $ 156464. | $ 234696. | $ 312928. | $ 391160. | $ 469392. | $ 547624. |
| 22500. | $ 80010. | $ 160020. | $ 240030. | $ 320040. | $ 400050. | $ 480060. | $ 560070. |

```
                 S
     Q           S
     Q           CCCCXX
     Q           C    X
     Q           C    X
     Q           C    X
     Q           C    X
     Q           C    X
   Q Q Q         C    X
    QQQ          OCXXXX
     Q           S
                 S       SITE CONFIGURATICN
```

APPROXIMATE

RIPRAP

COSTS

OUTSIDE CF BENDS

```
                    XXXXX
                   X
                  C -----5 YEAR
                 C
                C
 - - - - - - - C---------LCW CONTRCL POOL
   MAIN      C    5 FEET
            C
   CHANNEL C ------------
          X
         X
XXXXXXXXX        TYPICAL CROSS SECTICN
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION CF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 12635. | $ 15295. | $ 17955. | $ 20615. | $ 23275. | $ 25935. | $ 28595. |
| 1000. | $ 25270. | $ 30590. | $ 35910. | $ 41230. | $ 46550. | $ 51870. | $ 57190. |
| 1500. | $ 37905. | $ 45885. | $ 53865. | $ 61845. | $ 69825. | $ 77805. | $ 85785. |
| 2000. | $ 50540. | $ 61180. | $ 71820. | $ 82460. | $ 93100. | $ 103740. | $ 114380. |
| 2500. | $ 63175. | $ 76475. | $ 89775. | $ 103075. | $ 116375. | $ 129675. | $ 142975. |
| 3000. | $ 75810. | $ 91770. | $ 107730. | $ 123690. | $ 139650. | $ 155610. | $ 171570. |
| 3500. | $ 88445. | $ 107065. | $ 125685. | $ 144305. | $ 162925. | $ 181545. | $ 200165. |
| 4000. | $ 101080. | $ 122360. | $ 143640. | $ 164920. | $ 186200. | $ 207480. | $ 228760. |
| 4500. | $ 113715. | $ 137655. | $ 161595. | $ 185535. | $ 209475. | $ 233415. | $ 257355. |
| 5000. | $ 126350. | $ 152950. | $ 179550. | $ 206150. | $ 232750. | $ 259350. | $ 285950. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 138985. | $ 168245. | $ 197505. | $ 226765. | $ 256025. | $ 285285. | $ 314545. |
| 6000. | $ 151620. | $ 183540. | $ 215460. | $ 247380. | $ 279300. | $ 311220. | $ 343140. |
| 6500. | $ 164255. | $ 198835. | $ 233415. | $ 267995. | $ 302575. | $ 337155. | $ 371735. |
| 7000. | $ 176890. | $ 214130. | $ 251370. | $ 288610. | $ 325850. | $ 363090. | $ 400330. |
| 7500. | $ 189525. | $ 229425. | $ 269325. | $ 309225. | $ 349125. | $ 389025. | $ 428925. |
| 8000. | $ 202160. | $ 244720. | $ 287280. | $ 329840. | $ 372400. | $ 414960. | $ 457520. |
| 8500. | $ 214795. | $ 260015. | $ 305235. | $ 350455. | $ 395675. | $ 440895. | $ 486115. |
| 9000. | $ 227430. | $ 275310. | $ 323190. | $ 371070. | $ 418950. | $ 466830. | $ 514710. |
| 9500. | $ 240065. | $ 290605. | $ 341145. | $ 391685. | $ 442225. | $ 492765. | $ 543305. |
| 10000. | $ 252700. | $ 305900. | $ 359100. | $ 412300. | $ 465500. | $ 518700. | $ 571900. |
| 10500. | $ 265335. | $ 321195. | $ 377055. | $ 432915. | $ 488775. | $ 544635. | $ 600495. |
| 11000. | $ 277970. | $ 336490. | $ 395010. | $ 453530. | $ 512050. | $ 570570. | $ 629090. |
| 11500. | $ 290605. | $ 351785. | $ 412965. | $ 474145. | $ 535325. | $ 596505. | $ 657685. |
| 12000. | $ 303240. | $ 367080. | $ 430920. | $ 494760. | $ 558600. | $ 622440. | $ 686280. |
| 12500. | $ 315875. | $ 382375. | $ 448875. | $ 515375. | $ 581875. | $ 648375. | $ 714875. |
| 13000. | $ 328510. | $ 397670. | $ 466830. | $ 535990. | $ 605150. | $ 674310. | $ 743470. |
| 13500. | $ 341145. | $ 412965. | $ 484785. | $ 556605. | $ 628425. | $ 700245. | $ 772065. |
| 14000. | $ 353780. | $ 428260. | $ 502740. | $ 577220. | $ 651700. | $ 726180. | $ 800660. |
| 14500. | $ 366415. | $ 443555. | $ 520695. | $ 597835. | $ 674975. | $ 752115. | $ 829255. |
| 15000. | $ 379050. | $ 458850. | $ 538650. | $ 618450. | $ 698250. | $ 778050. | $ 857850. |
| 15500. | $ 391685. | $ 474145. | $ 556605. | $ 639065. | $ 721525. | $ 803985. | $ 886445. |
| 16000. | $ 404320. | $ 489440. | $ 574560. | $ 659680. | $ 744800. | $ 829920. | $ 915040. |
| 16500. | $ 416955. | $ 504735. | $ 592515. | $ 680295. | $ 768075. | $ 855855. | $ 943635. |
| 17000. | $ 429590. | $ 520030. | $ 610470. | $ 700910. | $ 791350. | $ 881790. | $ 972230. |
| 17500. | $ 442225. | $ 535325. | $ 628425. | $ 721525. | $ 814625. | $ 907725. | $1000825. |
| 18000. | $ 454860. | $ 550620. | $ 646380. | $ 742140. | $ 837900. | $ 933660. | $1029420. |
| 18500. | $ 467495. | $ 565915. | $ 664335. | $ 762755. | $ 861175. | $ 959595. | $1058015. |
| 19000. | $ 480130. | $ 581210. | $ 682290. | $ 783370. | $ 884450. | $ 985530. | $1086610. |
| 19500. | $ 492765. | $ 596505. | $ 700245. | $ 803985. | $ 907725. | $1011465. | $1115205. |
| 20000. | $ 505400. | $ 611800. | $ 718200. | $ 824600. | $ 931000. | $1037400. | $1143800. |
| 20500. | $ 518035. | $ 627095. | $ 736155. | $ 845215. | $ 954275. | $1063335. | $1172395. |
| 21000. | $ 530670. | $ 642390. | $ 754110. | $ 865830. | $ 977550. | $1089270. | $1200990. |
| 21500. | $ 543305. | $ 657685. | $ 772065. | $ 886445. | $1000825. | $1115205. | $1229585. |
| 22000. | $ 555940. | $ 672980. | $ 790020. | $ 907060. | $1024100. | $1141140. | $1258180. |
| 22500. | $ 568575. | $ 688275. | $ 807975. | $ 927675. | $1047375. | $1167075. | $1286775. |

```
     O            S
     O            S
     O            OOOOXX
     O            O    X
     O            O    X          APPROXIMATE
     O            O    X
     O            O    X          RIPRAP
     O            O    X
   O O O          O    X          COSTS
    OOO           OOXXXX
     O            S
                  S    SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                    XXXXX
                   X
                  O -----5 YEAR
                 O
                O
* * * * * * * * O--------LOW CONTROL POOL
  MAIN        O    5 FEET
             O
  CHANNEL   O -----------
           X
          X
XXXXXXXXX        TYPICAL CROSS SECTION
```

LEGEND
O = RIPRAP IN PLACE
S = SHORE LINE
O = DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 8446. | $ 10224. | $ 12002. | $ 13780. | $ 15558. | $ 17336. | $ 19114. |
| 1000. | $ 16891. | $ 20447. | $ 24003. | $ 27559. | $ 31115. | $ 34671. | $ 38227. |
| 1500. | $ 25337. | $ 30671. | $ 36005. | $ 41339. | $ 46673. | $ 52007. | $ 57341. |
| 2000. | $ 33782. | $ 40894. | $ 48006. | $ 55118. | $ 62230. | $ 69342. | $ 76454. |
| 2500. | $ 42228. | $ 51118. | $ 60008. | $ 68898. | $ 77788. | $ 86678. | $ 95568. |
| 3000. | $ 50673. | $ 61341. | $ 72009. | $ 82677. | $ 93345. | $ 104013. | $ 114681. |
| 3500. | $ 59119. | $ 71565. | $ 84011. | $ 96457. | $ 108903. | $ 121349. | $ 133795. |
| 4000. | $ 67564. | $ 81788. | $ 96012. | $ 110236. | $ 124460. | $ 138684. | $ 152908. |
| 4500. | $ 76010. | $ 92012. | $ 108014. | $ 124016. | $ 140018. | $ 156020. | $ 172022. |
| 5000. | $ 84455. | $ 102235. | $ 120015. | $ 137795. | $ 155575. | $ 173355. | $ 191135. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 92901. | $ 112459. | $ 132017. | $ 151575. | $ 171133. | $ 190691. | $ 210249. |
| 6000. | $ 101346. | $ 122682. | $ 144018. | $ 165354. | $ 186690. | $ 208026. | $ 229362. |
| 6500. | $ 109792. | $ 132906. | $ 156020. | $ 179134. | $ 202248. | $ 225362. | $ 248476. |
| 7000. | $ 118237. | $ 143129. | $ 168021. | $ 192913. | $ 217805. | $ 242697. | $ 267589. |
| 7500. | $ 126683. | $ 153353. | $ 180023. | $ 206693. | $ 233363. | $ 260033. | $ 286703. |
| | | | | | | | |
| 8000. | $ 135128. | $ 163576. | $ 192024. | $ 220472. | $ 248920. | $ 277368. | $ 305816. |
| 8500. | $ 143574. | $ 173800. | $ 204026. | $ 234252. | $ 264478. | $ 294704. | $ 324930. |
| 9000. | $ 152019. | $ 184023. | $ 216027. | $ 248031. | $ 280035. | $ 312039. | $ 344043. |
| 9500. | $ 160465. | $ 194247. | $ 228029. | $ 261811. | $ 295593. | $ 329375. | $ 363157. |
| 10000. | $ 168910. | $ 204470. | $ 240030. | $ 275590. | $ 311150. | $ 346710. | $ 382270. |
| | | | | | | | |
| 10500. | $ 177356. | $ 214694. | $ 252032. | $ 289370. | $ 326708. | $ 364046. | $ 401384. |
| 11000. | $ 185801. | $ 224917. | $ 264033. | $ 303149. | $ 342265. | $ 381381. | $ 420497. |
| 11500. | $ 194247. | $ 235141. | $ 276035. | $ 316929. | $ 357823. | $ 398717. | $ 439611. |
| 12000. | $ 202692. | $ 245364. | $ 288036. | $ 330708. | $ 373380. | $ 416052. | $ 458724. |
| 12500. | $ 211138. | $ 255588. | $ 300038. | $ 344488. | $ 388938. | $ 433388. | $ 477838. |
| | | | | | | | |
| 13000. | $ 219583. | $ 265811. | $ 312039. | $ 358267. | $ 404495. | $ 450723. | $ 496951. |
| 13500. | $ 228029. | $ 276035. | $ 324041. | $ 372047. | $ 420053. | $ 468059. | $ 516065. |
| 14000. | $ 236474. | $ 286258. | $ 336042. | $ 385826. | $ 435610. | $ 485394. | $ 535178. |
| 14500. | $ 244920. | $ 296482. | $ 348044. | $ 399606. | $ 451168. | $ 502730. | $ 554292. |
| 15000. | $ 253365. | $ 306705. | $ 360045. | $ 413385. | $ 466725. | $ 520065. | $ 573405. |
| | | | | | | | |
| 15500. | $ 261811. | $ 316929. | $ 372047. | $ 427165. | $ 482283. | $ 537401. | $ 592519. |
| 16000. | $ 270256. | $ 327152. | $ 384048. | $ 440944. | $ 497840. | $ 554736. | $ 611632. |
| 16500. | $ 278702. | $ 337376. | $ 396050. | $ 454724. | $ 513398. | $ 572072. | $ 630746. |
| 17000. | $ 287147. | $ 347599. | $ 408051. | $ 468503. | $ 528955. | $ 589407. | $ 649859. |
| 17500. | $ 295593. | $ 357823. | $ 420053. | $ 482283. | $ 544513. | $ 606743. | $ 668973. |
| | | | | | | | |
| 18000. | $ 304038. | $ 368046. | $ 432054. | $ 496062. | $ 560070. | $ 624078. | $ 688086. |
| 18500. | $ 312484. | $ 378270. | $ 444056. | $ 509842. | $ 575628. | $ 641414. | $ 707200. |
| 19000. | $ 320929. | $ 388493. | $ 456057. | $ 523621. | $ 591185. | $ 658749. | $ 726313. |
| 19500. | $ 329375. | $ 398717. | $ 468059. | $ 537401. | $ 606743. | $ 676085. | $ 745427. |
| 20000. | $ 337820. | $ 408940. | $ 480060. | $ 551180. | $ 622300. | $ 693420. | $ 764540. |
| | | | | | | | |
| 20500. | $ 346266. | $ 419164. | $ 492062. | $ 564960. | $ 637858. | $ 710756. | $ 783654. |
| 21000. | $ 354711. | $ 429387. | $ 504063. | $ 578739. | $ 653415. | $ 728091. | $ 802767. |
| 21500. | $ 363157. | $ 439611. | $ 516065. | $ 592519. | $ 668973. | $ 745427. | $ 821881. |
| 22000. | $ 371602. | $ 449834. | $ 528066. | $ 606298. | $ 684530. | $ 762762. | $ 840994. |
| 22500. | $ 380048. | $ 460058. | $ 540068. | $ 620078. | $ 700088. | $ 780098. | $ 860108. |

APPROXIMATE

RIPRAP

COSTS

```
        .           S
  Q                 S
  Q                 OOOOXX
  Q                 O    X
  Q                 O    X
  Q                 O    X
  Q                 O    X
  Q                 O    X
G Q G               O    X
 QQQ                OOXXXX
  Q                 S
                    S       SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                     XXXXX
                    X
                   O -----5 YEAR
                  O
                 O
- - - - - - - - O---------LOW CONTROL POOL
  MAIN         O
              O
 CHANNEL     O      12 FEET
            O
           O
XXXXXXXOO --------------

            TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 27598. | $ 30258. | $ 32918. | $ 35578. | $ 38238. | $ 40898. | $ 43558. |
| 1000. | $ 55195. | $ 60515. | $ 65835. | $ 71155. | $ 76475. | $ 81795. | $ 87115. |
| 1500. | $ 82793. | $ 90773. | $ 98753. | $ 106733. | $ 114713. | $ 122693. | $ 130673. |
| 2000. | $ 110390. | $ 121030. | $ 131670. | $ 142310. | $ 152950. | $ 163590. | $ 174230. |
| 2500. | $ 137988. | $ 151288. | $ 164588. | $ 177888. | $ 191188. | $ 204488. | $ 217788. |
| 3000. | $ 165585. | $ 181545. | $ 197505. | $ 213465. | $ 229425. | $ 245385. | $ 261345. |
| 3500. | $ 193183. | $ 211803. | $ 230423. | $ 249043. | $ 267663. | $ 286283. | $ 304903. |
| 4000. | $ 220780. | $ 242060. | $ 263340. | $ 284620. | $ 305900. | $ 327180. | $ 348460. |
| 4500. | $ 248378. | $ 272318. | $ 296258. | $ 320198. | $ 344138. | $ 368078. | $ 392018. |
| 5000. | $ 275975. | $ 302575. | $ 329175. | $ 355775. | $ 382375. | $ 408975. | $ 435575. |

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 303573. | $ 332833. | $ 362093. | $ 391353. | $ 420613. | $ 449873. | $ 479133. |
| 6000. | $ 331170. | $ 363090. | $ 395010. | $ 426930. | $ 458850. | $ 490770. | $ 522690. |
| 6500. | $ 358768. | $ 393348. | $ 427928. | $ 462508. | $ 497088. | $ 531668. | $ 566248. |
| 7000. | $ 386365. | $ 423605. | $ 460845. | $ 498085. | $ 535325. | $ 572565. | $ 609805. |
| 7500. | $ 413963. | $ 453863. | $ 493763. | $ 533663. | $ 573563. | $ 613463. | $ 653363. |
| 8000. | $ 441560. | $ 484120. | $ 526680. | $ 569240. | $ 611800. | $ 654360. | $ 696920. |
| 8500. | $ 469158. | $ 514378. | $ 559598. | $ 604818. | $ 650038. | $ 695258. | $ 740478. |
| 9000. | $ 496755. | $ 544635. | $ 592515. | $ 640395. | $ 688275. | $ 736155. | $ 784035. |
| 9500. | $ 524353. | $ 574893. | $ 625433. | $ 675973. | $ 726513. | $ 777053. | $ 827593. |
| 10000. | $ 551950. | $ 605150. | $ 658350. | $ 711550. | $ 764750. | $ 817950. | $ 871150. |
| 10500. | $ 579548. | $ 635408. | $ 691268. | $ 747128. | $ 802988. | $ 858848. | $ 914708. |
| 11000. | $ 607145. | $ 665665. | $ 724185. | $ 782705. | $ 841225. | $ 899745. | $ 958265. |
| 11500. | $ 634743. | $ 695923. | $ 757103. | $ 818283. | $ 879463. | $ 940643. | $1001823. |
| 12000. | $ 662340. | $ 726180. | $ 790020. | $ 853860. | $ 917700. | $ 981540. | $1045380. |
| 12500. | $ 689938. | $ 756438. | $ 822938. | $ 889438. | $ 955938. | $1022438. | $1088938. |
| 13000. | $ 717535. | $ 786695. | $ 855855. | $ 925015. | $ 994175. | $1063335. | $1132495. |
| 13500. | $ 745133. | $ 816953. | $ 888773. | $ 960593. | $1032413. | $1104233. | $1176053. |
| 14000. | $ 772730. | $ 847210. | $ 921690. | $ 996170. | $1070650. | $1145130. | $1219610. |
| 14500. | $ 800328. | $ 877468. | $ 954608. | $1031748. | $1108888. | $1186028. | $1263168. |
| 15000. | $ 827925. | $ 907725. | $ 987525. | $1067325. | $1147125. | $1226925. | $1306725. |
| 15500. | $ 855522. | $ 937982. | $1020443. | $1102903. | $1185363. | $1267823. | $1350283. |
| 16000. | $ 883120. | $ 968240. | $1053360. | $1138480. | $1223600. | $1308720. | $1393840. |
| 16500. | $ 910717. | $ 998498. | $1086278. | $1174058. | $1261838. | $1349618. | $1437398. |
| 17000. | $ 938315. | $1028755. | $1119195. | $1209635. | $1300075. | $1390515. | $1480955. |
| 17500. | $ 965913. | $1059013. | $1152113. | $1245213. | $1338313. | $1431413. | $1524513. |
| 18000. | $ 993510. | $1089270. | $1185030. | $1280790. | $1376550. | $1472310. | $1568070. |
| 18500. | $1021108. | $1119528. | $1217948. | $1316368. | $1414788. | $1513208. | $1611628. |
| 19000. | $1048705. | $1149785. | $1250865. | $1351945. | $1453025. | $1554105. | $1655185. |
| 19500. | $1076303. | $1180043. | $1283783. | $1387523. | $1491263. | $1595003. | $1698743. |
| 20000. | $1103900. | $1210300. | $1316700. | $1423100. | $1529500. | $1635900. | $1742300. |
| 20500. | $1131498. | $1240558. | $1349618. | $1458678. | $1567738. | $1676798. | $1785858. |
| 21000. | $1159095. | $1270815. | $1382535. | $1494255. | $1605975. | $1717695. | $1829415. |
| 21500. | $1186693. | $1301073. | $1415453. | $1529833. | $1644213. | $1758593. | $1872973. |
| 22000. | $1214290. | $1331330. | $1448370. | $1565410. | $1682450. | $1799490. | $1916530. |
| 22500. | $1241888. | $1361588. | $1481288. | $1600988. | $1720688. | $1840388. | $1960088. |

```
       .         S
       Q         S
       Q         CCCCXX
       Q         C    X
       Q         C    X        APPROXIMATE
       Q         C    X
       Q         C    X        RIPRAP
       Q         C    X
     Q Q Q       C    X        COSTS
      QQQ        CCXXXX
       Q         S
                 S      SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                         XXXXX
                        X
                       C -----5 YEAR
                      C
                     C
 . . . . . . . .    C---------LOW CONTROL POOL
   MAIN            C
                  C
   CHANNEL       C      12 FEET
                C
               C
 XXXXXXXXC  ---------------

             TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 18447. | $ 20225. | $ 22003. | $ 23781. | $ 25559. | $ 27337. | $ 29115. |
| 1000. | $ 36894. | $ 40450. | $ 44006. | $ 47562. | $ 51118. | $ 54674. | $ 58230. |
| 1500. | $ 55340. | $ 60674. | $ 66008. | $ 71342. | $ 76676. | $ 82010. | $ 87344. |
| 2000. | $ 73787. | $ 80899. | $ 88011. | $ 95123. | $ 102235. | $ 109347. | $ 116459. |
| 2500. | $ 92230. | $ 101124. | $ 110014. | $ 118904. | $ 127794. | $ 136684. | $ 145574. |
| 3000. | $ 110681. | $ 121349. | $ 132017. | $ 142685. | $ 153353. | $ 164021. | $ 174689. |
| 3500. | $ 129127. | $ 141573. | $ 154019. | $ 166465. | $ 178911. | $ 191357. | $ 203803. |
| 4000. | $ 147574. | $ 161798. | $ 176022. | $ 190246. | $ 204470. | $ 218694. | $ 232918. |
| 4500. | $ 166021. | $ 182023. | $ 198025. | $ 214027. | $ 230029. | $ 246031. | $ 262033. |
| 5000. | $ 184468. | $ 202248. | $ 220028. | $ 237808. | $ 255588. | $ 273368. | $ 291148. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 202918. | $ 222072. | $ 242030. | $ 261588. | $ 281146. | $ 300704. | $ 320262. |
| 6000. | $ 221361. | $ 242697. | $ 264033. | $ 285369. | $ 306705. | $ 328041. | $ 349377. |
| 6500. | $ 239804. | $ 262922. | $ 286036. | $ 309150. | $ 332264. | $ 355378. | $ 378492. |
| 7000. | $ 258255. | $ 283147. | $ 308039. | $ 332931. | $ 357823. | $ 382715. | $ 407607. |
| 7500. | $ 276701. | $ 303371. | $ 330041. | $ 356711. | $ 383381. | $ 410051. | $ 436721. |
| 8000. | $ 295148. | $ 323596. | $ 352044. | $ 380492. | $ 408940. | $ 437388. | $ 465836. |
| 8500. | $ 313595. | $ 343821. | $ 374047. | $ 404273. | $ 434499. | $ 464725. | $ 494951. |
| 9000. | $ 332042. | $ 364046. | $ 396050. | $ 428054. | $ 460058. | $ 492062. | $ 524066. |
| 9500. | $ 350488. | $ 384270. | $ 418052. | $ 451834. | $ 485616. | $ 519398. | $ 553180. |
| 10000. | $ 368935. | $ 404495. | $ 440055. | $ 475615. | $ 511175. | $ 546735. | $ 582295. |
| 10500. | $ 387382. | $ 424720. | $ 462058. | $ 499396. | $ 536734. | $ 574072. | $ 611410. |
| 11000. | $ 405825. | $ 444945. | $ 484061. | $ 523177. | $ 562293. | $ 601409. | $ 640525. |
| 11500. | $ 424275. | $ 465169. | $ 506063. | $ 546957. | $ 587851. | $ 628745. | $ 669639. |
| 12000. | $ 442722. | $ 485394. | $ 528066. | $ 570738. | $ 613410. | $ 656082. | $ 698754. |
| 12500. | $ 461165. | $ 505619. | $ 550069. | $ 594519. | $ 638969. | $ 683419. | $ 727869. |
| 13000. | $ 479616. | $ 525844. | $ 572072. | $ 618300. | $ 664528. | $ 710756. | $ 756984. |
| 13500. | $ 498062. | $ 546068. | $ 594074. | $ 642080. | $ 690086. | $ 738092. | $ 786098. |
| 14000. | $ 516505. | $ 566293. | $ 616077. | $ 665861. | $ 715645. | $ 765429. | $ 815213. |
| 14500. | $ 534956. | $ 586518. | $ 638080. | $ 689642. | $ 741204. | $ 792766. | $ 844328. |
| 15000. | $ 553403. | $ 606743. | $ 660083. | $ 713423. | $ 766763. | $ 820103. | $ 873443. |
| 15500. | $ 571849. | $ 626967. | $ 682085. | $ 737203. | $ 792321. | $ 847439. | $ 902557. |
| 16000. | $ 590296. | $ 647192. | $ 704088. | $ 760984. | $ 817880. | $ 874776. | $ 931672. |
| 16500. | $ 608743. | $ 667417. | $ 726091. | $ 784765. | $ 843439. | $ 902113. | $ 960787. |
| 17000. | $ 627190. | $ 687642. | $ 748094. | $ 808546. | $ 868998. | $ 929450. | $ 989902. |
| 17500. | $ 645636. | $ 707866. | $ 770096. | $ 832326. | $ 894556. | $ 956786. | $1019016. |
| 18000. | $ 664083. | $ 728091. | $ 792099. | $ 856107. | $ 920115. | $ 984123. | $1048131. |
| 18500. | $ 682530. | $ 748316. | $ 814102. | $ 879888. | $ 945674. | $1011460. | $1077246. |
| 19000. | $ 700977. | $ 768541. | $ 836105. | $ 903669. | $ 971233. | $1038797. | $1106361. |
| 19500. | $ 719423. | $ 788765. | $ 858107. | $ 927449. | $ 996791. | $1066133. | $1135475. |
| 20000. | $ 737870. | $ 808990. | $ 880110. | $ 951230. | $1022350. | $1093470. | $1164590. |
| 20500. | $ 756317. | $ 829215. | $ 902113. | $ 975011. | $1047909. | $1120807. | $1193705. |
| 21000. | $ 774760. | $ 849440. | $ 924116. | $ 998792. | $1073468. | $1148144. | $1222820. |
| 21500. | $ 793210. | $ 869664. | $ 946118. | $1022572. | $1099026. | $1175480. | $1251934. |
| 22000. | $ 811657. | $ 889889. | $ 968121. | $1046353. | $1124585. | $1202817. | $1281049. |
| 22500. | $ 830104. | $ 910114. | $ 990124. | $1070134. | $1150144. | $1230154. | $1310164. |

APPROXIMATE

RIPRAP

COSTS

```
           Q                   S
           Q                   S
           Q                   S
           Q                   OOOOOOXXX
           Q                   O       X
           Q                   O       X
           Q                   O       X
           Q                   O       X
         Q Q Q                 OOOOXXXXX
          QQQ                  S
           Q                   S
                               S       SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                                             XXXXX
                                            X
                                           O -----5 YEAR
                          FLOWING         O
                    XXXX  BACKWATER      O
 - - - - - - -X        X- - - - - -O ---------LOW CONTROL POOL
   MAIN       X        X          O  3 FEET
              X         XXXXXXXXO ----------
   CHANNEL   X
             X
            X
 XXXXXXXXX                  TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| | *DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION* | | | | | | |
| 500. | $ 8645. | $ 11305. | $ 13965. | $ 16625. | $ 19285. | $ 21945. | $ 24605. |
| 1000. | $ 17290. | $ 22610. | $ 27930. | $ 33250. | $ 38570. | $ 43890. | $ 49210. |
| 1500. | $ 25935. | $ 33915. | $ 41895. | $ 49875. | $ 57855. | $ 65835. | $ 73815. |
| 2000. | $ 34580. | $ 45220. | $ 55860. | $ 66500. | $ 77140. | $ 87780. | $ 98420. |
| 2500. | $ 43225. | $ 56525. | $ 69825. | $ 83125. | $ 96425. | $ 109725. | $ 123025. |
| 3000. | $ 51870. | $ 67830. | $ 83790. | $ 99750. | $ 115710. | $ 131670. | $ 147630. |
| 3500. | $ 60515. | $ 79135. | $ 97755. | $ 116375. | $ 134995. | $ 153615. | $ 172235. |
| 4000. | $ 69160. | $ 90440. | $ 111720. | $ 133000. | $ 154280. | $ 175560. | $ 196840. |
| 4500. | $ 77805. | $ 101745. | $ 125685. | $ 149625. | $ 173565. | $ 197505. | $ 221445. |
| 5000. | $ 86450. | $ 113050. | $ 139650. | $ 166250. | $ 192850. | $ 219450. | $ 246050. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 95095. | $ 124355. | $ 153615. | $ 182875. | $ 212135. | $ 241395. | $ 270655. |
| 6000. | $ 103740. | $ 135660. | $ 167580. | $ 199500. | $ 231420. | $ 263340. | $ 295260. |
| 6500. | $ 112385. | $ 146965. | $ 181545. | $ 216125. | $ 250705. | $ 285285. | $ 319865. |
| 7000. | $ 121030. | $ 158270. | $ 195510. | $ 232750. | $ 269990. | $ 307230. | $ 344470. |
| 7500. | $ 129675. | $ 169575. | $ 209475. | $ 249375. | $ 289275. | $ 329175. | $ 369075. |
| 8000. | $ 138320. | $ 180880. | $ 223440. | $ 266000. | $ 308560. | $ 351120. | $ 393680. |
| 8500. | $ 146965. | $ 192185. | $ 237405. | $ 282625. | $ 327845. | $ 373065. | $ 418285. |
| 9000. | $ 155610. | $ 203490. | $ 251370. | $ 299250. | $ 347130. | $ 395010. | $ 442890. |
| 9500. | $ 164255. | $ 214795. | $ 265335. | $ 315875. | $ 366415. | $ 416955. | $ 467495. |
| 10000. | $ 172900. | $ 226100. | $ 279300. | $ 332500. | $ 385700. | $ 438900. | $ 492100. |
| 10500. | $ 181545. | $ 237405. | $ 293265. | $ 349125. | $ 404985. | $ 460845. | $ 516705. |
| 11000. | $ 190190. | $ 248710. | $ 307230. | $ 365750. | $ 424270. | $ 482790. | $ 541310. |
| 11500. | $ 198835. | $ 260015. | $ 321195. | $ 382375. | $ 443555. | $ 504735. | $ 565915. |
| 12000. | $ 207480. | $ 271320. | $ 335160. | $ 399000. | $ 462840. | $ 526680. | $ 590520. |
| 12500. | $ 216125. | $ 282625. | $ 349125. | $ 415625. | $ 482125. | $ 548625. | $ 615125. |
| 13000. | $ 224770. | $ 293930. | $ 363090. | $ 432250. | $ 501410. | $ 570570. | $ 639730. |
| 13500. | $ 233415. | $ 305235. | $ 377055. | $ 448875. | $ 520695. | $ 592515. | $ 664335. |
| 14000. | $ 242060. | $ 316540. | $ 391020. | $ 465500. | $ 539980. | $ 614460. | $ 688940. |
| 14500. | $ 250705. | $ 327845. | $ 404985. | $ 482125. | $ 559265. | $ 636405. | $ 713545. |
| 15000. | $ 259350. | $ 339150. | $ 418950. | $ 498750. | $ 578550. | $ 658350. | $ 738150. |
| 15500. | $ 267995. | $ 350455. | $ 432915. | $ 515375. | $ 597835. | $ 680295. | $ 762755. |
| 16000. | $ 276640. | $ 361760. | $ 446880. | $ 532000. | $ 617120. | $ 702240. | $ 787360. |
| 16500. | $ 285285. | $ 373065. | $ 460845. | $ 548625. | $ 636405. | $ 724185. | $ 811965. |
| 17000. | $ 293930. | $ 384370. | $ 474810. | $ 565250. | $ 655690. | $ 746130. | $ 836570. |
| 17500. | $ 302575. | $ 395675. | $ 488775. | $ 581875. | $ 674975. | $ 768075. | $ 861175. |
| 18000. | $ 311220. | $ 406980. | $ 502740. | $ 598500. | $ 694260. | $ 790020. | $ 885780. |
| 18500. | $ 319865. | $ 418285. | $ 516705. | $ 615125. | $ 713545. | $ 811965. | $ 910385. |
| 19000. | $ 328510. | $ 429590. | $ 530670. | $ 631750. | $ 732830. | $ 833910. | $ 934990. |
| 19500. | $ 337155. | $ 440895. | $ 544635. | $ 648375. | $ 752115. | $ 855855. | $ 959595. |
| 20000. | $ 345800. | $ 452200. | $ 558600. | $ 665000. | $ 771400. | $ 877800. | $ 984200. |
| 20500. | $ 354445. | $ 463505. | $ 572565. | $ 681625. | $ 790685. | $ 899745. | $1008805. |
| 21000. | $ 363090. | $ 474810. | $ 586530. | $ 698250. | $ 809970. | $ 921690. | $1033410. |
| 21500. | $ 371735. | $ 486115. | $ 600495. | $ 714875. | $ 829255. | $ 943635. | $1058015. |
| 22000. | $ 380380. | $ 497420. | $ 614460. | $ 731500. | $ 848540. | $ 965580. | $1082620. |
| 22500. | $ 389025. | $ 508725. | $ 628425. | $ 748125. | $ 867825. | $ 987525. | $1107225. |

```
      G            S
      Q            S
      Q            S
      Q            OOOOOOXXX
      Q            O       X
      Q            O       X
      Q            O       X
      G            O       X
    G Q G          OOOOXXXXX
     QQQ           S
      Q            S
                   S
                   S
```

APPROXIMATE

RIPRAP

COSTS

SITE CONFIGURATION

OTHER THAN OUTSIDE OF BENDS

```
                                       XXXXX
                                      X
                                     O -----5 YEAR
                    FLOWING         O
               XXXX  BACKWATER     O
- - - - - - - -X    X- - - - - - -O --------LOW CONTROL POOL
   MAIN       X      X           O  3 FEET
             X        XXXXXXXXO ----------
  CHANNEL   X
           X
          X
XXXXXXXXX
```

TYPICAL CROSS SECTION

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 5776. | $ 7557. | $ 9335. | $ 11113. | $ 12891. | $ 14669. | $ 16447. |
| 1000. | $ 11557. | $ 15113. | $ 18669. | $ 22225. | $ 25781. | $ 29337. | $ 32893. |
| 1500. | $ 17336. | $ 22670. | $ 28004. | $ 33338. | $ 38672. | $ 44006. | $ 49340. |
| 2000. | $ 23114. | $ 30226. | $ 37338. | $ 44450. | $ 51562. | $ 58674. | $ 65786. |
| 2500. | $ 28893. | $ 37783. | $ 46673. | $ 55563. | $ 64453. | $ 73343. | $ 82233. |
| 3000. | $ 34671. | $ 45339. | $ 56007. | $ 66675. | $ 77343. | $ 88011. | $ 98679. |
| 3500. | $ 40450. | $ 52896. | $ 65342. | $ 77788. | $ 90234. | $ 102680. | $ 115126. |
| 4000. | $ 46228. | $ 60452. | $ 74676. | $ 88900. | $ 103124. | $ 117348. | $ 131572. |
| 4500. | $ 52007. | $ 68009. | $ 84011. | $ 100013. | $ 116015. | $ 132017. | $ 148019. |
| 5000. | $ 57785. | $ 75565. | $ 93345. | $ 111125. | $ 128905. | $ 146685. | $ 164465. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 63564. | $ 83122. | $ 102680. | $ 122238. | $ 141796. | $ 161354. | $ 180912. |
| 6000. | $ 69342. | $ 90678. | $ 112014. | $ 133350. | $ 154686. | $ 176022. | $ 197358. |
| 6500. | $ 75121. | $ 98235. | $ 121349. | $ 144463. | $ 167577. | $ 190691. | $ 213805. |
| 7000. | $ 80899. | $ 105791. | $ 130683. | $ 155575. | $ 180467. | $ 205359. | $ 230251. |
| 7500. | $ 86678. | $ 113348. | $ 140018. | $ 166688. | $ 193358. | $ 220028. | $ 246698. |
| 8000. | $ 92456. | $ 120904. | $ 149352. | $ 177800. | $ 206248. | $ 234696. | $ 263144. |
| 8500. | $ 98235. | $ 128461. | $ 158687. | $ 188913. | $ 219139. | $ 249365. | $ 279591. |
| 9000. | $ 104013. | $ 136017. | $ 168021. | $ 200025. | $ 232029. | $ 264033. | $ 296037. |
| 9500. | $ 109792. | $ 143574. | $ 177356. | $ 211138. | $ 244920. | $ 278702. | $ 312484. |
| 10000. | $ 115570. | $ 151130. | $ 186690. | $ 222250. | $ 257810. | $ 293370. | $ 328930. |
| 10500. | $ 121349. | $ 158687. | $ 196025. | $ 233363. | $ 270701. | $ 308039. | $ 345377. |
| 11000. | $ 127127. | $ 166243. | $ 205359. | $ 244475. | $ 283591. | $ 322707. | $ 361823. |
| 11500. | $ 132906. | $ 173800. | $ 214694. | $ 255588. | $ 296482. | $ 337376. | $ 378270. |
| 12000. | $ 138684. | $ 181356. | $ 224028. | $ 266700. | $ 309372. | $ 352044. | $ 394716. |
| 12500. | $ 144463. | $ 188913. | $ 233363. | $ 277813. | $ 322263. | $ 366713. | $ 411163. |
| 13000. | $ 150241. | $ 196469. | $ 242697. | $ 288925. | $ 335153. | $ 381381. | $ 427609. |
| 13500. | $ 156020. | $ 204026. | $ 252032. | $ 300038. | $ 348044. | $ 396050. | $ 444056. |
| 14000. | $ 161798. | $ 211582. | $ 261366. | $ 311150. | $ 360934. | $ 410718. | $ 460502. |
| 14500. | $ 167577. | $ 219139. | $ 270701. | $ 322263. | $ 373825. | $ 425387. | $ 476949. |
| 15000. | $ 173355. | $ 226695. | $ 280035. | $ 333375. | $ 386715. | $ 440055. | $ 493395. |
| 15500. | $ 179134. | $ 234252. | $ 289370. | $ 344488. | $ 399606. | $ 454724. | $ 509842. |
| 16000. | $ 184912. | $ 241808. | $ 298704. | $ 355600. | $ 412496. | $ 469392. | $ 526288. |
| 16500. | $ 190691. | $ 249365. | $ 308039. | $ 366713. | $ 425387. | $ 484061. | $ 542735. |
| 17000. | $ 196469. | $ 256921. | $ 317373. | $ 377825. | $ 438277. | $ 498729. | $ 559181. |
| 17500. | $ 202248. | $ 264478. | $ 326708. | $ 388938. | $ 451168. | $ 513398. | $ 575628. |
| 18000. | $ 208026. | $ 272034. | $ 336042. | $ 400050. | $ 464058. | $ 528066. | $ 592074. |
| 18500. | $ 213805. | $ 279591. | $ 345377. | $ 411163. | $ 476949. | $ 542735. | $ 608521. |
| 19000. | $ 219583. | $ 287147. | $ 354711. | $ 422275. | $ 489839. | $ 557403. | $ 624967. |
| 19500. | $ 225362. | $ 294704. | $ 364046. | $ 433388. | $ 502730. | $ 572072. | $ 641414. |
| 20000. | $ 231140. | $ 302260. | $ 373380. | $ 444500. | $ 515620. | $ 586740. | $ 657860. |
| 20500. | $ 236919. | $ 309817. | $ 382715. | $ 455613. | $ 528511. | $ 601409. | $ 674307. |
| 21000. | $ 242697. | $ 317373. | $ 392049. | $ 466725. | $ 541401. | $ 616077. | $ 690753. |
| 21500. | $ 248476. | $ 324930. | $ 401384. | $ 477838. | $ 554292. | $ 630746. | $ 707200. |
| 22000. | $ 254254. | $ 332486. | $ 410718. | $ 488950. | $ 567182. | $ 645414. | $ 723646. |
| 22500. | $ 260033. | $ 340043. | $ 420053. | $ 500063. | $ 580073. | $ 660083. | $ 740093. |

```
     C              S
     Q              S
     Q              S
     Q              ICCCCCCXXX
     Q              IC        X
     Q              IC        X
     Q              IC        X
     Q              IC        X
   Q Q C            ICCCCXXXXX
    QQQ             S
     Q              S
                    S       SITE CONFIGURATION
```

APPROXIMATE

RIPRAP

COSTS

OUTSIDE OF BENDS

```
                         XXXXX
                        X
                       IC -----5 YEAR
                      C
                     IC
 - - - - - - - -XXXC --------LOW CONTROL POOL
   MAIN         X
               X
  CHANNEL     X
             X
            X
XXXXXXXXX          TYPICAL CROSS SECTION
```

LEGEND
- O - RIPRAP IN PLACE
- S - SHORE LINE
- Q - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 2660. | $ 5320. | $ 7980. | $ 10640. | $ 13300. | $ 15960. | $ 18620. |
| 1000. | $ 5320. | $ 10640. | $ 15960. | $ 21280. | $ 26600. | $ 31920. | $ 37240. |
| 1500. | $ 7980. | $ 15960. | $ 23940. | $ 31920. | $ 39900. | $ 47880. | $ 55860. |
| 2000. | $ 10640. | $ 21280. | $ 31920. | $ 42560. | $ 53200. | $ 63840. | $ 74480. |
| 2500. | $ 13300. | $ 26600. | $ 39900. | $ 53200. | $ 66500. | $ 79800. | $ 93100. |
| 3000. | $ 15960. | $ 31920. | $ 47880. | $ 63840. | $ 79800. | $ 95760. | $ 111720. |
| 3500. | $ 18620. | $ 37240. | $ 55860. | $ 74480. | $ 93100. | $ 111720. | $ 130340. |
| 4000. | $ 21280. | $ 42560. | $ 63840. | $ 85120. | $ 106400. | $ 127680. | $ 148960. |
| 4500. | $ 23940. | $ 47880. | $ 71820. | $ 95760. | $ 119700. | $ 143640. | $ 167580. |
| 5000. | $ 26600. | $ 53200. | $ 79800. | $ 106400. | $ 133000. | $ 159600. | $ 186200. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 29260. | $ 58520. | $ 87780. | $ 117040. | $ 146300. | $ 175560. | $ 204820. |
| 6000. | $ 31920. | $ 63840. | $ 95760. | $ 127680. | $ 159600. | $ 191520. | $ 223440. |
| 6500. | $ 34580. | $ 69160. | $ 103740. | $ 138320. | $ 172900. | $ 207480. | $ 242060. |
| 7000. | $ 37240. | $ 74480. | $ 111720. | $ 148960. | $ 186200. | $ 223440. | $ 260680. |
| 7500. | $ 39900. | $ 79800. | $ 119700. | $ 159600. | $ 199500. | $ 239400. | $ 279300. |
| 8000. | $ 42560. | $ 85120. | $ 127680. | $ 170240. | $ 212800. | $ 255360. | $ 297920. |
| 8500. | $ 45220. | $ 90440. | $ 135660. | $ 180880. | $ 226100. | $ 271320. | $ 316540. |
| 9000. | $ 47880. | $ 95760. | $ 143640. | $ 191520. | $ 239400. | $ 287280. | $ 335160. |
| 9500. | $ 50540. | $ 101080. | $ 151620. | $ 202160. | $ 252700. | $ 303240. | $ 353780. |
| 10000. | $ 53200. | $ 106400. | $ 159600. | $ 212800. | $ 266000. | $ 319200. | $ 372400. |
| 10500. | $ 55860. | $ 111720. | $ 167580. | $ 223440. | $ 279300. | $ 335160. | $ 391020. |
| 11000. | $ 58520. | $ 117040. | $ 175560. | $ 234080. | $ 292600. | $ 351120. | $ 409640. |
| 11500. | $ 61180. | $ 122360. | $ 183540. | $ 244720. | $ 305900. | $ 367080. | $ 428260. |
| 12000. | $ 63840. | $ 127680. | $ 191520. | $ 255360. | $ 319200. | $ 383040. | $ 446880. |
| 12500. | $ 66500. | $ 133000. | $ 199500. | $ 266000. | $ 332500. | $ 399000. | $ 465500. |
| 13000. | $ 69160. | $ 138320. | $ 207480. | $ 276640. | $ 345800. | $ 414960. | $ 484120. |
| 13500. | $ 71820. | $ 143640. | $ 215460. | $ 287280. | $ 359100. | $ 430920. | $ 502740. |
| 14000. | $ 74480. | $ 148960. | $ 223440. | $ 297920. | $ 372400. | $ 446880. | $ 521360. |
| 14500. | $ 77140. | $ 154280. | $ 231420. | $ 308560. | $ 385700. | $ 462840. | $ 539980. |
| 15000. | $ 79800. | $ 159600. | $ 239400. | $ 319200. | $ 399000. | $ 478800. | $ 558600. |
| 15500. | $ 82460. | $ 164920. | $ 247380. | $ 329840. | $ 412300. | $ 494760. | $ 577220. |
| 16000. | $ 85120. | $ 170240. | $ 255360. | $ 340480. | $ 425600. | $ 510720. | $ 595840. |
| 16500. | $ 87780. | $ 175560. | $ 263340. | $ 351120. | $ 438900. | $ 526680. | $ 614460. |
| 17000. | $ 90440. | $ 180880. | $ 271320. | $ 361760. | $ 452200. | $ 542640. | $ 633080. |
| 17500. | $ 93100. | $ 186200. | $ 279300. | $ 372400. | $ 465500. | $ 558600. | $ 651700. |
| 18000. | $ 95760. | $ 191520. | $ 287280. | $ 383040. | $ 478800. | $ 574560. | $ 670320. |
| 18500. | $ 98420. | $ 196840. | $ 295260. | $ 393680. | $ 492100. | $ 590520. | $ 688940. |
| 19000. | $ 101080. | $ 202160. | $ 303240. | $ 404320. | $ 505400. | $ 606480. | $ 707560. |
| 19500. | $ 103740. | $ 207480. | $ 311220. | $ 414960. | $ 518700. | $ 622440. | $ 726180. |
| 20000. | $ 106400. | $ 212800. | $ 319200. | $ 425600. | $ 532000. | $ 638400. | $ 744800. |
| 20500. | $ 109060. | $ 218120. | $ 327180. | $ 436240. | $ 545300. | $ 654360. | $ 763420. |
| 21000. | $ 111720. | $ 223440. | $ 335160. | $ 446880. | $ 558600. | $ 670320. | $ 782040. |
| 21500. | $ 114380. | $ 228760. | $ 343140. | $ 457520. | $ 571900. | $ 686280. | $ 800660. |
| 22000. | $ 117040. | $ 234080. | $ 351120. | $ 468160. | $ 585200. | $ 702240. | $ 819280. |
| 22500. | $ 119700. | $ 239400. | $ 359100. | $ 478800. | $ 598500. | $ 718200. | $ 837900. |

```
                        S
  Q                     S
  Q                     S
  Q                     CCCCCCXXX
  Q                     C     X         APPROXIMATE
  Q                     C     X
  Q                     C     X         RIPRAP
  Q                     C     X
Q Q Q                   CCCCXXXXX       COSTS
 QQQ                    S
  Q                     S
                        S     SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                    XXXXX
                   X
                  C -----5 YEAR
                 C
                C
- - - - - - -XXXC --------LOW CONTROL POOL
  MAIN        X
             X
 CHANNEL    X
           X
          X
XXXXXXXXX          TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 1778. | $ 3556. | $ 5334. | $ 7112. | $ 8890. | $ 10668. | $ 12446. |
| 1000. | $ 3556. | $ 7112. | $ 10668. | $ 14224. | $ 17780. | $ 21336. | $ 24892. |
| 1500. | $ 5334. | $ 10668. | $ 16002. | $ 21336. | $ 26670. | $ 32004. | $ 37338. |
| 2000. | $ 7112. | $ 14224. | $ 21336. | $ 28448. | $ 35560. | $ 42672. | $ 49784. |
| 2500. | $ 8890. | $ 17780. | $ 26670. | $ 35560. | $ 44450. | $ 53340. | $ 62230. |
| 3000. | $ 10668. | $ 21336. | $ 32004. | $ 42672. | $ 53340. | $ 64008. | $ 74676. |
| 3500. | $ 12446. | $ 24892. | $ 37338. | $ 49784. | $ 62230. | $ 74676. | $ 87122. |
| 4000. | $ 14224. | $ 28448. | $ 42672. | $ 56896. | $ 71120. | $ 85344. | $ 99568. |
| 4500. | $ 16002. | $ 32004. | $ 48006. | $ 64008. | $ 80010. | $ 96012. | $ 112014. |
| 5000. | $ 17780. | $ 35560. | $ 53340. | $ 71120. | $ 88900. | $ 106680. | $ 124460. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 19558. | $ 39116. | $ 58674. | $ 78232. | $ 97790. | $ 117348. | $ 136906. |
| 6000. | $ 21336. | $ 42672. | $ 64008. | $ 85344. | $ 106680. | $ 128016. | $ 149352. |
| 6500. | $ 23114. | $ 46228. | $ 69342. | $ 92456. | $ 115570. | $ 138684. | $ 161798. |
| 7000. | $ 24892. | $ 49784. | $ 74676. | $ 99568. | $ 124460. | $ 149352. | $ 174244. |
| 7500. | $ 26670. | $ 53340. | $ 80010. | $ 106680. | $ 133350. | $ 160020. | $ 186690. |
| 8000. | $ 28448. | $ 56896. | $ 85344. | $ 113792. | $ 142240. | $ 170688. | $ 199136. |
| 8500. | $ 30226. | $ 60452. | $ 90678. | $ 120904. | $ 151130. | $ 181356. | $ 211582. |
| 9000. | $ 32004. | $ 64008. | $ 96012. | $ 128016. | $ 160020. | $ 192024. | $ 224028. |
| 9500. | $ 33782. | $ 67564. | $ 101346. | $ 135128. | $ 168910. | $ 202692. | $ 236474. |
| 10000. | $ 35560. | $ 71120. | $ 106680. | $ 142240. | $ 177800. | $ 213360. | $ 248920. |
| 10500. | $ 37338. | $ 74676. | $ 112014. | $ 149352. | $ 186690. | $ 224028. | $ 261366. |
| 11000. | $ 39116. | $ 78232. | $ 117348. | $ 156464. | $ 195580. | $ 234696. | $ 273812. |
| 11500. | $ 40894. | $ 81788. | $ 122682. | $ 163576. | $ 204470. | $ 245364. | $ 286258. |
| 12000. | $ 42672. | $ 85344. | $ 128016. | $ 170688. | $ 213360. | $ 256032. | $ 298704. |
| 12500. | $ 44450. | $ 88900. | $ 133350. | $ 177800. | $ 222250. | $ 266700. | $ 311150. |
| 13000. | $ 46228. | $ 92456. | $ 138684. | $ 184912. | $ 231140. | $ 277368. | $ 323596. |
| 13500. | $ 48006. | $ 96012. | $ 144018. | $ 192024. | $ 240030. | $ 288036. | $ 336042. |
| 14000. | $ 49784. | $ 99568. | $ 149352. | $ 199136. | $ 248920. | $ 298704. | $ 348488. |
| 14500. | $ 51562. | $ 103124. | $ 154686. | $ 206248. | $ 257810. | $ 309372. | $ 360934. |
| 15000. | $ 53340. | $ 106680. | $ 160020. | $ 213360. | $ 266700. | $ 320040. | $ 373380. |
| 15500. | $ 55118. | $ 110236. | $ 165354. | $ 220472. | $ 275590. | $ 330708. | $ 385826. |
| 16000. | $ 56896. | $ 113792. | $ 170688. | $ 227584. | $ 284480. | $ 341376. | $ 398272. |
| 16500. | $ 58674. | $ 117348. | $ 176022. | $ 234696. | $ 293370. | $ 352044. | $ 410718. |
| 17000. | $ 60452. | $ 120904. | $ 181356. | $ 241808. | $ 302260. | $ 362712. | $ 423164. |
| 17500. | $ 62230. | $ 124460. | $ 186690. | $ 248920. | $ 311150. | $ 373380. | $ 435610. |
| 18000. | $ 64008. | $ 128016. | $ 192024. | $ 256032. | $ 320040. | $ 384048. | $ 448056. |
| 18500. | $ 65786. | $ 131572. | $ 197358. | $ 263144. | $ 328930. | $ 394716. | $ 460502. |
| 19000. | $ 67564. | $ 135128. | $ 202692. | $ 270256. | $ 337820. | $ 405384. | $ 472948. |
| 19500. | $ 69342. | $ 138684. | $ 208026. | $ 277368. | $ 346710. | $ 416052. | $ 485394. |
| 20000. | $ 71120. | $ 142240. | $ 213360. | $ 284480. | $ 355600. | $ 426720. | $ 497840. |
| 20500. | $ 72898. | $ 145796. | $ 218694. | $ 291592. | $ 364490. | $ 437388. | $ 510286. |
| 21000. | $ 74676. | $ 149352. | $ 224028. | $ 298704. | $ 373380. | $ 448056. | $ 522732. |
| 21500. | $ 76454. | $ 152908. | $ 229362. | $ 305816. | $ 382270. | $ 458724. | $ 535178. |
| 22000. | $ 78232. | $ 156464. | $ 234696. | $ 312928. | $ 391160. | $ 469392. | $ 547624. |
| 22500. | $ 80010. | $ 160020. | $ 240030. | $ 320040. | $ 400050. | $ 480060. | $ 560070. |

```
   Q            S
   Q            S
   Q            S
   Q            OOOOOOXXX
   Q            O       X
   Q            O       X
   Q            O       X
 Q Q Q          OOOOXXXXX
  QQQ           S
   Q            S
                S      SITE CONFIGURATION
```

APPROXIMATE

RIPRAP

COSTS

OUTSIDE OF BENDS

```
                  XXXXX
                 X
                O -----5 YEAR
               O
              O
- - - - - - - O--------LOW CONTROL POOL
  MAIN       O    5 FEET
            O
  CHANNEL  O -----------
          X
         X
XXXXXXXXX        TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 12635. | $ 15295. | $ 17955. | $ 20615. | $ 23275. | $ 25935. | $ 28595. |
| 1000. | $ 25270. | $ 30590. | $ 35910. | $ 41230. | $ 46550. | $ 51870. | $ 57190. |
| 1500. | $ 37905. | $ 45885. | $ 53865. | $ 61845. | $ 69825. | $ 77805. | $ 85785. |
| 2000. | $ 50540. | $ 61180. | $ 71820. | $ 82460. | $ 93100. | $ 103740. | $ 114380. |
| 2500. | $ 63175. | $ 76475. | $ 89775. | $ 103075. | $ 116375. | $ 129675. | $ 142975. |
| 3000. | $ 75810. | $ 91770. | $ 107730. | $ 123690. | $ 139650. | $ 155610. | $ 171570. |
| 3500. | $ 88445. | $ 107065. | $ 125685. | $ 144305. | $ 162925. | $ 181545. | $ 200165. |
| 4000. | $ 101080. | $ 122360. | $ 143640. | $ 164920. | $ 186200. | $ 207480. | $ 228760. |
| 4500. | $ 113715. | $ 137655. | $ 161595. | $ 185535. | $ 209475. | $ 233415. | $ 257355. |
| 5000. | $ 126350. | $ 152950. | $ 179550. | $ 206150. | $ 232750. | $ 259350. | $ 285950. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO [illegible]-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 138985. | $ 168245. | $ 197505. | $ 226765. | $ 256025. | $ 285285. | $ 314545. |
| 6000. | $ 151620. | $ 183540. | $ 215460. | $ 247380. | $ 279300. | $ 311220. | $ 343140. |
| 6500. | $ 164255. | $ 198835. | $ 233415. | $ 267995. | $ 302575. | $ 337155. | $ 371735. |
| 7000. | $ 176890. | $ 214130. | $ 251370. | $ 288610. | $ 325850. | $ 363090. | $ 400330. |
| 7500. | $ 189525. | $ 229425. | $ 269325. | $ 309225. | $ 349125. | $ 389025. | $ 428925. |
| 8000. | $ 202160. | $ 244720. | $ 287280. | $ 329840. | $ 372400. | $ 414960. | $ 457520. |
| 8500. | $ 214795. | $ 260015. | $ 305235. | $ 350455. | $ 395675. | $ 440895. | $ 486115. |
| 9000. | $ 227430. | $ 275310. | $ 323190. | $ 371070. | $ 418950. | $ 466830. | $ 514710. |
| 9500. | $ 240065. | $ 290605. | $ 341145. | $ 391685. | $ 442225. | $ 492765. | $ 543305. |
| 10000. | $ 252700. | $ 305900. | $ 359100. | $ 412300. | $ 465500. | $ 518700. | $ 571900. |
| 10500. | $ 265335. | $ 321195. | $ 377055. | $ 432915. | $ 488775. | $ 544635. | $ 600495. |
| 11000. | $ 277970. | $ 336490. | $ 395010. | $ 453530. | $ 512050. | $ 570570. | $ 629090. |
| 11500. | $ 290605. | $ 351785. | $ 412965. | $ 474145. | $ 535325. | $ 596505. | $ 657685. |
| 12000. | $ 303240. | $ 367080. | $ 430920. | $ 494760. | $ 558600. | $ 622440. | $ 686280. |
| 12500. | $ 315875. | $ 382375. | $ 448875. | $ 515375. | $ 581875. | $ 648375. | $ 714875. |
| 13000. | $ 328510. | $ 397670. | $ 466830. | $ 535990. | $ 605150. | $ 674310. | $ 743470. |
| 13500. | $ 341145. | $ 412965. | $ 484785. | $ 556605. | $ 628425. | $ 700245. | $ 772065. |
| 14000. | $ 353780. | $ 428260. | $ 502740. | $ 577220. | $ 651700. | $ 726180. | $ 800660. |
| 14500. | $ 366415. | $ 443555. | $ 520695. | $ 597835. | $ 674975. | $ 752115. | $ 829255. |
| 15000. | $ 379050. | $ 458850. | $ 538650. | $ 618450. | $ 698250. | $ 778050. | $ 857850. |
| 15500. | $ 391685. | $ 474145. | $ 556605. | $ 639065. | $ 721525. | $ 803985. | $ 886445. |
| 16000. | $ 404320. | $ 489440. | $ 574560. | $ 659680. | $ 744800. | $ 829920. | $ 915040. |
| 16500. | $ 416955. | $ 504735. | $ 592515. | $ 680295. | $ 768075. | $ 855855. | $ 943635. |
| 17000. | $ 429590. | $ 520030. | $ 610470. | $ 700910. | $ 791350. | $ 881790. | $ 972230. |
| 17500. | $ 442225. | $ 535325. | $ 628425. | $ 721525. | $ 814625. | $ 907725. | $1000825. |
| 18000. | $ 454860. | $ 550620. | $ 646380. | $ 742140. | $ 837900. | $ 933660. | $1029420. |
| 18500. | $ 467495. | $ 565915. | $ 664335. | $ 762755. | $ 861175. | $ 959595. | $1058015. |
| 19000. | $ 480130. | $ 581210. | $ 682290. | $ 783370. | $ 884450. | $ 985530. | $1086610. |
| 19500. | $ 492765. | $ 596505. | $ 700245. | $ 803985. | $ 907725. | $1011465. | $1115205. |
| 20000. | $ 505400. | $ 611800. | $ 718200. | $ 824600. | $ 931000. | $1037400. | $1143800. |
| 20500. | $ 518035. | $ 627095. | $ 736155. | $ 845215. | $ 954275. | $1063335. | $1172395. |
| 21000. | $ 530670. | $ 642390. | $ 754110. | $ 865830. | $ 977550. | $1089270. | $1200990. |
| 21500. | $ 543305. | $ 657685. | $ 772065. | $ 886445. | $1000825. | $1115205. | $1229585. |
| 22000. | $ 555940. | $ 672980. | $ 790020. | $ 907060. | $1024100. | $1141140. | $1258180. |
| 22500. | $ 568575. | $ 688275. | $ 807975. | $ 927675. | $1047375. | $1167075. | $1286775. |

APPROXIMATE

RIPRAP

COSTS

```
   .            S
   O            S
   O            S
   O            OOOOOOXXX
   O            C        X
   O            C        X
   O            C        X
   O            C        X
 G O G          OOOCXXXXX
  GGG           S
   G            S
                S       SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                      XXXXX
                     X
                    C -----5 YEAR
                   C
                  C
 - - - - - - - - C---------LOW CONTROL POOL
   MAIN         C    5 FEET
               C
   CHANNEL    C -----------
             X
            X
XXXXXXXXX            TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
G - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 8446. | $ 10224. | $ 12002. | $ 13780. | $ 15558. | $ 17336. | $ 19114. |
| 1000. | $ 16891. | $ 20447. | $ 24003. | $ 27559. | $ 31115. | $ 34671. | $ 38227. |
| 1500. | $ 25337. | $ 30671. | $ 36005. | $ 41339. | $ 46673. | $ 52007. | $ 57341. |
| 2000. | $ 33782. | $ 40894. | $ 48006. | $ 55118. | $ 62230. | $ 69342. | $ 76454. |
| 2500. | $ 42228. | $ 51118. | $ 60008. | $ 68898. | $ 77788. | $ 86678. | $ 95568. |
| 3000. | $ 50673. | $ 61341. | $ 72009. | $ 82677. | $ 93345. | $ 104013. | $ 114681. |
| 3500. | $ 59119. | $ 71565. | $ 84011. | $ 96457. | $ 108903. | $ 121349. | $ 133795. |
| 4000. | $ 67564. | $ 81788. | $ 96012. | $ 110236. | $ 124460. | $ 138684. | $ 152908. |
| 4500. | $ 76010. | $ 92012. | $ 108014. | $ 124016. | $ 140018. | $ 156020. | $ 172022. |
| 5000. | $ 84455. | $ 102235. | $ 120015. | $ 137795. | $ 155575. | $ 173355. | $ 191135. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 92901. | $ 112459. | $ 132017. | $ 151575. | $ 171133. | $ 190691. | $ 210249. |
| 6000. | $ 101346. | $ 122682. | $ 144018. | $ 165354. | $ 186690. | $ 208026. | $ 229362. |
| 6500. | $ 109792. | $ 132906. | $ 156020. | $ 179134. | $ 202248. | $ 225362. | $ 248476. |
| 7000. | $ 118237. | $ 143129. | $ 168021. | $ 192913. | $ 217805. | $ 242697. | $ 267589. |
| 7500. | $ 126683. | $ 153353. | $ 180023. | $ 206693. | $ 233363. | $ 260033. | $ 286703. |
| 8000. | $ 135128. | $ 163576. | $ 192024. | $ 220472. | $ 248920. | $ 277368. | $ 305816. |
| 8500. | $ 143574. | $ 173800. | $ 204026. | $ 230252. | $ 264478. | $ 294704. | $ 324930. |
| 9000. | $ 152019. | $ 184023. | $ 216027. | $ 248031. | $ 280035. | $ 312039. | $ 344043. |
| 9500. | $ 160465. | $ 194247. | $ 228029. | $ 261811. | $ 295593. | $ 329375. | $ 363157. |
| 10000. | $ 168910. | $ 204470. | $ 240030. | $ 275590. | $ 311150. | $ 346710. | $ 382270. |
| 10500. | $ 177356. | $ 214694. | $ 252032. | $ 289370. | $ 326708. | $ 364046. | $ 401384. |
| 11000. | $ 185801. | $ 224917. | $ 264033. | $ 303149. | $ 342265. | $ 381381. | $ 420497. |
| 11500. | $ 194247. | $ 235141. | $ 276035. | $ 316929. | $ 357823. | $ 398717. | $ 439611. |
| 12000. | $ 202692. | $ 245364. | $ 288036. | $ 330708. | $ 373380. | $ 416052. | $ 458724. |
| 12500. | $ 211138. | $ 255588. | $ 300038. | $ 344488. | $ 388938. | $ 433388. | $ 477838. |
| 13000. | $ 219583. | $ 265811. | $ 312039. | $ 358267. | $ 404495. | $ 450723. | $ 496951. |
| 13500. | $ 228029. | $ 276035. | $ 324041. | $ 372047. | $ 420053. | $ 468059. | $ 516065. |
| 14000. | $ 236474. | $ 286258. | $ 336042. | $ 385826. | $ 435610. | $ 485394. | $ 535178. |
| 14500. | $ 244920. | $ 296482. | $ 348044. | $ 399606. | $ 451168. | $ 502730. | $ 554292. |
| 15000. | $ 253365. | $ 306705. | $ 360045. | $ 413385. | $ 466725. | $ 520065. | $ 573405. |
| 15500. | $ 261811. | $ 316929. | $ 372047. | $ 427165. | $ 482283. | $ 537401. | $ 592519. |
| 16000. | $ 270256. | $ 327152. | $ 384048. | $ 440944. | $ 497840. | $ 554736. | $ 611632. |
| 16500. | $ 278702. | $ 337376. | $ 396050. | $ 454724. | $ 513398. | $ 572072. | $ 630746. |
| 17000. | $ 287147. | $ 347599. | $ 408051. | $ 468503. | $ 528955. | $ 589407. | $ 649859. |
| 17500. | $ 295593. | $ 357823. | $ 420053. | $ 482283. | $ 544513. | $ 606743. | $ 668973. |
| 18000. | $ 304038. | $ 368046. | $ 432054. | $ 496062. | $ 560070. | $ 624078. | $ 688086. |
| 18500. | $ 312484. | $ 378270. | $ 444056. | $ 509842. | $ 575628. | $ 641414. | $ 707200. |
| 19000. | $ 320929. | $ 388493. | $ 456057. | $ 523621. | $ 591185. | $ 658749. | $ 726313. |
| 19500. | $ 329375. | $ 398717. | $ 468059. | $ 537401. | $ 606743. | $ 676085. | $ 745427. |
| 20000. | $ 337820. | $ 408940. | $ 480060. | $ 551180. | $ 622300. | $ 693420. | $ 764540. |
| 20500. | $ 346266. | $ 419164. | $ 492062. | $ 564960. | $ 637858. | $ 710756. | $ 783654. |
| 21000. | $ 354711. | $ 429387. | $ 504063. | $ 578739. | $ 653415. | $ 728091. | $ 802767. |
| 21500. | $ 363157. | $ 439611. | $ 516065. | $ 592519. | $ 668973. | $ 745427. | $ 821881. |
| 22000. | $ 371602. | $ 449834. | $ 528066. | $ 606298. | $ 684530. | $ 762762. | $ 840994. |
| 22500. | $ 380048. | $ 460058. | $ 540068. | $ 620078. | $ 700088. | $ 780098. | $ 860108. |

```
         Q                S
         Q                S
         Q                OOOOOOXXX
         Q                O       X          APPROXIMATE
         Q                O       X
         Q                O       X          RIPRAP
         Q                O       X
       Q Q Q              OOOOXXXXX          COSTS
        QQQ               S
         Q                S
                          S      SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                   XXXXX
                  X
                 O -----5 YEAR
                O
               O
 - - - - - - - O---------LOW CONTROL POOL
   MAIN       O
             O
  CHANNEL   O      12 FEET
           O
          O
 XXXXXXXO --------------

              TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 27558. | $ 30258. | $ 32918. | $ 35578. | $ 38238. | $ 40898. | $ 43558. |
| 1000. | $ 55155. | $ 60515. | $ 65835. | $ 71155. | $ 76475. | $ 81795. | $ 87115. |
| 1500. | $ 82793. | $ 90773. | $ 98753. | $ 106733. | $ 114713. | $ 122693. | $ 130673. |
| 2000. | $ 110390. | $ 121030. | $ 131670. | $ 142310. | $ 152950. | $ 163590. | $ 174230. |
| 2500. | $ 137988. | $ 151288. | $ 164588. | $ 177888. | $ 191188. | $ 204488. | $ 217788. |
| 3000. | $ 165585. | $ 181545. | $ 197505. | $ 213465. | $ 229425. | $ 245385. | $ 261345. |
| 3500. | $ 193183. | $ 211803. | $ 230423. | $ 249043. | $ 267463. | $ 286283. | $ 304903. |
| 4000. | $ 220780. | $ 242060. | $ 263340. | $ 284620. | $ 305900. | $ 327180. | $ 348460. |
| 4500. | $ 248378. | $ 272318. | $ 296258. | $ 320198. | $ 344138. | $ 368078. | $ 392018. |
| 5000. | $ 275975. | $ 302575. | $ 329175. | $ 355775. | $ 382375. | $ 408975. | $ 435575. |

PERIMETER

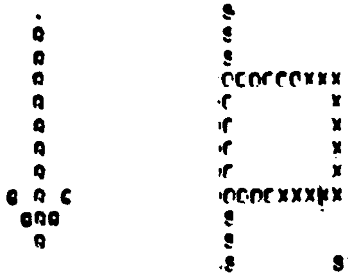
DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 303573. | $ 332833. | $ 362093. | $ 391353. | $ 420613. | $ 449873. | $ 479133. |
| 6000. | $ 331170. | $ 363090. | $ 395010. | $ 426930. | $ 458850. | $ 490770. | $ 522690. |
| 6500. | $ 358768. | $ 393348. | $ 427928. | $ 462508. | $ 497088. | $ 531668. | $ 566248. |
| 7000. | $ 386365. | $ 423605. | $ 460845. | $ 498085. | $ 535325. | $ 572565. | $ 609805. |
| 7500. | $ 413963. | $ 453863. | $ 493763. | $ 533663. | $ 573563. | $ 613463. | $ 653363. |
| 8000. | $ 441560. | $ 484120. | $ 526680. | $ 569240. | $ 611800. | $ 654360. | $ 696920. |
| 8500. | $ 469158. | $ 514378. | $ 559598. | $ 604818. | $ 650038. | $ 695258. | $ 740478. |
| 9000. | $ 496755. | $ 544635. | $ 592515. | $ 640395. | $ 688275. | $ 736155. | $ 784035. |
| 9500. | $ 524353. | $ 574893. | $ 625433. | $ 675973. | $ 726513. | $ 777053. | $ 827593. |
| 10000. | $ 551950. | $ 605150. | $ 658350. | $ 711550. | $ 764750. | $ 817950. | $ 871150. |
| 10500. | $ 579548. | $ 635408. | $ 691268. | $ 747128. | $ 802988. | $ 858848. | $ 914708. |
| 11000. | $ 607145. | $ 665665. | $ 724185. | $ 782705. | $ 841225. | $ 899745. | $ 958265. |
| 11500. | $ 634743. | $ 695923. | $ 757103. | $ 818283. | $ 879463. | $ 940643. | $1001823. |
| 12000. | $ 662340. | $ 726180. | $ 790020. | $ 853860. | $ 917700. | $ 981540. | $1045380. |
| 12500. | $ 689938. | $ 756438. | $ 822938. | $ 889438. | $ 955938. | $1022438. | $1088938. |
| 13000. | $ 717535. | $ 786695. | $ 855855. | $ 925015. | $ 994175. | $1063335. | $1132495. |
| 13500. | $ 745133. | $ 816953. | $ 888773. | $ 960593. | $1032413. | $1104233. | $1176053. |
| 14000. | $ 772730. | $ 847210. | $ 921690. | $ 996170. | $1070650. | $1145130. | $1219610. |
| 14500. | $ 800328. | $ 877468. | $ 954608. | $1031748. | $1108888. | $1186028. | $1263168. |
| 15000. | $ 827925. | $ 907725. | $ 987525. | $1067325. | $1147125. | $1226925. | $1306725. |
| 15500. | $ 855522. | $ 937982. | $1020443. | $1102903. | $1185363. | $1267823. | $1350283. |
| 16000. | $ 883120. | $ 968240. | $1053360. | $1138480. | $1223600. | $1308720. | $1393840. |
| 16500. | $ 910717. | $ 998498. | $1086278. | $1174058. | $1261838. | $1349618. | $1437398. |
| 17000. | $ 938315. | $1028755. | $1119195. | $1209635. | $1300075. | $1390515. | $1480955. |
| 17500. | $ 965913. | $1059013. | $1152113. | $1245213. | $1338313. | $1431413. | $1524513. |
| 18000. | $ 993510. | $1089270. | $1185030. | $1280790. | $1376550. | $1472310. | $1568070. |
| 18500. | $1021108. | $1119528. | $1217948. | $1316368. | $1414788. | $1513208. | $1611628. |
| 19000. | $1048705. | $1149785. | $1250865. | $1351945. | $1453025. | $1554105. | $1655185. |
| 19500. | $1076303. | $1180043. | $1283783. | $1387523. | $1491263. | $1595003. | $1698743. |
| 20000. | $1103900. | $1210300. | $1316700. | $1423100. | $1529500. | $1635900. | $1742300. |
| 20500. | $1131498. | $1240558. | $1349618. | $1458678. | $1567738. | $1676798. | $1785858. |
| 21000. | $1159095. | $1270815. | $1382535. | $1494255. | $1605975. | $1717695. | $1829415. |
| 21500. | $1186693. | $1301073. | $1415453. | $1529833. | $1644213. | $1758593. | $1872973. |
| 22000. | $1214290. | $1331330. | $1448370. | $1565410. | $1682450. | $1799490. | $1916530. |
| 22500. | $1241888. | $1361588. | $1481288. | $1600988. | $1720688. | $1840388. | $1960088. |

APPROXIMATE

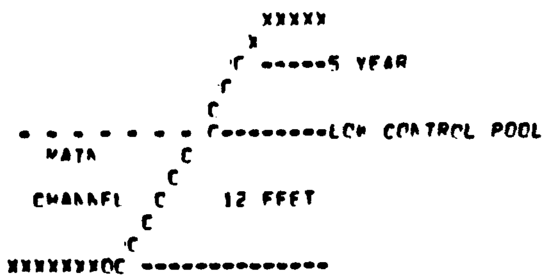
RIPRAP

COSTS



SITE CONFIGURATION

OTHER THAN OUTSIDE OF BENDS




TYPICAL CROSS SECTION

LEGEND
Q - RIPRAP IN PLACE
S - SHORE LINE
O - DIRECTION OF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 18447. | $ 20225. | $ 22003. | $ 23781. | $ 25559. | $ 27337. | $ 29115. |
| 1000. | $ 36894. | $ 40450. | $ 44006. | $ 47562. | $ 51118. | $ 54674. | $ 58230. |
| 1500. | $ 55340. | $ 60674. | $ 66008. | $ 71342. | $ 76676. | $ 82010. | $ 87344. |
| 2000. | $ 73787. | $ 80899. | $ 88011. | $ 95123. | $ 102235. | $ 109347. | $ 116459. |
| 2500. | $ 92234. | $ 101124. | $ 110014. | $ 118904. | $ 127794. | $ 136684. | $ 145574. |
| 3000. | $ 110681. | $ 121349. | $ 132017. | $ 142685. | $ 153353. | $ 164021. | $ 174689. |
| 3500. | $ 129127. | $ 141573. | $ 154019. | $ 166465. | $ 178911. | $ 191357. | $ 203803. |
| 4000. | $ 147574. | $ 161798. | $ 176022. | $ 190246. | $ 204470. | $ 218694. | $ 232918. |
| 4500. | $ 166021. | $ 182023. | $ 198025. | $ 214027. | $ 230029. | $ 246031. | $ 262033. |
| 5000. | $ 184468. | $ 202248. | $ 220028. | $ 237808. | $ 255588. | $ 273368. | $ 291148. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 202514. | $ 222072. | $ 242030. | $ 261588. | $ 281146. | $ 300704. | $ 320262. |
| 6000. | $ 221361. | $ 242697. | $ 264033. | $ 285369. | $ 306705. | $ 328041. | $ 349377. |
| 6500. | $ 239808. | $ 262922. | $ 286036. | $ 309150. | $ 332264. | $ 355378. | $ 378492. |
| 7000. | $ 258255. | $ 283147. | $ 308039. | $ 332931. | $ 357823. | $ 382715. | $ 407607. |
| 7500. | $ 276701. | $ 303371. | $ 330041. | $ 356711. | $ 383381. | $ 410051. | $ 436721. |
| 8000. | $ 295148. | $ 323596. | $ 352044. | $ 380492. | $ 408940. | $ 437388. | $ 465836. |
| 8500. | $ 313595. | $ 343821. | $ 374047. | $ 404273. | $ 434499. | $ 464725. | $ 494951. |
| 9000. | $ 332042. | $ 364046. | $ 396050. | $ 428054. | $ 460058. | $ 492062. | $ 524066. |
| 9500. | $ 350488. | $ 384270. | $ 418052. | $ 451834. | $ 485616. | $ 519398. | $ 553180. |
| 10000. | $ 368935. | $ 404495. | $ 440055. | $ 475615. | $ 511175. | $ 546735. | $ 582295. |
| 10500. | $ 387382. | $ 424720. | $ 462058. | $ 499396. | $ 536734. | $ 574072. | $ 611410. |
| 11000. | $ 405829. | $ 444945. | $ 484061. | $ 523177. | $ 562293. | $ 601409. | $ 640525. |
| 11500. | $ 424275. | $ 465169. | $ 506063. | $ 546957. | $ 587851. | $ 628745. | $ 669639. |
| 12000. | $ 442722. | $ 485394. | $ 528066. | $ 570738. | $ 613410. | $ 656082. | $ 698754. |
| 12500. | $ 461169. | $ 505619. | $ 550069. | $ 594519. | $ 638969. | $ 683419. | $ 727869. |
| 13000. | $ 479616. | $ 525844. | $ 572072. | $ 618300. | $ 664528. | $ 710756. | $ 756984. |
| 13500. | $ 498062. | $ 546068. | $ 594074. | $ 642080. | $ 690086. | $ 738092. | $ 786098. |
| 14000. | $ 516509. | $ 566293. | $ 616077. | $ 665861. | $ 715645. | $ 765429. | $ 815213. |
| 14500. | $ 534956. | $ 586518. | $ 638080. | $ 689642. | $ 741204. | $ 792766. | $ 844328. |
| 15000. | $ 553403. | $ 606743. | $ 660083. | $ 713423. | $ 766763. | $ 820103. | $ 873443. |
| 15500. | $ 571849. | $ 626967. | $ 682085. | $ 737203. | $ 792321. | $ 847439. | $ 902557. |
| 16000. | $ 590296. | $ 647192. | $ 704088. | $ 760984. | $ 817880. | $ 874776. | $ 931672. |
| 16500. | $ 608743. | $ 667417. | $ 726091. | $ 784765. | $ 843439. | $ 902113. | $ 960787. |
| 17000. | $ 627190. | $ 687642. | $ 748094. | $ 808546. | $ 868998. | $ 929450. | $ 989902. |
| 17500. | $ 645636. | $ 707866. | $ 770096. | $ 832326. | $ 894556. | $ 956786. | $1019016. |
| 18000. | $ 664083. | $ 728091. | $ 792099. | $ 856107. | $ 920115. | $ 984123. | $1048131. |
| 18500. | $ 682530. | $ 748316. | $ 814102. | $ 879888. | $ 945674. | $1011460. | $1077246. |
| 19000. | $ 700977. | $ 768541. | $ 836105. | $ 903669. | $ 971233. | $1038797. | $1106361. |
| 19500. | $ 719423. | $ 788765. | $ 858107. | $ 927449. | $ 996791. | $1066133. | $1135475. |
| 20000. | $ 737870. | $ 808990. | $ 880110. | $ 951230. | $1022350. | $1093470. | $1164590. |
| 20500. | $ 756317. | $ 829215. | $ 902113. | $ 975011. | $1047909. | $1120807. | $1193705. |
| 21000. | $ 774764. | $ 849440. | $ 924116. | $ 998792. | $1073468. | $1148144. | $1222820. |
| 21500. | $ 793210. | $ 869664. | $ 946118. | $1022572. | $1099026. | $1175480. | $1251934. |
| 22000. | $ 811657. | $ 889889. | $ 968121. | $1046353. | $1124585. | $1202817. | $1281049. |
| 22500. | $ 830104. | $ 910114. | $ 990124. | $1070134. | $1150144. | $1230154. | $1310164. |

```
                            S
  Q                         S
  Q      CCCC               S
  Q     C    C              S            APPROXIMATE
  Q     C     C             S
  Q     C     C             S            RIPRAP
  Q     C     C             S
  Q      C   C              S            COSTS
Q Q C     X X               S
 QQQ      X X               S
  Q        X                S
                            S  SITE CONFIGURATION
```

CUTSTOF CF BENDS

```
                                   XXXXX
                                  X
                                 C -----5 YEAR
                  FLCWING       C
              XXXX  BACKWATER  C
- - - - - - - -X    X- - - - - - -C ---------LCW CONTROL POCL
  WATA        X      X          C  3 FEET
              X            XXXXXXXXC ----------
 CHANNEL    X
             X
            X
XXXXXXXXX                TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHCRE LINE
Q - DIRECTION CF FLOW

| PERIMETER | DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
| 500. | $ 15727. | $ 20821. | $ 25915. | $ 31009. | $ 36103. | $ 41197. | $ 46291. |
| 1000. | $ 31455. | $ 41642. | $ 51830. | $ 62018. | $ 72206. | $ 82394. | $ 92581. |
| 1500. | $ 47182. | $ 62463. | $ 77745. | $ 93027. | $ 108309. | $ 123590. | $ 138872. |
| 2000. | $ 62909. | $ 83285. | $ 103660. | $ 124036. | $ 144411. | $ 164787. | $ 185163. |
| 2500. | $ 78636. | $ 104106. | $ 129575. | $ 155045. | $ 180514. | $ 205984. | $ 231453. |
| 3000. | $ 94363. | $ 124927. | $ 155490. | $ 186054. | $ 216617. | $ 247181. | $ 277744. |
| 3500. | $ 110091. | $ 145748. | $ 181405. | $ 217063. | $ 252720. | $ 288377. | $ 324035. |
| 4000. | $ 125818. | $ 166569. | $ 207320. | $ 248072. | $ 288823. | $ 329574. | $ 370325. |
| 4500. | $ 141545. | $ 187390. | $ 233235. | $ 279081. | $ 324926. | $ 370771. | $ 416616. |
| 5000. | $ 157273. | $ 208212. | $ 259151. | $ 310090. | $ 361029. | $ 411968. | $ 462907. |

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 173000. | $ 229033. | $ 285066. | $ 341098. | $ 397131. | $ 453164. | $ 509197. |
| 6000. | $ 188727. | $ 249850. | $ 310981. | $ 372107. | $ 433234. | $ 494361. | $ 555488. |
| 6500. | $ 204454. | $ 270675. | $ 336896. | $ 403116. | $ 469337. | $ 535558. | $ 601778. |
| 7000. | $ 220182. | $ 291496. | $ 362811. | $ 434125. | $ 505440. | $ 576755. | $ 648069. |
| 7500. | $ 235909. | $ 312317. | $ 388726. | $ 465134. | $ 541543. | $ 617951. | $ 694360. |
| 8000. | $ 251636. | $ 333138. | $ 414641. | $ 496143. | $ 577646. | $ 659148. | $ 740650. |
| 8500. | $ 267363. | $ 353960. | $ 440556. | $ 527152. | $ 613748. | $ 700345. | $ 786941. |
| 9000. | $ 283091. | $ 374781. | $ 466471. | $ 558161. | $ 649851. | $ 741542. | $ 833232. |
| 9500. | $ 298818. | $ 395602. | $ 492386. | $ 589170. | $ 685954. | $ 782738. | $ 879522. |
| 10000. | $ 314545. | $ 416423. | $ 518301. | $ 620179. | $ 722057. | $ 823935. | $ 925813. |
| 10500. | $ 330272. | $ 437244. | $ 544216. | $ 651188. | $ 758160. | $ 865132. | $ 972104. |
| 11000. | $ 346000. | $ 458065. | $ 570131. | $ 682197. | $ 794263. | $ 906329. | $1018394. |
| 11500. | $ 361727. | $ 478886. | $ 596046. | $ 713206. | $ 830366. | $ 947525. | $1064685. |
| 12000. | $ 377454. | $ 499708. | $ 621961. | $ 744215. | $ 866468. | $ 988722. | $1110976. |
| 12500. | $ 393181. | $ 520529. | $ 647876. | $ 775224. | $ 902571. | $1029919. | $1157266. |
| 13000. | $ 408909. | $ 541350. | $ 673791. | $ 806233. | $ 938674. | $1071116. | $1203557. |
| 13500. | $ 424636. | $ 562171. | $ 699706. | $ 837242. | $ 974777. | $1112312. | $1249848. |
| 14000. | $ 440363. | $ 582992. | $ 725621. | $ 868251. | $1010880. | $1153509. | $1296138. |
| 14500. | $ 456090. | $ 603813. | $ 751536. | $ 899260. | $1046983. | $1194706. | $1342429. |
| 15000. | $ 471818. | $ 624635. | $ 777452. | $ 930268. | $1083086. | $1235903. | $1388720. |
| 15500. | $ 487545. | $ 645456. | $ 803367. | $ 961277. | $1119188. | $1277099. | $1435010. |
| 16000. | $ 503272. | $ 666277. | $ 829282. | $ 992286. | $1155291. | $1318296. | $1481301. |
| 16500. | $ 518999. | $ 687098. | $ 855197. | $1023295. | $1191394. | $1359493. | $1527591. |
| 17000. | $ 534727. | $ 707919. | $ 881112. | $1054304. | $1227497. | $1400690. | $1573882. |
| 17500. | $ 550454. | $ 728740. | $ 907027. | $1085313. | $1263600. | $1441886. | $1620173. |
| 18000. | $ 566181. | $ 749561. | $ 932942. | $1116322. | $1299703. | $1483083. | $1666463. |
| 18500. | $ 581908. | $ 770383. | $ 958857. | $1147331. | $1335805. | $1524280. | $1712754. |
| 19000. | $ 597636. | $ 791204. | $ 984772. | $1178340. | $1371908. | $1565477. | $1759045. |
| 19500. | $ 613363. | $ 812025. | $1010687. | $1209349. | $1408011. | $1606673. | $1805335. |
| 20000. | $ 629090. | $ 832846. | $1036602. | $1240358. | $1444114. | $1647870. | $1851626. |
| 20500. | $ 644817. | $ 853667. | $1062517. | $1271367. | $1480217. | $1689067. | $1897917. |
| 21000. | $ 660545. | $ 874488. | $1088432. | $1302376. | $1516320. | $1730264. | $1944207. |
| 21500. | $ 676272. | $ 895309. | $1114347. | $1333385. | $1552423. | $1771460. | $1990498. |
| 22000. | $ 691999. | $ 916131. | $1140262. | $1364394. | $1588525. | $1812657. | $2036789. |
| 22500. | $ 707726. | $ 936952. | $1166177. | $1395403. | $1624628. | $1853854. | $2083079. |

```
                                S
   Q                            S
   Q        CCCC                S
   Q      C      C              S
   Q      C        C            S                    APPROXIMATE
   Q      C        C            S
   Q      C        C            S                    RIPRAP
   Q        C    C              S
 C Q C       X   X              S                    COSTS
  QQQ        X X                S
   Q          X                 S
                                S  SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                                     XXXXX
                                    X
                                   C -----5 YEAR
                  FLOWING         C
             XXXX  BACKWATER   C
- - - - - - - -X     X- - - - - -C ---------LOW CONTROL POOL
  MAIN        X      X          C  3 FEET
             X        XXXXXXXXO ----------
 CHANNEL   X
          X
         X
XXXXXXXXX                TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

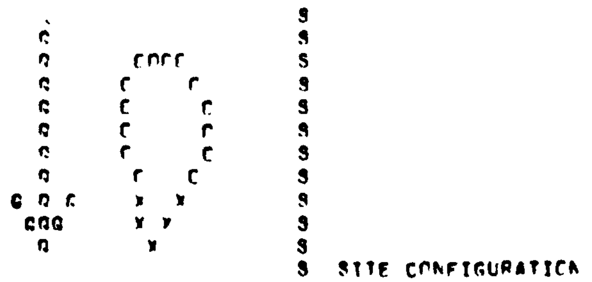
PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 10512. | $ 13917. | $ 17322. | $ 20727. | $ 24132. | $ 27537. | $ 30942. |
| 1000. | $ 21025. | $ 27835. | $ 34644. | $ 41454. | $ 48264. | $ 55074. | $ 61883. |
| 1500. | $ 31537. | $ 41752. | $ 51966. | $ 62181. | $ 72396. | $ 82610. | $ 92825. |
| 2000. | $ 42050. | $ 55669. | $ 69289. | $ 82908. | $ 96528. | $ 110147. | $ 123767. |
| 2500. | $ 52562. | $ 69586. | $ 86611. | $ 103635. | $ 120660. | $ 137684. | $ 154708. |
| 3000. | $ 63075. | $ 83504. | $ 103933. | $ 124362. | $ 144791. | $ 165221. | $ 185650. |
| 3500. | $ 73587. | $ 97421. | $ 121255. | $ 145089. | $ 168923. | $ 192757. | $ 216592. |
| 4000. | $ 84095. | $ 111338. | $ 138577. | $ 165816. | $ 193055. | $ 220294. | $ 247533. |
| 4500. | $ 94612. | $ 125256. | $ 155899. | $ 186543. | $ 217187. | $ 247831. | $ 278475. |
| 5000. | $ 105124. | $ 139173. | $ 173222. | $ 207270. | $ 241319. | $ 275360. | $ 309416. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 115637. | $ 153090. | $ 190544. | $ 227997. | $ 265451. | $ 302905. | $ 340358. |
| 6000. | $ 126145. | $ 167008. | $ 207866. | $ 248724. | $ 289583. | $ 330441. | $ 371300. |
| 6500. | $ 136662. | $ 180925. | $ 225188. | $ 269451. | $ 313715. | $ 357978. | $ 402241. |
| 7000. | $ 147174. | $ 194842. | $ 242510. | $ 290178. | $ 337847. | $ 385515. | $ 433183. |
| 7500. | $ 157686. | $ 208759. | $ 259832. | $ 310906. | $ 361979. | $ 413052. | $ 464125. |
| 8000. | $ 168195. | $ 222677. | $ 277155. | $ 331633. | $ 386110. | $ 440588. | $ 495066. |
| 8500. | $ 178711. | $ 236594. | $ 294477. | $ 352360. | $ 410242. | $ 468125. | $ 526008. |
| 9000. | $ 189224. | $ 250511. | $ 311799. | $ 373087. | $ 434374. | $ 495662. | $ 556950. |
| 9500. | $ 199736. | $ 264429. | $ 329121. | $ 393814. | $ 458506. | $ 523199. | $ 587891. |
| 10000. | $ 210245. | $ 278346. | $ 346443. | $ 414541. | $ 482638. | $ 550736. | $ 618833. |
| 10500. | $ 220761. | $ 292263. | $ 363765. | $ 435268. | $ 506770. | $ 578272. | $ 649775. |
| 11000. | $ 231273. | $ 306180. | $ 381088. | $ 455995. | $ 530902. | $ 605809. | $ 680716. |
| 11500. | $ 241786. | $ 320098. | $ 398410. | $ 476722. | $ 555034. | $ 633346. | $ 711658. |
| 12000. | $ 252298. | $ 334015. | $ 415732. | $ 497449. | $ 579166. | $ 660883. | $ 742599. |
| 12500. | $ 262811. | $ 347932. | $ 433054. | $ 518176. | $ 603298. | $ 688419. | $ 773541. |
| 13000. | $ 273323. | $ 361850. | $ 450376. | $ 538903. | $ 627430. | $ 715956. | $ 804483. |
| 13500. | $ 283835. | $ 375767. | $ 467698. | $ 559630. | $ 651561. | $ 743493. | $ 835424. |
| 14000. | $ 294348. | $ 389684. | $ 485021. | $ 580357. | $ 675693. | $ 771030. | $ 866366. |
| 14500. | $ 304860. | $ 403602. | $ 502343. | $ 601084. | $ 699825. | $ 798566. | $ 897308. |
| 15000. | $ 315373. | $ 417519. | $ 519665. | $ 621811. | $ 723957. | $ 826103. | $ 928249. |
| 15500. | $ 325885. | $ 431436. | $ 536987. | $ 642538. | $ 748089. | $ 853640. | $ 959191. |
| 16000. | $ 336398. | $ 445353. | $ 554309. | $ 663265. | $ 772221. | $ 881177. | $ 990133. |
| 16500. | $ 346910. | $ 459271. | $ 571631. | $ 683992. | $ 796353. | $ 908714. | $1021074. |
| 17000. | $ 357422. | $ 473188. | $ 588954. | $ 704719. | $ 820485. | $ 936250. | $1052016. |
| 17500. | $ 367935. | $ 487105. | $ 606276. | $ 725446. | $ 844617. | $ 963787. | $1082958. |
| 18000. | $ 378447. | $ 501023. | $ 623598. | $ 746173. | $ 868749. | $ 991324. | $1113899. |
| 18500. | $ 388960. | $ 514940. | $ 640920. | $ 766900. | $ 892880. | $1018861. | $1144841. |
| 19000. | $ 399472. | $ 528857. | $ 658242. | $ 787627. | $ 917012. | $1046397. | $1175783. |
| 19500. | $ 409985. | $ 542775. | $ 675564. | $ 808354. | $ 941144. | $1073934. | $1206724. |
| 20000. | $ 420497. | $ 556692. | $ 692887. | $ 829081. | $ 965276. | $1101471. | $1237666. |
| 20500. | $ 431009. | $ 570609. | $ 710209. | $ 849808. | $ 989408. | $1129008. | $1268607. |
| 21000. | $ 441522. | $ 584526. | $ 727531. | $ 870535. | $1013540. | $1156545. | $1299549. |
| 21500. | $ 452034. | $ 598444. | $ 744853. | $ 891263. | $1037672. | $1184081. | $1330491. |
| 22000. | $ 462547. | $ 612361. | $ 762175. | $ 911990. | $1061804. | $1211618. | $1361432. |
| 22500. | $ 473059. | $ 626278. | $ 779497. | $ 932717. | $1085936. | $1239155. | $1392374. |

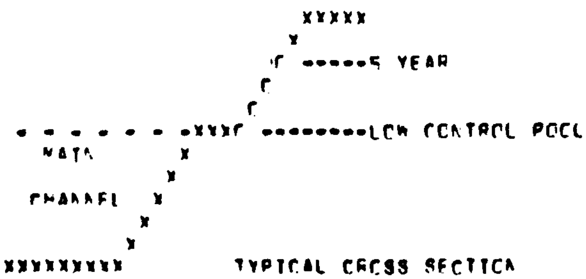



APPROXIMATE

RIPRAP

COSTS

OUTSIDE OF BENDS




LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

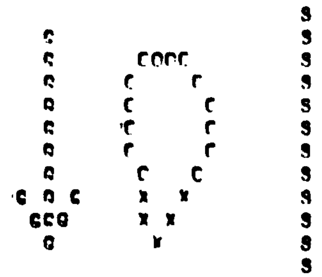
PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 5094. | $ 10188. | $ 15282. | $ 20376. | $ 25470. | $ 30563. | $ 35657. |
| 1000. | $ 10188. | $ 20376. | $ 30563. | $ 40751. | $ 50939. | $ 61127. | $ 71315. |
| 1500. | $ 15282. | $ 30563. | $ 45845. | $ 61127. | $ 76409. | $ 91690. | $ 106972. |
| 2000. | $ 20376. | $ 40751. | $ 61127. | $ 81502. | $ 101878. | $ 122254. | $ 142629. |
| 2500. | $ 25470. | $ 50939. | $ 76409. | $ 101878. | $ 127348. | $ 152817. | $ 178287. |
| 3000. | $ 30563. | $ 61127. | $ 91690. | $ 122254. | $ 152817. | $ 183380. | $ 213944. |
| 3500. | $ 35657. | $ 71315. | $ 106972. | $ 142629. | $ 178287. | $ 213944. | $ 249601. |
| 4000. | $ 40751. | $ 81502. | $ 122254. | $ 163005. | $ 203756. | $ 244507. | $ 285258. |
| 4500. | $ 45845. | $ 91690. | $ 137535. | $ 183380. | $ 229226. | $ 275071. | $ 320916. |
| 5000. | $ 50939. | $ 101878. | $ 152817. | $ 203756. | $ 254695. | $ 305634. | $ 356573. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 56033. | $ 112066. | $ 168099. | $ 224132. | $ 280165. | $ 336197. | $ 392230. |
| 6000. | $ 61127. | $ 122254. | $ 183380. | $ 244507. | $ 305634. | $ 366761. | $ 427888. |
| 6500. | $ 66221. | $ 132441. | $ 198662. | $ 264883. | $ 331104. | $ 397324. | $ 463545. |
| 7000. | $ 71315. | $ 142629. | $ 213944. | $ 285258. | $ 356573. | $ 427888. | $ 499202. |
| 7500. | $ 76409. | $ 152817. | $ 229226. | $ 305634. | $ 382043. | $ 458451. | $ 534860. |
| 8000. | $ 81502. | $ 163005. | $ 244507. | $ 326010. | $ 407512. | $ 489014. | $ 570517. |
| 8500. | $ 86596. | $ 173193. | $ 259789. | $ 346385. | $ 432982. | $ 519578. | $ 606174. |
| 9000. | $ 91690. | $ 183380 | $ 275071. | $ 366761. | $ 458451. | $ 550141. | $ 641831. |
| 9500. | $ 96784. | $ 193568. | $ 290352. | $ 387136. | $ 483921. | $ 580705. | $ 677489. |
| 10000. | $ 101878. | $ 203756. | $ 305634. | $ 407512. | $ 509390. | $ 611268. | $ 713146. |
| 10500. | $ 106972. | $ 213944. | $ 320916. | $ 427888. | $ 534860. | $ 641831. | $ 748803. |
| 11000. | $ 112066. | $ 224132. | $ 336197. | $ 448263. | $ 560329. | $ 672395. | $ 784461. |
| 11500. | $ 117160. | $ 234319. | $ 351479. | $ 468639. | $ 585799. | $ 702958. | $ 820118. |
| 12000. | $ 122254. | $ 244507. | $ 366761. | $ 489014. | $ 611268. | $ 733522. | $ 855775. |
| 12500. | $ 127348. | $ 254695. | $ 382043. | $ 509390. | $ 636738. | $ 764085. | $ 891433. |
| 13000. | $ 132441. | $ 264883. | $ 397324. | $ 529766. | $ 662207. | $ 794648. | $ 927090. |
| 13500. | $ 137535. | $ 275071. | $ 412606. | $ 550141. | $ 687677. | $ 825212. | $ 962747. |
| 14000. | $ 142629. | $ 285258. | $ 427888. | $ 570517. | $ 713146. | $ 855775. | $ 998404. |
| 14500. | $ 147723. | $ 295446. | $ 443169. | $ 590892. | $ 738616. | $ 886339. | $1034062. |
| 15000. | $ 152817. | $ 305634. | $ 458451. | $ 611268. | $ 764085. | $ 916902. | $1069719. |
| 15500. | $ 157911. | $ 315822. | $ 473733. | $ 631644. | $ 789555. | $ 947465. | $1105376. |
| 16000. | $ 163005. | $ 326010. | $ 489014. | $ 652019. | $ 815024. | $ 978029. | $1141034. |
| 16500. | $ 168099. | $ 336197. | $ 504296. | $ 672395. | $ 840494. | $1008592. | $1176691. |
| 17000. | $ 173193. | $ 346385. | $ 519578. | $ 692770. | $ 865963. | $1039156. | $1212348. |
| 17500. | $ 178287. | $ 356573. | $ 534860. | $ 713146. | $ 891433. | $1069719. | $1248006. |
| 18000. | $ 183380. | $ 366761. | $ 550141. | $ 733522. | $ 916902. | $1100282. | $1283663. |
| 18500. | $ 188474. | $ 376949. | $ 565423. | $ 753897. | $ 942372. | $1130846. | $1319320. |
| 19000. | $ 193568. | $ 387136. | $ 580705. | $ 774273. | $ 967841. | $1161409. | $1354977. |
| 19500. | $ 198662. | $ 397324. | $ 595986. | $ 794648. | $ 993311. | $1191973. | $1390635. |
| 20000. | $ 203756. | $ 407512. | $ 611268. | $ 815024. | $1018780. | $1222536. | $1426292. |
| 20500. | $ 208850. | $ 417700. | $ 626550. | $ 835400. | $1044250. | $1253099. | $1461949. |
| 21000. | $ 213944. | $ 427888. | $ 641831. | $ 855775. | $1069719. | $1283663. | $1497607. |
| 21500. | $ 219038. | $ 438075. | $ 657113. | $ 876151. | $1095189. | $1314226. | $1533264. |
| 22000. | $ 224132. | $ 448263. | $ 672395. | $ 896526. | $1120658. | $1344790. | $1568921. |
| 22500. | $ 229226. | $ 458451. | $ 687677. | $ 916902. | $1146128. | $1375353. | $1604579. |



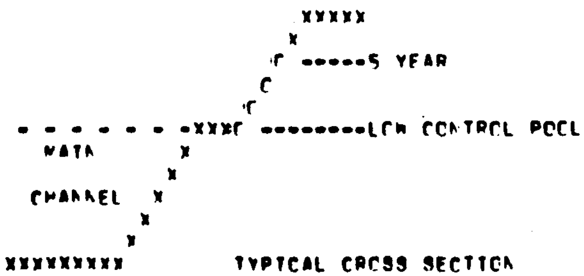
SITE CONFIGURATION

APPROXIMATE

RIPRAP

COSTS

OTHER THAN OUTSIDE OF BENDS




TYPICAL CROSS SECTION

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

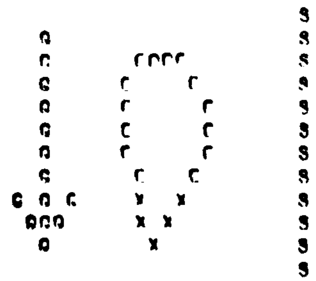
DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 3405. | $ 6810. | $ 10215. | $ 13619. | $ 17024. | $ 20429. | $ 23834. |
| 1000. | $ 6810. | $ 13619. | $ 20429. | $ 27239. | $ 34049. | $ 40858. | $ 47668. |
| 1500. | $ 10215. | $ 20429. | $ 30644. | $ 40858. | $ 51073. | $ 61288. | $ 71502. |
| 2000. | $ 13619. | $ 27239. | $ 40858. | $ 54478. | $ 68097. | $ 81717. | $ 95336. |
| 2500. | $ 17024. | $ 34049. | $ 51073. | $ 68097. | $ 85122. | $ 102146. | $ 119170. |
| 3000. | $ 20429. | $ 40858. | $ 61288. | $ 81717. | $ 102146. | $ 122575. | $ 143005. |
| 3500. | $ 23834. | $ 47668. | $ 71502. | $ 95336. | $ 119170. | $ 143005. | $ 166839. |
| 4000. | $ 27239. | $ 54478. | $ 81717. | $ 108956. | $ 136195. | $ 163434. | $ 190673. |
| 4500. | $ 30644. | $ 61288. | $ 91931. | $ 122575. | $ 153219. | $ 183863. | $ 214507. |
| 5000. | $ 34049. | $ 68097. | $ 102146. | $ 136195. | $ 170244. | $ 204292. | $ 238341. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 37454. | $ 74907. | $ 112361. | $ 149814. | $ 187268. | $ 224721. | $ 262175. |
| 6000. | $ 40858. | $ 81717. | $ 122575. | $ 163434. | $ 204292. | $ 245151. | $ 286009. |
| 6500. | $ 44263. | $ 88527. | $ 132790. | $ 177053. | $ 221317. | $ 265580. | $ 309843. |
| 7000. | $ 47668. | $ 95336. | $ 143005. | $ 190673. | $ 238341. | $ 286009. | $ 333677. |
| 7500. | $ 51073. | $ 102146. | $ 153219. | $ 204292. | $ 255365. | $ 306438. | $ 357511. |
| 8000. | $ 54478. | $ 108956. | $ 163434. | $ 217912. | $ 272390. | $ 326868. | $ 381345. |
| 8500. | $ 57883. | $ 115766. | $ 173648. | $ 231531. | $ 289414. | $ 347297. | $ 405180. |
| 9000. | $ 61288. | $ 122575. | $ 183863. | $ 245151. | $ 306438. | $ 367726. | $ 429014. |
| 9500. | $ 64693. | $ 129385. | $ 194078. | $ 258770. | $ 323463. | $ 388155. | $ 452848. |
| 10000. | $ 68097. | $ 136195. | $ 204292. | $ 272390. | $ 340487. | $ 408584. | $ 476682. |
| 10500. | $ 71502. | $ 143005. | $ 214507. | $ 286009. | $ 357511. | $ 429014. | $ 500516. |
| 11000. | $ 74907. | $ 149814. | $ 224721. | $ 299629. | $ 374536. | $ 449443. | $ 524350. |
| 11500. | $ 78312. | $ 156624. | $ 234936. | $ 313248. | $ 391560. | $ 469872. | $ 548184. |
| 12000. | $ 81717. | $ 163434. | $ 24515 . | $ 326868. | $ 408584. | $ 490301. | $ 572018. |
| 12500. | $ 85122. | $ 170244. | $ 25536 . | $ 340487. | $ 425609. | $ 510731. | $ 595852. |
| 13000. | $ 88527. | $ 177053. | $ 265580. | $ 354106. | $ 442633. | $ 531160. | $ 619686. |
| 13500. | $ 91931. | $ 183863. | $ 275794. | $ 367726. | $ 459657. | $ 551589. | $ 643520. |
| 14000. | $ 95336. | $ 190673. | $ 286009. | $ 381345. | $ 476682. | $ 572018. | $ 667355. |
| 14500. | $ 98741. | $ 197482. | $ 296224. | $ 394965. | $ 493706. | $ 592447. | $ 691189. |
| 15000. | $ 102146. | $ 204292. | $ 306438. | $ 408584. | $ 510731. | $ 612877. | $ 715023. |
| 15500. | $ 105551. | $ 211102. | $ 316653. | $ 422204. | $ 527755. | $ 633306. | $ 738857. |
| 16000. | $ 108956. | $ 217912. | $ 326868. | $ 435823. | $ 544779. | $ 653735. | $ 762691. |
| 16500. | $ 112361. | $ 224721. | $ 337082. | $ 449443. | $ 561804. | $ 674164. | $ 786525. |
| 17000. | $ 115766. | $ 231531. | $ 347297. | $ 463062. | $ 578828. | $ 694593. | $ 810359. |
| 17500. | $ 119170. | $ 238341. | $ 357511. | $ 476682. | $ 595852. | $ 715023. | $ 834193. |
| 18000. | $ 122575. | $ 245151. | $ 367726. | $ 490301. | $ 612877. | $ 735452. | $ 858027. |
| 18500. | $ 125980. | $ 251960. | $ 377941. | $ 503921. | $ 629901. | $ 755881. | $ 881861. |
| 19000. | $ 129385. | $ 258770. | $ 388155. | $ 517540. | $ 646925. | $ 776310. | $ 905695. |
| 19500. | $ 132790. | $ 265580. | $ 398370. | $ 531160. | $ 663950. | $ 796740. | $ 929530. |
| 20000. | $ 136195. | $ 272390. | $ 408584. | $ 544779. | $ 6 0974. | $ 817169. | $ 953364. |
| 20500. | $ 139600. | $ 279199. | $ 418799. | $ 558399. | $ 697998. | $ 837598. | $ 977198. |
| 21000. | $ 143005. | $ 286009. | $ 429014. | $ 572018. | $ 715023. | $ 858027. | $1001032. |
| 21500. | $ 146409. | $ 292819. | $ 439228. | $ 585638. | $ 732047. | $ 878456. | $1024866. |
| 22000. | $ 149814. | $ 299629. | $ 449443. | $ 599257. | $ 749071. | $ 898886. | $1048700. |
| 22500. | $ 153219. | $ 306438. | $ 459657. | $ 612877. | $ 766096. | $ 919315. | $1072534. |



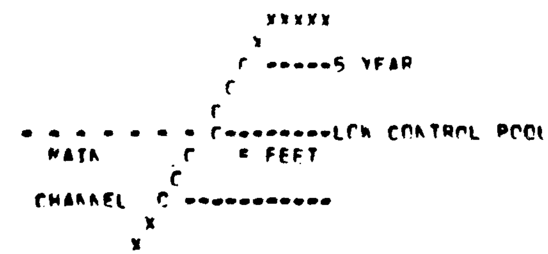
SITE CONFIGURATION

APPROXIMATE

RIPRAP

COSTS

OUTSIDE OF BENDS




TYPICAL CROSS SECTION

LEGEND
C - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 22816. | $ 27910. | $ 33004. | $ 38098. | $ 43192. | $ 48286. | $ 53380. |
| 1000. | $ 45632. | $ 55820. | $ 66008. | $ 76196. | $ 86384. | $ 96571. | $ 106759. |
| 1500. | $ 68448. | $ 83730. | $ 99012. | $ 114294. | $ 129576. | $ 144857. | $ 160139. |
| 2000. | $ 91265. | $ 111640. | $ 132016. | $ 152391. | $ 172767. | $ 193143. | $ 213518. |
| 2500. | $ 114081. | $ 139550. | $ 165020. | $ 190489. | $ 215959. | $ 241428. | $ 266898. |
| 3000. | $ 136897. | $ 167460. | $ 198024. | $ 228587. | $ 259151. | $ 289714. | $ 320277. |
| 3500. | $ 159713. | $ 195370. | $ 231028. | $ 266685. | $ 302342. | $ 338000. | $ 373657. |
| 4000. | $ 182529. | $ 223280. | $ 264032. | $ 304783. | $ 345534. | $ 386285. | $ 427036. |
| 4500. | $ 205345. | $ 251190. | $ 297036. | $ 342881. | $ 388726. | $ 434571. | $ 480416. |
| 5000. | $ 228162. | $ 279101. | $ 330040. | $ 380979. | $ 431918. | $ 482857. | $ 533796. |

PERIMETER

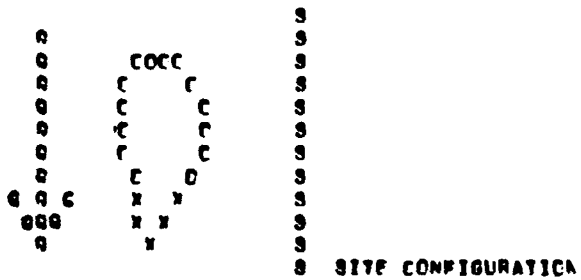
DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 250978. | $ 307011. | $ 363043. | $ 419076. | $ 475109. | $ 531142. | $ 587175. |
| 6000. | $ 273794. | $ 334921. | $ 396047. | $ 457174. | $ 518301. | $ 579428. | $ 640555. |
| 6500. | $ 296610. | $ 362831. | $ 429051. | $ 495272. | $ 561493. | $ 627713. | $ 693934. |
| 7000. | $ 319426. | $ 390741. | $ 462055. | $ 533370. | $ 604685. | $ 675999. | $ 747314. |
| 7500. | $ 342242. | $ 418651. | $ 495059. | $ 571468. | $ 647876. | $ 724285. | $ 800693. |
| 8000. | $ 365058. | $ 446561. | $ 528063. | $ 609566. | $ 691068. | $ 772570. | $ 854073. |
| 8500. | $ 387875. | $ 474471. | $ 561067. | $ 647663. | $ 734260. | $ 820856. | $ 907452. |
| 9000. | $ 410691. | $ 502381. | $ 594071. | $ 685761. | $ 777452. | $ 869142. | $ 960832. |
| 9500. | $ 433507. | $ 530291. | $ 627075. | $ 723859. | $ 820643. | $ 917427. | $1014211. |
| 10000. | $ 456323. | $ 558201. | $ 660079. | $ 761957. | $ 863835. | $ 965713. | $1067591. |
| 10500. | $ 479139. | $ 586111. | $ 693083. | $ 800055. | $ 907027. | $1013999. | $1120971. |
| 11000. | $ 501955. | $ 614021. | $ 726087. | $ 838153. | $ 950219. | $1062284. | $1174350. |
| 11500. | $ 524771. | $ 641931. | $ 759091. | $ 876251. | $ 993410. | $1110570. | $1227730. |
| 12000. | $ 547588. | $ 669841. | $ 792095. | $ 914348. | $1036602. | $1158856. | $1281109. |
| 12500. | $ 570404. | $ 697751. | $ 825099. | $ 952446. | $1079794. | $1207141. | $1334489. |
| 13000. | $ 593220. | $ 725661. | $ 858103. | $ 990544. | $1122986. | $1255427. | $1387868. |
| 13500. | $ 616036. | $ 753571. | $ 891107. | $1028642. | $1166177. | $1303713. | $1441248. |
| 14000. | $ 638852. | $ 781481. | $ 924111. | $1066740. | $1209369. | $1351998. | $1494627. |
| 14500. | $ 661668. | $ 809391. | $ 957115. | $1104838. | $1252561. | $1400284. | $1548007. |
| 15000. | $ 684485. | $ 837301. | $ 990119. | $1142936. | $1295753. | $1448570. | $1601387. |
| 15500. | $ 707301. | $ 865212. | $1023122. | $1181033. | $1338944. | $1496855. | $1654766. |
| 16000. | $ 730117. | $ 893122. | $1056126. | $1219131. | $1382136. | $1545141. | $1708146. |
| 16500. | $ 752933. | $ 921032. | $1089130. | $1257229. | $1425328. | $1593426. | $1761525. |
| 17000. | $ 775749. | $ 948942. | $1122134. | $1295327. | $1468520. | $1641712. | $1814905. |
| 17500. | $ 798565. | $ 976852. | $1155138. | $1333425. | $1511711. | $1689998. | $1868284. |
| 18000. | $ 821381. | $1004762. | $1188142. | $1371523. | $1554903. | $1738283. | $1921664. |
| 18500. | $ 844198. | $1032672. | $1221146. | $1409620. | $1598095. | $1786569. | $1975043. |
| 19000. | $ 867014. | $1060582. | $1254150. | $1447718. | $1641287. | $1834855. | $2028423. |
| 19500. | $ 889830. | $1088492. | $1287154. | $1485816. | $1684478. | $1883140. | $2081802. |
| 20000. | $ 912646. | $1116402. | $1320158. | $1523914. | $1727670. | $1931426. | $2135182. |
| 20500. | $ 935462. | $1144312. | $1353162. | $1562012. | $1770862. | $1979712. | $2188562. |
| 21000. | $ 958278. | $1172222. | $1386166. | $1600110. | $1814054. | $2027997. | $2241941. |
| 21500. | $ 981094. | $1200132. | $1419170. | $1638208. | $1857245. | $2076283. | $2295321. |
| 22000. | $1003911. | $1228042. | $1452174. | $1676305. | $1900437. | $2124569. | $2348700. |
| 22500. | $1026727. | $1255952. | $1485178. | $1714403. | $1943629. | $2172854. | $2402080. |

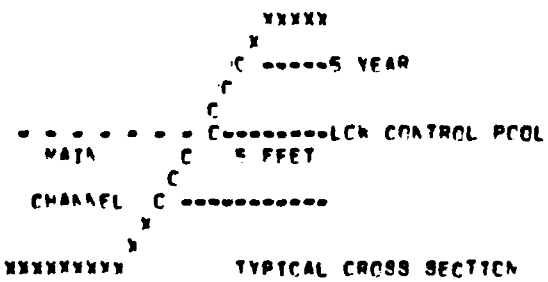
APPROXIMATE

RIPRAP

COSTS




OTHER THAN OUTSIDE OF BENDS




174

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER — DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 15251. | $ 18656. | $ 22061. | $ 25465. | $ 28870. | $ 32275. | $ 35680. |
| 1000. | $ 30502. | $ 37311. | $ 44121. | $ 50931. | $ 57741. | $ 64550. | $ 71360. |
| 1500. | $ 45752. | $ 55967. | $ 66182. | $ 76396. | $ 86611. | $ 96825. | $ 107040. |
| 2000. | $ 61003. | $ 74623. | $ 88242. | $ 101862. | $ 115481. | $ 129101. | $ 142720. |
| 2500. | $ 76254. | $ 93278. | $ 110303. | $ 127327. | $ 144351. | $ 161376. | $ 178400. |
| 3000. | $ 91505. | $ 111934. | $ 132363. | $ 152792. | $ 173222. | $ 193651. | $ 214080. |
| 3500. | $ 106756. | $ 130590. | $ 154424. | $ 178258. | $ 202092. | $ 225926. | $ 249760. |
| 4000. | $ 122006. | $ 149245. | $ 176484. | $ 203723. | $ 230962. | $ 258201. | $ 285440. |
| 4500. | $ 137257. | $ 167901. | $ 198545. | $ 229189. | $ 259832. | $ 290476. | $ 321120. |
| 5000. | $ 152508. | $ 186557. | $ 220605. | $ 254654. | $ 288703. | $ 322751. | $ 356800. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 167755. | $ 205212. | $ 242666. | $ 280119. | $ 317573. | $ 355027. | $ 392480. |
| 6000. | $ 183010. | $ 223868. | $ 264726. | $ 305585. | $ 346443. | $ 387302. | $ 428160. |
| 6500. | $ 198266. | $ 242524. | $ 286787. | $ 331050. | $ 375314. | $ 419577. | $ 463840. |
| 7000. | $ 213511. | $ 261179. | $ 308847. | $ 356516. | $ 404184. | $ 451852. | $ 499520. |
| 7500. | $ 228762. | $ 279835. | $ 330908. | $ 381981. | $ 433054. | $ 484127. | $ 535200. |
| 8000. | $ 244013. | $ 298491. | $ 352969. | $ 407446. | $ 461924. | $ 516402. | $ 570880. |
| 8500. | $ 259264. | $ 317146. | $ 375029. | $ 432912. | $ 490795. | $ 548677. | $ 606560. |
| 9000. | $ 274514. | $ 335802. | $ 397090. | $ 458377. | $ 519665. | $ 580953. | $ 642240. |
| 9500. | $ 289765. | $ 354458. | $ 419150. | $ 483843. | $ 548535. | $ 613228. | $ 677920. |
| 10000. | $ 305016. | $ 373113. | $ 441211. | $ 509308. | $ 577406. | $ 645503. | $ 713600. |
| 10500. | $ 320267. | $ 391769. | $ 463271. | $ 534774. | $ 606276. | $ 677778. | $ 749280. |
| 11000. | $ 335517. | $ 410425. | $ 485332. | $ 560239. | $ 635146. | $ 710053. | $ 784960. |
| 11500. | $ 350768. | $ 429080. | $ 507392. | $ 585704. | $ 664016. | $ 742328. | $ 820640. |
| 12000. | $ 366019. | $ 447736. | $ 529453. | $ 611170. | $ 692887. | $ 774603. | $ 856320. |
| 12500. | $ 381270. | $ 466392. | $ 551513. | $ 636635. | $ 721757. | $ 806879. | $ 892000. |
| 13000. | $ 396521. | $ 485047. | $ 573574. | $ 662101. | $ 750627. | $ 839154. | $ 927680. |
| 13500. | $ 411771. | $ 503703. | $ 595634. | $ 687566. | $ 779497. | $ 871429. | $ 963360. |
| 14000. | $ 427022. | $ 522359. | $ 617695. | $ 713031. | $ 808368. | $ 903704. | $ 999040. |
| 14500. | $ 442273. | $ 541014. | $ 639756. | $ 738497. | $ 837238. | $ 935979. | $1034720. |
| 15000. | $ 457524. | $ 559670. | $ 661816. | $ 763962. | $ 866108. | $ 968254. | $1070400. |
| 15500. | $ 472775. | $ 578326. | $ 683877. | $ 789428. | $ 894979. | $1000529. | $1106080. |
| 16000. | $ 488025. | $ 596981. | $ 705937. | $ 814893. | $ 923849. | $1032805. | $1141760. |
| 16500. | $ 503276. | $ 615637. | $ 727998. | $ 840358. | $ 952719. | $1065080. | $1177440. |
| 17000. | $ 518527. | $ 634293. | $ 750058. | $ 865824. | $ 981589. | $1097355. | $1213121. |
| 17500. | $ 533778. | $ 652948. | $ 772119. | $ 891289. | $1010460. | $1129630. | $1248801. |
| 18000. | $ 549029. | $ 671604. | $ 794179. | $ 916755. | $1039330. | $1161905. | $1284481. |
| 18500. | $ 564279. | $ 690260. | $ 816240. | $ 942220. | $1068200. | $1194180. | $1320161. |
| 19000. | $ 579530. | $ 708915. | $ 838300. | $ 967685. | $1097070. | $1226456. | $1355841. |
| 19500. | $ 594781. | $ 727571. | $ 860361. | $ 993151. | $1125941. | $1258731. | $1391521. |
| 20000. | $ 610032. | $ 746227. | $ 882421. | $1018616. | $1154811. | $1291006. | $1427201. |
| 20500. | $ 625283. | $ 764882. | $ 904482. | $1044082. | $1183681. | $1323281. | $1462881. |
| 21000. | $ 640533. | $ 783538. | $ 926542. | $1069547. | $1212552. | $1355556. | $1498561. |
| 21500. | $ 655784. | $ 802194. | $ 9486[illegible]. | $1095012. | $1241422. | $1387831. | $1534241. |
| 22000. | $ 671035. | $ 820849. | $ 970664. | $1120478. | $1270292. | $1420106. | $1569921. |
| 22500. | $ 686286. | $ 839505. | $ 992724. | $1145943. | $1299162. | $1452382. | $1605601. |

```
       Q           S
       Q   CCCC    S
       Q  C    C   S
       Q  C     C  S                      APPROXIMATE
       Q  C     C  S
       Q  C     C  S                      RIPRAP
       Q   C   C   S
      Q Q Q  X  X  S                      COSTS
       QQQ   X X   S
        Q     X    S
                   S  SITE CONFIGURATION
```

OUTSIDE OF BENDS

```
                    XXXXX
                   X
                  C -----5 YEAR
                 C
                C
- - - - - - - - C--------LOW CONTROL POOL
   MAIN        C
              C
  CHANNEL    C      12 FEET
            C
           C
XXXXXXXXCC --------------

              TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 49400. | $ 54493. | $ 59587. | $ 64681. | $ 69775. | $ 74869. | $ 79963. |
| 1000. | $ 98799. | $ 108987. | $ 119175. | $ 129362. | $ 139550. | $ 149738. | $ 159926. |
| 1500. | $ 148199. | $ 163480. | $ 178762. | $ 194044. | $ 209325. | $ 224607. | $ 239889. |
| 2000. | $ 197598. | $ 217974. | $ 238349. | $ 258725. | $ 279101. | $ 299476. | $ 319852. |
| 2500. | $ 246998. | $ 272467. | $ 297937. | $ 323406. | $ 348876. | $ 374345. | $ 399815. |
| 3000. | $ 296397. | $ 326961. | $ 357524. | $ 388087. | $ 418651. | $ 449214. | $ 479778. |
| 3500. | $ 345797. | $ 381454. | $ 417111. | $ 452769. | $ 488426. | $ 524083. | $ 559740. |
| 4000. | $ 395196. | $ 435947. | $ 476699. | $ 517450. | $ 558201. | $ 598952. | $ 639703. |
| 4500. | $ 444596. | $ 490441. | $ 536286. | $ 582131. | $ 627976. | $ 673821. | $ 719666. |
| 5000. | $ 493995. | $ 544934. | $ 595873. | $ 646812. | $ 697751. | $ 748690. | $ 799629. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 543395. | $ 599428. | $ 655461. | $ 711493. | $ 767526. | $ 823559. | $ 879592. |
| 6000. | $ 592794. | $ 653921. | $ 715048. | $ 776175. | $ 837301. | $ 898428. | $ 959555. |
| 6500. | $ 642194. | $ 708415. | $ 774635. | $ 840856. | $ 907077. | $ 973297. | $1039518. |
| 7000. | $ 691593. | $ 762908. | $ 834223. | $ 905537. | $ 976852. | $1048166. | $1119481. |
| 7500. | $ 740993. | $ 817401. | $ 893810. | $ 970218. | $1046627. | $1123035. | $1199444. |
| 8000. | $ 790392. | $ 871895. | $ 953397. | $1034900. | $1116402. | $1197904. | $1279407. |
| 8500. | $ 839792. | $ 926388. | $1012985. | $1099581. | $1186177. | $1272773. | $1359370. |
| 9000. | $ 889191. | $ 980882. | $1072572. | $1164262. | $1255952. | $1347642. | $1439333. |
| 9500. | $ 938591. | $1035375. | $1132159. | $1228943. | $1325727. | $1422511. | $1519296. |
| 10000. | $ 987990. | $1089869. | $1191747. | $1293625. | $1395503. | $1497381. | $1599259. |
| 10500. | $1037390. | $1144362. | $1251334. | $1358306. | $1465278. | $1572250. | $1679221. |
| 11000. | $1086790. | $1198855. | $1310921. | $1422987. | $1535053. | $1647119. | $1759184. |
| 11500. | $1136189. | $1253349. | $1370508. | $1487668. | $1604828. | $1721988. | $1839147. |
| 12000. | $1185589. | $1307842. | $1430096. | $1552349. | $1674603. | $1796857. | $1919110. |
| 12500. | $1234988. | $1362336. | $1489683. | $1617031. | $1744378. | $1871726. | $1999073. |
| 13000. | $1284388. | $1416829. | $1549270. | $1681712. | $1814153. | $1946595. | $2079036. |
| 13500. | $1333787. | $1471322. | $1608858. | $1746393. | $1883928. | $2021464. | $2158999. |
| 14000. | $1383187. | $1525816. | $1668445. | $1811074. | $1953704. | $2096333. | $2238962. |
| 14500. | $1432586. | $1580309. | $1728032. | $1875756. | $2023479. | $2171202. | $2318925. |
| 15000. | $1481986. | $1634803. | $1787620. | $1940437. | $2093254. | $2246071. | $2398888. |
| 15500. | $1531385. | $1689296. | $1847207. | $2005118. | $2163029. | $2320940. | $2478851. |
| 16000. | $1580785. | $1743790. | $1906794. | $2069799. | $2232804. | $2395809. | $2558814. |
| 16500. | $1630184. | $1798283. | $1966382. | $2134480. | $2302579. | $2470678. | $2638777. |
| 17000. | $1679584. | $1852776. | $2025969. | $2199162. | $2372354. | $2545547. | $2718739. |
| 17500. | $1728983. | $1907270. | $2085556. | $2263843. | $2442129. | $2620416. | $2798702. |
| 18000. | $1778383. | $1961763. | $2145144. | $2328524. | $2511905. | $2695285. | $2878665. |
| 18500. | $1827782. | $2016257. | $2204731. | $2393205. | $2581680. | $2770154. | $2958628. |
| 19000. | $1877182. | $2070750. | $2264318. | $2457887. | $2651455. | $2845023. | $3038591. |
| 19500. | $1926581. | $2125244. | $2323906. | $2522568. | $2721230. | $2919892. | $3118554. |
| 20000. | $1975981. | $2179737. | $2383493. | $2587249. | $2791005. | $2994761. | $3198517. |
| 20500. | $2025381. | $2234230. | $2443080. | $2651930. | $2860780. | $3069630. | $3278480. |
| 21000. | $2074780. | $2288724. | $2502668. | $2716611. | $2930555. | $3144499. | $3358443. |
| 21500. | $2124180. | $2343217. | $2562255. | $2781293. | $3000330. | $3219368. | $3438406. |
| 22000. | $2173579. | $2397711. | $2621842. | $2845974. | $3070106. | $3294237. | $3518369. |
| 22500. | $2222979. | $2452204. | $2681430. | $2910655. | $3139881. | $3369106. | $3598332. |

```
                             S
      O                      S
      O       COCC           S
      O      C    C          S
      O      C     C         S                  APPROXIMATE
      O      C     C         S
      O      C     C         S                  RIPRAP
      O       C   C          S
    O O C     X  X           S                  COSTS.
     OOO      X X            S
      O        X             S
                             S  SITE CONFIGURATION
```

OTHER THAN OUTSIDE OF BENDS

```
                 XXXXX
                X
               C -----5 YEAR
              C
             C
 - - - - - - C--------LOW CONTROL POOL
   MAIN     C
           C
 CHANNEL  C      12 FEET
         C
        C
XXXXXXOC -------------

             TYPICAL CROSS SECTION
```

LEGEND
O - RIPRAP IN PLACE
S - SHORE LINE
Q - DIRECTION OF FLOW

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL TO 5-YEAR FLOOD ELEVATION

| PERIMETER | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 500. | $ 33020. | $ 36425. | $ 39829. | $ 43234. | $ 46639. | $ 50044. | $ 53449. |
| 1000. | $ 66035. | $ 72849. | $ 79659. | $ 86469. | $ 93278. | $ 100088. | $ 106898. |
| 1500. | $ 99055. | $ 109274. | $ 119488. | $ 129703. | $ 139917. | $ 150132. | $ 160347. |
| 2000. | $ 132075. | $ 145698. | $ 159318. | $ 172937. | $ 186557. | $ 200176. | $ 213796. |
| 2500. | $ 165098. | $ 182123. | $ 199147. | $ 216171. | $ 233196. | $ 250220. | $ 267245. |
| 3000. | $ 198118. | $ 218547. | $ ,8977. | $ 259406. | $ 279835. | $ 300264. | $ 320693. |
| 3500. | $ 231138. | $ 254972. | $ 278806. | $ 302640. | $ 326474. | $ 350308. | $ 374142. |
| 4000. | $ 264157. | $ 291396. | $ 318635. | $ 345874. | $ 373113. | $ 400352. | $ 427591. |
| 4500. | $ 297177. | $ 327821. | $ 358465. | $ 389109. | $ 419752. | $ 450396. | $ 481040. |
| 5000. | $ 330197. | $ 364246. | $ 398294. | $ 432343. | $ 466392. | $ 500440. | $ 534489. |

PERIMETER

DIFFERENCE IN ELEVATION FROM LOW CONTROL POOL
TO 5-YEAR FLOOD ELEVATION

| | 2 FEET | 4 FEET | 6 FEET | 8 FEET | 10 FEET | 12 FEET | 14 FEET |
|---|---|---|---|---|---|---|---|
| 5500. | $ 363217. | $ 400670. | $ 438124. | $ 475577. | $ 513031. | $ 550484. | $ 587938. |
| 6000. | $ 396236. | $ 437095. | $ 477953. | $ 518812. | $ 559670. | $ 600528. | $ 641387. |
| 6500. | $ 429256. | $ 473519. | $ 517782. | $ 562046. | $ 606309. | $ 650572. | $ 694836. |
| 7000. | $ 462276. | $ 509944. | $ 557612. | $ 605280. | $ 652948. | $ 700616. | $ 748285. |
| 7500. | $ 495295. | $ 546368. | $ 597441. | $ 648514. | $ 699587. | $ 750660. | $ 801734. |
| 8000. | $ 528315. | $ 582793. | $ 637271. | $ 691749. | $ 746227. | $ 800705. | $ 855182. |
| 8500. | $ 561335. | $ 619217. | $ 677100. | $ 734983. | $ 792866. | $ 850749. | $ 908631. |
| 9000. | $ 594354. | $ 655642. | $ 716930. | $ 778217. | $ 839505. | $ 900793. | $ 962080. |
| 9500. | $ 627374. | $ 692066. | $ 756759. | $ 821452. | $ 886144. | $ 950837. | $1015529. |
| 10000. | $ 660394. | $ 728491. | $ 796588. | $ 864686. | $ 932783. | $1000881. | $1068978. |
| 10500. | $ 693413. | $ 764916. | $ 836418. | $ 907920. | $ 979422. | $1050925. | $1122427. |
| 11000. | $ 726433. | $ 801340. | $ 876247. | $ 951154. | $1026062. | $1100969. | $1175876. |
| 11500. | $ 759453. | $ 837765. | $ 916077. | $ 994389. | $1072701. | $1151013. | $1229325. |
| 12000. | $ 792072. | $ 874189. | $ 955906. | $1037623. | $1119340. | $1201057. | $1282774. |
| 12500. | $ 825492. | $ 910614. | $ 995736. | $1080857. | $1165979. | $1251101. | $1336223. |
| 13000. | $ 858512. | $ 947038. | $1035565. | $1124092. | $1212618. | $1301145. | $1389671. |
| 13500. | $ 891531. | $ 983463. | $1075394. | $1167326. | $1259257. | $1351189. | $1443120. |
| 14000. | $ 924551. | $1019887. | $1115224. | $1210560. | $1305897. | $1401233. | $1496569. |
| 14500. | $ 957571. | $1056312. | $1155053. | $1253794. | $1352536. | $1451277. | $1550018. |
| 15000. | $ 990590. | $1092737. | $1194883. | $1297029. | $1399175. | $1501321. | $1603467. |
| 15500. | $1023610. | $1129161. | $1234712. | $1340263. | $1445814. | $1551365. | $1656916. |
| 16000. | $1056630. | $1165586. | $1274542. | $1383497. | $1492453. | $1601409. | $1710365. |
| 16500. | $1089650. | $1202010. | $1314371. | $1426732. | $1539092. | $1651453. | $1763814. |
| 17000. | $1122669. | $1238435. | $1354200. | $1469966. | $1585732. | $1701497. | $1817263. |
| 17500. | $1155689. | $1274859. | $1394030. | $1513200. | $1632371. | $1751541. | $1870712. |
| 18000. | $1188709. | $1311284. | $1433859. | $1556435. | $1679010. | $1801585. | $1924160. |
| 18500. | $1221728. | $1347708. | $1473689. | $1599669. | $1725649. | $1851629. | $1977609. |
| 19000. | $1254748. | $1384133. | $1513518. | $1642903. | $1772288. | $1901673. | $2031058. |
| 19500. | $1287768. | $1420558. | $1553347. | $1686137. | $1818927. | $1951717. | $2084507. |
| 20000. | $1320787. | $1456982. | $1593177. | $1729372. | $1865567. | $2001761. | $2137956. |
| 20500. | $1353807. | $1493407. | $1633006. | $1772606. | $1912206. | $2051805. | $2191405. |
| 21000. | $1386827. | $1529831. | $1672836. | $1815840. | $1958845. | $2101849. | $2244854. |
| 21500. | $1419846. | $1566256. | $1712665. | $1859075. | $2005484. | $2151893. | $2298303. |
| 22000. | $1452866. | $1602680. | $1752495. | $1902309. | $2052123. | $2201937. | $2351752. |
| 22500. | $1485886. | $1639105. | $1792324. | $1945543. | $2098762. | $2251981. | $2405201. |

# CHAPTER 10

## PROCEDURE FOR ESTIMATING SITE ACQUISITION COSTS

### METHODS TO DETERMINE LAND MARKET VALUES

In the development of the channel maintenance plan, various land tracts were considered as possible placement sites for dredged material. In most instances, sites considered are owned publicly, and no land acquisition cost would be necessary. However, 32 of the 94 sites in the CMP are privately owned. In these instances, the market value of the tract was estimated and considered with other costs (for example, costs for equipment and riprap) in the development of the plan.

The basic valuation method for the areas from lock and dam 3 to lock and dam 10 was developed by the U.S. Fish and Wildlife Service for the purpose of revenue sharing on the Upper Mississippi River National Wild Life and Fish Refuge and is discussed in greater detail in the "Appraisal Report, Upper Mississippi National Wildlife Refuge, Revenue Sharing FY 79, North Central Region." The valuation method for the areas north of lock and dam 3 was developed with the assistance of the Fish and Wildlife Service.

As a result of the complexity of commercial parcels and the availability of construction permits and zoning regulations, these estimates may vary considerably. The costs of acquisition determined by the GREAT I Team are meant to be used for planning and site selection only. If acquisition becomes necessary, a thorough real estate appraisal would have to be done.

### VALUATION METHOD, MISSISSIPPI RIVER, LOCK AND DAM 3 THROUGH LOCK AND DAM 10

A market approach was used to estimate the value of each marketable tract along the Mississippi River from Red Wing, Minnesota, to Guttenberg, Iowa. Actual sales were analyzed by multiple linear regression where variance in the sale price is accounted for by statistically significant variables which were also considered important in establishing value in the marketplace.

In all, 66 sales were analyzed. Information on these sales was obtained from the counties, Departments of Natural Resources, or conservation agencies and appraisers, all of whom are considered reliable sources and are as close to the subject property as possible. These sales were tested for size; date; acres and percent of crop, pasture, and timber; distance from Red Wing; farm use; development potential; and location.

The variables which were significant at the 5-percent level include date, distance, remote (location),farm, and development potential. Size was included, but was not significant at the 5-percent level. Inaccuracies would result if large tracts were used. This factor was controlled by the average floodplain sale of 100 acres. The formula that best fits or the mathematical model that best explains the differences in price is:

Market value = -597.070 + (9.623 x Date) + (-0.040 x Size) + (0.591 x Distance) + (229.134 x Remote) + (504.058 x Farm Potential) + (135.367 x Development Potential).

Where: Market value = probable purchase price of the tract.

Date = the month and year for which the value is calculated (example October 1979 is 79.83 and March 1978 is 78.25).

Size = number of acres in the tract.

Distance = number of river miles downstream from Red Wing.

Remote = 1 or 0 to indicate the remoteness of the tract (0 for a remote site). A tract is considered remote if it is more than 10 miles from a community and there is no building or activity near the tract.

Farm Potential = 1 or 0 to indicate suitability for the growing of crops (1 for suitable soil and land cover conditions).

Development Potential = 1 or 0 to indicate suitability for either commercial or residential development. Tracts in the floodplain are always conside unsuitable.

Displays of the per-acre market values under each combination of remoteness farm potential, and development potential factors for tracts between Red Wing an Guttenberg for June 1978 are on file in the St. Paul District office of the Corp of Engineers.

The appraisal report referred to above concludes that for tracts between lock and dam 3 and Red Wing the values computed for Red Wing should be used.

Actual sales show that the resulting price may fluctuate ±$65 per acre when value of land of all types is estimated by this equation. The actual fluctuation of lowland marsh and timbered lands will probably be lower because of the narrow range of uses it has and the specific interest of a typical buyer.

The price estimate represents the most probable sale price of the land. Prices of individual tracts within each of the marketable units will vary; however, the typical prices will have a tendency to be grouped near the estimated value.

VALUATION METHOD, MINNESOTA RIVER AND MISSISSIPPI RIVER NORTH OF LOCK AND DAM 3

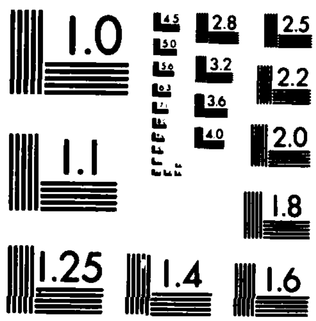
Market values were also developed for privately owned lands considered for dredged material placement along the Minnesota River and the Mississippi River above lock and dam 3. Actual sale prices of land acquired as part of the Lower Minnesota River Refuge and recreation area along the Minnesota River were used as base cost. Minnesota River and pool 2 estimates were presumed equal to the average land sale along the Minnesota River. Pool 3 estimates are based on a 75-percent reduction of the average land sale along the Minnesota River. In addition, the estimated costs were developed considering the location of a site. Sites were divided into three categories:

1. In the "floodway."
2. In the "flood fringe" and out of the "floodway."
3. Out of the floodplain.

The following table lists the estimated cost of land per acre in each area by category.

AD-A127 094 GREAT I STUDY OF THE UPPER MISSISSIPPI RIVER TECHNICAL APPENDIXES VOLUME 8 CHANNEL MAINTENANCE PART I NARRATIVE(U) GREAT RIVER ENVIRONMENTAL ACTION TEAM SEP 80 3/4

UNCLASSIFIED F/G 13/2 NL


1.0
4.5
5.0
5.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

Estimated cost of land per acre

| Category | Cost per acre: Minnesota River and pool 2 | Cost per acre: Mississippi River pool 3 |
|---|---|---|
| 1. Floodway | $1,200 - $1,500 | $900 - $1,125 |
| 2. Flood fringe | 5,000 - 6,500 | 3,750 - 4,875 |
| 3. Out of the floodplain | $25,000 | $18,750 |

For category 3, out of the floodplain, an easement or lease agreement may be feasible because fill at many of these locations appears to benefit the landowners.

## ADMINISTRATIVE COSTS

Administrative costs for land acquisition in the entire study area were determined by the size of a tract. The following table lists the percent of the market value used to calculate the administrative cost by size category. These administrative costs are acquisition costs in addition to the market value of the properties.

Percent of market value used to calculate administrative cost

| Size of tract (acres) | Percent of market value |
|---|---|
| 0.1 - 10 | 75 |
| 11 - 40 | 50 |
| More than 40 | 40 |

## ACQUISITION COSTS

The GREAT I Channel Maintenance Plan includes approximately 100 material placement sites. Most of these sites are owned by the Federal Government (Corps of Engineers or Fish and Wildlife Service) or local governments. Private parties own 54 sites.

These sites cover a full range of types from remote wetlands to industrial parks to upland meadows. In all, nine different descriptions of land cover (shown in the EIS) fit these sites. The most prevalent is wetland. The following table lists the basic land cover descriptions for these sites.

Types of land cover for privately owned sites in the CMP

| Wetland | Previously used placement site | Commercial/ industrial | Upland meadow | Wooded bottomland | Wooded and agricultural | Wooded wetland | Agricultural | Residential |
|---|---|---|---|---|---|---|---|---|
| MN.03 | 2.15 | U.03 | MN.06 | 4.63 | 3.46 | 3.27 | 4.19 | 8.28 |
| 2.13 | 4.03 | MN.30 | 2.35 | 5.26T | | 3.42 | 5.24 | 10.17 |
| 2.14 | 4.18 | 2.02 | 10.40 | 10.16 | | 4.20 | 5.28 | |
| SC.24 | 4.20 | 2.37 | 10.03 | | | 4.49 | 8.22 | |
| 3.09 | 5A.25 | 2.10 | | | | 4.63 | | |
| 3.42 | 6.11 | 2.18 | | | | 7.01 | | |
| 5.26 | 10.01 | 4.37 | | | | 9.41 | | |
| 5A.32 | | 4.38 | | | | 9.11 | | |
| 6.17 | | 4.48 | | | | 9.33 | | |
| 9.07 | | 4.24 | | | | | | |
| 10.04 | | 4.25 | | | | | | |
| 10.41 | | 9.47 | | | | | | |

For many of these sites, acquisition will not be necessary. The majority of the industrial sites do not need to be acquired, but permission to use them or easements should be obtained from the owner. Sites MN.06, MN.30, 2.13, and 6.17 are zoned industrial. Material placement on these sites would increase their industrial development potential considerably. It would not be in the Government's nor the region's best interest to acquire these sites. Again, permission to use the sites or obtaining an easement are preferred.

For the remaining sites, acquisition would not be required in all cases but should be pursued for several to guarantee their use as placement sites. Costs were estimated for these sites using the valuation methods described above. None of the sites could be described as remote and none had farm potential without development potential. Five sites had farm and development potential and two had neither farm nor development potential. The remaining sites had development potential - usually recreationally oriented commercial development. The estimates ranged from $1,000 for a 1-acre site in pool 7 to $380,000 for a 40-acre site in lower pool 2.

## CHAPTER 11

## PROCEDURE FOR ADDRESSING BENEFICIAL USE OF DREDGED MATERIAL

One of the objectives of GREAT I was to identify and develop ways to use dredged material as a valuable resource. The DMUWG (Dredged Material Uses Work Group) had that objective as its primary mission. The work group conducted several studies. Its conclusions and recommendations are found in Volume 2 of the GREAT I report, the DMUWG Appendix

The concept that material should be made available for beneficial use played an important role in development of the channel maintenance plan. If material is placed where it can be removed for beneficial use, some of the adverse impacts (e.g., the isolation of backwaters, the burying of valuable terrestrial and aquatic habitat, or the need for additional land to confine material) associated with the placement of dredged material can be reduced. An assessment of the effects of the CMP found in the Environmental Impact Statement of the GREAT I report confirmed this assumption. In addition, the DMUWG determined that the beneficial use of dredged material can provide economic benefits to the region and that the total demand for material throughout the study area exceeds the total volume dredged. The difficulty is that the dredging and the identified markets often are not near each other.

The value of dredged material for beneficial use varies widely depending primarily on location and timing. Where a specific user can be identified, a reasonable estimate of the value of the material can be made. If, for example, the cost to the user of material from the least cost alternative source is $2.00 per cubic yard, transportation costs for the user are the same from the proposed stockpile site and from the alternate source, and no additional processing cost is required to make the dredged material acceptable for the intended use, the value of the material at the stockpile site can be considered to be $2.00 per cubic yard. This cost can be compared to the increased cost of making the material available for beneficial use (cost above that necessary to place the material at an environmentally acceptable site that does not provide for beneficial use). If the value of the material is greater than the increased cost, the material should be made available for use, ignoring for now the question of who should pay the increased cost. If transportation costs for the user are not equal, processing of the material is required, land must be purchased for the stockpile site, or the environmental acceptability of the alternative placement site is questioned, the value assigned to the material in the stockpile changes and the analysis can become much more difficult. If a specific user cannot be identified but uses are expected to develop if the material is made available, it is impossible to document what value, if any, the material might have. St. Paul District cost estimators were reluctant to attach any value to dredged material under these conditions but speculated that the value could range from $0 to $0.25 per cubic yard.

In preparing a Channel Maintenance Plan, the GREAT I Team did not assign values to the material as a means of offsetting any costs of dredging. In areas where material has been placed in a "beneficial use" site and is being removed (for example, material used by the city of Minneapolis for street sanding), GREAT I selected placement sites that would encourage the practice to continue.

The marketing study identified several parties desiring material and estimated the volume of material required to satisfy their needs. Two types of uses were apparent - annual demand which is continual, and one-time demand, such as fill for land development. These uses were incorporated into the CMP where significant adverse impacts could be avoided at alternate sites.

The Wisconsin Department of Natural Resources is doing a follow-up marketing study to further identify dredged material beneficial use demand. This survey goes beyond the initial marketing study by quantifying demand from private companies who have a possible need for material now that Team approved CMP sites are known.

The GREAT I Team was confident that beneficial use demand for material would develop in some areas even though no demand was identified in the original marketing survey. In these cases, a site that would encourage beneficial use to develop was chosen only when other factors were nearly equal. Impacts at these sites were predicted assuming none of the material was removed.

The volume expected to be removed from each beneficial use site or put to a beneficial use at that site is presented in chapter 3. Also in chapter 3, a possible removal for beneficial use amount is shown for many sites. This amount is the total that may be removed from a site if material is placed there (i.e., the total demand of all beneficial users who stated a desire to remove material from that site). This figure could result in some double counting of demand when users identified more than one site from which they would remove material. The data collected in the Dredged Material Marketing Study were not precise enough to avoid this duplication. However, GREAT I apportioned beneficial use demands to adjacent placement sites when this duplication occurred to more accurately develop the CMP.

Several unresolved questions remain concerning the use of beneficial use demand in the plan formulation process and how beneficial use should be handled in the daily operation of maintaining the 9-foot navigation project.

1. What value should be placed on the material in calculating maintenance costs and benefits?

2. What, if any, should the cost sharing be for providing the material at a beneficial use?

3. What should government policy be on making material available, and any requirement for cost recovery, to State and local governments? To private parties?

4. If the material is to support another Federal program, how should costs be allocated?

Despite these uncertainties, GREAT I concluded that demand for dredged material for beneficial use should be accommodated whenever possible. When placed in the river floodplain where there is no beneficial use, dredged material is an undesirable waste product that destroys aquatic and terrestrial wildlife habitat. When placed at an accessible location where beneficial use demand does exist, dredged material is a valuable resource, fostering safer roadways and economic development.

# CHAPTER 12

## SPECIAL FEATURES OF THE CHANNEL MAINTENANCE PLAN

Many of the actions recommended in the GREAT I CMP are novel when compared with historic dredging practices and past demands of State and Federal natural resource agencies. However, GREAT believes that several actions warrant special attention: the Weaver Bottoms rehabilitation program, the placement plan for Read's Landing, the placement sites for the St. Paul Barge Terminal, and the Spring Lake rehabilitation project in pool 2. The following descriptions are meant to provide some of the details necessary to understand these special features of the CMP.

### THE WEAVER BOTTOMS REHABILITATION PROJECT (POOL 5, PLACEMENT SITES FOR CUTS 1, 2, 3, AND 4)

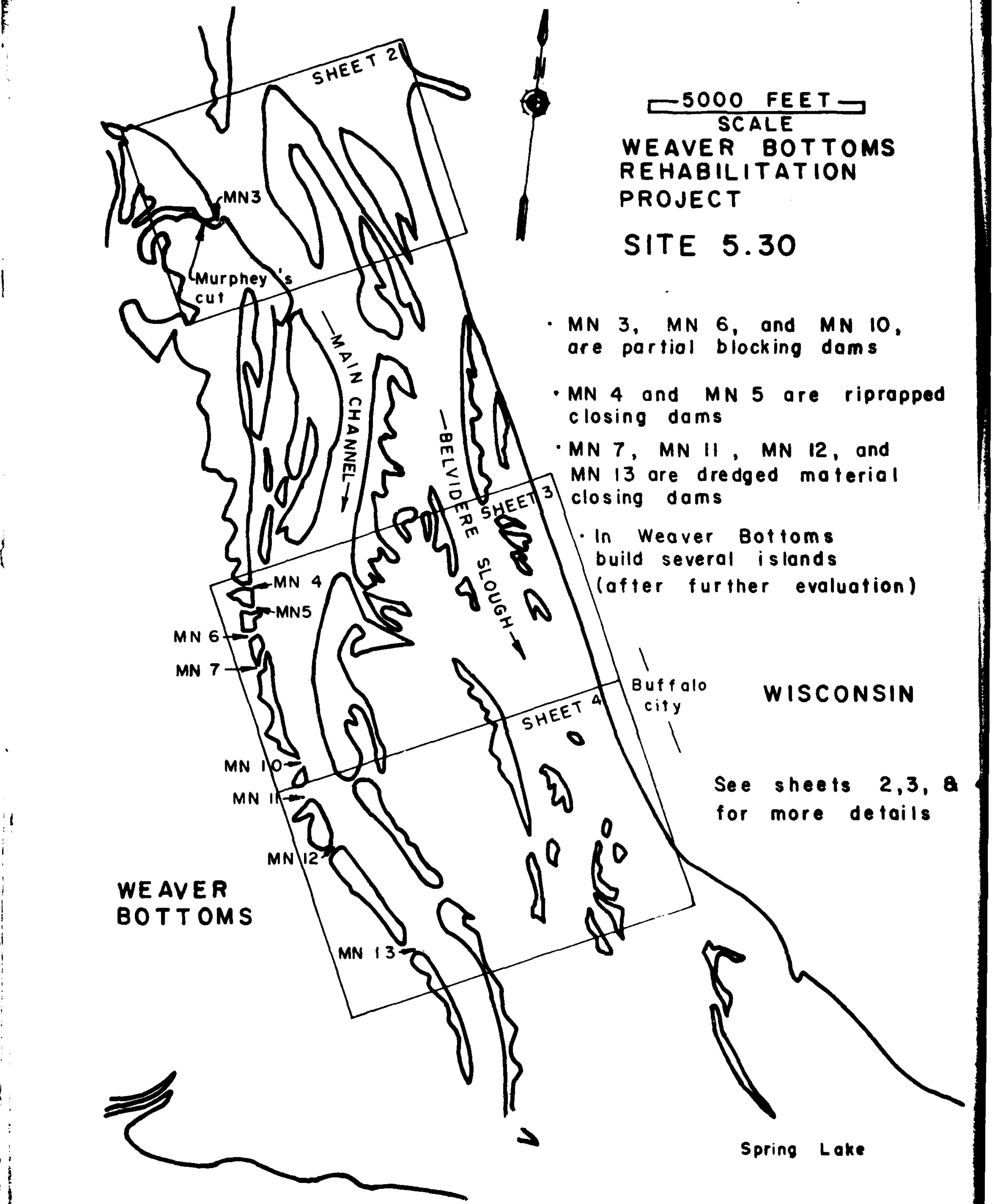
Biologists and sportsmen alike are concerned about the changes occurring in the Weaver Bottoms in pool 5 north of Winona. Since the creation of the 9-foot navigation project, this backwater area has changed from a highly productive deep-water marsh to a relatively unproductive shallow lake with marsh vegetation on the perimeters.

In 1975, the FWWG (Fish and Wildlife Work Group) awarded a contract for an extensive study of the 4,000-acre backwater lake to determine what might be done to restore its original habitat values. Results of the study indicate that the Weaver Bottoms could be restored substantially by building blocking dams made of dredged material between the bottoms and the main channel and possibly by building dredged material islands in the open-water area. The dams and islands would be built with dredged material cores and riprap or vegetated outer surfaces. Details of the study and recommended actions are in:

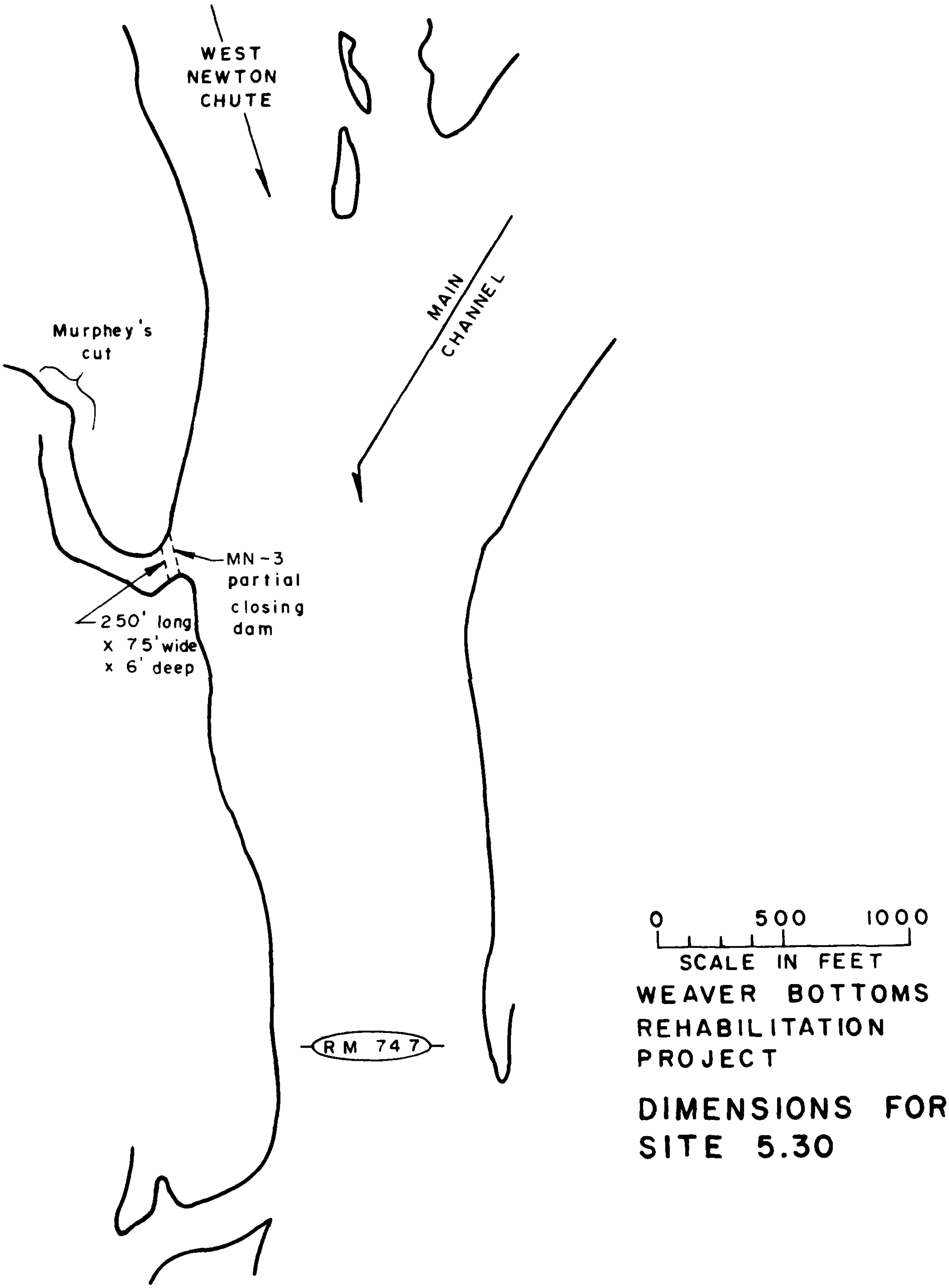
1. Fremling, C. R., D. R. McConville, D. N. Nielsen, and R. N. Vose. The Weaver Bottoms: A Field Model for the Rehabilitation of Backwater Areas of the Upper Mississippi River by Modification of Standard Channel Maintenance Practices. Winona State University and St. Mary's College, Winona, Minnesota, 1976.

2. Nielsen, D. N., R. N. Vose, C. R. Fremling, and D. R. McConville. Phase I Study of the Weaver-Belvidere Area, Upper Mississippi River, Winona State University and St. Mary's College, Winona, Minnesota, 1978.

The study recommends incorporation of the rehabilitation measures into the CMP. GREAT has conditionally recommended implementing the project (Further Study Item 21). If all recommended actions are taken, including island construction, the project would provide beneficial use for all dredged material from cuts 1-4 of pool 5 for the 40-year planning period. The initial recommended actions are displayed in the following figure.


5000 FEET
SCALE
WEAVER BOTTOMS REHABILITATION PROJECT
SITE 5.30
• MN 3, MN 6, and MN 10, are partial blocking dams
• MN 4 and MN 5 are riprapped closing dams
• MN 7, MN 11, MN 12, and MN 13 are dredged material closing dams
• In Weaver Bottoms build several islands (after further evaluation)
See sheets 2,3, & for more details
SHEET 2
SHEET 3
SHEET 4
MN3
Murphey's cut
MAIN CHANNEL
BELVIDERE SLOUGH
MN 4
MN5
MN 6
MN 7
MN 10
MN 11
MN 12
MN 13
Buffalo city
WISCONSIN
WEAVER BOTTOMS
Spring Lake

Partial closing dams are recommended at Murphey's Cut, MN 3 (see the following figure); Botsford's Cut, MN 6 (see the figure on page 195); and the old mouth of the Zumbro River, MN 10 (see the figure on page 195). Complete blocking dams armored with riprap are recommended at MN 4 and MN 5 (figure on page 195). Dredged material blocking dams with facings riprapped are to be built at MN 7, MN 11, MN 12, and MN 13 (see the figures on pages 195 and 196).

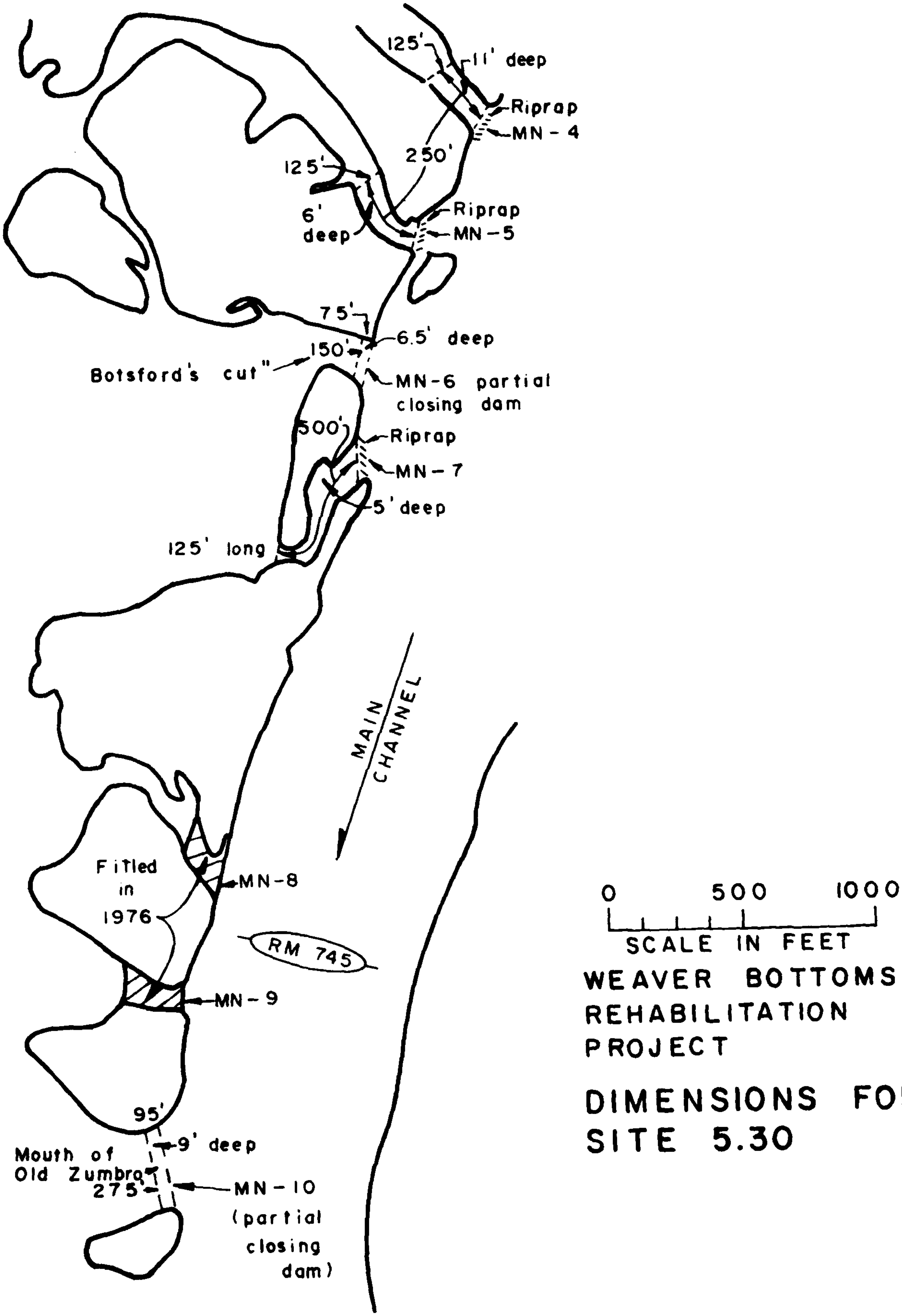



WEAVER BOTTOMS REHABILITATION PROJECT

DIMENSIONS FOR SITE 5.30



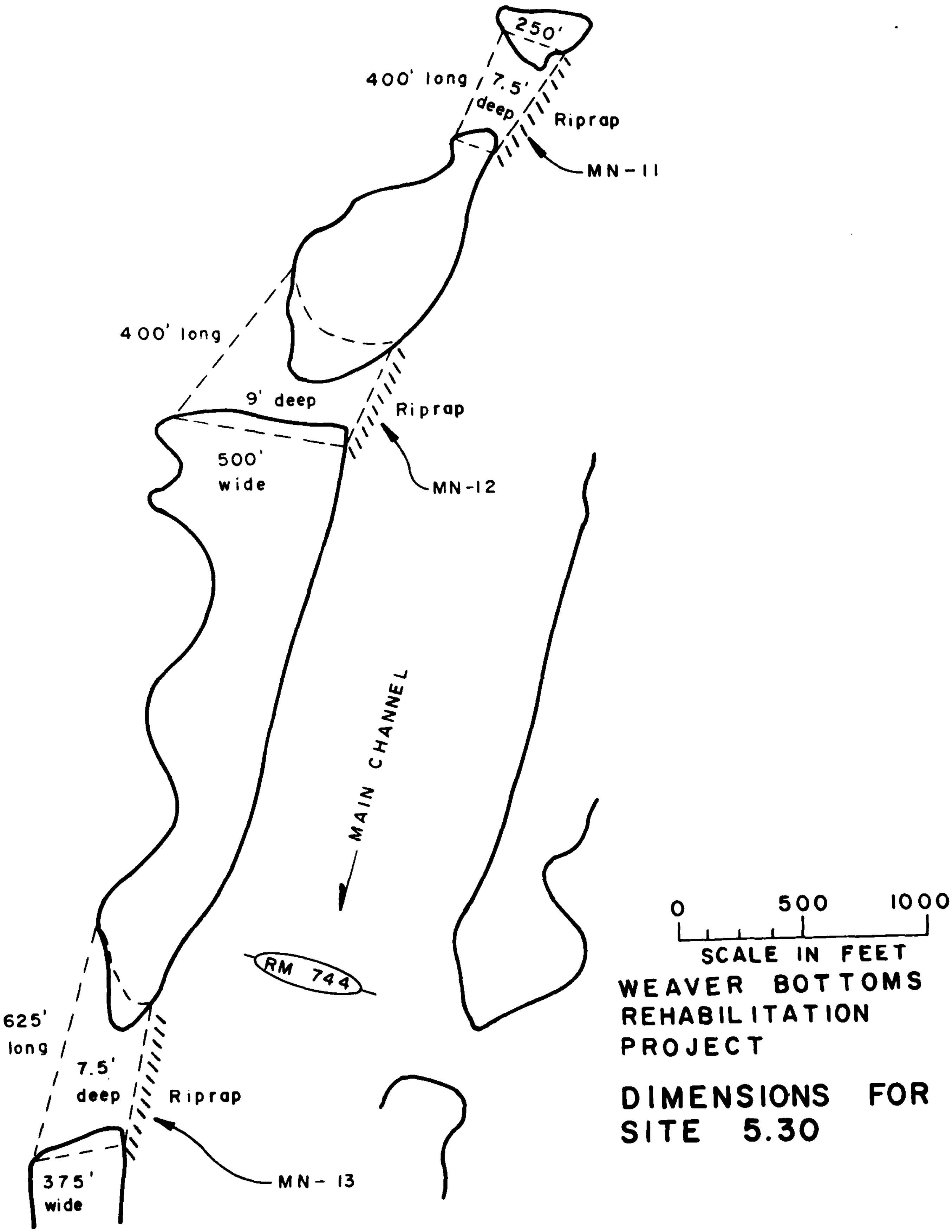
SHEET 2




**WEAVER BOTTOMS REHABILITATION PROJECT**

## DIMENSIONS FOR SITE 5.30

SHEET 3




WEAVER BOTTOMS REHABILITATION PROJECT

DIMENSIONS FOR SITE 5.30

The amount of dredged material needed to complete the side channel modifications is estimated at 258,300 cubic yards. At an assumed annual dredged material production rate of 41,500 cubic yards from the shoals at Mt. Vernon (cut 1), Sommerfield (cut 2), Lower Zumbro (cut 3), and Fisher Island (cut 4) it will take 6 years to complete this phase of the restoration project. During this time, island construction can be further evaluated and construction could begin when the other modifications are completed.

The cost of these rehabilitation measures is estimated to be $1 million more than the cost of traditional dredging and material placement methods for cuts 1 through 4 over the 40-year planning period. Traditional methods would cost between $5 and $6 million.

The following tables present some of the design assumptions used to develop this proposal (also see the figures on pages 194, 195, and 196).

Material placement volumes for rehabilitation

| | Dimensions (feet) | | | Volume | |
|---|---|---|---|---|---|
| Placement site | Width | Length | Depth | Cubic feet | Cubic yards |
| MN-3 | 75 | ~250 | ~ 6 | 112,500 | 4,167 |
| MN-4 | 250 | 125 | 11 | 343,750 | 12,731 |
| MN-5 | 250 | 125 | ~10.5 | 328,125 | 12,153 |
| MN-6 | 75 | ~150 | ~ 6.5 | 73,125 | 2,708 |
| MN-7 | ~500 | ~ 125 | ~ 5 | 312,500 | 11,574 |
| MN-10 | ~ 75 | ~ 275 | ~ 15 | 309,375 | 11,458 |
| MN-11 | ~ 250 | ~ 400 | ~ 7.5 | 750,000 | 27,778 |
| MN-12 | ~500 | ~400 | ~ 9 | 1,800,000 | 66,667 |
| MN-13 | ~ 375 | ~627 | ~ 7.5 | 1,757,812 | 65,104 |
| Total volume | | | | | 214,340 |

Volumes of material to be dredged(1)

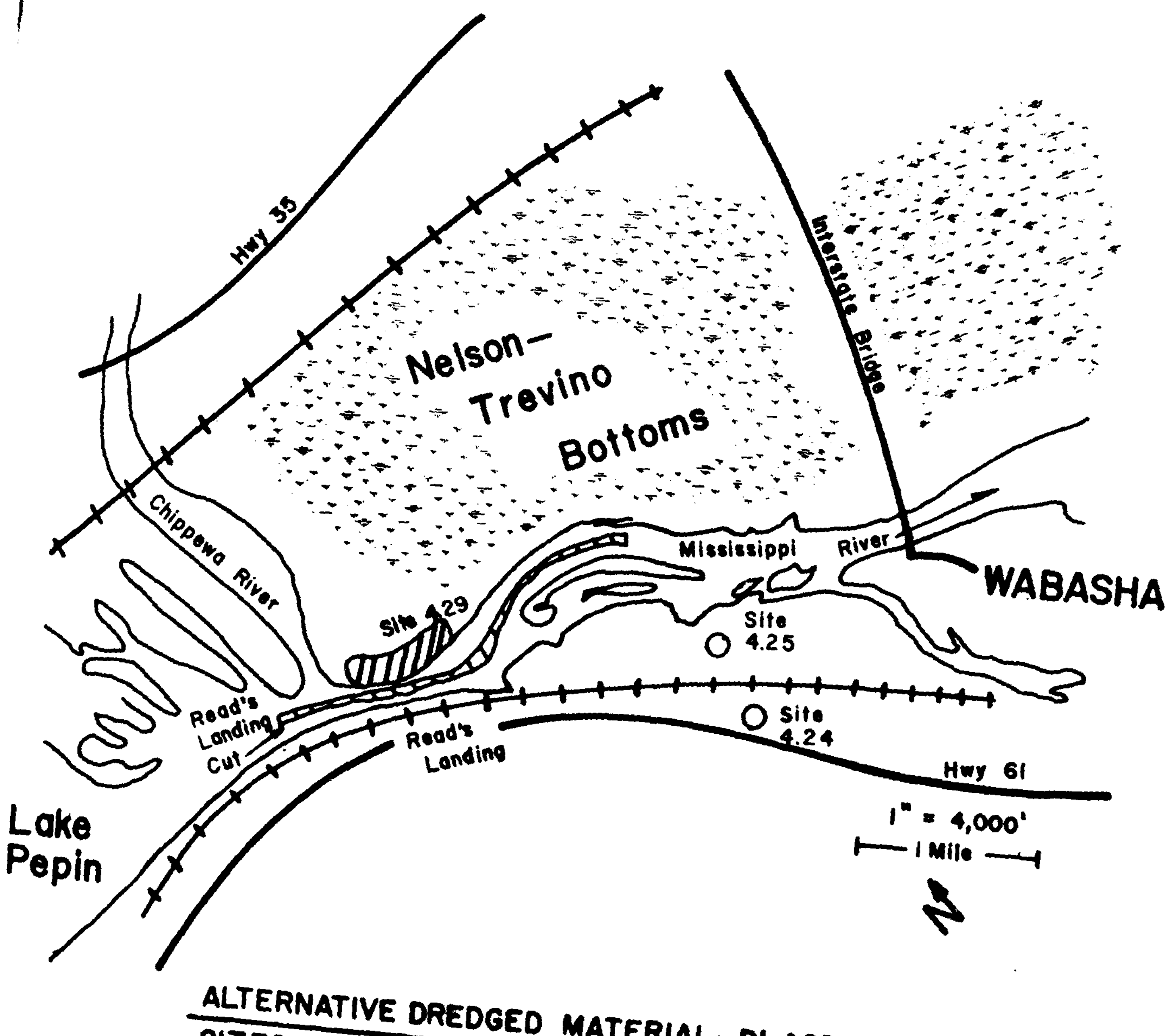
| Dredge cut | Volume (cubic yards) Per job | Total for 40-year period |
|---|---|---|
| Cut 1 (Mt. Vernon) | 22,800 | 136,000 |
| Cut 2 (Sommerfield) | 27,700 | 332,000 |
| Cut 3 (Lower Zumbro) | 21,700 | 520,000 |
| Cut 4 (Fisher Island) | 25,800 | 671,000 |
| Total | | 1,659,000 |

According to Simons and Chen (Nielsen et al., 1978), the proposed closings will reduce dredging requirements by 25 percent. Thus, there will be an excess of 1,083,495 cubic yards of dredged material [(1,659,000 cubic yards - 214,340 cubic yards) (0.75) = 1,083,495 cubic yards]. This volume would be used for core material for the islands proposed for the interior of the Weaver Bottoms.

*The Weaver Bottoms rehabilitation* project is a prime example of the progress achieved by GREAT in making necessary dredging in the river main channel compatible with natural resource values in the remaining river floodplain. The interagency cooperation approach turned one of the worst dredged material placement problems in the St. Paul District into an exciting program for restoring fish and wildlife values in a 4,000-acre backwater marsh.

READ'S LANDING

Read's Landing (see the following figure), just below the mouth of the Chippewa River, is the most frequently dredged shoal in the St. Paul District. Dredged material volumes from this site are among the greatest in the District, and the shoal at this site is among the fastest developing on the Upper Mississippi River. From 1974 to 1978, the channel shallowed to less than 9 feet three times and vessels grounded twice because of the delta of the Chippewa River.




ALTERNATIVE DREDGED MATERIAL PLACEMENT SITES FOR THE READ'S LANDING DREDGING CUT

In the past, the material dredged from the Read's Landing shoal was placed along the left descending bank in an area known as the Nelson-Trevino bottoms, site 4.29. Before 1974, material was placed along the shore wherever it was most convenient to the dredging operation. Since 1974, efforts have been made to place the dredged material on top of previously placed sand and avoid filling of undisturbed wetland areas. To maximize use of the historic placement site, a sand-diked containment area was built during the 1977 dredging season. Material dredged in 1978 was placed in the containment area with no apparent problems.

When it became necessary to dredge the area again in 1979, the material was placed in the containment area. However, much of the available capacity of the site had been used in 1978, and, as material filled the containment area, seepage through the sand dikes increased. A combination of seepage runoff and sloughing of the steep outside slopes resulted in encroachment of material into previously undisturbed wetlands.

The containment area can be expanded. However, it is increasingly apparent that continued use of this site would have significant adverse environmental impacts. Expansion of the containment site will further disturb a major roosting area for bald eagles, fill in additional side channel areas, and destroy additional bottomland hardwoods.

One of the alternative sites considered in the various material placement plans was site 4.24, an abandoned gravel pit located northwest of Wabasha, Minnesota, between U.S. Highway 61 and the Milwaukee Railroad Company tracks.

It is estimated to have about 1.25 million cubic yards capacity without significant filling above the surrounding topography. The site could be used for at least 15 years on the basis of average annual dredging requirements. Site 4.24 also has the potential for material removal for beneficial use which would increase the amount of time the site could be used. It is also important to note that a major sand and gravel company has a processing facility within one-half mile of the quarry.

Two estimates for placing material at site 4.24 were prepared. Both presumed using a 16-inch pipeline cutterhead dredge under contract. The first, shown in the following table, estimates dredging directly from the dredge cut to site 4.24. The table on page 203 represents a two-step operation - moving material from the present containment site at site 4.29 to site 4.24 and then dredging into the now empty containment site until filled. The table on page 206 provides a comparison of the two approaches for getting material to site 4.24.

Estimate for dredging directly into site 4.24

| Item | Cost: Per month | Cost: Per workday |
|---|---|---|
| Investment costs | | |
| $\frac{\text{\$10,700,000 total investment + 12-percent interest cost/year}}{\text{6 work months/year + 26 weekdays/work month}}$ | | $8,200 |
| Depreciation | | |
| Dredge | $24,000 | |
| Booster | 8,800 | |
| In-water pipe (1,500 feet x $2.75/ foot/month) | 4,100 | |
| Shore pipe (6,000 feet x $1.30/ foot/month | 7,800 | |
| Two 200-hp tenders | 2,200 | |
| One 400-hp tender | 1,100 | |
| One work barge | 700 | |
| One fuel-water barge | 1,000 | |
| Two dozers | 1,800 | |
| Total | 51,500 | 4,000 |
| Fuel costs | | |
| $\frac{\text{325 work hrs/mo x 7,000 hp x 0.067 gal/hp/hr x \$1.20/gal}}{\text{26 workdays/mo}}$ | | 7,000 |
| Yard costs | | |
| $\frac{\text{\$40,000/mo}}{\text{6 work mos/12 mos x 26 workdays/mo}}$ | | 3,100 |

Estimate for dredging directly into site 4.24 (cont)

| Item | Cost Per month | Cost Per workday |
|---|---|---|
| **Supplies** | | |
| $\frac{\$112,000/\text{mo.}}{6 \text{ work mos}/12 \text{ mos} \times 26 \text{ workdays/mo}}$ | | $8,600 |
| **Superintendent and captain salaries** | | |
| $\frac{\$3,800/\text{mo}}{6 \text{ work mos}/12 \text{ mos} \times 26 \text{ workdays/mo}}$ | | 300 |
| **Wages** | | |
| 3 levermen (3 x $10.70/hr x 1.3 x 8 hrs/day) | | 340 |
| 3 strikers (3 x $10.60/hr x 1.3 x 8 hrs/day) | | 330 |
| 4 mates (4 x $10.40/hr x 1.3 x 8 hrs/day) | | 430 |
| 6 equipment operators (6 x $9.80/hr x 1.3 x 8 hrs/day) | | 610 |
| 10 deckhands (10 x $7.00/hr x 1.3 x 8 hrs/day) | | 730 |
| 1 dump foreman (1 x $10.00/hr x 1.3 x 8 hrs/day) | | 100 |
| 8 shoremen (8 x $7.00/hr x 1.3 x 8 hrs/day) | | 580 |
| Total | | 3,120 |
| **Per diem** | | |
| 37 people x $40/day/person x 7 days/6 workdays | | 1,700 |
| Total (not including transit costs) | | 35,700 |

**Transit, setup, and breakdown costs**

$$\frac{130 \text{ mi}^{(1)}/5 \text{ mi/hr} + 8 \text{ hrs}^{(2)} + 8 \text{ hrs}^{(3)}}{24 \text{ hrs/day}} = 1.75 \text{ days/job}$$

Assume job = 87,000 $yd^3$

$$\text{Costs} = \frac{87,000 \text{ yd}^3 \times \$35,700/\text{workday}}{190 \text{ yd}^3 \times 14 \text{ hrs/day}} + (1.75 \text{ days} \times \$35,700/\text{workday})$$

= $1,168,000 + $62,500 = $1,230,000/job

$$\frac{\$1,230,000/\text{job}}{87,000 \text{ yd}^3/\text{job}} = \$14.14/\text{yd}^3 \text{ (job takes 32 workdays)}$$

(1) Round trip from La Crosse.
(2) Setup time.
(3) Breakdown time.

Estimate for placement at site 4.24 with temporary storage at site 4.29

| Item | Cost: Per month | Cost: Per workday |
|---|---|---|
| Moving material from site 4.29 to 4.24 | | |
| Investment cost | | |
| $\frac{\$10,400,000 \text{ total investment} \times 12\text{-percent interest/yr}}{6 \text{ work mos/yr} \times 26 \text{ workdays/work mo}}$ | | $8,000 |
| Depreciation | | |
| Dredge | $24,000 | |
| Booster | 8,800 | |
| In-water pipe (1,500 ft x $2.75/ft/mo) | 4,100 | |
| Shore pipe (6,000 ft x $1.30/ft/mo) | 7,800 | |
| One 200-hp tender | 1,100 | |
| One work barge | 700 | |
| One fuel-water barge | 1,000 | |
| Four dozers | 3,700 | |
| Total | 51,200 | 3,900 |
| Fuel costs | | |
| $\frac{325 \text{ work hrs/mo} \times 6,400 \text{ hp} \times 0.067 \text{ gal/hp/hr} \times \$1.20\text{/gal}}{26 \text{ workdays/mo}}$ | | 6,400 |
| Yard costs | | |
| $\frac{\$40,000\text{/mo}}{6 \text{ work mos/12 mos} \times 26 \text{ workdays/mo}}$ | | 3,100 |
| Supplies | | |
| $\frac{\$112,000\text{/mo}}{6 \text{ work mos/12 mos} \times 26 \text{ workdays/mo}}$ | | 8,600 |
| Superintendent and captain salaries | | |
| $\frac{\$3,800\text{/mo}}{6 \text{ work mos/12 mos} \times 26 \text{ workdays/mo}}$ | | 300 |
| Wages | | |
| 3 levermen (3 x $10.70/hr x 1.3 x 8 hrs) | | 340 |
| 3 strikers (3 x $10.60/hr x 1.3 x 8 hrs) | | 330 |
| 3 mates (3 x $10.40/hr x 1.3 x 8 hrs) | | 320 |
| 6 equipment operators (6 x $9.80/hr x 1.3 x 8 hrs) | | 610 |
| 6 deckhands (6 x $7.00/hr x 1.3 x 8 hrs) | | 440 |
| 1 dump foreman (1 x $10.00/hr x 1.3 x 8 hrs) | | 100 |
| 3 shoremen (3 x $7.00/hr x 1.3 x 8 hrs) | | 220 |
| Total | | 2,360 |
| Per diem | | |
| 25 people x $40/day/person x 7 days/6 workdays | | 1,200 |
| Total (not including transit costs) | | 34,300 |

Estimate for placement at site 4.24 with temporary storage at site 4.29 (cont)

| Item | Cost Per month | Cost Per workday |
|---|---|---|
| **Transit, setup, and breakdown costs** | | |

$$\frac{130\ mi^{(1)}/5\ mi/hr + 8\ hrs^{(2)} + 8\ hrs^{(3)}}{24\ hrs/day} = 1.75\ days/job$$

1. Assume job = 400,000 $yd^3$

$$Costs = \frac{400{,}000\ yd^3 \times \$34{,}300/workday}{350\ yd^3/hr \times 22\ hrs/workday} + (1.75\ days \times \$34{,}300/day)$$

$$= \$1{,}782{,}000 + 60{,}000 = \$1{,}842{,}000$$

$$\frac{\$1{,}842{,}000/job}{400{,}000/yd^3} = \$4.60/yd^{(3)}\ \text{(job takes 36 workdays)}$$

2. Assume job = 1,000,000 $yd^3$

$$Costs = \frac{1{,}000{,}000\ yd^3 \times \$34{,}300/workday}{350\ yd^3/hr \times 22\ hrs/workday} + (1.75\ days \times \$34{,}300/day)$$

$$= \$4{,}455{,}000 + \$60{,}000 = \$4{,}515{,}000$$

$$\frac{\$4{,}515{,}000/job}{1{,}000{,}000\ yd^3/job} = \$4.52/yd^3\ \text{(job takes 91 workdays)}$$

**Dredging material into site 4.29**

**Investment cost**

| Item | Per month | Per workday |
|---|---|---|
| $\frac{\$750{,}000\ \text{total investment} \times 12\ \text{percent interest/yr}}{6\ \text{work mos/yr} \times 26\ \text{workdays/work mo}}$ | | $5,800 |

**Depreciation**

| Item | Per month | Per workday |
|---|---|---|
| Dredge | $24,000 | |
| In-water pipe (1,500 ft x $2.70/ft/mo) | 4,000 | |
| Shore pipe (2,000 ft x $1.30/ft/mo) | 2,600 | |
| Two 200-hp tenders | 2,200 | |
| One 400-hp tender | 1,100 | |
| One work barge | 700 | |
| One fuel-water barge | 1,000 | |
| Two dozers | 1,800 | |
| | $37,400 | 2,900 |

**Fuel costs**

| Item | Per month | Per workday |
|---|---|---|
| $\frac{325\ \text{work hours/mo} \times 4{,}300\ hp \times 0.067\ gal/hp/hr \times \$1.20/gal}{26\ \text{workdays/mo}}$ | | 4,300 |

**Yard costs**

| Item | Per month | Per workday |
|---|---|---|
| $\frac{\$40{,}000/mo}{6\ \text{work mos}/12\ \text{mos} \times 26\ \text{workdays/work mo}}$ | | 3,100 |

Estimate for placement at site 4.24 with temporary storage at site 4.29 (cont)

| Item | Cost | |
|---|---|---|
| | Per month | Per workday |
| **Supplies** | | |
| $\dfrac{\$112{,}000/\text{mo}}{6 \text{ work mos}/12 \text{ mos} \times 26 \text{ workdays/work mo}}$ | | 8,600 |
| **Superintendent and captain salaries** | | |
| $\dfrac{\$3{,}800/\text{mo}}{6 \text{ work mos}/12 \text{ months} \times 26 \text{ workdays}}$ | | 300 |
| **Wages** | | |
| 3 levermen (3 x \$10.70/hr x 1.3 x 8 hrs/day) | | 340 |
| 3 strikers (3 x \$10.60/hr x 1.3 x 8 hrs/day) | | 330 |
| 4 mates (4 x \$10.40/hr x 1.3 x 8 hrs/day) | | 430 |
| 6 equipment operators (6 x \$9.80/hr x 1.3 x 8 hrs/day) | | 610 |
| 10 deckhands (10 x \$7.00/hr x 1.3 x 8 hrs/day) | | 730 |
| 1 dump foreman (1 x \$10.00/hr x 1.3 x 8 hrs/day) | | 100 |
| 6 shoremen (6 x \$7.00/hr x 1.3 x 8 hrs/day) | | 580 |
| Total | | 3,120 |
| **Per diem** | | |
| 35 people x \$40/person/day x 7 days/6 workdays | | \$1,600 |
| Total (not including transit costs) | | 29,700 |

**Transit, setup, and breakdown costs**

$$\frac{130 \text{ mi}^{(1)}/5 \text{ mi/hr} + 4 \text{ hrs}^{(2)} + 4 \text{ hrs}^{(3)}}{24 \text{ hrs/day}} = 1.4 \text{ days/job}$$

Assume job = 87,000 $yd^3$

$$\text{Costs} = \frac{87{,}000 \text{ yd}^3 \times \$29{,}700/\text{workday}}{275 \text{ yd}^3/\text{hr} \times 15 \text{ hrs/workday}} + (1.4 \text{ days} \times \$29{,}700/\text{workday})$$

$$= \$626{,}000 + \$42{,}000 = \$668{,}000$$

$$\frac{\$668{,}000/\text{job}}{87{,}000 \text{ yd}^3/\text{job}} = \$7.68/\text{yd}^3 \text{ (job takes 21 days)}$$

The following table compares the two estimates. On the basis of these estimates, dredging directly to site 4.24 costs about 15 to 25 percent less than temporarily storing material at site 4.29.

Comparison of estimates for the two dredging procedures

1. Assume 400,000 $yd^3$ can be emptied from site 4.29. With a dredging frequency of 65 percent and an average size per job of 87,000 $yd^3$, site 4.29 would have to be cleaned out every 7 years (400,000 $yd^3$/(87,000 $yd^3$/yr x 65%))

   a. $1,842,000 (cost of cleaning out site 4.29)
   x 0.1864 (interest and amortization for 7 years at 7 1/8 percent interest)
   343,300 (average annual cost of cleaning out site 4.29)

   b. $668,000 (cost of dredging to 4.29)
   x0.65 (annual frequency of dredging)
   434,200 (average annual cost of dredging to site 4.29)

   c. $343,300
   434,200
   777,500 (average annual cost of two-step option; $13.72/$yd^3$)

   d. $1,230,000 (cost of dredging directly to site 4.24)
   x 0.65 (annual frequency of dredging)
   799,500 (average annual cost of "direct to site 4.24" option; 14.14/$yd^3$)

Therefore, if 400,000 $yd^3$ is emptied from site 4.29, the option that pumps dredged material from site 4.29 to 4.24 has an average annual cost advantage of $22,000, essentially an even choice within the ranges of accuracy for the assumptions made.

2. Assume 1,000,000 $yd^3$ can be emptied from site 4.29. With a dredging frequency of 65 percent and an average size per job of 87,000 $yd^3$, site 4.29 would have to be cleaned out every 18 years. (1,000,000 $yd^3$/(87,000 $yd^3$ x 0.65) = 17.7 years).

   a. $4,515,000 (cost of cleaning out site 4.29)
   x 0.1003 (interest and amortization for 18 years at 7 1/2 percent)
   452,800 (average annual cost of cleaning out site 4.29)

   b. $665,000 (cost for each dredging to site 4.29)
   x 0.65 (annual frequency of dredging)
   434,200 (average annual cost of dredging to site 4.29)

   c. $452,800
   434,200
   887,000 (average annual cost of "two-step" option; $15.88/$yd^3$)

   d. $1,230,000 (cost for dredging from river to site 4.24)
   x 0.65 (annual frequency of dredging)
   799,500 (average annual cost of "direct to site 4.24" option; $14.14/$yd^3$)

Therefore, if 1,000,000 $yd^3$ is emptied from site 4.29, the option that pumps dredged material directly to site 4.24 from the river has an average annual cost advantage of $87,500.

Comparison of estimates for the two procedures (cont)

NOTE: This analysis assumed that if the "direct to site 4.24" option is chosen, nothing will have to be done to the present material placement site. However, if 200,000 $yd^3$ would have to be moved from site 4.29 to site 4.24 to satisfy environmental concerns, site 4.29 would have a capacity of 1,000,000 $yd^3$ - enough for 18 years (assuming a capacity of 1,200,000 $yd^3$ at site 4.24). If the average annual cost of moving 200,000 $yd^3$ to site 4.24 is $104,312 (first cost of $1,040,000 (200,000 $yd^3$ x $5.20/$yd^3$)), the advantage of dredging directly to site 4.24 would be offset. However, some recreational benefit may be associated with removing 200,000 $yds^3$ from the present placement site and discontinuing its use.

---

The data in the table on page 203 show that costs will not be the critical criteria for choosing a dredged material placement method. Matters such as State regulations and policies will have greater influence in the choice. For instance, political pressures and permit requirements may make necessary the permanent removal of the material now in place at site 4.29. If the material has to be removed, the amortized cost of removal should be added to this analysis. Some or all of the cost savings shown in the table on page 203 would be negated.

Use of site 4.25 (see the figure on page 199) for Read's Landing material placement would present much the same set of challenges as site 4.24 and the costs would not vary greatly from those shown here for site 4.24. Site 4.25 should not be actively considered for the Read's Landing cut until all other avenues have been explored because it is the primary placement site for the Crat's Island cut and its capacity is needed to maintain a navigable channel through lower pool 4.

The notoriety of Read's Landing (the groundings, the containment sites, etc.) has created public interest in the problem and suggestions for the use of the material. One example is documented in the Section 107 Small-Boat Harbor Study at Lake City, Minnesota. The study recommends a sand fill breakwater which requires 164,000 cubic yards of sand. The material in place at site 4.29 is suitable for this purpose. To be used, the material would probably be loaded onto barges with a power shovel or backhoe, transported the more than 5 miles to the breakwater site, unloaded, and shaped with backhoe or dragline equipment.

The costs for this operation had not been prepared by the time this appendix was printed but preliminary estimates showed that $3.50 to $5.50 per cubic yard appeared reasonable. The comparable cost of mining material from site 4.29 to site 4.24 is $5.16.

Although the channel maintenance plan for Read's Landing is not as mutually acceptable as the Weaver Bottoms project in pool 5, the fact that a viable solution to the problem emerged from the process is a credit to the GREAT I interagency approach. If the CMP for Read's Landing is implemented, a major dredged material placement problem will be turned into a service to both the environment and local economy.

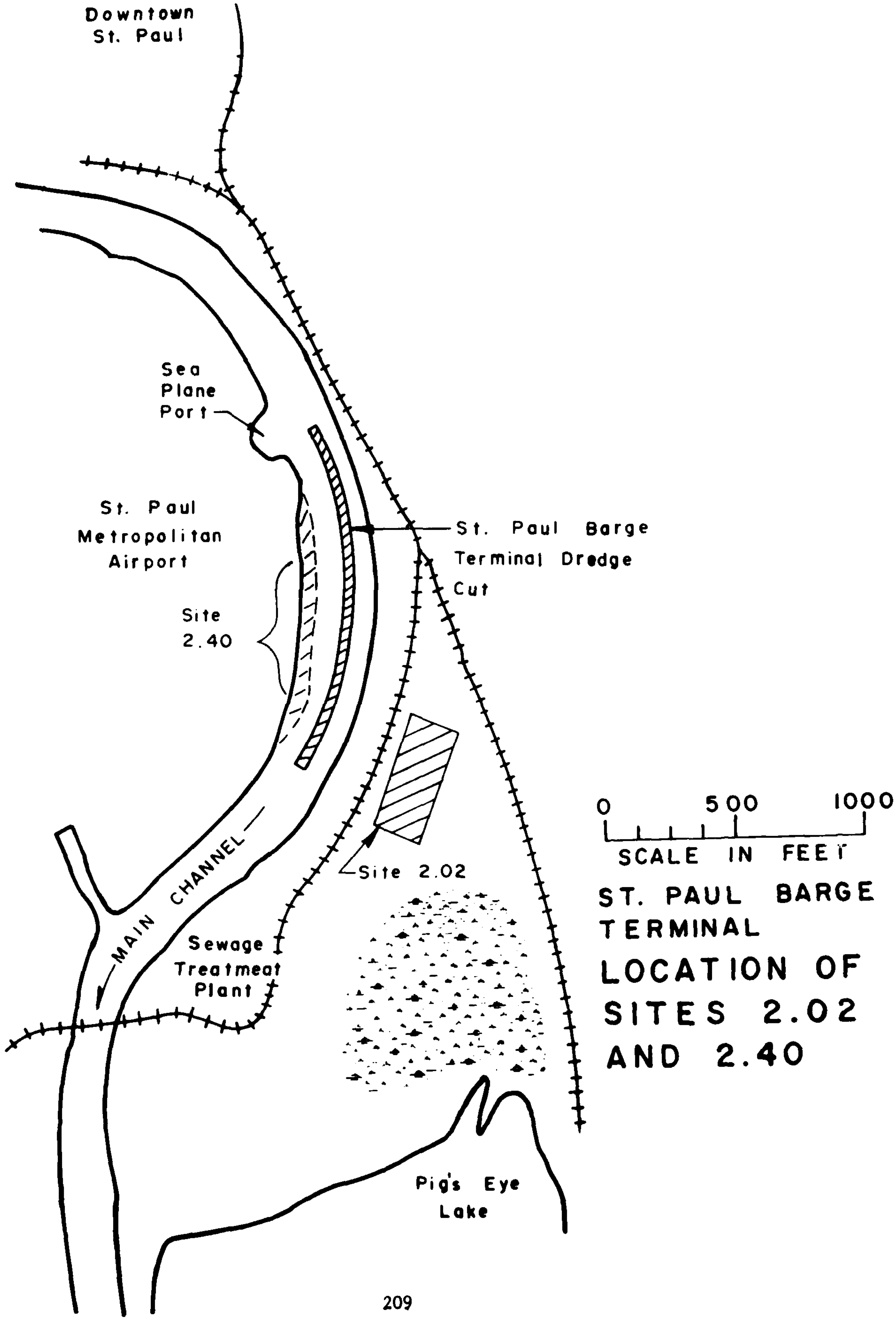
ST. PAUL BARGE TERMINAL MATERIAL PLACEMENT SITES

Selecting placement sites for material dredged from the St. Paul barge terminal (or turning basin) is a major problem. This site has the largest dredging volume of any site in the St. Paul District, and the sediments in the shoal are more contaminated with trace metals and chemicals than those anywhere else in the District. Therefore, the great volume of material dredged from the basin must be completely contained to meet State and Federal water quality standards. The lack of placement sites within reach of the Corps hydraulic dredging equipment further complicates this problem.

GREAT developed two alternative placement sites that would provide adequate capacity and acceptable containment for most of the material to be dredged (see the following figure).

Site 2.02

Site 2.02 is next to the traditional dredge cut on the east side of the channel. The site is between two major railroad corridors at the north end of Pig's Eye Lake and marsh. More than 100 acres of this area is an abandoned landfill with adequate capacity for a 100-percent containment structure. The site is well protected from erosion.




ST. PAUL BARGE TERMINAL

LOCATION OF SITES 2.02 AND 2.40

Site 2.02 would make an excellent material placement site for the St. Paul barge terminal dredging. However, two matters would have to be resolved before the site could be used.

The Corps would probably have to purchase the property. The Chicago, Milwaukee, St. Paul, and Pacific Railroad (Milwaukee Road) owns the property and leases it to the city of St. Paul for storing diseased trees (see the following figure). The Milwaukee Road has filed for bankruptcy and is selling property through Federal court supervision. Therefore, the property may be available at a reasonable price. However, action may need to be taken quickly because the city of St. Paul may also want to purchase the property.

SUBDIVISION ST PAUL WARD 02 | SCH DIST 625 | PARCEL NO 02 01000 030 25

| INSTRUMENT KIND | INSTRUMENT DATE | TRANSFER DATE | TRANSFER NO | LAST GRANTEE | TAX DESCRIPTION | SEC LOT | TWN BLK | RG | LOC |
|---|---|---|---|---|---|---|---|---|---|
| Lease | 01 02 79 | 01 1979 | 011979 | CHI MILW ST P & PACIFIC RR | UNPLATTED LANDS | | | | |
| | | | | CITY OF ST PAUL | AN IRREGULAR SHAPED PARCEL LEASED TO CITY OF ST PAUL NUMBERED 82316 LYING SWLY OF RR CO'S HUMP YARD, ELY OF PIGS EYE RUN FROM NW COR OF SEC 10 SE TO SE COR OF NE 1/4 OF NW 1/4 OF SEC 10; BEING PART OF SW 1/4 & NW 1/4 (SUBJ TO ESMTS) OF | 10 | 28 | 22 | |

| | |
|---|---|
| MAP NO. | 000095 |
| ACRES | 117,6 |
| SQ. FT. | 5122660 |
| COUNTY COMM. DIST. | 6 |
| SEWER DIST. | |
| LEG. DIST | 67B |

| | |
|---|---|
| WATERSHED DIST. | m |
| DEVELOPMENT DIST. | |
| GREEN ACRES | |
| DEFERRED TAX | |
| DELINQUENT TAX | |

DIV NO 054229

Ownership and lease record for Site 2.02 on file at the Ramsey County Court House, Taxation Department.

The second matter is that a permanent pipe or culvert will have to be placed through the railroad dike between the river and site 2.02. This can be done without interrupting rail service. However, the Rock Island Railroad owns the track involved, and it has also filed for bankruptcy.

Site 2.40T

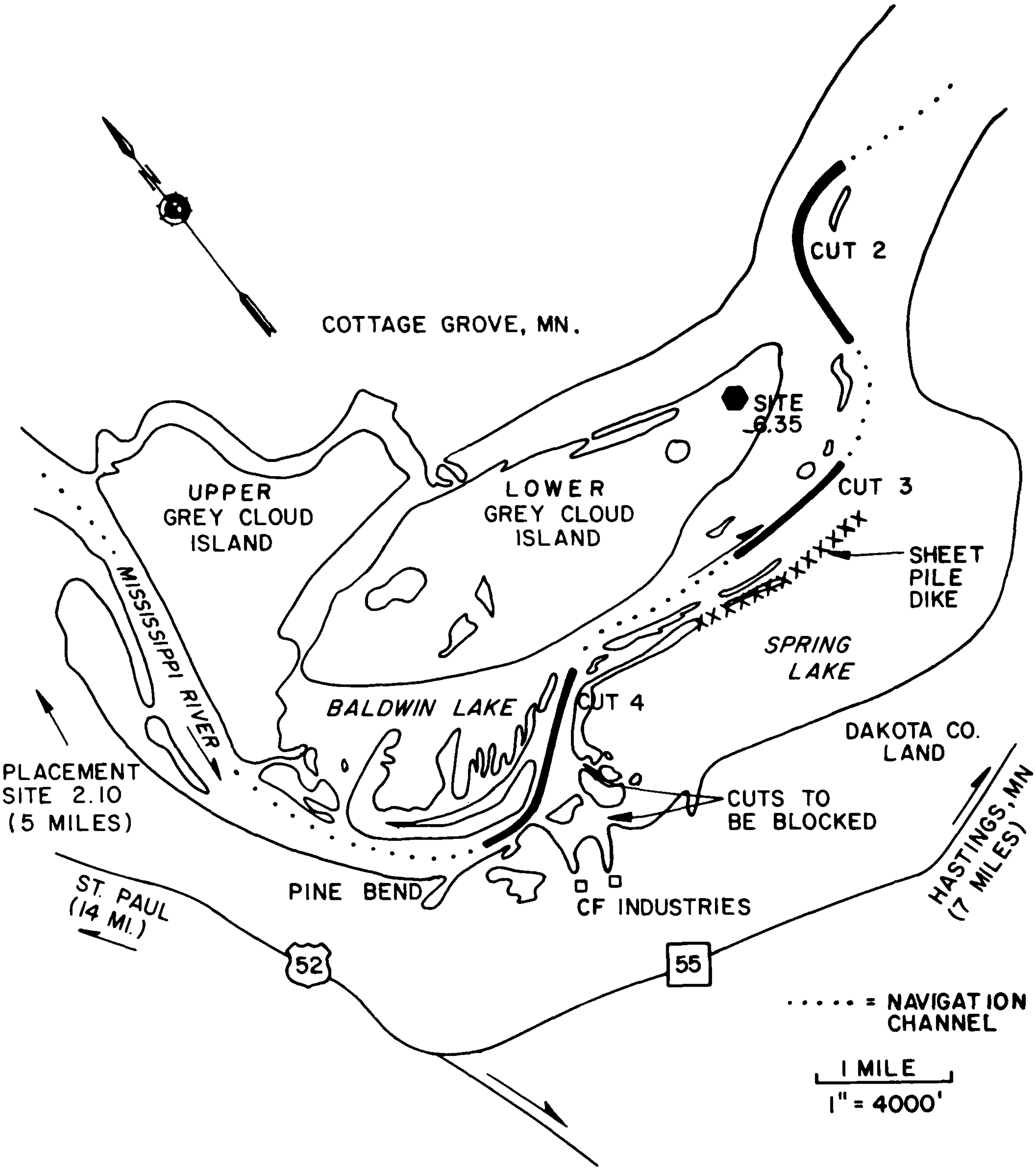
Site 2.40T is along the main channel border immediately adjacent to the St. Paul Metropolitan Airport (Holman Field). The proposed design is to build a sheet pile wall parallel to the existing shoreline for approximately three-quarters of a mile and place dredged material behind the sheet-pile wall. The main channel border to be cut off is the primary shoaling area in the turning basin. The isolated area could adequately serve as the containment site required to meet water quality standards.

The St. Paul Port Authority is the riparian landowner and may be willing to pay for the sheet pile if the containment area could be used for development after it was filled. Although State and Federal permits would be required for the filling and development, the site is a good candidate because alternative sites are lacking and the habitat and water quality at the site are relatively poor. Also, the reduced width at the basin would increase sediment transport capability and reduce dredging requirements at the cut.

Again, the interagency effort fostered by GREAT I has turned a very difficult problem into a situation where the environment and economic development could benefit. GREAT I believes that implementing one of these two plans is the best possible approach to dredged material placement at the turning basin, given existing equipment and technology.

SPRING LAKE (POOL 2)

The proposal to incorporate channel maintenance in lower pool 2 with enhancement of Spring Lake (a large backwater lake in pool 2) is not an approved element of the CMP. Several questions regarding the proposal could not be answered adequately at the time the CMP was approved. The Team recognized the proposal's potential benefits to channel maintenance and the area's natural resources. It has urged the Corps of Engineers to complete the investigation of the proposal. If the Ongoing River Resource Management Team (see Chapter VIII in the main report) approves the proposal, the Spring Lake enhancement project should replace the CMP's provisions for cuts 2, 3, and 4 (see the following figure). The proposal would enhance a commercial harbor, eliminate the need to purchase or acquire an easement for site 2.35, eliminate the need to barge material from cut 4 to site 2.10, and improve the recreation and fish and wildlife quality of Spring Lake.




**LOCATION OF PROPOSED SPRING LAKE ENHANCEMENT PROJECT IN POOL 2 & CHANNEL MAINTENANCE PLAN FOR CUTS 2,3 & 4.**

## The Proposal

The idea of enhancing Spring Lake by blocking off the flow of Mississippi River water was first presented in a report titled Spring Lake by R. C. Einsweiler. The report was prepared in 1973 for the Twin Cities Metropolitan Council. It pointed out that heavily polluted water from the river was adversely affecting this potential recreation area. The report proposed that river flow be prevented from entering the lake, thereby allowing the natural springs supplying the lake to continuously flush the lake out.

The quality of river water in this area is particularly poor because the Metropolitan Waste Treatment Plant discharges effluent several miles upstream at Pig's Eye. In part because of the river water's high turbidity and contamination levels, Spring Lake has poor aesthetic appeal and wildlife habitat. If the inflow of poor quality river water could be stopped, Spring Lake should become clearer and cleaner. It would be more suitable for broad-based water recreation and would enhance vegetation growth around the lake.

In 1979, C. F. Industries of Rosemount, Minnesota, also proposed blocking the flow of river water into the upper portion of Spring Lake. It has barge loading facilities on the west side of the river just upstream of Spring Lake (see preceding figure), and sedimentation in its barge slips is a problem. Representatives of the company believe cutting off flow which passes from the river, past the company's barge slips, and into Spring Lake would alleviate the sedimentation problem. In a 28 July 1979 meeting with the Corps of Engineers, they proposed cutting off flow from the river (see Exhibit 1 of this document).

## CMP Application to Spring Lake Enhancement

During its development of the CMP, GREAT I considered using dredged material from cuts 2 (Boulanger Bend Lower Light), 3 (Boulanger Bend), and 4 (Pine Bend Foot Light) to build partial or complete blocking dams at the upstream inlets to Spring Lake and extend the dike along the east side of the lake. The upstream blocking dams would be built first and would require riprap armoring (similar to the Devil's Cut dam in pool 5A). The dike extension between the river channel and Spring Lake would be constructed next.

Mr. Dennis Cin, Chief, Maintenance Branch, St. Paul District, Corps of Engineers, outlined an approach for this work. Sheet piling cells would be constructed as needed from the end of the existing dike and progressing downstream. Riprap armoring would be needed at least along the river side of the new dike sections.

GREAT I did not include this approach in the CMP for pool 2 because information on possible impacts was lacking. Specific concerns included possible impacts on flood stages which might affect residences on Grey Cloud Island. However, GREAT did consider the proposed CMP very promising. With this proposal, proximate placement sites for cuts 2, 3, and 4 would be provided for the entire planning period (1985-2025). C. F. Industries would have a better barge loading facility. Dakota County could develop an attractive recreation area. Wildlife habitat would be improved. And the sediment transport capability of the river in this reach would be improved, resulting in a reduced need for dredging.

GREAT urges the Corps of Engineers to complete the investigation of the Spring Lake enhancement project. Also, GREAT urges the Ongoing River Resources Management Team (GREAT's successor) to reconsider this proposal as the CMP for cuts 2, 3, and 4 once an adequate investigation of its possible impacts has been made.

# CHAPTER 13

# ALLOWANCES FOR EMERGENCY CONDITIONS

## INTRODUCTION

Maintaining a navigation channel in the Upper Mississippi River is a complicated problem. In rivers, shoal development is a function of several interrelated factors including effective flow area, main streamflow, tributary flow, sediment supply, differences between tributary and main stem flow, channel curvature, and seasonal high-water cycles. The interrelationship of these factors causes shoals in the 9-foot channel of the Upper Mississippi River to develop rapidly and their behaviors to be difficult to predict. As a result, emergency situations such as barge groundings or the development of an impassable channel occasionally occur. The GREAT I Team examined several examples of channel closure emergency situations and determined a sound response to these situations.

## EMERGENCY DEFINITION

The first element of the Team's recommended response was a definition of what would be called an emergency. Two definitions were adopted - one for emergency and one for imminent closure. These are presented in Chapter VII - "Recommendations" of the GREAT I main report as "Policy Item Number 3." Essentially, an emergency dredging situation exists when ". . . dredging is required to free a grounded vessel or remove shoals in the channel as a result of a vessel freeing itself." Imminent closure was defined as when ". . . the actual water depth is projected by the District Engineer to be 10 feet or less within 14 days or less" or ". . . the channel width is less than 85 percent of the normally maintained width."

EMERGENCY CONDITIONS

When the Corps of Engineers determines that an emergency dredging situation exists, as defined above, immediate notice will be given to the U.S. Coast Guard, the appropriate Federal and State regulatory agencies, and representatives of the On-Site Inspection Team for that pool. Equipment will be mobilized directly to the site and dredging will be accomplished as expeditiously as possible to restore navigation. As soon as a passable channel is restored, the emergency condition ceases to exist.

The material placement sites should be chosen based on the following priority:

1. Sites shown in the channel maintenance plan.

2. Temporary placement sites shown in this report.

3. Other sites as determined by the Corps of Engineers.

The placement site selection process will include consultation with the On-Site Inspection Team, coordination with regulatory agencies, and consideration of environmental values to the extent practical under the existing situation.

IMMINENT CLOSURE CONDITIONS

The imminent closure provision is intended to avoid the need for emergency dredging by preventing foreseeable closures of the navigation channel. When an imminent closure condition is recognized, the Corps will follow the same notification procedure used for emergency dredging, including furnishing appropriate agencies scientific information justifying the imminent closure projection. Before beginning dredging, however, the Corps will take additional depth measurements at the site to determine if the shoal will stabilize at a depth of 10 feet or greater.

The placement sites should be chosen based on the following priority:

1. Sites shown in the channel maintenance plan.

2. Temporary placement sites shown in this report.

3. Temporary sites approved by other appropriate regulatory agencies with subsequent removal to the channel maintenance plan sites.

The two major differences between "emergency" and "imminent closure" are in the dredging conditions described above and in the last resort choice of placement sites. As a last resort in an emergency, the Corps of Engineers can choose the placement site. As a last resort in an imminent closure situation, other agency concurrence must be given to the placement site.

## AFTER DREDGING ACTIONS

Within 30 days of the emergency or imminent closure dredging, the Corps will provide the following information to appropriate regulatory agencies: (1) nature of occurrence that necessitated the emergency or imminent closure dredging; (2) sounding data; (3) dredging depths; (4) volume of dredged material; (5) type(s) of dredging equipment used; (6) method(s) of dredged material placement; (7) available data concerning the chemical and physical composition of the sediment; (8) duration of dredging operation, including beginning and end dates; (9) project alternatives considered including alternative dredging methods and placement sites; (10) discussion of mitigative measures that were considered and used; (11) discussion of any biological effects; and (12) written projections of water surface and depth.

# CHAPTER 14

## INTERIM GUIDELINES FOR DREDGING AND DREDGED MATERIAL PLACEMENT (1981-1985)

The GREAT I long-range CMP is meant to be fully implemented in the 1986 dredging season. To continue the good working relationships and coordination established during the GREAT I study from the end of the study until 1986, GREAT I has prepared interim guidelines for dredged material placement and continued coordination of channel maintenance activities. While equipment and funding constraints will not allow total compliance with the GREAT I CMP until 1986, the guidelines listed below should be adhered to to the maximum extent possible for dredged material placement in the interim period.

### PURPOSE

The interim plan is to guide the Corps of Engineers in dredging and dredged material placement through 1985. After 1985, full compliance with the GREAT I CMP will be possible. Provided is a recommended procedure for the Corps and affected States and agencies to follow when dealing with dredging and dredged material placement.

### PROCEDURE

1. The primary guide for the interim is the long-range CMP approved by GREAT I. The placement sites and methods detailed in the CMP should be used in the interim whenever possible. Where the Corps does not have control over approved CMP sites, a systematic acquisition program should be immediately initiated. The CMP has been thoroughly evaluated and debated by GREAT and warrants highest priority.

2. When the CMP cannot be followed, the On-Site Inspection Team (OSIT) should determine the best material placement method and site. The OSIT and its procedures are described in detail in another section of this report. This interagency team should have the experience and perspective to make wise and viable recommendations regarding dredged material placement.

a. Beneficial use sites have the highest priority when the CMP placement sites cannot be used. Short-term beneficial uses for dredged material may arise in the interim. If such uses do materialize, dredged material should be provided whenever possible.

b. The second priority for placement site selection when the recommended CMP sites cannot be used is placement of material on existing sites. In such cases, the OSIT will specify what measures should be taken to substantially limit erosion or secondary movement from such sites.

c. Temporary material placement sites and existing containment sites can be used in the interim if the CMP site is not attainable. However, as specified in the CMP, these sites should be emptied periodically to ensure the integrity of the dikes and the capacity to handle emergency dredging volumes. If the OSIT concludes that a particular containment site cannot be used without a high risk of further wetland loss, an alternative site should be chosen.

3. When the Corps equipment is not adequate or available for a given project, privately owned equipment should be sought and the recommended CMP site or the OSIT's highest priority site should be used. All potential contractors should be directly contacted in such cases.

4. Reduced-depth dredging should continue to be used and evaluated during the interim period.

SUMMARY

In the interim (1981-1985), the GREAT I CMP should be implemented whenever and wherever possible. When equipment or cost limitations make use of the CMP for a given site impossible, the OSIT procedure (as described in this report) should be used to determine the best placement site and method. Private equipment and reduced-depth dredging are to be used in the interim where appropriate.

# CHAPTER 15

## TYPICAL STOCKPILE DIMENSIONS

For the majority of decisions involving dredged material placement, the impacts of placement are not solely related to where the placement site is located. Often, the amount of damage done depends on how much material is placed at the site, how much area is covered, and the height and shape of the material pile. Usually, volumes to be dredged are readily available from the Corps of Engineers. But, historically the translation of these volumes into site dimensions (areas, heights, etc.) has been left to the skill, experience, and biases of the Corps of Engineers technicians.

To allow all involved with future dredged material placement decisions the opportunity to analyze alternative placement site configurations, we have provided the following table. The table allows one to determine what site dimensions are possible for a given volume of dredged material. It is divided into two primary sections, one for relatively small volumes of dredged material and one for larger volumes. The variables which are provided are length, width, height, and volume. The calculations used to produce the table provided for appropriate side slopes.

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 5. FT.,HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 184. | 184. | 5. | 1. | 225. | 150. | 5. | 1. | 234. | 146. | 5. | 1. | 262. | 131. | 5. | 1. | 430. | 86. | 5. | 1. |
| 10000. | 252. | 252. | 5. | 1. | 309. | 206. | 5. | 1. | 320. | 200. | 5. | 1. | 358. | 179. | 5. | 1. | 580. | 116. | 5. | 2. |
| 15000. | 304. | 304. | 5. | 2. | 374. | 249. | 5. | 2. | 386. | 241. | 5. | 2. | 432. | 216. | 5. | 2. | 700. | 140. | 5. | 2. |
| 20000. | 349. | 349. | 5. | 3. | 428. | 285. | 5. | 3. | 442. | 276. | 5. | 3. | 496. | 248. | 5. | 3. | 795. | 159. | 5. | 3. |
| 25000. | 387. | 387. | 5. | 3. | 476. | 317. | 5. | 3. | 491. | 307. | 5. | 3. | 550. | 275. | 5. | 3. | 885. | 177. | 5. | 4. |
| 30000. | 422. | 422. | 5. | 4. | 518. | 345. | 5. | 4. | 536. | 335. | 5. | 4. | 600. | 300. | 5. | 4. | 960. | 192. | 5. | 4. |
| 35000. | 455. | 455. | 5. | 5. | 558. | 372. | 5. | 5. | 576. | 360. | 5. | 5. | 646. | 323. | 5. | 5. | 1035. | 207. | 5. | 5. |
| 40000. | 485. | 485. | 5. | 5. | 594. | 396. | 5. | 5. | 614. | 384. | 5. | 5. | 688. | 344. | 5. | 5. | 1100. | 220. | 5. | 6. |
| 45000. | 513. | 513. | 5. | 6. | 629. | 419. | 5. | 6. | 650. | 406. | 5. | 6. | 728. | 364. | 5. | 6. | 1165. | 233. | 5. | 6. |
| 50000. | 540. | 540. | 5. | 7. | 662. | 441. | 5. | 7. | 683. | 427. | 5. | 7. | 766. | 383. | 5. | 7. | 1225. | 245. | 5. | 7. |
| 55000. | 565. | 565. | 5. | 7. | 693. | 462. | 5. | 7. | 715. | 447. | 5. | 7. | 802. | 401. | 5. | 7. | 1280. | 256. | 5. | 8. |
| 60000. | 589. | 589. | 5. | 8. | 723. | 482. | 5. | 8. | 746. | 466. | 5. | 8. | 836. | 418. | 5. | 8. | 1335. | 267. | 5. | 8. |
| 65000. | 613. | 613. | 5. | 9. | 752. | 501. | 5. | 9. | 776. | 485. | 5. | 9. | 868. | 434. | 5. | 9. | 1385. | 277. | 5. | 9. |
| 70000. | 635. | 635. | 5. | 9. | 779. | 519. | 5. | 9. | 805. | 503. | 5. | 9. | 900. | 450. | 5. | 9. | 1435. | 287. | 5. | 9. |
| 75000. | 657. | 657. | 5. | 10. | 806. | 537. | 5. | 10. | 832. | 520. | 5. | 10. | 930. | 465. | 5. | 10. | 1485. | 297. | 5. | 10. |
| 80000. | 677. | 677. | 5. | 11. | 831. | 554. | 5. | 11. | 858. | 536. | 5. | 11. | 960. | 480. | 5. | 11. | 1530. | 306. | 5. | 11. |
| 85000. | 698. | 698. | 5. | 11. | 855. | 570. | 5. | 11. | 883. | 552. | 5. | 11. | 988. | 494. | 5. | 11. | 1575. | 315. | 5. | 11. |
| 90000. | 717. | 717. | 5. | 12. | 879. | 586. | 5. | 12. | 909. | 568. | 5. | 12. | 1016. | 508. | 5. | 12. | 1620. | 324. | 5. | 12. |
| 95000. | 736. | 736. | 5. | 12. | 903. | 602. | 5. | 12. | 933. | 583. | 5. | 12. | 1044. | 522. | 5. | 13. | 1665. | 333. | 5. | 13. |
| 100000. | 755. | 755. | 5. | 13. | 925. | 617. | 5. | 13. | 955. | 597. | 5. | 13. | 1070. | 535. | 5. | 13. | 1705. | 341. | 5. | 13. |
| 105000. | 773. | 773. | 5. | 14. | 948. | 632. | 5. | 14. | 979. | 612. | 5. | 14. | 1096. | 548. | 5. | 14. | 1745. | 349. | 5. | 14. |
| 110000. | 791. | 791. | 5. | 14. | 969. | 646. | 5. | 14. | 1002. | 626. | 5. | 14. | 1120. | 560. | 5. | 14. | 1785. | 357. | 5. | 15. |
| 115000. | 808. | 808. | 5. | 15. | 990. | 660. | 5. | 15. | 1024. | 640. | 5. | 15. | 1146. | 573. | 5. | 15. | 1825. | 365. | 5. | 15. |
| 120000. | 825. | 825. | 5. | 16. | 1011. | 674. | 5. | 16. | 1045. | 653. | 5. | 16. | 1170. | 585. | 5. | 16. | 1860. | 372. | 5. | 16. |
| 125000. | 842. | 842. | 5. | 16. | 1032. | 688. | 5. | 16. | 1066. | 666. | 5. | 16. | 1192. | 596. | 5. | 16. | 1900. | 380. | 5. | 17. |
| 130000. | 858. | 858. | 5. | 17. | 1052. | 701. | 5. | 17. | 1086. | 679. | 5. | 17. | 1216. | 608. | 5. | 17. | 1935. | 387. | 5. | 17. |
| 135000. | 874. | 874. | 5. | 18. | 1071. | 714. | 5. | 18. | 1107. | 692. | 5. | 18. | 1238. | 619. | 5. | 18. | 1970. | 394. | 5. | 18. |
| 140000. | 890. | 890. | 5. | 18. | 1091. | 727. | 5. | 18. | 1126. | 704. | 5. | 18. | 1260. | 630. | 5. | 18. | 2005. | 401. | 5. | 18. |
| 145000. | 905. | 905. | 5. | 19. | 1109. | 739. | 5. | 19. | 1146. | 716. | 5. | 19. | 1282. | 641. | 5. | 19. | 2040. | 408. | 5. | 19. |
| 150000. | 920. | 920. | 5. | 19. | 1128. | 752. | 5. | 19. | 1165. | 728. | 5. | 19. | 1304. | 652. | 5. | 20. | 2075. | 415. | 5. | 20. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 10. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 150. | 150. | 10. | 1. | 185. | 123. | 10. | 1. | 192. | 120. | 10. | 1. | 216. | 108. | 10. | 1. | 380. | 76. | 10. | 1. |
| 10000. | 200. | 200. | 10. | 1. | 246. | 164. | 10. | 1. | 254. | 159. | 10. | 1. | 288. | 144. | 10. | 1. | 490. | 98. | 10. | 1. |
| 15000. | 238. | 238. | 10. | 1. | 293. | 195. | 10. | 1. | 302. | 189. | 10. | 1. | 340. | 170. | 10. | 1. | 570. | 114. | 10. | 1. |
| 20000. | 269. | 269. | 10. | 2. | 332. | 221. | 10. | 2. | 342. | 214. | 10. | 2. | 386. | 193. | 10. | 2. | 640. | 128. | 10. | 2. |
| 25000. | 297. | 297. | 10. | 2. | 366. | 244. | 10. | 2. | 378. | 236. | 10. | 2. | 424. | 212. | 10. | 2. | 700. | 140. | 10. | 2. |
| 30000. | 322. | 322. | 10. | 2. | 396. | 264. | 10. | 2. | 410. | 256. | 10. | 2. | 460. | 230. | 10. | 2. | 760. | 152. | 10. | 3. |
| 35000. | 345. | 345. | 10. | 3. | 425. | 283. | 10. | 3. | 438. | 274. | 10. | 3. | 492. | 246. | 10. | 3. | 810. | 162. | 10. | 3. |
| 40000. | 367. | 367. | 10. | 3. | 450. | 300. | 10. | 3. | 466. | 291. | 10. | 3. | 522. | 261. | 10. | 3. | 855. | 171. | 10. | 3. |
| 45000. | 387. | 387. | 10. | 3. | 476. | 317. | 10. | 3. | 491. | 307. | 10. | 3. | 552. | 276. | 10. | 3. | 900. | 180. | 10. | 4. |
| 50000. | 406. | 406. | 10. | 4. | 498. | 332. | 10. | 4. | 515. | 322. | 10. | 4. | 578. | 289. | 10. | 4. | 945. | 189. | 10. | 4. |
| 55000. | 424. | 424. | 10. | 4. | 521. | 347. | 10. | 4. | 538. | 336. | 10. | 4. | 604. | 302. | 10. | 4. | 985. | 197. | 10. | 4. |
| 60000. | 441. | 441. | 10. | 4. | 542. | 361. | 10. | 4. | 560. | 350. | 10. | 4. | 628. | 314. | 10. | 5. | 1020. | 204. | 10. | 5. |
| 65000. | 458. | 458. | 10. | 5. | 561. | 374. | 10. | 5. | 581. | 363. | 10. | 5. | 652. | 326. | 10. | 5. | 1060. | 212. | 10. | 5. |
| 70000. | 473. | 473. | 10. | 5. | 581. | 387. | 10. | 5. | 600. | 375. | 10. | 5. | 674. | 337. | 10. | 5. | 1095. | 219. | 10. | 6. |
| 75000. | 489. | 489. | 10. | 5. | 600. | 400. | 10. | 6. | 619. | 387. | 10. | 6. | 696. | 348. | 10. | 6. | 1130. | 226. | 10. | 6. |
| 80000. | 504. | 504. | 10. | 6. | 618. | 412. | 10. | 6. | 638. | 399. | 10. | 6. | 716. | 358. | 10. | 6. | 1160. | 232. | 10. | 6. |
| 85000. | 518. | 518. | 10. | 6. | 636. | 424. | 10. | 6. | 656. | 410. | 10. | 6. | 736. | 368. | 10. | 6. | 1195. | 239. | 10. | 7. |
| 90000. | 532. | 532. | 10. | 6. | 653. | 435. | 10. | 7. | 674. | 421. | 10. | 7. | 756. | 378. | 10. | 7. | 1225. | 245. | 10. | 7. |
| 95000. | 545. | 545. | 10. | 7. | 669. | 446. | 10. | 7. | 691. | 432. | 10. | 7. | 776. | 388. | 10. | 7. | 1255. | 251. | 10. | 7. |
| 100000. | 559. | 559. | 10. | 7. | 686. | 457. | 10. | 7. | 709. | 443. | 10. | 7. | 794. | 397. | 10. | 7. | 1285. | 257. | 10. | 8. |
| 105000. | 571. | 571. | 10. | 7. | 701. | 467. | 10. | 8. | 725. | 453. | 10. | 8. | 812. | 406. | 10. | 8. | 1310. | 262. | 10. | 8. |
| 110000. | 584. | 584. | 10. | 8. | 717. | 478. | 10. | 8. | 741. | 463. | 10. | 8. | 830. | 415. | 10. | 8. | 1340. | 268. | 10. | 8. |
| 115000. | 596. | 596. | 10. | 8. | 732. | 488. | 10. | 8. | 755. | 472. | 10. | 8. | 848. | 424. | 10. | 8. | 1370. | 274. | 10. | 9. |
| 120000. | 608. | 608. | 10. | 8. | 746. | 497. | 10. | 9. | 771. | 482. | 10. | 9. | 864. | 432. | 10. | 9. | 1395. | 279. | 10. | 9. |
| 125000. | 620. | 620. | 10. | 9. | 761. | 507. | 10. | 9. | 786. | 491. | 10. | 9. | 880. | 440. | 10. | 9. | 1420. | 284. | 10. | 9. |
| 130000. | 632. | 632. | 10. | 9. | 776. | 517. | 10. | 9. | 800. | 500. | 10. | 9. | 898. | 449. | 10. | 9. | 1445. | 289. | 10. | 10. |
| 135000. | 643. | 643. | 10. | 9. | 789. | 526. | 10. | 10. | 814. | 509. | 10. | 10. | 914. | 457. | 10. | 10. | 1470. | 294. | 10. | 10. |
| 140000. | 654. | 654. | 10. | 10. | 803. | 535. | 10. | 10. | 829. | 518. | 10. | 10. | 928. | 464. | 10. | 10. | 1495. | 299. | 10. | 10. |
| 145000. | 665. | 665. | 10. | 10. | 816. | 544. | 10. | 10. | 843. | 527. | 10. | 10. | 944. | 472. | 10. | 10. | 1520. | 304. | 10. | 11. |
| 150000. | 676. | 676. | 10. | 10. | 828. | 552. | 10. | 10. | 856. | 535. | 10. | 11. | 960. | 480. | 10. | 11. | 1545. | 309. | 10. | 11. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 20. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 165. | 165. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 198. | 198. | 20. | 1. | 246. | 164. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 224. | 224. | 20. | 1. | 278. | 185. | 20. | 1. | 288. | 180. | 20. | 1. | 328. | 164. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 246. | 246. | 20. | 1. | 305. | 203. | 20. | 1. | 315. | 197. | 20. | 1. | 358. | 179. | 20. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 265. | 265. | 20. | 2. | 329. | 219. | 20. | 2. | 339. | 212. | 20. | 2. | 386. | 193. | 20. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 283. | 283. | 20. | 2. | 350. | 233. | 20. | 2. | 362. | 226. | 20. | 2. | 410. | 205. | 20. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 299. | 299. | 20. | 2. | 369. | 246. | 20. | 2. | 382. | 239. | 20. | 2. | 432. | 216. | 20. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 314. | 314. | 20. | 2. | 387. | 258. | 20. | 2. | 400. | 250. | 20. | 2. | 454. | 227. | 20. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 328. | 328. | 20. | 2. | 404. | 269. | 20. | 2. | 418. | 261. | 20. | 3. | 472. | 236. | 20. | 3. | 820. | 164. | 20. | 3. |
| 55000. | 341. | 341. | 20. | 3. | 420. | 280. | 20. | 3. | 435. | 272. | 20. | 3. | 492. | 246. | 20. | 3. | 845. | 169. | 20. | 3. |
| 60000. | 354. | 354. | 20. | 3. | 437. | 291. | 20. | 3. | 451. | 282. | 20. | 3. | 510. | 255. | 20. | 3. | 875. | 175. | 20. | 4. |
| 65000. | 366. | 366. | 20. | 3. | 450. | 300. | 20. | 3. | 466. | 291. | 20. | 3. | 526. | 263. | 20. | 3. | 900. | 180. | 20. | 4. |
| 70000. | 377. | 377. | 20. | 3. | 465. | 310. | 20. | 3. | 482. | 301. | 20. | 3. | 542. | 271. | 20. | 3. | 925. | 185. | 20. | 4. |
| 75000. | 388. | 388. | 20. | 3. | 479. | 319. | 20. | 4. | 494. | 309. | 20. | 4. | 558. | 279. | 20. | 4. | 950. | 190. | 20. | 4. |
| 80000. | 399. | 399. | 20. | 4. | 492. | 328. | 20. | 4. | 509. | 318. | 20. | 4. | 574. | 287. | 20. | 4. | 975. | 195. | 20. | 4. |
| 85000. | 410. | 410. | 20. | 4. | 504. | 336. | 20. | 4. | 522. | 326. | 20. | 4. | 588. | 294. | 20. | 4. | 995. | 199. | 20. | 5. |
| 90000. | 420. | 420. | 20. | 4. | 516. | 344. | 20. | 4. | 534. | 334. | 20. | 4. | 602. | 301. | 20. | 4. | 1020. | 204. | 20. | 5. |
| 95000. | 430. | 430. | 20. | 4. | 528. | 352. | 20. | 4. | 547. | 342. | 20. | 4. | 616. | 308. | 20. | 4. | 1040. | 208. | 20. | 5. |
| 100000. | 439. | 439. | 20. | 4. | 540. | 360. | 20. | 4. | 558. | 349. | 20. | 4. | 630. | 315. | 20. | 5. | 1060. | 212. | 20. | 5. |
| 105000. | 448. | 448. | 20. | 5. | 552. | 368. | 20. | 5. | 571. | 357. | 20. | 5. | 642. | 321. | 20. | 5. | 1080. | 216. | 20. | 5. |
| 110000. | 457. | 457. | 20. | 5. | 563. | 375. | 20. | 5. | 582. | 364. | 20. | 5. | 656. | 328. | 20. | 5. | 1100. | 220. | 20. | 6. |
| 115000. | 466. | 466. | 20. | 5. | 573. | 382. | 20. | 5. | 594. | 371. | 20. | 5. | 668. | 334. | 20. | 5. | 1120. | 224. | 20. | 6. |
| 120000. | 475. | 475. | 20. | 5. | 585. | 390. | 20. | 5. | 605. | 378. | 20. | 5. | 680. | 340. | 20. | 5. | 1140. | 228. | 20. | 6. |
| 125000. | 483. | 483. | 20. | 5. | 594. | 396. | 20. | 5. | 614. | 384. | 20. | 5. | 692. | 346. | 20. | 5. | 1160. | 232. | 20. | 6. |
| 130000. | 492. | 492. | 20. | 6. | 605. | 403. | 20. | 6. | 626. | 391. | 20. | 6. | 704. | 352. | 20. | 6. | 1175. | 235. | 20. | 6. |
| 135000. | 500. | 500. | 20. | 6. | 615. | 410. | 20. | 6. | 635. | 397. | 20. | 6. | 716. | 358. | 20. | 6. | 1195. | 239. | 20. | 7. |
| 140000. | 508. | 508. | 20. | 6. | 624. | 416. | 20. | 6. | 646. | 404. | 20. | 6. | 726. | 363. | 20. | 6. | 1210. | 242. | 20. | 7. |
| 145000. | 516. | 516. | 20. | 6. | 635. | 423. | 20. | 6. | 656. | 410. | 20. | 6. | 738. | 369. | 20. | 6. | 1230. | 246. | 20. | 7. |
| 150000. | 523. | 523. | 20. | 6. | 644. | 429. | 20. | 6. | 666. | 416. | 20. | 6. | 748. | 374. | 20. | 6. | 1245. | 249. | 20. | 7. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 25. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 208. | 208. | 25. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 231. | 231. | 25. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 250. | 250. | 25. | 1. | 311. | 207. | 25. | 1. | 323. | 202. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 267. | 267. | 25. | 2. | 332. | 221. | 25. | 2. | 344. | 215. | 25. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 283. | 283. | 25. | 2. | 351. | 234. | 25. | 2. | 363. | 227. | 25. | 2. | 414. | 207. | 25. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 297. | 297. | 25. | 2. | 368. | 245. | 25. | 2. | 381. | 238. | 25. | 2. | 434. | 217. | 25. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 310. | 310. | 25. | 2. | 384. | 256. | 25. | 2. | 398. | 249. | 25. | 2. | 452. | 226. | 25. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 323. | 323. | 25. | 2. | 399. | 266. | 25. | 2. | 413. | 258. | 25. | 2. | 470. | 235. | 25. | 3. | 845. | 169. | 21. | 3. |
| 60000. | 335. | 335. | 25. | 3. | 414. | 276. | 25. | 3. | 429. | 268. | 25. | 3. | 486. | 243. | 25. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 346. | 346. | 25. | 3. | 428. | 285. | 25. | 3. | 443. | 277. | 25. | 3. | 502. | 251. | 25. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 357. | 357. | 25. | 3. | 441. | 294. | 25. | 3. | 456. | 285. | 25. | 3. | 516. | 258. | 25. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 367. | 367. | 25. | 3. | 453. | 302. | 25. | 3. | 469. | 293. | 25. | 3. | 532. | 266. | 25. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 377. | 377. | 25. | 3. | 465. | 310. | 25. | 3. | 482. | 301. | 25. | 3. | 546. | 273. | 25. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 387. | 387. | 25. | 3. | 477. | 318. | 25. | 3. | 494. | 309. | 25. | 4. | 558. | 279. | 25. | 4. | 975. | 195. | 24. | 4. |
| 90000. | 396. | 396. | 25. | 4. | 489. | 326. | 25. | 4. | 506. | 316. | 25. | 4. | 572. | 286. | 25. | 4. | 995. | 199. | 25. | 5. |
| 95000. | 405. | 405. | 25. | 4. | 500. | 333. | 25. | 4. | 517. | 323. | 25. | 4. | 584. | 292. | 25. | 4. | 1010. | 202. | 25. | 5. |
| 100000. | 414. | 414. | 25. | 4. | 510. | 340. | 25. | 4. | 528. | 330. | 25. | 4. | 596. | 298. | 25. | 4. | 1030. | 206. | 25. | 5. |
| 105000. | 422. | 422. | 25. | 4. | 521. | 347. | 25. | 4. | 539. | 337. | 25. | 4. | 608. | 304. | 25. | 4. | 1050. | 210. | 25. | 5. |
| 110000. | 430. | 430. | 25. | 4. | 531. | 354. | 25. | 4. | 549. | 343. | 25. | 4. | 620. | 310. | 25. | 4. | 1065. | 213. | 25. | 5. |
| 115000. | 438. | 438. | 25. | 4. | 540. | 360. | 25. | 4. | 560. | 350. | 25. | 4. | 632. | 316. | 25. | 5. | 1085. | 217. | 25. | 5. |
| 120000. | 446. | 446. | 25. | 5. | 551. | 367. | 25. | 5. | 570. | 356. | 25. | 5. | 642. | 321. | 25. | 5. | 1100. | 220. | 25. | 6. |
| 125000. | 454. | 454. | 25. | 5. | 560. | 373. | 25. | 5. | 579. | 362. | 25. | 5. | 654. | 327. | 25. | 5. | 1120. | 224. | 25. | 6. |
| 130000. | 462. | 462. | 25. | 5. | 569. | 379. | 25. | 5. | 589. | 368. | 25. | 5. | 664. | 332. | 25. | 5. | 1135. | 227. | 25. | 6. |
| 135000. | 469. | 469. | 25. | 5. | 578. | 385. | 25. | 5. | 598. | 374. | 25. | 5. | 674. | 337. | 25. | 5. | 1150. | 230. | 25. | 6. |
| 140000. | 476. | 476. | 25. | 5. | 587. | 391. | 25. | 5. | 606. | 379. | 25. | 5. | 684. | 342. | 25. | 5. | 1165. | 233. | 25. | 6. |
| 145000. | 483. | 483. | 25. | 5. | 596. | 397. | 25. | 5. | 616. | 385. | 25. | 5. | 694. | 347. | 25. | 6. | 1180. | 236. | 25. | 6. |
| 150000. | 490. | 490. | 25. | 6. | 605. | 403. | 25. | 6. | 626. | 391. | 25. | 6. | 704. | 352. | 25. | 6. | 1195. | 239. | 25. | 7. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 30. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 251. | 251. | 30. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 267. | 267. | 30. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 282. | 282. | 30. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 295. | 295. | 30. | 2. | 368. | 245. | 30. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 308. | 308. | 30. | 2. | 383. | 255. | 30. | 2. | 397. | 248. | 30. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 319. | 319. | 30. | 2. | 396. | 264. | 30. | 2. | 411. | 257. | 30. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 330. | 330. | 30. | 3. | 410. | 273. | 30. | 3. | 426. | 266. | 30. | 3. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 341. | 341. | 30. | 3. | 423. | 282. | 30. | 3. | 438. | 274. | 30. | 3. | 498. | 249. | 30. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 351. | 351. | 30. | 3. | 435. | 290. | 30. | 3. | 451. | 282. | 30. | 3. | 512. | 256. | 30. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 360. | 360. | 30. | 3. | 446. | 297. | 30. | 3. | 462. | 289. | 30. | 3. | 526. | 263. | 30. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 370. | 370. | 30. | 3. | 458. | 305. | 30. | 3. | 474. | 296. | 30. | 3. | 538. | 269. | 30. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 379. | 379. | 30. | 3. | 468. | 312. | 30. | 3. | 485. | 303. | 30. | 3. | 550. | 275. | 30. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 387. | 387. | 30. | 3. | 479. | 319. | 30. | 4. | 496. | 310. | 30. | 4. | 562. | 281. | 30. | 4. | 1010. | 202. | 25. | 5. |
| 100000. | 395. | 395. | 30. | 4. | 489. | 326. | 30. | 4. | 507. | 317. | 30. | 4. | 574. | 287. | 30. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 404. | 404. | 30. | 4. | 498. | 332. | 30. | 4. | 517. | 323. | 30. | 4. | 586. | 293. | 30. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 411. | 411. | 30. | 4. | 509. | 339. | 30. | 4. | 526. | 329. | 30. | 4. | 596. | 298. | 30. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 419. | 419. | 30. | 4. | 518. | 345. | 30. | 4. | 536. | 335. | 30. | 4. | 608. | 304. | 30. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 426. | 426. | 30. | 4. | 527. | 351. | 30. | 4. | 546. | 341. | 30. | 4. | 616. | 309. | 30. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 434. | 434. | 30. | 4. | 536. | 357. | 30. | 4. | 555. | 347. | 30. | 4. | 628. | 314. | 30. | 5. | 1110. | 222. | 28. | 6. |
| 130000. | 441. | 441. | 30. | 4. | 545. | 363. | 30. | 5. | 563. | 352. | 30. | 5. | 638. | 319. | 30. | 5. | 1120. | 224. | 28. | 6. |
| 135000. | 448. | 448. | 30. | 5. | 552. | 368. | 30. | 5. | 573. | 358. | 30. | 5. | 648. | 324. | 30. | 5. | 1135. | 227. | 28. | 6. |
| 140000. | 455. | 455. | 30. | 5. | 561. | 374. | 30. | 5. | 581. | 363. | 30. | 5. | 658. | 329. | 30. | 5. | 1150. | 230. | 29. | 6. |
| 145000. | 461. | 461. | 30. | 5. | 569. | 379. | 30. | 5. | 589. | 368. | 30. | 5. | 666. | 333. | 30. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 468. | 468. | 30. | 5. | 578. | 385. | 30. | 5. | 597. | 373. | 30. | 5. | 676. | 338. | 30. | 5. | 1175. | 235. | 29. | 6. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 35. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 292. | 292. | 35. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 304. | 304. | 35. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 315. | 315. | 35. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 326. | 326. | 35. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 336. | 336. | 35. | 3. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 346. | 346. | 35. | 3. | 429. | 286. | 35. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 355. | 355. | 35. | 3. | 441. | 294. | 35. | 3. | 458. | 286. | 35. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 364. | 364. | 35. | 3. | 452. | 301. | 35. | 3. | 469. | 293. | 35. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 372. | 372. | 35. | 3. | 462. | 308. | 35. | 3. | 478. | 299. | 35. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 380. | 380. | 35. | 3. | 471. | 314. | 35. | 3. | 490. | 306. | 35. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 388. | 388. | 35. | 3. | 482. | 321. | 35. | 4. | 499. | 312. | 35. | 4. | 568. | 284. | 35. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 396. | 396. | 35. | 4. | 491. | 327. | 35. | 4. | 509. | 318. | 35. | 4. | 578. | 289. | 35. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 403. | 403. | 35. | 4. | 500. | 333. | 35. | 4. | 518. | 324. | 35. | 4. | 590. | 295. | 35. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 411. | 411. | 35. | 4. | 509. | 339. | 35. | 4. | 526. | 329. | 35. | 4. | 600. | 300. | 35. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 418. | 418. | 35. | 4. | 518. | 345. | 35. | 4. | 536. | 335. | 35. | 4. | 610. | 305. | 35. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 425. | 425. | 35. | 4. | 525. | 350. | 35. | 4. | 544. | 340. | 35. | 4. | 618. | 309. | 35. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 431. | 431. | 35. | 4. | 534. | 356. | 35. | 4. | 554. | 346. | 35. | 4. | 628. | 314. | 35. | 5. | 1135. | 227. | 28. | 6. |
| 140000. | 438. | 438. | 35. | 4. | 542. | 361. | 35. | 4. | 562. | 351. | 35. | 5. | 638. | 319. | 35. | 5. | 1150. | 230. | 29. | 6. |
| 145000. | 444. | 444. | 35. | 5. | 549. | 366. | 35. | 5. | 570. | 356. | 35. | 5. | 646. | 323. | 35. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 451. | 451. | 35. | 5. | 557. | 371. | 35. | 5. | 578. | 361. | 35. | 5. | 654. | 327. | 35. | 5. | 1175. | 235. | 29. | 6. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 40. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 143. | 143. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 329. | 329. | 40. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 339. | 339. | 40. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 348. | 348. | 40. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 357. | 357. | 40. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 365. | 365. | 40. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 373. | 373. | 40. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 381. | 381. | 40. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 389. | 389. | 40. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 396. | 396. | 40. | 4. | 492. | 328. | 40. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 403. | 403. | 40. | 4. | 501. | 334. | 40. | 4. | 518. | 324. | 40. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 410. | 410. | 40. | 4. | 509. | 339. | 40. | 4. | 528. | 330. | 40. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 416. | 416. | 40. | 4. | 518. | 345. | 40. | 4. | 536. | 335. | 40. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 423. | 423. | 40. | 4. | 525. | 350. | 40. | 4. | 544. | 340. | 40. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 429. | 429. | 40. | 4. | 533. | 355. | 40. | 4. | 552. | 345. | 40. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 436. | 436. | 40. | 4. | 540. | 360. | 40. | 4. | 560. | 350. | 40. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 45. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 272. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 364. | 364. | 45. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 372. | 372. | 45. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 379. | 379. | 45. | 3. | 489. | 326. | 41. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 387. | 387. | 45. | 3. | 497. | 331. | 41. | 4. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 394. | 394. | 45. | 4. | 503. | 335. | 42. | 4. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 401. | 401. | 45. | 4. | 509. | 339. | 42. | 4. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 408. | 408. | 45. | 4. | 515. | 343. | 43. | 4. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 414. | 414. | 45. | 4. | 521. | 347. | 43. | 4. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 420. | 420. | 45. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

# STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 50. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 363. | 363. | 45. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 368. | 368. | 46. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 373. | 373. | 47. | 3. | 489. | 326. | 41. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 378. | 378. | 47. | 3. | 497. | 331. | 41. | 4. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 383. | 383. | 48. | 3. | 503. | 335. | 42. | 4. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 388. | 388. | 49. | 3. | 509. | 339. | 42. | 4. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 393. | 393. | 49. | 4. | 515. | 343. | 43. | 4. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 398. | 398. | 50. | 4. | 521. | 347. | 43. | 4. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 403. | 403. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 55. FT. HIGH

STOCKPILE SHAPE

| VOLUME | SQUARE LONG | SQUARE WIDE | SQUARE HIGH | SQUARE AREA | 3-2 LONG | 3-2 WIDE | 3-2 HIGH | 3-2 AREA |
|---|---|---|---|---|---|---|---|---|
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. |
| 110000. | 363. | 363. | 45. | 3. | 476. | 317. | 40. | 3. |
| 115000. | 368. | 368. | 46. | 3. | 483. | 322. | 40. | 4. |
| 120000. | 373. | 373. | 47. | 3. | 489. | 326. | 41. | 4. |
| 125000. | 378. | 378. | 47. | 3. | 497. | 331. | 41. | 4. |
| 130000. | 383. | 383. | 48. | 3. | 503. | 335. | 42. | 4. |
| 135000. | 388. | 388. | 49. | 3. | 509. | 339. | 42. | 4. |
| 140000. | 393. | 393. | 49. | 4. | 515. | 343. | 43. | 4. |
| 145000. | 398. | 398. | 50. | 4. | 521. | 347. | 43. | 4. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. |

| VOLUME | 8-5 LONG | 8-5 WIDE | 8-5 HIGH | 8-5 AREA | 2-1 LONG | 2-1 WIDE | 2-1 HIGH | 2-1 AREA |
|---|---|---|---|---|---|---|---|---|
| 5000. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. |
| 10000. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. |
| 15000. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. |
| 20000. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. |
| 25000. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. |
| 30000. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. |
| 35000. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. |
| 40000. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. |
| 45000. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. |
| 50000. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. |
| 55000. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. |
| 60000. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. |
| 65000. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. |
| 70000. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. |
| 75000. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. |
| 80000. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. |
| 85000. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. |
| 90000. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. |
| 95000. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. |
| 100000. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. |
| 105000. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. |
| 110000. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. |
| 115000. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. |
| 120000. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. |
| 125000. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. |
| 130000. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. |
| 135000. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. |
| 140000. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. |
| 145000. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. |
| 150000. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. |

| VOLUME | 5-1 LONG | 5-1 WIDE | 5-1 HIGH | 5-1 AREA |
|---|---|---|---|---|
| 5000. | 380. | 76. | 10. | 1. |
| 10000. | 480. | 96. | 12. | 1. |
| 15000. | 550. | 110. | 14. | 1. |
| 20000. | 600. | 120. | 15. | 2. |
| 25000. | 650. | 130. | 16. | 2. |
| 30000. | 690. | 138. | 17. | 2. |
| 35000. | 725. | 145. | 18. | 2. |
| 40000. | 760. | 152. | 19. | 3. |
| 45000. | 790. | 158. | 20. | 3. |
| 50000. | 815. | 163. | 20. | 3. |
| 55000. | 845. | 169. | 21. | 3. |
| 60000. | 870. | 174. | 22. | 3. |
| 65000. | 890. | 178. | 22. | 4. |
| 70000. | 915. | 183. | 23. | 4. |
| 75000. | 935. | 187. | 23. | 4. |
| 80000. | 955. | 191. | 24. | 4. |
| 85000. | 975. | 195. | 24. | 4. |
| 90000. | 995. | 199. | 25. | 5. |
| 95000. | 1010. | 202. | 25. | 5. |
| 100000. | 1030. | 206. | 26. | 5. |
| 105000. | 1045. | 209. | 26. | 5. |
| 110000. | 1060. | 212. | 27. | 5. |
| 115000. | 1075. | 215. | 27. | 5. |
| 120000. | 1095. | 219. | 27. | 6. |
| 125000. | 1110. | 222. | 28. | 6. |
| 130000. | 1120. | 224. | 28. | 6. |
| 135000. | 1135. | 227. | 28. | 6. |
| 140000. | 1150. | 230. | 29. | 6. |
| 145000. | 1165. | 233. | 29. | 6. |
| 150000. | 1175. | 235. | 29. | 6. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 60. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 363. | 363. | 45. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 368. | 368. | 46. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 373. | 373. | 47. | 3. | 489. | 326. | 41. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 378. | 378. | 47. | 3. | 497. | 331. | 41. | 4. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 383. | 383. | 48. | 3. | 503. | 335. | 42. | 4. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 388. | 388. | 49. | 3. | 509. | 339. | 42. | 4. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 393. | 393. | 49. | 4. | 515. | 343. | 43. | 4. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 398. | 398. | 50. | 4. | 521. | 347. | 43. | 4. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 65. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 363. | 363. | 45. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 368. | 368. | 46. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 373. | 373. | 47. | 3. | 489. | 326. | 41. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 378. | 378. | 47. | 3. | 497. | 331. | 41. | 4. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 383. | 383. | 48. | 3. | 503. | 335. | 42. | 4. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 388. | 388. | 49. | 3. | 509. | 339. | 42. | 4. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 393. | 393. | 49. | 4. | 515. | 343. | 43. | 4. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 398. | 398. | 50. | 4. | 521. | 347. | 43. | 4. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 70. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 363. | 363. | 45. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 368. | 368. | 46. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 373. | 373. | 47. | 3. | 489. | 326. | 41. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 378. | 378. | 47. | 3. | 497. | 331. | 41. | 4. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 383. | 383. | 48. | 3. | 503. | 335. | 42. | 4. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 388. | 388. | 49. | 3. | 509. | 339. | 42. | 4. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 393. | 393. | 49. | 4. | 515. | 343. | 43. | 4. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 398. | 398. | 50. | 4. | 521. | 347. | 43. | 4. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 75. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 5000. | 130. | 130. | 16. | 0. | 170. | 113. | 14. | 0. | 178. | 111. | 14. | 0. | 206. | 103. | 13. | 0. | 380. | 76. | 10. | 1. |
| 10000. | 163. | 163. | 20. | 1. | 215. | 143. | 18. | 1. | 224. | 140. | 18. | 1. | 260. | 130. | 16. | 1. | 480. | 96. | 12. | 1. |
| 15000. | 187. | 187. | 23. | 1. | 245. | 163. | 20. | 1. | 256. | 160. | 20. | 1. | 296. | 148. | 19. | 1. | 550. | 110. | 14. | 1. |
| 20000. | 206. | 206. | 26. | 1. | 270. | 180. | 23. | 1. | 282. | 176. | 22. | 1. | 326. | 163. | 20. | 1. | 600. | 120. | 15. | 2. |
| 25000. | 222. | 222. | 28. | 1. | 291. | 194. | 24. | 1. | 302. | 189. | 24. | 1. | 352. | 176. | 22. | 1. | 650. | 130. | 16. | 2. |
| 30000. | 235. | 235. | 29. | 1. | 309. | 206. | 26. | 1. | 322. | 201. | 25. | 1. | 374. | 187. | 23. | 2. | 690. | 138. | 17. | 2. |
| 35000. | 248. | 248. | 31. | 1. | 326. | 217. | 27. | 2. | 339. | 212. | 27. | 2. | 394. | 197. | 25. | 2. | 725. | 145. | 18. | 2. |
| 40000. | 259. | 259. | 32. | 2. | 339. | 226. | 28. | 2. | 355. | 222. | 28. | 2. | 412. | 206. | 26. | 2. | 760. | 152. | 19. | 3. |
| 45000. | 269. | 269. | 34. | 2. | 353. | 235. | 29. | 2. | 368. | 230. | 29. | 2. | 428. | 214. | 27. | 2. | 790. | 158. | 20. | 3. |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 55000. | 288. | 288. | 36. | 2. | 378. | 252. | 32. | 2. | 394. | 246. | 31. | 2. | 458. | 229. | 29. | 2. | 845. | 169. | 21. | 3. |
| 60000. | 296. | 296. | 37. | 2. | 389. | 259. | 32. | 2. | 406. | 254. | 32. | 2. | 470. | 235. | 29. | 3. | 870. | 174. | 22. | 3. |
| 65000. | 304. | 304. | 38. | 2. | 399. | 266. | 33. | 2. | 416. | 260. | 33. | 2. | 484. | 242. | 30. | 3. | 890. | 178. | 22. | 4. |
| 70000. | 312. | 312. | 39. | 2. | 410. | 273. | 34. | 3. | 427. | 267. | 33. | 3. | 496. | 248. | 31. | 3. | 915. | 183. | 23. | 4. |
| 75000. | 319. | 319. | 40. | 2. | 419. | 279. | 35. | 3. | 437. | 273. | 34. | 3. | 508. | 254. | 32. | 3. | 935. | 187. | 23. | 4. |
| 80000. | 326. | 326. | 41. | 2. | 428. | 285. | 36. | 3. | 446. | 279. | 35. | 3. | 518. | 259. | 32. | 3. | 955. | 191. | 24. | 4. |
| 85000. | 333. | 333. | 42. | 3. | 437. | 291. | 36. | 3. | 456. | 285. | 36. | 3. | 528. | 264. | 33. | 3. | 975. | 195. | 24. | 4. |
| 90000. | 339. | 339. | 42. | 3. | 444. | 296. | 37. | 3. | 464. | 290. | 36. | 3. | 538. | 269. | 34. | 3. | 995. | 199. | 25. | 5. |
| 95000. | 345. | 345. | 43. | 3. | 453. | 302. | 38. | 3. | 472. | 295. | 37. | 3. | 548. | 274. | 34. | 3. | 1010. | 202. | 25. | 5. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 105000. | 357. | 357. | 45. | 3. | 468. | 312. | 39. | 3. | 488. | 305. | 38. | 3. | 568. | 284. | 36. | 4. | 1045. | 209. | 26. | 5. |
| 110000. | 363. | 363. | 45. | 3. | 476. | 317. | 40. | 3. | 496. | 310. | 39. | 4. | 576. | 288. | 36. | 4. | 1060. | 212. | 27. | 5. |
| 115000. | 368. | 368. | 46. | 3. | 483. | 322. | 40. | 4. | 504. | 315. | 39. | 4. | 584. | 292. | 37. | 4. | 1075. | 215. | 27. | 5. |
| 120000. | 373. | 373. | 47. | 3. | 489. | 326. | 41. | 4. | 510. | 319. | 40. | 4. | 592. | 296. | 37. | 4. | 1095. | 219. | 27. | 6. |
| 125000. | 378. | 378. | 47. | 3. | 497. | 331. | 41. | 4. | 518. | 324. | 41. | 4. | 600. | 300. | 38. | 4. | 1110. | 222. | 28. | 6. |
| 130000. | 38L. | 2"8. | 22I?JZF | | 501.Y | P35. | 42. | 4. | 525. | 328. | 41. | 4. | 608. | 304. | 38. | 4. | 1120. | 224. | 28. | 6. |
| 135000. | 388. | 388. | 49. | 3. | 509. | 339. | 42. | 4. | 531. | 332. | 42. | 4. | 616. | 308. | 39. | 4. | 1135. | 227. | 28. | 6. |
| 140000. | 393. | 393. | 49. | 4. | 515. | 343. | 43. | 4. | 538. | 336. | 42. | 4. | 624. | 312. | 39. | 4. | 1150. | 230. | 29. | 6. |
| 145000. | 398. | 398. | 50. | 4. | 521. | 347. | 43. | 4. | 544. | 340. | 43. | 4. | 632. | 316. | 40. | 5. | 1165. | 233. | 29. | 6. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 5. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 540. | 540. | 5. | 7. | 662. | 441. | 5. | 7. | 683. | 427. | 5. | 7. | 766. | 383. | 5. | 7. | 1225. | 245. | 5. | 7. |
| 100000. | 755. | 755. | 5. | 13. | 925. | 617. | 5. | 13. | 955. | 597. | 5. | 13. | 1070. | 535. | 5. | 13. | 1705. | 341. | 5. | 13. |
| 150000. | 920. | 920. | 5. | 19. | 1128. | 752. | 5. | 19. | 1165. | 728. | 5. | 19. | 1304. | 652. | 5. | 20. | 2075. | 415. | 5. | 20. |
| 200000. | 1060. | 1060. | 5. | 26. | 1299. | 866. | 5. | 26. | 1341. | 838. | 5. | 26. | 1500. | 750. | 5. | 26. | 2385. | 477. | 5. | 26. |
| 250000. | 1182. | 1182. | 5. | 32. | 1449. | 966. | 5. | 32. | 1496. | 935. | 5. | 32. | 1674. | 837. | 5. | 32. | 2660. | 532. | 5. | 32. |
| 300000. | 1293. | 1293. | 5. | 38. | 1584. | 1056. | 5. | 38. | 1637. | 1023. | 5. | 38. | 1830. | 915. | 5. | 38. | 2910. | 582. | 5. | 39. |
| 350000. | 1395. | 1395. | 5. | 45. | 1710. | 1140. | 5. | 45. | 1765. | 1103. | 5. | 45. | 1976. | 988. | 5. | 45. | 3135. | 627. | 5. | 45. |
| 400000. | 1490. | 1490. | 5. | 51. | 1826. | 1217. | 5. | 51. | 1886. | 1179. | 5. | 51. | 2110. | 1055. | 5. | 51. | 3350. | 670. | 5. | 52. |
| 450000. | 1579. | 1579. | 5. | 57. | 1935. | 1290. | 5. | 57. | 1998. | 1249. | 5. | 57. | 2236. | 1118. | 5. | 57. | 3550. | 710. | 5. | 58. |
| 500000. | 1664. | 1664. | 5. | 64. | 2039. | 1359. | 5. | 64. | 2106. | 1316. | 5. | 64. | 2354. | 1177. | 5. | 64. | 3735. | 747. | 5. | 64. |
| 550000. | 1744. | 1744. | 5. | 70. | 2136. | 1424. | 5. | 70. | 2206. | 1379. | 5. | 70. | 2468. | 1234. | 5. | 70. | 3915. | 783. | 5. | 70. |
| 600000. | 1820. | 1820. | 5. | 76. | 2231. | 1487. | 5. | 76. | 2304. | 1440. | 5. | 76. | 2576. | 1288. | 5. | 76. | 4085. | 817. | 5. | 77. |
| 650000. | 1894. | 1894. | 5. | 82. | 2321. | 1547. | 5. | 82. | 2397. | 1498. | 5. | 82. | 2680. | 1340. | 5. | 82. | 4250. | 850. | 5. | 83. |
| 700000. | 1965. | 1965. | 5. | 89. | 2408. | 1605. | 5. | 89. | 2486. | 1554. | 5. | 89. | 2780. | 1390. | 5. | 89. | 4410. | 882. | 5. | 89. |
| 750000. | 2033. | 2033. | 5. | 95. | 2490. | 1660. | 5. | 95. | 2573. | 1608. | 5. | 95. | 2876. | 1438. | 5. | 95. | 4560. | 912. | 5. | 95. |
| 800000. | 2099. | 2099. | 5. | 101. | 2571. | 1714. | 5. | 101. | 2656. | 1660. | 5. | 101. | 2970. | 1485. | 5. | 101. | 4710. | 942. | 5. | 102. |
| 850000. | 2163. | 2163. | 5. | 107. | 2649. | 1766. | 5. | 107. | 2736. | 1710. | 5. | 107. | 3060. | 1530. | 5. | 107. | 4855. | 971. | 5. | 108. |
| 900000. | 2225. | 2225. | 5. | 114. | 2726. | 1817. | 5. | 114. | 2816. | 1760. | 5. | 114. | 3148. | 1574. | 5. | 114. | 4990. | 998. | 5. | 114. |
| 950000. | 2285. | 2285. | 5. | 120. | 2799. | 1866. | 5. | 120. | 2891. | 1807. | 5. | 120. | 3234. | 1617. | 5. | 120. | 5125. | 1025. | 5. | 121. |
| 1000000. | 2344. | 2344. | 5. | 126. | 2871. | 1914. | 5. | 126. | 2966. | 1854. | 5. | 126. | 3318. | 1659. | 5. | 126. | 5260. | 1052. | 5. | 127. |
| 1050000. | 2402. | 2402. | 5. | 132. | 2942. | 1961. | 5. | 132. | 3038. | 1899. | 5. | 132. | 3398. | 1699. | 5. | 133. | 5385. | 1077. | 5. | 133. |
| 1100000. | 2458. | 2458. | 5. | 139. | 3011. | 2007. | 5. | 139. | 3109. | 1943. | 5. | 139. | 3478. | 1739. | 5. | 139. | 5510. | 1102. | 5. | 139. |
| 1150000. | 2512. | 2512. | 5. | 145. | 3078. | 2052. | 5. | 145. | 3179. | 1987. | 5. | 145. | 3556. | 1778. | 5. | 145. | 5635. | 1127. | 5. | 146. |
| 1200000. | 2566. | 2566. | 5. | 151. | 3144. | 2096. | 5. | 151. | 3246. | 2029. | 5. | 151. | 3630. | 1815. | 5. | 151. | 5755. | 1151. | 5. | 152. |
| 1250000. | 2618. | 2618. | 5. | 157. | 3207. | 2138. | 5. | 157. | 3314. | 2071. | 5. | 158. | 3706. | 1853. | 5. | 158. | 5870. | 1174. | 5. | 158. |
| 1300000. | 2670. | 2670. | 5. | 164. | 3270. | 2180. | 5. | 164. | 3378. | 2111. | 5. | 164. | 3778. | 1889. | 5. | 164. | 5985. | 1197. | 5. | 164. |
| 1350000. | 2720. | 2720. | 5. | 170. | 3333. | 2222. | 5. | 170. | 3442. | 2151. | 5. | 170. | 3850. | 1925. | 5. | 170. | 6100. | 1220. | 5. | 171. |
| 1400000. | 2770. | 2770. | 5. | 176. | 3393. | 2262. | 5. | 176. | 3504. | 2190. | 5. | 176. | 3920. | 1960. | 5. | 176. | 6210. | 1242. | 5. | 177. |
| 1450000. | 2819. | 2819. | 5. | 182. | 3453. | 2302. | 5. | 182. | 3566. | 2229. | 5. | 182. | 3988. | 1994. | 5. | 183. | 6320. | 1264. | 5. | 183. |
| 1500000. | 2866. | 2866. | 5. | 189. | 3512. | 2341. | 5. | 189. | 3627. | 2267. | 5. | 189. | 4056. | 2028. | 5. | 189. | 6425. | 1285. | 5. | 190. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 10. FT. HIGH

STOCKPILE SHAPE

| VOLUME | SQUARE LONG | SQUARE WIDE | SQUARE HIGH | SQUARE AREA | 3-2 LONG | 3-2 WIDE | 3-2 HIGH | 3-2 AREA |
|---|---|---|---|---|---|---|---|---|
| 50000. | 406. | 406. | 10. | 4. | 498. | 332. | 10. | 4. |
| 100000. | 559. | 559. | 10. | 7. | 686. | 457. | 10. | 7. |
| 150000. | 676. | 676. | 10. | 10. | 828. | 552. | 10. | 10. |
| 200000. | 774. | 774. | 10. | 14. | 950. | 633. | 10. | 14. |
| 250000. | 861. | 861. | 10. | 17. | 1056. | 704. | 10. | 17. |
| 300000. | 940. | 940. | 10. | 20. | 1152. | 768. | 10. | 20. |
| 350000. | 1012. | 1012. | 10. | 24. | 1241. | 827. | 10. | 24. |
| 400000. | 1079. | 1079. | 10. | 27. | 1323. | 882. | 10. | 27. |
| 450000. | 1142. | 1142. | 10. | 30. | 1400. | 93[illegible] | 10. | 30. |
| 500000. | 1202. | 1202. | 10. | 33. | 1473. | 982. | 10. | 33. |
| 550000. | 1258. | 1258. | 10. | 36. | 1542. | 1028. | 10. | 36. |
| 600000. | 1313. | 1313. | 10. | 40. | 1610. | 1073. | 10. | 40. |
| 650000. | 1365. | 1365. | 10. | 43. | 1673. | 1115. | 10. | 43. |
| 700000. | 1415. | 1415. | 10. | 46. | 1734. | 1156. | 10. | 46. |
| 750000. | 1463. | 1463. | 10. | 49. | 1793. | 1195. | 10. | 49. |
| 800000. | 1510. | 1510. | 10. | 52. | 1850. | 1233. | 10. | 52. |
| 850000. | 1555. | 1555. | 10. | 56. | 1905. | 1270. | 10. | 56. |
| 900000. | 1599. | 1599. | 10. | 59. | 1959. | 1306. | 10. | 59. |
| 950000. | 1642. | 1642. | 10. | 62. | 2012. | 1341. | 10. | 62. |
| 1000000. | 1683. | 1683. | 10. | 65. | 2063. | 1375. | 10. | 65. |
| 1050000. | 1724. | 1724. | 10. | 68. | 2112. | 1408. | 10. | 68. |
| 1100000. | 1763. | 1763. | 10. | 71. | 2162. | 1441. | 10. | 72. |
| 1150000. | 1802. | 1802. | 10. | 75. | 2208. | 1472. | 10. | 75. |
| 1200000. | 1840. | 1840. | 10. | 78. | 2255. | 1503. | 10. | 78. |
| 1250000. | 1877. | 1877. | 10. | 81. | 2300. | 1533. | 10. | 81. |
| 1300000. | 1914. | 1914. | 10. | 84. | 2345. | 1563. | 10. | 84. |
| 1350000. | 1949. | 1949. | 10. | 87. | 2388. | 1592. | 10. | 87. |
| 1400000. | 1984. | 1984. | 10. | 90. | 2432. | 1621. | 10. | 90. |
| 1450000. | 2019. | 2019. | 10. | 94. | 2474. | 1649. | 10. | 94. |
| 1500000. | 2053. | 2053. | 10. | 97. | 2516. | 1677. | 10. | 97. |

| VOLUME | 8-5 LONG | 8-5 WIDE | 8-5 HIGH | 8-5 AREA | 2-1 LONG | 2-1 WIDE | 2-1 HIGH | 2-1 AREA | 5-1 LONG | 5-1 WIDE | 5-1 HIGH | 5-1 AREA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50000. | 515. | 322. | 10. | 4. | 578. | 289. | 10. | 4. | 945. | 189. | 10. | 4. |
| 100000. | 709. | 443. | 10. | 7. | 794. | 397. | 10. | 7. | 1285. | 257. | 10. | 8. |
| 150000. | 856. | 535. | 10. | 11. | 960. | 480. | 10. | 11. | 1545. | 309. | 10. | 11. |
| 200000. | 981. | 613. | 10. | 14. | 1098. | 549. | 10. | 14. | 1765. | 353. | 10. | 14. |
| 250000. | 1091. | 682. | 10. | 17. | 1222. | 611. | 10. | 17. | 1960. | 392. | 10. | 18. |
| 300000. | 1190. | 744. | 10. | 20. | 1332. | 666. | 10. | 20. | 2135. | 427. | 10. | 21. |
| 350000. | 1282. | 601. | 10. | 24. | 1434. | 717. | 10. | 24. | 2295. | 459. | 10. | 24. |
| 400000. | 1366. | 854. | 10. | 27. | 1530. | 765. | 10. | 27. | 2445. | 489. | 10. | 27. |
| 450000. | 1446. | 904. | 10. | 30. | 1618. | 809. | 10. | 30. | 2585. | 517. | 10. | 31. |
| 500000. | 1522. | 951. | 10. | 33. | 1704. | 852. | 10. | 33. | 2720. | 544. | 10. | 34. |
| 550000. | 1594. | 996. | 10. | 36. | 1784. | 892. | 10. | 37. | 2845. | 569. | 10. | 37. |
| 600000. | 1662. | 1039. | 10. | 40. | 1860. | 930. | 10. | 40. | 2970. | 594. | 10. | 41. |
| 650000. | 1728. | 1080. | 10. | 43. | 1934. | 967. | 10. | 43. | 3085. | 617. | 10. | 44. |
| 700000. | 1790. | 1119. | 10. | 46. | 2004. | 1002. | 10. | 46. | 3195. | 639. | 10. | 47. |
| 750000. | 1853. | 1158. | 10. | 49. | 2072. | 1036. | 10. | 49. | 3305. | 661. | 10. | 50. |
| 800000. | 1910. | 1194. | 10. | 52. | 2138. | 1069. | 10. | 52. | 3410. | 682. | 10. | 53. |
| 850000. | 1968. | 1230. | 10. | 56. | 2202. | 1101. | 10. | 56. | 3510. | 702. | 10. | 57. |
| 900000. | 2024. | 1265. | 10. | 59. | 2264. | 1132. | 10. | 59. | 3610. | 722. | 10. | 60. |
| 950000. | 2078. | 1299. | 10. | 62. | 2326. | 1163. | 10. | 62. | 3705. | 741. | 10. | 63. |
| 1000000. | 2131. | 1332. | 10. | 65. | 2384. | 1192. | 10. | 65. | 3795. | 759. | 10. | 66. |
| 1050000. | 2182. | 1364. | 10. | 68. | 2442. | 1221. | 10. | 68. | 3885. | 777. | 10. | 69. |
| 1100000. | 2232. | 1395. | 10. | 71. | 2498. | 1249. | 10. | 72. | 3975. | 795. | 10. | 73. |
| 1150000. | 2282. | 1426. | 10. | 75. | 2552. | 1276. | 10. | 75. | 4060. | 812. | 10. | 76. |
| 1200000. | 2330. | 1456. | 10. | 78. | 2606. | 1303. | 10. | 78. | 4145. | 829. | 10. | 79. |
| 1250000. | 2376. | 1485. | 10. | 81. | 2658. | 1329. | 10. | 81. | 4230. | 846. | 10. | 82. |
| 1300000. | 2422. | 1514. | 10. | 84. | 2710. | 1355. | 10. | 84. | 4310. | 862. | 10. | 85. |
| 1350000. | 2467. | 1542. | 10. | 87. | 2760. | 1380. | 10. | 87. | 4390. | 878. | 10. | 88. |
| 1400000. | 2512. | 1570. | 10. | 91. | 2810. | 1405. | 10. | 91. | 4470. | 894. | 10. | 92. |
| 1450000. | 2555. | 1597. | 10. | 94. | 2858. | 1429. | 10. | 94. | 4545. | 909. | 10. | 95. |
| 1500000. | 2598. | 1624. | 10. | 97. | 2906. | 1453. | 10. | 97. | 4620. | 924. | 10. | 98. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 15. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 354. | 354. | 15. | 3. | 437. | 291. | 15. | 3. | 451. | 282. | 15. | 3. | 508. | 254. | 15. | 3. | 850. | 170. | 15. | 3. |
| 100000. | 480. | 480. | 15. | 5. | 591. | 394. | 15. | 5. | 610. | 381. | 15. | 5. | 686. | 343. | 15. | 5. | 1130. | 226. | 15. | 6. |
| 150000. | 577. | 577. | 15. | 8. | 708. | 472. | 15. | 8. | 731. | 457. | 15. | 8. | 822. | 411. | 15. | 8. | 1345. | 269. | 15. | 8. |
| 200000. | 657. | 657. | 15. | 10. | 807. | 538. | 15. | 10. | 834. | 521. | 15. | 10. | 936. | 468. | 15. | 10. | 1525. | 305. | 15. | 11. |
| 250000. | 729. | 729. | 15. | 12. | 894. | 596. | 15. | 12. | 925. | 578. | 15. | 12. | 1036. | 518. | 15. | 12. | 1680. | 336. | 15. | 13. |
| 300000. | 793. | 793. | 15. | 14. | 974. | 649. | 15. | 15. | 1005. | 628. | 15. | 14. | 1128. | 564. | 15. | 15. | 1825. | 365. | 15. | 15. |
| 350000. | 852. | 852. | 15. | 17. | 1046. | 697. | 15. | 17. | 1080. | 675. | 15. | 17. | 1210. | 605. | 15. | 17. | 1955. | 391. | 15. | 18. |
| 400000. | 907. | 907. | 15. | 19. | 1113. | 742. | 15. | 19. | 1149. | 718. | 15. | 19. | 1288. | 644. | 15. | 19. | 2080. | 416. | 15. | 20. |
| 450000. | 958. | 958. | 15. | 21. | 1176. | 784. | 15. | 21. | 1214. | 759. | 15. | 21. | 1362. | 681. | 15. | 21. | 2195. | 439. | 15. | 22. |
| 500000. | 1007. | 1007. | 15. | 23. | 1236. | 824. | 15. | 23. | 1277. | 798. | 15. | 23. | 1430. | 715. | 15. | 23. | 2305. | 461. | 15. | 24. |
| 550000. | 1054. | 1054. | 15. | 26. | 1292. | 861. | 15. | 26. | 1336. | 835. | 15. | 26. | 1496. | 748. | 15. | 26. | 2405. | 481. | 15. | 27. |
| 600000. | 1098. | 1098. | 15. | 28. | 1347. | 898. | 15. | 28. | 1392. | 870. | 15. | 28. | 1558. | 779. | 15. | 28. | 2505. | 501. | 15. | 29. |
| 650000. | 1140. | 1140. | 15. | 30. | 1398. | 932. | 15. | 30. | 1445. | 903. | 15. | 30. | 1618. | 809. | 15. | 30. | 2600. | 520. | 15. | 31. |
| 700000. | 1181. | 1181. | 15. | 32. | 1449. | 966. | 15. | 32. | 1496. | 935. | 15. | 32. | 1676. | 838. | 15. | 32. | 2690. | 538. | 15. | 33. |
| 750000. | 1221. | 1221. | 15. | 34. | 1497. | 998. | 15. | 34. | 1547. | 967. | 15. | 34. | 1732. | 866. | 15. | 34. | 2780. | 556. | 15. | 35. |
| 800000. | 1259. | 1259. | 15. | 36. | 1544. | 1029. | 15. | 36. | 1595. | 997. | 15. | 37. | 1786. | 893. | 15. | 37. | 2865. | 573. | 15. | 38. |
| 850000. | 1296. | 1296. | 15. | 39. | 1589. | 1059. | 15. | 39. | 1642. | 1026. | 15. | 39. | 1838. | 919. | 15. | 39. | 2950. | 590. | 15. | 40. |
| 900000. | 1332. | 1332. | 15. | 41. | 1634. | 1089. | 15. | 41. | 1686. | 1054. | 15. | 41. | 1890. | 945. | 15. | 41. | 3030. | 606. | 15. | 42. |
| 950000. | 1367. | 1367. | 15. | 43. | 1676. | 1117. | 15. | 43. | 1731. | 1082. | 15. | 43. | 1938. | 969. | 15. | 43. | 3105. | 621. | 15. | 44. |
| 1000000. | 1401. | 1401. | 15. | 45. | 1718. | 1145. | 15. | 45. | 1774. | 1109. | 15. | 45. | 1986. | 993. | 15. | 45. | 3180. | 636. | 15. | 46. |
| 1050000. | 1434. | 1434. | 15. | 47. | 1758. | 1172. | 15. | 47. | 1816. | 1135. | 15. | 47. | 2034. | 1017. | 15. | 47. | 3255. | 651. | 15. | 49. |
| 1100000. | 1466. | 1466. | 15. | 49. | 1797. | 1198. | 15. | 49. | 1858. | 1161. | 15. | 50. | 2080. | 1040. | 15. | 50. | 3330. | 666. | 15. | 51. |
| 1150000. | 1498. | 1498. | 15. | 52. | 1836. | 1224. | 15. | 52. | 1898. | 1186. | 15. | 52. | 2124. | 1062. | 15. | 52. | 3400. | 680. | 15. | 53. |
| 1200000. | 1529. | 1529. | 15. | 54. | 1875. | 1250. | 15. | 54. | 1936. | 1210. | 15. | 54. | 2168. | 1084. | 15. | 54. | 3470. | 694. | 15. | 55. |
| 1250000. | 1559. | 1559. | 15. | 56. | 1911. | 1274. | 15. | 56. | 1974. | 1234. | 15. | 56. | 2210. | 1105. | 15. | 56. | 3535. | 707. | 15. | 57. |
| 1300000. | 1589. | 1589. | 15. | 58. | 1949. | 1299. | 15. | 58. | 2013. | 1258. | 15. | 58. | 2252. | 1126. | 15. | 58. | 3600. | 720. | 15. | 60. |
| 1350000. | 1618. | 1618. | 15. | 60. | 1983. | 1322. | 15. | 60. | 2050. | 1281. | 15. | 60. | 2294. | 1147. | 15. | 60. | 3670. | 734. | 15. | 62. |
| 1400000. | 1647. | 1647. | 15. | 62. | 2019. | 1346. | 15. | 62. | 2085. | 1303. | 15. | 62. | 2334. | 1167. | 15. | 63. | 3730. | 746. | 15. | 64. |
| 1450000. | 1675. | 1675. | 15. | 64. | 2054. | 1369. | 15. | 65. | 2122. | 1326. | 15. | 65. | 2374. | 1187. | 15. | 65. | 3795. | 759. | 15. | 66. |
| 1500000. | 1703. | 1703. | 15. | 67. | 2087. | 1391. | 15. | 67. | 2155. | 1347. | 15. | 67. | 2414. | 1207. | 15. | 67. | 3855. | 771. | 15. | 68. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 20. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 328. | 328. | 20. | 2. | 404. | 269. | 20. | 2. | 418. | 261. | 20. | 3. | 472. | 236. | 20. | 3. | 820. | 164. | 20. | 3. |
| 100000. | 439. | 439. | 20. | 4. | 540. | 360. | 20. | 4. | 558. | 349. | 20. | 4. | 630. | 315. | 20. | 5. | 1060. | 212. | 20. | 5. |
| 150000. | 523. | 523. | 20. | 6. | 644. | 429. | 20. | 6. | 666. | 416. | 20. | 6. | 748. | 374. | 20. | 6. | 1245. | 249. | 20. | 7. |
| 200000. | 594. | 594. | 20. | 8. | 731. | 487. | 20. | 8. | 755. | 472. | 20. | 8. | 848. | 424. | 20. | 8. | 1400. | 280. | 20. | 9. |
| 250000. | 656. | 656. | 20. | 10. | 806. | 537. | 20. | 10. | 834. | 521. | 20. | 10. | 936. | 468. | 20. | 10. | 1540. | 308. | 20. | 11. |
| 300000. | 712. | 712. | 20. | 12. | 875. | 583. | 20. | 12. | 904. | 565. | 20. | 12. | 1014. | 507. | 20. | 12. | 1665. | 333. | 20. | 13. |
| 350000. | 763. | 763. | 20. | 13. | 938. | 625. | 20. | 13. | 968. | 605. | 20. | 13. | 1088. | 544. | 20. | 14. | 1775. | 355. | 20. | 14. |
| 400000. | 811. | 811. | 20. | 15. | 996. | 664. | 20. | 15. | 1029. | 643. | 20. | 15. | 1154. | 577. | 20. | 15. | 1885. | 377. | 20. | 16. |
| 450000. | 856. | 856. | 20. | 17. | 1050. | 700. | 20. | 17. | 1086. | 679. | 20. | 17. | 1218. | 609. | 20. | 17. | 1985. | 397. | 20. | 18. |
| 500000. | 898. | 898. | 20. | 19. | 1103. | 735. | 20. | 19. | 1139. | 712. | 20. | 19. | 1278. | 639. | 20. | 19. | 2080. | 416. | 20. | 20. |
| 550000. | 938. | 938. | 20. | 20. | 1152. | 768. | 20. | 20. | 1190. | 744. | 20. | 20. | 1336. | 668. | 20. | 20. | 2170. | 434. | 20. | 22. |
| 600000. | 977. | 977. | 20. | 22. | 1199. | 799. | 20. | 22. | 1238. | 774. | 20. | 22. | 1390. | 695. | 20. | 22. | 2255. | 451. | 20. | 23. |
| 650000. | 1014. | 1014. | 20. | 24. | 1244. | 829. | 20. | 24. | 1286. | 804. | 20. | 24. | 1442. | 721. | 20. | 24. | 2335. | 467. | 20. | 25. |
| 700000. | 1049. | 1049. | 20. | 25. | 1287. | 858. | 20. | 25. | 1331. | 832. | 20. | 25. | 1492. | 746. | 20. | 26. | 2415. | 483. | 20. | 27. |
| 750000. | 1084. | 1084. | 20. | 27. | 1329. | 886. | 20. | 27. | 1374. | 859. | 20. | 27. | 1540. | 770. | 20. | 27. | 2490. | 498. | 20. | 28. |
| 800000. | 1117. | 1117. | 20. | 29. | 1370. | 913. | 20. | 29. | 1416. | 885. | 20. | 29. | 1586. | 793. | 20. | 29. | 2565. | 513. | 20. | 30. |
| 850000. | 1149. | 1149. | 20. | 30. | 1409. | 939. | 20. | 30. | 1456. | 910. | 20. | 30. | 1632. | 816. | 20. | 31. | 2635. | 527. | 20. | 32. |
| 900000. | 1180. | 1180. | 20. | 32. | 1448. | 965. | 20. | 32. | 1496. | 935. | 20. | 32. | 1676. | 838. | 20. | 32. | 2705. | 541. | 20. | 34. |
| 950000. | 1210. | 1210. | 20. | 34. | 1485. | 990. | 20. | 34. | 1534. | 959. | 20. | 34. | 1720. | 860. | 20. | 34. | 2775. | 555. | 20. | 35. |
| 1000000. | 1240. | 1240. | 20. | 35. | 1521. | 1014. | 20. | 35. | 1571. | 982. | 20. | 35. | 1760. | 880. | 20. | 36. | 2840. | 568. | 20. | 37. |
| 1050000. | 1268. | 1268. | 20. | 37. | 1556. | 1037. | 20. | 37. | 1608. | 1005. | 20. | 37. | 1802. | 901. | 20. | 37. | 2905. | 581. | 20. | 39. |
| 1100000. | 1296. | 1296. | 20. | 39. | 1590. | 1060. | 20. | 39. | 1643. | 1027. | 20. | 39. | 1842. | 921. | 20. | 39. | 2965. | 593. | 20. | 40. |
| 1150000. | 1324. | 1324. | 20. | 40. | 1625. | 1083. | 20. | 40. | 1678. | 1049. | 20. | 40. | 1880. | 940. | 20. | 41. | 3025. | 605. | 20. | 42. |
| 1200000. | 1351. | 1351. | 20. | 42. | 1656. | 1104. | 20. | 42. | 1712. | 1070. | 20. | 42. | 1918. | 959. | 20. | 42. | 3085. | 617. | 20. | 44. |
| 1250000. | 1377. | 1377. | 20. | 44. | 1689. | 1126. | 20. | 44. | 1746. | 1091. | 20. | 44. | 1956. | 978. | 20. | 44. | 3145. | 629. | 20. | 45. |
| 1300000. | 1403. | 1403. | 20. | 45. | 1721. | 1147. | 20. | 45. | 1778. | 1111. | 20. | 45. | 1992. | 996. | 20. | 46. | 3205. | 641. | 20. | 47. |
| 1350000. | 1428. | 1428. | 20. | 47. | 1752. | 1168. | 20. | 47. | 1810. | 1131. | 20. | 47. | 2028. | 1014. | 20. | 47. | 3260. | 652. | 20. | 49. |
| 1400000. | 1453. | 1453. | 20. | 48. | 1782. | 1188. | 20. | 49. | 1842. | 1151. | 20. | 49. | 2062. | 1031. | 20. | 49. | 3315. | 663. | 20. | 50. |
| 1450000. | 1477. | 1477. | 20. | 50. | 1812. | 1208. | 20. | 50. | 1872. | 1170. | 20. | 50. | 2096. | 1048. | 20. | 50. | 3370. | 674. | 20. | 52. |
| 1500000. | 1501. | 1501. | 20. | 52. | 1841. | 1227. | 20. | 52. | 1902. | 1189. | 20. | 52. | 2130. | 1065. | 20. | 52. | 3425. | 685. | 20. | 54. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 25. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 310. | 310. | 25. | 2. | 384. | 256. | 25. | 2. | 398. | 249. | 25. | 2. | 452. | 226. | 25. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 414. | 414. | 25. | 4. | 510. | 340. | 25. | 4. | 528. | 330. | 25. | 4. | 596. | 298. | 25. | 4. | 1030. | 206. | 25. | 5. |
| 150000. | 490. | 490. | 25. | 6. | 605. | 403. | 25. | 6. | 626. | 391. | 25. | 6. | 704. | 352. | 25. | 6. | 1195. | 239. | 25. | 7. |
| 200000. | 554. | 554. | 25. | 7. | 683. | 455. | 25. | 7. | 706. | 441. | 25. | 7. | 794. | 397. | 25. | 7. | 1335. | 267. | 25. | 8. |
| 250000. | 610. | 610. | 25. | 9. | 750. | 500. | 25. | 9. | 776. | 485. | 25. | 9. | 874. | 437. | 25. | 9. | 1460. | 292. | 25. | 10. |
| 300000. | 661. | 661. | 25. | 10. | 813. | 542. | 25. | 10. | 840. | 525. | 25. | 10. | 946. | 473. | 25. | 10. | 1570. | 314. | 25. | 11. |
| 350000. | 707. | 707. | 25. | 11. | 869. | 579. | 25. | 12. | 899. | 562. | 25. | 12. | 1010. | 505. | 25. | 12. | 1675. | 335. | 25. | 13. |
| 400000. | 750. | 750. | 25. | 13. | 923. | 615. | 25. | 13. | 954. | 596. | 25. | 13. | 1072. | 536. | 25. | 13. | 1770. | 354. | 25. | 14. |
| 450000. | 790. | 790. | 25. | 14. | 971. | 647. | 25. | 14. | 1005. | 628. | 25. | 14. | 1128. | 564. | 25. | 15. | 1860. | 372. | 25. | 16. |
| 500000. | 829. | 829. | 25. | 16. | 1017. | 678. | 25. | 16. | 1053. | 658. | 25. | 16. | 1182. | 591. | 25. | 16. | 1945. | 389. | 25. | 17. |
| 550000. | 865. | 865. | 25. | 17. | 1062. | 708. | 25. | 17. | 1098. | 686. | 25. | 17. | 1232. | 616. | 25. | 17. | 2025. | 405. | 25. | 19. |
| 600000. | 899. | 899. | 25. | 19. | 1104. | 736. | 25. | 19. | 1141. | 713. | 25. | 19. | 1282. | 641. | 25. | 19. | 2100. | 420. | 25. | 20. |
| 650000. | 932. | 932. | 25. | 20. | 1145. | 763. | 25. | 20. | 1184. | 740. | 25. | 20. | 1328. | 664. | 25. | 20. | 2175. | 435. | 25. | 22. |
| 700000. | 964. | 964. | 25. | 21. | 1184. | 789. | 25. | 21. | 1224. | 765. | 25. | 21. | 1374. | 687. | 25. | 22. | 2245. | 449. | 25. | 23. |
| 750000. | 995. | 995. | 25. | 23. | 1221. | 814. | 25. | 23. | 1262. | 789. | 25. | 23. | 1416. | 708. | 25. | 23. | 2310. | 462. | 25. | 25. |
| 800000. | 1025. | 1025. | 25. | 24. | 1259. | 839. | 25. | 24. | 1301. | 813. | 25. | 24. | 1458. | 729. | 25. | 24. | 2380. | 476. | 25. | 26. |
| 850000. | 1053. | 1053. | 25. | 25. | 1293. | 862. | 25. | 26. | 1336. | 835. | 25. | 26. | 1500. | 750. | 25. | 26. | 2445. | 489. | 25. | 27. |
| 900000. | 1081. | 1081. | 25. | 27. | 1328. | 885. | 25. | 27. | 1371. | 857. | 25. | 27. | 1538. | 769. | 25. | 27. | 2505. | 501. | 25. | 29. |
| 950000. | 1108. | 1108. | 25. | 28. | 1361. | 907. | 25. | 28. | 1406. | 879. | 25. | 28. | 1578. | 789. | 25. | 29. | 2565. | 513. | 25. | 30. |
| 1000000. | 1135. | 1135. | 25. | 30. | 1394. | 929. | 25. | 30. | 1440. | 900. | 25. | 30. | 1614. | 807. | 25. | 30. | 2625. | 525. | 25. | 32. |
| 1050000. | 1161. | 1161. | 25. | 31. | 1425. | 950. | 25. | 31. | 1472. | 920. | 25. | 31. | 1652. | 826. | 25. | 31. | 2680. | 536. | 25. | 33. |
| 1100000. | 1186. | 1186. | 25. | 32. | 1455. | 970. | 25. | 32. | 1504. | 940. | 25. | 32. | 1686. | 843. | 25. | 33. | 2740. | 548. | 25. | 34. |
| 1150000. | 1210. | 1210. | 25. | 34. | 1485. | 990. | 25. | 34. | 1534. | 959. | 25. | 34. | 1722. | 861. | 25. | 34. | 2790. | 558. | 25. | 36. |
| 1200000. | 1235. | 1235. | 25. | 35. | 1515. | 1010. | 25. | 35. | 1565. | 978. | 25. | 35. | 1756. | 878. | 25. | 35. | 2845. | 569. | 25. | 37. |
| 1250000. | 1258. | 1258. | 25. | 36. | 1544. | 1029. | 25. | 36. | 1595. | 997. | 25. | 37. | 1788. | 894. | 25. | 37. | 2900. | 580. | 25. | 39. |
| 1300000. | 1281. | 1281. | 25. | 38. | 1572. | 1048. | 25. | 38. | 1624. | 1015. | 25. | 38. | 1822. | 911. | 25. | 38. | 2950. | 590. | 25. | 40. |
| 1350000. | 1304. | 1304. | 25. | 39. | 1599. | 1066. | 25. | 39. | 1653. | 1033. | 25. | 39. | 1854. | 927. | 25. | 39. | 3000. | 600. | 25. | 41. |
| 1400000. | 1326. | 1326. | 25. | 40. | 1628. | 1085. | 25. | 41. | 1682. | 1051. | 25. | 41. | 1884. | 942. | 25. | 41. | 3050. | 610. | 25. | 43. |
| 1450000. | 1348. | 1348. | 25. | 42. | 1653. | 1102. | 25. | 42. | 1709. | 1068. | 25. | 42. | 1916. | 958. | 25. | 42. | 3100. | 620. | 25. | 44. |
| 1500000. | 1369. | 1369. | 25. | 43. | 1680. | 1120. | 25. | 43. | 1736. | 1085. | 25. | 43. | 1946. | 973. | 25. | 43. | 3145. | 629. | 25. | 45. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 30. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 295. | 295. | 30. | 2. | 368. | 245. | 30. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 395. | 395. | 30. | 4. | 489. | 326. | 30. | 4. | 507. | 317. | 30. | 4. | 574. | 287. | 30. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 468. | 468. | 30. | 5. | 578. | 385. | 30. | 5. | 597. | 373. | 30. | 5. | 676. | 338. | 30. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 527. | 527. | 30. | 6. | 650. | 433. | 30. | 6. | 672. | 420. | 30. | 6. | 760. | 380. | 30. | 7. | 1305. | 261. | 30. | 8. |
| 250000. | 579. | 579. | 30. | 8. | 714. | 476. | 30. | 8. | 738. | 461. | 30. | 8. | 832. | 416. | 30. | 8. | 1415. | 283. | 30. | 9. |
| 300000. | 626. | 626. | 30. | 9. | 771. | 514. | 30. | 9. | 797. | 498. | 30. | 9. | 898. | 449. | 30. | 9. | 1520. | 304. | 30. | 11. |
| 350000. | 669. | 669. | 30. | 10. | 824. | 549. | 30. | 10. | 851. | 532. | 30. | 10. | 958. | 479. | 30. | 11. | 1610. | 322. | 30. | 12. |
| 400000. | 708. | 708. | 30. | 12. | 872. | 581. | 30. | 12. | 901. | 563. | 30. | 12. | 1014. | 507. | 30. | 12. | 1700. | 340. | 30. | 13. |
| 450000. | 745. | 745. | 30. | 13. | 917. | 611. | 30. | 13. | 949. | 593. | 30. | 13. | 1066. | 533. | 30. | 13. | 1780. | 356. | 30. | 15. |
| 500000. | 780. | 780. | 30. | 14. | 960. | 640. | 30. | 14. | 992. | 620. | 30. | 14. | 1116. | 558. | 30. | 14. | 1860. | 372. | 30. | 16. |
| 550000. | 814. | 814. | 30. | 15. | 1001. | 667. | 30. | 15. | 1035. | 647. | 30. | 15. | 1164. | 582. | 30. | 16. | 1930. | 386. | 30. | 17. |
| 600000. | 845. | 845. | 30. | 16. | 1040. | 693. | 30. | 17. | 1075. | 672. | 30. | 17. | 1208. | 604. | 30. | 17. | 2000. | 400. | 30. | 18. |
| 650000. | 876. | 876. | 30. | 18. | 1077. | 718. | 30. | 18. | 1114. | 696. | 30. | 18. | 1250. | 625. | 30. | 18. | 2070. | 414. | 30. | 20. |
| 700000. | 905. | 905. | 30. | 19. | 1112. | 741. | 30. | 19. | 1150. | 719. | 30. | 19. | 1292. | 646. | 30. | 19. | 2135. | 427. | 30. | 21. |
| 750000. | 933. | 933. | 30. | 20. | 1146. | 764. | 30. | 20. | 1186. | 741. | 30. | 20. | 1332. | 666. | 30. | 20. | 2195. | 439. | 30. | 22. |
| 800000. | 960. | 960. | 30. | 21. | 1181. | 787. | 30. | 21. | 1219. | 762. | 30. | 21. | 1370. | 685. | 30. | 22. | 2255. | 451. | 30. | 23. |
| 850000. | 987. | 987. | 30. | 22. | 1212. | 808. | 30. | 22. | 1253. | 783. | 30. | 23. | 1408. | 704. | 30. | 23. | 2315. | 463. | 30. | 25. |
| 900000. | 1012. | 1012. | 30. | 24. | 1244. | 829. | 30. | 24. | 1286. | 804. | 30. | 24. | 1444. | 722. | 30. | 24. | 2370. | 474. | 30. | 26. |
| 950000. | 1037. | 1037. | 30. | 25. | 1274. | 849. | 30. | 25. | 1317. | 823. | 30. | 25. | 1478. | 739. | 30. | 25. | 2425. | 485. | 30. | 27. |
| 1000000. | 1062. | 1062. | 30. | 26. | 1304. | 869. | 30. | 26. | 1347. | 842. | 30. | 26. | 1514. | 757. | 30. | 26. | 2480. | 496. | 30. | 28. |
| 1050000. | 1085. | 1085. | 30. | 27. | 1332. | 888. | 30. | 27. | 1378. | 861. | 30. | 27. | 1546. | 773. | 30. | 27. | 2535. | 507. | 30. | 30. |
| 1100000. | 1108. | 1108. | 30. | 28. | 1361. | 907. | 30. | 28. | 1406. | 879. | 30. | 28. | 1580. | 790. | 30. | 29. | 2585. | 517. | 30. | 31. |
| 1150000. | 1131. | 1131. | 30. | 29. | 1389. | 926. | 30. | 30. | 1435. | 897. | 30. | 30. | 1610. | 805. | 30. | 30. | 2635. | 527. | 30. | 32. |
| 1200000. | 1153. | 1153. | 30. | 31. | 1416. | 944. | 30. | 31. | 1462. | 914. | 30. | 31. | 1642. | 821. | 30. | 31. | 2685. | 537. | 30. | 33. |
| 1250000. | 1174. | 1174. | 30. | 32. | 1442. | 961. | 30. | 32. | 1490. | 931. | 30. | 32. | 1672. | 836. | 30. | 32. | 2730. | 546. | 30. | 34. |
| 1300000. | 1195. | 1195. | 30. | 33. | 1467. | 978. | 30. | 33. | 1517. | 948. | 30. | 33. | 1702. | 851. | 30. | 33. | 2780. | 556. | 30. | 35. |
| 1350000. | 1216. | 1216. | 30. | 34. | 1493. | 995. | 30. | 34. | 1544. | 965. | 30. | 34. | 1732. | 866. | 30. | 34. | 2825. | 565. | 30. | 37. |
| 1400000. | 1237. | 1237. | 30. | 35. | 1518. | 1012. | 30. | 35. | 1570. | 981. | 30. | 35. | 1760. | 880. | 30. | 36. | 2870. | 574. | 30. | 38. |
| 1450000. | 1257. | 1257. | 30. | 36. | 1542. | 1028. | 30. | 35. | 1594. | 996. | 30. | 36. | 1788. | 894. | 30. | 37. | 2915. | 583. | 30. | 39. |
| 1500000. | 1276. | 1276. | 30. | 37. | 1566. | 1044. | 30. | 38. | 1619. | 1012. | 30. | 38. | 1816. | 908. | 30. | 38. | 2960. | 592. | 30. | 40. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 35. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 380. | 380. | 35. | 3. | 471. | 314. | 35. | 3. | 490. | 306. | 35. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 451. | 451. | 35. | 5. | 557. | 371. | 35. | 5. | 578. | 361. | 35. | 5. | 654. | 327. | 35. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 507. | 507. | 35. | 6. | 627. | 418. | 35. | 6. | 650. | 406. | 35. | 6. | 734. | 367. | 35. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 557. | 557. | 35. | 7. | 687. | 458. | 35. | 7. | 710. | 444. | 35. | 7. | 804. | 402. | 35. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 601. | 601. | 35. | 8. | 741. | 494. | 35. | 8. | 766. | 479. | 35. | 8. | 866. | 433. | 35. | 9. | 1490. | 298. | 35. | 10. |
| 350000. | 641. | 641. | 35. | 9. | 789. | 526. | 35. | 10. | 818. | 511. | 35. | 10. | 922. | 461. | 35. | 10. | 1575. | 315. | 35. | 11. |
| 400000. | 678. | 678. | 35. | 11. | 836. | 557. | 35. | 11. | 864. | 540. | 35. | 11. | 974. | 487. | 35. | 11. | 1655. | 331. | 35. | 13. |
| 450000. | 713. | 713. | 35. | 12. | 878. | 585. | 35. | 12. | 907. | 567. | 35. | 12. | 1024. | 512. | 35. | 12. | 1735. | 347. | 35. | 14. |
| 500000. | 746. | 746. | 35. | 13. | 918. | 612. | 35. | 13. | 949. | 593. | 35. | 13. | 1070. | 535. | 35. | 13. | 1805. | 361. | 35. | 15. |
| 550000. | 777. | 777. | 35. | 14. | 956. | 637. | 35. | 14. | 989. | 618. | 35. | 14. | 1114. | 557. | 35. | 14. | 1870. | 374. | 35. | 16. |
| 600000. | 806. | 806. | 35. | 15. | 992. | 661. | 35. | 15. | 1026. | 641. | 35. | 15. | 1156. | 578. | 35. | 15. | 1935. | 387. | 35. | 17. |
| 650000. | 835. | 835. | 35. | 16. | 1026. | 684. | 35. | 16. | 1062. | 664. | 35. | 16. | 1196. | 598. | 35. | 16. | 2000. | 400. | 35. | 18. |
| 700000. | 862. | 862. | 35. | 17. | 1061. | 707. | 35. | 17. | 1096. | 685. | 35. | 17. | 1234. | 617. | 35. | 17. | 2060. | 412. | 35. | 19. |
| 750000. | 888. | 888. | 35. | 18. | 1092. | 728. | 35. | 18. | 1130. | 706. | 35. | 18. | 1270. | 635. | 35. | 19. | 2120. | 424. | 35. | 21. |
| 800000. | 914. | 914. | 35. | 19. | 1124. | 749. | 35. | 19. | 1162. | 726. | 35. | 19. | 1306. | 653. | 35. | 20. | 2175. | 435. | 35. | 22. |
| 850000. | 938. | 938. | 35. | 20. | 1154. | 769. | 35. | 20. | 1192. | 745. | 35. | 20. | 1342. | 671. | 35. | 21. | 2230. | 446. | 35. | 23. |
| 900000. | 962. | 962. | 35. | 21. | 1182. | 788. | 35. | 21. | 1222. | 764. | 35. | 21. | 1374. | 687. | 35. | 22. | 2280. | 456. | 35. | 24. |
| 950000. | 985. | 985. | 35. | 22. | 1211. | 807. | 35. | 22. | 1251. | 782. | 35. | 22. | 1408. | 704. | 35. | 23. | 2330. | 466. | 35. | 25. |
| 1000000. | 1008. | 1008. | 35. | 23. | 1239. | 826. | 35. | 23. | 1280. | 800. | 35. | 24. | 1440. | 720. | 35. | 24. | 2380. | 476. | 35. | 26. |
| 1050000. | 1030. | 1030. | 35. | 24. | 1265. | 843. | 35. | 24. | 1309. | 818. | 35. | 25. | 1470. | 735. | 35. | 25. | 2430. | 486. | 35. | 27. |
| 1100000. | 1051. | 1051. | 35. | 25. | 1292. | 861. | 35. | 26. | 1336. | 835. | 35. | 26. | 1500. | 750. | 35. | 26. | 2480. | 496. | 35. | 28. |
| 1150000. | 1072. | 1072. | 35. | 26. | 1317. | 878. | 35. | 27. | 1362. | 851. | 35. | 27. | 1530. | 765. | 35. | 27. | 2525. | 505. | 35. | 29. |
| 1200000. | 1092. | 1092. | 35. | 27. | 1343. | 895. | 35. | 28. | 1387. | 867. | 35. | 28. | 1560. | 780. | 35. | 28. | 2570. | 514. | 35. | 30. |
| 1250000. | 1112. | 1112. | 35. | 28. | 1367. | 911. | 35. | 29. | 1413. | 883. | 35. | 29. | 1588. | 794. | 35. | 29. | 2615. | 523. | 35. | 31. |
| 1300000. | 1132. | 1132. | 35. | 29. | 1391. | 927. | 35. | 30. | 1438. | 899. | 35. | 30. | 1616. | 808. | 35. | 30. | 2655. | 531. | 35. | 32. |
| 1350000. | 1151. | 1151. | 35. | 30. | 1415. | 943. | 35. | 31. | 1462. | 914. | 35. | 31. | 1642. | 821. | 35. | 31. | 2700. | 540. | 35. | 33. |
| 1400000. | 1170. | 1170. | 35. | 31. | 1437. | 958. | 35. | 32. | 1486. | 929. | 35. | 32. | 1668. | 834. | 35. | 32. | 2740. | 548. | 35. | 34. |
| 1450000. | 1189. | 1189. | 35. | 32. | 1460. | 973. | 35. | 33. | 1509. | 943. | 35. | 33. | 1696. | 848. | 35. | 33. | 2785. | 557. | 35. | 36. |
| 1500000. | 1207. | 1207. | 35. | 33. | 1482. | 988. | 35. | 34. | 1533. | 958. | 35. | 34. | 1720. | 860. | 35. | 34. | 2825. | 565. | 35. | 37. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 40. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 00000. | 345. | 345. | 40. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 50000. | 436. | 436. | 40. | 4. | 540. | 360. | 40. | 4. | 560. | 350. | 40. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 00000. | 491. | 491. | 40. | 6. | 608. | 405. | 40. | 6. | 630. | 394. | 40. | 6. | 716. | 358. | 40. | 6. | 1295. | 259. | 32. | 8. |
| 50000. | 539. | 539. | 40. | 7. | 666. | 444. | 40. | 7. | 690. | 431. | 40. | 7. | 782. | 391. | 40. | 7. | 1395. | 279. | 35. | 9. |
| 00000. | 581. | 581. | 40. | 8. | 717. | 478. | 40. | 8. | 742. | 464. | 40. | 8. | 842. | 421. | 40. | 8. | 1480. | 296. | 37. | 10. |
| 50000. | 619. | 619. | 40. | 9. | 765. | 510. | 40. | 9. | 792. | 495. | 40. | 9. | 894. | 447. | 40. | 9. | 1560. | 312. | 39. | 11. |
| 00000. | 655. | 655. | 40. | 10. | 807. | 538. | 40. | 10. | 835. | 522. | 40. | 10. | 944. | 472. | 40. | 10. | 1635. | 327. | 40. | 12. |
| 50000. | 688. | 688. | 40. | 11. | 848. | 565. | 40. | 11. | 878. | 549. | 40. | 11. | 992. | 496. | 40. | 11. | 1705. | 341. | 40. | 13. |
| 00000. | 719. | 719. | 40. | 12. | 887. | 591. | 40. | 12. | 917. | 573. | 40. | 12. | 1034. | 517. | 40. | 12. | 1770. | 354. | 40. | 14. |
| 50000. | 748. | 748. | 40. | 13. | 923. | 615. | 40. | 13. | 954. | 596. | 40. | 13. | 1076. | 538. | 40. | 13. | 1835. | 367. | 40. | 15. |
| 00000. | 776. | 776. | 40. | 14. | 956. | 637. | 40. | 14. | 989. | 618. | 40. | 14. | 1116. | 558. | 40. | 14. | 1895. | 379. | 40. | 16. |
| 50000. | 803. | 803. | 40. | 15. | 989. | 659. | 40. | 15. | 1024. | 640. | 40. | 15. | 1154. | 577. | 40. | 15. | 1955. | 391. | 40. | 18. |
| 00000. | 829. | 829. | 40. | 16. | 1020. | 680. | 40. | 16. | 1056. | 660. | 40. | 16. | 1190. | 595. | 40. | 16. | 2010. | 402. | 40. | 19. |
| 50000. | 854. | 854. | 40. | 17. | 1052. | 701. | 40. | 17. | 1086. | 679. | 40. | 17. | 1224. | 612. | 40. | 17. | 2065. | 413. | 40. | 20. |
| 00000. | 878. | 878. | 40. | 18. | 1080. | 720. | 40. | 18. | 1117. | 698. | 40. | 18. | 1258. | 629. | 40. | 18. | 2120. | 424. | 40. | 21. |
| 50000. | 901. | 901. | 40. | 19. | 1109. | 739. | 40. | 19. | 1147. | 717. | 40. | 19. | 1292. | 646. | 40. | 19. | 2170. | 434. | 40. | 22. |
| 00000. | 923. | 923. | 40. | 20. | 1136. | 757. | 40. | 20. | 1174. | 734. | 40. | 20. | 1322. | 661. | 40. | 20. | 2220. | 444. | 40. | 23. |
| 50000. | 945. | 945. | 40. | 21. | 1163. | 775. | 40. | 21. | 1203. | 752. | 40. | 21. | 1354. | 677. | 40. | 21. | 2265. | 453. | 40. | 24. |
| 00000. | 966. | 966. | 40. | 21. | 1188. | 792. | 40. | 22. | 1229. | 768. | 40. | 22. | 1384. | 692. | 40. | 22. | 2315. | 463. | 40. | 25. |
| 50000. | 987. | 987. | 40. | 22. | 1214. | 809. | 40. | 23. | 1256. | 785. | 40. | 23. | 1412. | 706. | 40. | 23. | 2360. | 472. | 40. | 26. |
| 00000. | 1007. | 1007. | 40. | 23. | 1239. | 826. | 40. | 23. | 1282. | 801. | 40. | 24. | 1442. | 721. | 40. | 24. | 2405. | 481. | 40. | 27. |
| 50000. | 1027. | 1027. | 40. | 24. | 1263. | 842. | 40. | 24. | 1306. | 816. | 40. | 24. | 1468. | 734. | 40. | 25. | 2445. | 489. | 40. | 27. |
| 00000. | 1046. | 1046. | 40. | 25. | 1286. | 857. | 40. | 25. | 1330. | 831. | 40. | 25. | 1496. | 748. | 40. | 26. | 2490. | 498. | 40. | 28. |
| 0000. | 1065. | 1065. | 40. | 26. | 1310. | 873. | 40. | 26. | 1354. | 846. | 40. | 26. | 1522. | 761. | 40. | 27. | 2530. | 506. | 40. | 29. |
| 0000. | 1083. | 1083. | 40. | 27. | 1332. | 888. | 40. | 27. | 1378. | 861. | 40. | 27. | 1548. | 774. | 40. | 28. | 2570. | 514. | 40. | 30. |
| 0000. | 1102. | 1102. | 40. | 28. | 1355. | 903. | 40. | 28. | 1400. | 875. | 40. | 28. | 1574. | 787. | 40. | 28. | 2610. | 522. | 40. | 31. |
| 0000. | 1119. | 1119. | 40. | 29. | 1376. | 917. | 40. | 29. | 1422. | 889. | 40. | 29. | 1600. | 800. | 40. | 29. | 2650. | 530. | 40. | 32. |
| 0000. | 1137. | 1137. | 40. | 30. | 1397. | 931. | 40. | 30. | 1445. | 903. | 40. | 30. | 1624. | 812. | 40. | 30. | 2690. | 538. | 40. | 33. |
| 0000. | 1154. | 1154. | 40. | 31. | 1418. | 945. | 40. | 31. | 1466. | 916. | 40. | 31. | 1648. | 824. | 40. | 31. | 2725. | 545. | 40. | 34. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 45. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 420. | 420. | 45. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 476. | 476. | 45. | 5. | 591. | 394. | 45. | 5. | 613. | 383. | 45. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 523. | 523. | 45. | 6. | 648. | 432. | 45. | 6. | 672. | 420. | 45. | 6. | 764. | 382. | 45. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 565. | 565. | 45. | 7. | 699. | 466. | 45. | 7. | 723. | 452. | 45. | 8. | 822. | 411. | 45. | 8. | 1480. | 296. | 37. | 10. |
| 350000. | 602. | 602. | 45. | 8. | 744. | 496. | 45. | 8. | 771. | 482. | 45. | 9. | 874. | 437. | 45. | 9. | 1560. | 312. | 39. | 11. |
| 400000. | 636. | 636. | 45. | 9. | 786. | 524. | 45. | 9. | 814. | 509. | 45. | 10. | 922. | 461. | 45. | 10. | 1630. | 326. | 41. | 12. |
| 450000. | 668. | 668. | 45. | 10. | 825. | 550. | 45. | 10. | 854. | 534. | 45. | 10. | 966. | 483. | 45. | 11. | 1695. | 339. | 42. | 13. |
| 500000. | 698. | 698. | 45. | 11. | 861. | 574. | 45. | 11. | 891. | 557. | 45. | 11. | 1008. | 504. | 45. | 12. | 1755. | 351. | 44. | 14. |
| 550000. | 726. | 726. | 45. | 12. | 896. | 597. | 45. | 12. | 926. | 579. | 45. | 12. | 1048. | 524. | 45. | 13. | 1815. | 363. | 45. | 15. |
| 600000. | 753. | 753. | 45. | 13. | 929. | 619. | 45. | 13. | 960. | 600. | 45. | 13. | 1086. | 543. | 45. | 14. | 1870. | 374. | 45. | 16. |
| 650000. | 778. | 778. | 45. | 14. | 960. | 640. | 45. | 14. | 994. | 621. | 45. | 14. | 1122. | 561. | 45. | 14. | 1925. | 385. | 45. | 17. |
| 700000. | 803. | 803. | 45. | 15. | 990. | 660. | 45. | 15. | 1024. | 640. | 45. | 15. | 1156. | 578. | 45. | 15. | 1980. | 396. | 45. | 18. |
| 750000. | 827. | 827. | 45. | 16. | 1019. | 679. | 45. | 16. | 1054. | 659. | 45. | 16. | 1190. | 595. | 45. | 16. | 2030. | 406. | 45. | 19. |
| 800000. | 850. | 850. | 45. | 17. | 1047. | 698. | 45. | 17. | 1083. | 677. | 45. | 17. | 1222. | 611. | 45. | 17. | 2080. | 416. | 45. | 20. |
| 850000. | 872. | 872. | 45. | 17. | 1074. | 716. | 45. | 18. | 1110. | 694. | 45. | 18. | 1252. | 626. | 45. | 18. | 2130. | 426. | 45. | 21. |
| 900000. | 893. | 893. | 45. | 18. | 1100. | 733. | 45. | 19. | 1138. | 711. | 45. | 19. | 1282. | 641. | 45. | 19. | 2175. | 435. | 45. | 22. |
| 950000. | 914. | 914. | 45. | 19. | 1125. | 750. | 45. | 19. | 1163. | 727. | 45. | 19. | 1312. | 656. | 45. | 20. | 2220. | 444. | 45. | 23. |
| 1000000. | 934. | 934. | 45. | 20. | 1149. | 766. | 45. | 20. | 1189. | 743. | 45. | 20. | 1340. | 670. | 45. | 21. | 2265. | 453. | 45. | 24. |
| 1050000. | 954. | 954. | 45. | 21. | 1173. | 782. | 45. | 21. | 1214. | 759. | 45. | 21. | 1368. | 684. | 45. | 21. | 2310. | 462. | 45. | 25. |
| 1100000. | 973. | 973. | 45. | 22. | 1197. | 798. | 45. | 22. | 1238. | 774. | 45. | 22. | 1394. | 697. | 45. | 22. | 2350. | 470. | 45. | 25. |
| 1150000. | 991. | 991. | 45. | 23. | 1220. | 813. | 45. | 23. | 1262. | 789. | 45. | 23. | 1422. | 711. | 45. | 23. | 2390. | 478. | 45. | 26. |
| 1200000. | 1010. | 1010. | 45. | 23. | 1242. | 828. | 45. | 24. | 1285. | 803. | 45. | 24. | 1448. | 724. | 45. | 24. | 2430. | 486. | 45. | 27. |
| 1250000. | 1028. | 1028. | 45. | 24. | 1265. | 843. | 45. | 24. | 1307. | 817. | 45. | 25. | 1472. | 736. | 45. | 25. | 2470. | 494. | 45. | 28. |
| 1300000. | 1045. | 1045. | 45. | 25. | 1286. | 857. | 45. | 25. | 1330. | 831. | 45. | 25. | 1498. | 749. | 45. | 26. | 2510. | 502. | 45. | 29. |
| 1350000. | 1062. | 1062. | 45. | 26. | 1307. | 871. | 45. | 26. | 1352. | 845. | 45. | 26. | 1522. | 761. | 45. | 27. | 2545. | 509. | 45. | 30. |
| 1400000. | 1079. | 1079. | 45. | 27. | 1328. | 885. | 45. | 27. | 1373. | 858. | 45. | 27. | 1546. | 773. | 45. | 27. | 2585. | 517. | 45. | 31. |
| 1450000. | 1096. | 1096. | 45. | 28. | 1347. | 898. | 45. | 28. | 1394. | 871. | 45. | 28. | 1568. | 784. | 45. | 28. | 2620. | 524. | 45. | 32. |
| 1500000. | 1112. | 1112. | 45. | 28. | 1368. | 912. | 45. | 29. | 1414. | 884. | 45. | 29. | 1592. | 796. | 45. | 29. | 2655. | 531. | 45. | 32. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 50. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 403. | 403. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 461. | 461. | 50. | 5. | 581. | 387. | 48. | 5. | 605. | 378. | 47. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 509. | 509. | 50. | 6. | 632. | 421. | 50. | 6. | 656. | 410. | 50. | 6. | 756. | 378. | 47. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 550. | 550. | 50. | 7. | 681. | 454. | 50. | 7. | 707. | 442. | 50. | 7. | 804. | 402. | 50. | 7. | 1480. | 296. | 37. | 10. |
| 350000. | 587. | 587. | 50. | 8. | 726. | 484. | 50. | 8. | 752. | 470. | 50. | 8. | 856. | 428. | 50. | 8. | 1560. | 312. | 39. | 11. |
| 400000. | 620. | 620. | 50. | 9. | 767. | 511. | 50. | 9. | 795. | 497. | 50. | 9. | 902. | 451. | 50. | 9. | 1630. | 326. | 41. | 12. |
| 450000. | 651. | 651. | 50. | 10. | 806. | 537. | 50. | 10. | 834. | 521. | 50. | 10. | 946. | 473. | 50. | 10. | 1695. | 339. | 42. | 13. |
| 500000. | 680. | 680. | 50. | 11. | 840. | 560. | 50. | 11. | 870. | 544. | 50. | 11. | 986. | 493. | 50. | 11. | 1755. | 351. | 44. | 14. |
| 550000. | 707. | 707. | 50. | 11. | 873. | 582. | 50. | 12. | 906. | 566. | 50. | 12. | 1024. | 512. | 50. | 12. | 1815. | 363. | 45. | 15. |
| 600000. | 733. | 733. | 50. | 12. | 906. | 604. | 50. | 13. | 938. | 586. | 50. | 13. | 1062. | 531. | 50. | 13. | 1865. | 373. | 47. | 16. |
| 650000. | 758. | 758. | 50. | 13. | 936. | 624. | 50. | 13. | 968. | 605. | 50. | 13. | 1096. | 548. | 50. | 14. | 1915. | 383. | 48. | 17. |
| 700000. | 782. | 782. | 50. | 14. | 965. | 643. | 50. | 14. | 998. | 624. | 50. | 14. | 1130. | 565. | 50. | 15. | 1965. | 393. | 49. | 18. |
| 750000. | 805. | 805. | 50. | 15. | 993. | 662. | 50. | 15. | 1027. | 642. | 50. | 15. | 1162. | 581. | 50. | 15. | 2010. | 402. | 50. | 19. |
| 800000. | 827. | 827. | 50. | 16. | 1019. | 679. | 50. | 16. | 1054. | 659. | 50. | 16. | 1192. | 596. | 50. | 16. | 2060. | 412. | 50. | 19. |
| 850000. | 848. | 848. | 50. | 17. | 1046. | 697. | 50. | 17. | 1082. | 676. | 50. | 17. | 1222. | 611. | 50. | 17. | 2105. | 421. | 50. | 20. |
| 900000. | 868. | 868. | 50. | 17. | 1070. | 713. | 50. | 18. | 1107. | 692. | 50. | 18. | 1250. | 625. | 50. | 18. | 2150. | 430. | 50. | 21. |
| 950000. | 888. | 888. | 50. | 18. | 1095. | 730. | 50. | 18. | 1133. | 708. | 50. | 18. | 1278. | 639. | 50. | 19. | 2190. | 438. | 50. | 22. |
| 1000000. | 908. | 908. | 50. | 19. | 1118. | 745. | 50. | 19. | 1157. | 723. | 50. | 19. | 1306. | 653. | 50. | 20. | 2235. | 447. | 50. | 23. |
| 1050000. | 926. | 926. | 50. | 20. | 1142. | 761. | 50. | 20. | 1181. | 738. | 50. | 20. | 1332. | 666. | 50. | 20. | 2275. | 455. | 50. | 24. |
| 1100000. | 945. | 945. | 50. | 21. | 1164. | 776. | 50. | 21. | 1205. | 753. | 50. | 21. | 1358. | 679. | 50. | 21. | 2315. | 463. | 50. | 25. |
| 1150000. | 963. | 963. | 50. | 21. | 1185. | 790. | 50. | 21. | 1227. | 767. | 50. | 22. | 1384. | 692. | 50. | 22. | 2355. | 471. | 50. | 25. |
| 1200000. | 980. | 980. | 50. | 22. | 1208. | 805. | 50. | 22. | 1250. | 781. | 50. | 22. | 1408. | 704. | 50. | 23. | 2390. | 478. | 50. | 26. |
| 1250000. | 997. | 997. | 50. | 23. | 1229. | 819. | 50. | 23. | 1270. | 794. | 50. | 23. | 1432. | 716. | 50. | 24. | 2430. | 486. | 50. | 27. |
| 1300000. | 1014. | 1014. | 50. | 24. | 1248. | 832. | 50. | 24. | 1291. | 807. | 50. | 24. | 1456. | 728. | 50. | 24. | 2465. | 493. | 50. | 28. |
| 1350000. | 1031. | 1031. | 50. | 24. | 1269. | 846. | 50. | 25. | 1312. | 820. | 50. | 25. | 1480. | 740. | 50. | 25. | 2500. | 500. | 50. | 29. |
| 1400000. | 1047. | 1047. | 50. | 25. | 1289. | 859. | 50. | 25. | 1333. | 833. | 50. | 25. | 1502. | 751. | 50. | 26. | 2535. | 507. | 50. | 30. |
| 1450000. | 1062. | 1062. | 50. | 26. | 1308. | 872. | 50. | 26. | 1352. | 845. | 50. | 26. | 1524. | 762. | 50. | 27. | 2570. | 514. | 50. | 30. |
| 1500000. | 1078. | 1078. | 50. | 27. | 1326. | 884. | 50. | 27. | 1373. | 858. | 50. | 27. | 1546. | 773. | 50. | 27. | 2605. | 521. | 50. | 31. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 55. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 444. | 444. | 55. | 5. | 581. | 387. | 48. | 5. | 605. | 378. | 47. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 493. | 493. | 55. | 6. | 626. | 417. | 52. | 6. | 653. | 408. | 51. | 6. | 756. | 378. | 47. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 535. | 535. | 55. | 7. | 665. | 443. | 55. | 7. | 693. | 433. | 54. | 7. | 804. | 402. | 50. | 7. | 1480. | 296. | 37. | 10. |
| 350000. | 572. | 572. | 55. | 8. | 710. | 473. | 55. | 8. | 736. | 460. | 55. | 8. | 846. | 423. | 53. | 8. | 1560. | 312. | 39. | 11. |
| 400000. | 605. | 605. | 55. | 8. | 750. | 500. | 55. | 9. | 778. | 486. | 55. | 9. | 886. | 443. | 55. | 9. | 1630. | 326. | 41. | 12. |
| 450000. | 636. | 636. | 55. | 9. | 788. | 525. | 55. | 9. | 816. | 510. | 55. | 10. | 928. | 464. | 55. | 10. | 1695. | 339. | 42. | 13. |
| 500000. | 664. | 664. | 55. | 10. | 822. | 548. | 55. | 10. | 853. | 533. | 55. | 10. | 968. | 484. | 55. | 11. | 1755. | 351. | 44. | 14. |
| 550000. | 691. | 691. | 55. | 11. | 855. | 570. | 55. | 11. | 886. | 554. | 55. | 11. | 1006. | 503. | 55. | 12. | 1815. | 363. | 45. | 15. |
| 600000. | 717. | 717. | 55. | 12. | 887. | 591. | 55. | 12. | 918. | 574. | 55. | 12. | 1042. | 521. | 55. | 12. | 1865. | 373. | 47. | 16. |
| 650000. | 741. | 741. | 55. | 13. | 915. | 610. | 55. | 13. | 949. | 593. | 55. | 13. | 1074. | 537. | 55. | 13. | 1915. | 383. | 48. | 17. |
| 700000. | 764. | 764. | 55. | 13. | 944. | 629. | 55. | 14. | 978. | 611. | 55. | 14. | 1108. | 554. | 55. | 14. | 1965. | 393. | 49. | 18. |
| 750000. | 786. | 786. | 55. | 14. | 971. | 647. | 55. | 14. | 1005. | 628. | 55. | 14. | 1138. | 569. | 55. | 15. | 2010. | 402. | 50. | 19. |
| 800000. | 807. | 807. | 55. | 15. | 996. | 664. | 55. | 15. | 1032. | 645. | 55. | 15. | 1168. | 584. | 55. | 16. | 2055. | 411. | 51. | 19. |
| 850000. | 828. | 828. | 55. | 16. | 1022. | 681. | 55. | 16. | 1058. | 661. | 55. | 16. | 1196. | 598. | 55. | 16. | 2095. | 419. | 52. | 20. |
| 900000. | 848. | 848. | 55. | 17. | 1046. | 697. | 55. | 17. | 1083. | 677. | 55. | 17. | 1224. | 612. | 55. | 17. | 2135. | 427. | 53. | 21. |
| 950000. | 867. | 867. | 55. | 17. | 1070. | 713. | 55. | 18. | 1107. | 692. | 55. | 18. | 1252. | 626. | 55. | 18. | 2175. | 435. | 54. | 22. |
| 1000000. | 886. | 886. | 55. | 18. | 1092. | 728. | 55. | 18. | 1131. | 707. | 55. | 18. | 1278. | 639. | 55. | 19. | 2215. | 443. | 55. | 23. |
| 1050000. | 904. | 904. | 55. | 19. | 1115. | 743. | 55. | 19. | 1154. | 721. | 55. | 19. | 1304. | 652. | 55. | 20. | 2255. | 451. | 55. | 23. |
| 1100000. | 922. | 922. | 55. | 20. | 1136. | 757. | 55. | 20. | 1176. | 735. | 55. | 20. | 1328. | 664. | 55. | 20. | 2290. | 458. | 55. | 24. |
| 1150000. | 939. | 939. | 55. | 20. | 1158. | 772. | 55. | 21. | 1198. | 749. | 55. | 21. | 1352. | 676. | 55. | 21. | 2330. | 466. | 55. | 25. |
| 1200000. | 956. | 956. | 55. | 21. | 1178. | 785. | 55. | 21. | 1219. | 762. | 55. | 21. | 1376. | 688. | 55. | 22. | 2365. | 473. | 55. | 26. |
| 1250000. | 972. | 972. | 55. | 22. | 1199. | 799. | 55. | 22. | 1240. | 775. | 55. | 22. | 1400. | 700. | 55. | 22. | 2400. | 480. | 55. | 26. |
| 1300000. | 988. | 988. | 55. | 22. | 1218. | 812. | 55. | 23. | 1261. | 788. | 55. | 23. | 1422. | 711. | 55. | 23. | 2435. | 487. | 55. | 27. |
| 1350000. | 1004. | 1004. | 55. | 23. | 1238. | 825. | 55. | 23. | 1280. | 800. | 55. | 24. | 1444. | 722. | 55. | 24. | 2470. | 494. | 55. | 28. |
| 1400000. | 1020. | 1020. | 55. | 24. | 1256. | 837. | 55. | 24. | 1299. | 812. | 55. | 24. | 1466. | 733. | 55. | 25. | 2505. | 501. | 55. | 29. |
| 1450000. | 1035. | 1035. | 55. | 25. | 1275. | 850. | 55. | 25. | 1318. | 824. | 55. | 25. | 1488. | 744. | 55. | 25. | 2535. | 507. | 55. | 30. |
| 1500000. | 1050. | 1050. | 55. | 25. | 1293. | 862. | 55. | 26. | 1338. | 836. | 55. | 26. | 1510. | 755. | 55. | 26. | 2570. | 514. | 55. | 30. |

## STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 60. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 402. | 402. | 50. | 4. | -527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 443. | 443. | 55. | 5. | 581. | 387. | 48. | 5. | 605. | 378. | 47. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 477. | 477. | 60. | 5. | 626. | 417. | 52. | 6. | 653. | 408. | 51. | 6. | 756. | 378. | 47. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 519. | 519. | 60. | 6. | 665. | 443. | 55. | 7. | 693. | 433. | 54. | 7. | 804. | 402. | 50. | 7. | 1480. | 296. | 37. | 10. |
| 350000. | 557. | 557. | 60. | 7. | 699. | 466. | 58. | 7. | 730. | 456. | 57. | 8. | 846. | 423. | 53. | 8. | 1560. | 312. | 39. | 11. |
| 400000. | 590. | 590. | 60. | 8. | 734. | 489. | 60. | 8. | 765. | 477. | 60. | 8. | 886. | 443. | 55. | 9. | 1630. | 326. | 41. | 12. |
| 450000. | 621. | 621. | 60. | 9. | 771. | 514. | 60. | 9. | 800. | 500. | 60. | 9. | 920. | 460. | 58. | 10. | 1695. | 339. | 42. | 13. |
| 500000. | 650. | 650. | 60. | 10. | 806. | 537. | 60. | 10. | 835. | 522. | 60. | 10. | 954. | 477. | 60. | 10. | 1755. | 351. | 44. | 14. |
| 550000. | 676. | 676. | 60. | 10. | 839. | 559. | 60. | 11. | 869. | 543. | 60. | 11. | 988. | 494. | 60. | 11. | 1815. | 363. | 45. | 15. |
| 600000. | 701. | 701. | 60. | 11. | 869. | 579. | 60. | 12. | 901. | 563. | 60. | 12. | 1024. | 512. | 60. | 12. | 1865. | 373. | 47. | 16. |
| 650000. | 725. | 725. | 60. | 12. | 897. | 598. | 60. | 12. | 930. | 581. | 60. | 12. | 1056. | 528. | 60. | 13. | 1915. | 383. | 48. | 17. |
| 700000. | 748. | 748. | 60. | 13. | 925. | 617. | 60. | 13. | 958. | 599. | 60. | 13. | 1088. | 544. | 60. | 14. | 1965. | 393. | 49. | 18. |
| 750000. | 770. | 770. | 60. | 14. | 951. | 634. | 60. | 14. | 986. | 616. | 60. | 14. | 1118. | 559. | 60. | 14. | 2010. | 402. | 50. | 19. |
| 800000. | 790. | 790. | 60. | 14. | 976. | 651. | 60. | 15. | 1013. | 633. | 60. | 15. | 1148. | 574. | 60. | 15. | 2055. | 411. | 51. | 19. |
| 850000. | 810. | 810. | 60. | 15. | 1002. | 668. | 60. | 15. | 1037. | 648. | 60. | 15. | 1176. | 588. | 60. | 16. | 2095. | 419. | 52. | 20. |
| 900000. | 830. | 830. | 60. | 16. | 1025. | 683. | 60. | 16. | 1062. | 664. | 60. | 16. | 1204. | 602. | 60. | 17. | 2135. | 427. | 53. | 21. |
| 950000. | 849. | 849. | 60. | 17. | 1049. | 699. | 60. | 17. | 1085. | 678. | 60. | 17. | 1230. | 615. | 60. | 17. | 2175. | 435. | 54. | 22. |
| 1000000. | 867. | 867. | 60. | 17. | 1071. | 714. | 60. | 18. | 1109. | 693. | 60. | 18. | 1254. | 627. | 60. | 18. | 2215. | 443. | 55. | 23. |
| 1050000. | 885. | 885. | 60. | 18. | 1092. | 728. | 60. | 18. | 1131. | 707. | 60. | 18. | 1280. | 640. | 60. | 19. | 2250. | 450. | 56. | 23. |
| 1100000. | 902. | 902. | 60. | 19. | 1113. | 742. | 60. | 19. | 1152. | 720. | 60. | 19. | 1304. | 652. | 60. | 20. | 2285. | 457. | 57. | 24. |
| 1150000. | 919. | 919. | 60. | 19. | 1134. | 756. | 60. | 20. | 1174. | 734. | 60. | 20. | 1328. | 664. | 60. | 20. | 2320. | 464. | 58. | 25. |
| 1200000. | 935. | 935. | 60. | 20. | 1154. | 769. | 60. | 20. | 1194. | 746. | 60. | 20. | 1350. | 675. | 60. | 21. | 2350. | 470. | 59. | 25. |
| 1250000. | 951. | 951. | 60. | 21. | 1173. | 782. | 60. | 21. | 1214. | 759. | 60. | 21. | 1374. | 687. | 60. | 22. | 2385. | 477. | 60. | 26. |
| 1300000. | 967. | 967. | 60. | 21. | 1193. | 795. | 60. | 22. | 1234. | 771. | 60. | 22. | 1396. | 698. | 60. | 22. | 2415. | 483. | 60. | 27. |
| 1350000. | 982. | 982. | 60. | 22. | 1211. | 807. | 60. | 22. | 1253. | 783. | 60. | 23. | 1416. | 708. | 60. | 23. | 2450. | 490. | 60. | 28. |
| 1400000. | 997. | 997. | 60. | 23. | 1230. | 820. | 60. | 23. | 1272. | 795. | 60. | 23. | 1438. | 719. | 60. | 24. | 2480. | 496. | 60. | 28. |
| 1450000. | 1012. | 1012. | 60. | 24. | 1248. | 832. | 60. | 24. | 1291. | 807. | 60. | 24. | 1458. | 729. | 60. | 24. | 2515. | 503. | 60. | 29. |
| 1500000. | 1026. | 1026. | 60. | 24. | 1265. | 843. | 60. | 24. | 1309. | 818. | 60. | 25. | 1478. | 739. | 60. | 25. | 2545. | 509. | 60. | 30. |

# STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 65. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 443. | 443. | 55. | 5. | 581. | 387. | 48. | 5. | 605. | 378. | 47. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 477. | 477. | 60. | 5. | 626. | 417. | 52. | 6. | 653. | 408. | 51. | 6. | 756. | 378. | 47. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 507. | 507. | 63. | 6. | 665. | 443. | 55. | 7. | 693. | 433. | 54. | 7. | 804. | 402. | 50. | 7. | 1480. | 296. | 37. | 10. |
| 350000. | 539. | 539. | 65. | 7. | 699. | 466. | 58. | 7. | 730. | 456. | 57. | 8. | 846. | 423. | 53. | 8. | 1560. | 312. | 39. | 11. |
| 400000. | 574. | 574. | 65. | 8. | 731. | 487. | 61. | 8. | 763. | 477. | 60. | 8. | 886. | 443. | 55. | 9. | 1630. | 326. | 41. | 12. |
| 450000. | 606. | 606. | 65. | 8. | 761. | 507. | 63. | 9. | 794. | 496. | 62. | 9. | 920. | 460. | 58. | 10. | 1695. | 339. | 42. | 13. |
| 500000. | 635. | 635. | 65. | 9. | 789. | 526. | 65. | 10. | 821. | 513. | 64. | 10. | 954. | 477. | 60. | 10. | 1755. | 351. | 44. | 14. |
| 550000. | 662. | 662. | 65. | 10. | 821. | 547. | 65. | 10. | 853. | 533. | 65. | 10. | 984. | 492. | 62. | 11. | 1815. | 363. | 45. | 15. |
| 600000. | 687. | 687. | 65. | 11. | 852. | 568. | 65. | 11. | 883. | 552. | 65. | 11. | 1014. | 507. | 63. | 12. | 1865. | 373. | 47. | 16. |
| 650000. | 710. | 710. | 65. | 12. | 881. | 587. | 65. | 12. | 914. | 571. | 65. | 12. | 1040. | 520. | 65. | 12. | 1915. | 383. | 48. | 17. |
| 700000. | 733. | 733. | 65. | 12. | 908. | 605. | 65. | 13. | 941. | 588. | 65. | 13. | 1072. | 536. | 65. | 13. | 1965. | 393. | 49. | 18. |
| 750000. | 754. | 754. | 65. | 13. | 935. | 623. | 65. | 13. | 968. | 605. | 65. | 13. | 1102. | 551. | 65. | 14. | 2010. | 402. | 50. | 19. |
| 800000. | 775. | 775. | 65. | 14. | 959. | 639. | 65. | 14. | 994. | 621. | 65. | 14. | 1130. | 565. | 65. | 15. | 2055. | 411. | 51. | 19. |
| 850000. | 795. | 795. | 65. | 15. | 984. | 656. | 65. | 15. | 1019. | 637. | 65. | 15. | 1158. | 579. | 65. | 15. | 2095. | 419. | 52. | 20. |
| 900000. | 814. | 814. | 65. | 15. | 1007. | 671. | 65. | 16. | 1043. | 652. | 65. | 16. | 1184. | 592. | 65. | 16. | 2135. | 427. | 53. | 21. |
| 950000. | 832. | 832. | 65. | 16. | 1029. | 686. | 65. | 16. | 1066. | 666. | 65. | 16. | 1210. | 605. | 65. | 17. | 2175. | 435. | 54. | 22. |
| 1000000. | 850. | 850. | 65. | 17. | 1052. | 701. | 65. | 17. | 1090. | 681. | 65. | 17. | 1236. | 618. | 65. | 18. | 2215. | 443. | 55. | 23. |
| 1050000. | 868. | 868. | 65. | 17. | 1073. | 715. | 65. | 18. | 1110. | 694. | 65. | 18. | 1260. | 630. | 65. | 18. | 2250. | 450. | 56. | 23. |
| 1100000. | 884. | 884. | 65. | 18. | 1092. | 728. | 65. | 18. | 1131. | 707. | 65. | 18. | 1282. | 641. | 65. | 19. | 2285. | 457. | 57. | 24. |
| 1150000. | 901. | 901. | 65. | 19. | 1113. | 742. | 65. | 19. | 1152. | 720. | 65. | 19. | 1306. | 653. | 65. | 20. | 2320. | 464. | 58. | 25. |
| 1200000. | 917. | 917. | 65. | 19. | 1133. | 755. | 65. | 20. | 1173. | 733. | 65. | 20. | 1328. | 664. | 65. | 20. | 2350. | 470. | 59. | 25. |
| 1250000. | 933. | 933. | 65. | 20. | 1152. | 768. | 65. | 20. | 1192. | 745. | 65. | 20. | 1350. | 675. | 65. | 21. | 2385. | 477. | 60. | 26. |
| 1300000. | 948. | 948. | 65. | 21. | 1170. | 780. | 65. | 21. | 1211. | 757. | 65. | 21. | 1372. | 686. | 65. | 22. | 2415. | 483. | 60. | 27. |
| 1350000. | 963. | 963. | 65. | 21. | 1188. | 792. | 65. | 22. | 1230. | 769. | 65. | 22. | 1392. | 696. | 65. | 22. | 2445. | 489. | 61. | 27. |
| 1400000. | 977. | 977. | 65. | 22. | 1206. | 804. | 65. | 22. | 1250. | 781. | 65. | 22. | 1414. | 707. | 65. | 23. | 2475. | 495. | 62. | 28. |
| 1450000. | 992. | 992. | 65. | 23. | 1224. | 816. | 65. | 23. | 1267. | 792. | 65. | 23. | 1434. | 717. | 65. | 24. | 2505. | 501. | 63. | 29. |
| 1500000. | 1006. | 1006. | 65. | 23. | 1241. | 827. | 65. | 24. | 1285. | 803. | 65. | 24. | 1454. | 727. | 65. | 24. | 2535. | 507. | 63. | 30. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 70. FT. HIGH

| | STOCKPILE SHAPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 402. | 402. | 50. | 4. | 527. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 443. | 443. | 55. | 5. | 581. | 387. | 48. | 5. | 605. | 378. | 47. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 477. | 477. | 60. | 5. | 626. | 417. | 52. | 6. | 653. | 408. | 51. | 6. | 756. | 378. | 47. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 507. | 507. | 63. | 6. | 665. | 443. | 55. | 7. | 693. | 433. | 54. | 7. | 804. | 402. | 50. | 7. | 1480. | 296. | 37. | 10. |
| 350000. | 533. | 533. | 67. | 7. | 699. | 466. | 58. | 7. | 730. | 456. | 57. | 8. | 846. | 423. | 53. | 8. | 1560. | 312. | 39. | 11. |
| 400000. | 557. | 557. | 70. | 7. | 731. | 487. | 61. | 8. | 763. | 477. | 60. | 8. | 886. | 443. | 55. | 9. | 1630. | 326. | 41. | 12. |
| 450000. | 589. | 589. | 70. | 8. | 761. | 507. | 63. | 9. | 794. | 496. | 62. | 9. | 920. | 460. | 58. | 10. | 1695. | 339. | 42. | 13. |
| 500000. | 619. | 619. | 70. | 9. | 788. | 525. | 66. | 9. | 821. | 513. | 64. | 10. | 954. | 477. | 60. | 10. | 1755. | 351. | 44. | 14. |
| 550000. | 646. | 646. | 70. | 10. | 813. | 542. | 68. | 10. | 848. | 530. | 66. | 10. | 984. | 492. | 62. | 11. | 1815. | 363. | 45. | 15. |
| 600000. | 672. | 672. | 70. | 10. | 836. | 557. | 70. | 11. | 874. | 546. | 68. | 11. | 1014. | 507. | 63. | 12. | 1865. | 373. | 47. | 16. |
| 650000. | 696. | 696. | 70. | 11. | 864. | 576. | 70. | 11. | 896. | 560. | 70. | 12. | 1040. | 520. | 65. | 12. | 1915. | 383. | 48. | 17. |
| 700000. | 718. | 718. | 70. | 12. | 891. | 594. | 70. | 12. | 925. | 578. | 70. | 12. | 1066. | 533. | 67. | 13. | 1965. | 393. | 49. | 18. |
| 750000. | 740. | 740. | 70. | 13. | 918. | 612. | 70. | 13. | 952. | 595. | 70. | 13. | 1092. | 546. | 68. | 14. | 2010. | 402. | 50. | 19. |
| 800000. | 760. | 760. | 70. | 13. | 942. | 628. | 70. | 14. | 978. | 611. | 70. | 14. | 1114. | 557. | 70. | 14. | 2055. | 411. | 51. | 19. |
| 850000. | 780. | 780. | 70. | 14. | 966. | 644. | 70. | 14. | 1002. | 626. | 70. | 14. | 1142. | 571. | 70. | 15. | 2095. | 419. | 52. | 20. |
| 900000. | 799. | 799. | 70. | 15. | 990. | 660. | 70. | 15. | 1026. | 641. | 70. | 15. | 1168. | 584. | 70. | 16. | 2135. | 427. | 53. | 21. |
| 950000. | 817. | 817. | 70. | 15. | 1013. | 675. | 70. | 16. | 1050. | 656. | 70. | 16. | 1192. | 596. | 70. | 16. | 2175. | 435. | 54. | 22. |
| 1000000. | 835. | 835. | 70. | 16. | 1034. | 689. | 70. | 16. | 1070. | 669. | 70. | 16. | 1218. | 609. | 70. | 17. | 2215. | 443. | 55. | 23. |
| 1050000. | 852. | 852. | 70. | 17. | 1055. | 703. | 70. | 17. | 1093. | 683. | 70. | 17. | 1242. | 621. | 70. | 18. | 2250. | 450. | 56. | 23. |
| 1100000. | 869. | 869. | 70. | 17. | 1074. | 716. | 70. | 18. | 1114. | 696. | 70. | 18. | 1264. | 632. | 70. | 18. | 2285. | 457. | 57. | 24. |
| 1150000. | 885. | 885. | 70. | 18. | 1094. | 729. | 70. | 18. | 1134. | 709. | 70. | 18. | 1286. | 643. | 70. | 19. | 2320. | 464. | 58. | 25. |
| 1200000. | 901. | 901. | 70. | 19. | 1113. | 742. | 70. | 19. | 1154. | 721. | 70. | 19. | 1308. | 654. | 70. | 20. | 2350. | 470. | 59. | 25. |
| 1250000. | 916. | 916. | 70. | 19. | 1133. | 755. | 70. | 20. | 1173. | 733. | 70. | 20. | 1330. | 665. | 70. | 20. | 2385. | 477. | 60. | 26. |
| 1300000. | 931. | 931. | 70. | 20. | 1151. | 767. | 70. | 20. | 1192. | 745. | 70. | 20. | 1352. | 676. | 70. | 21. | 2415. | 483. | 60. | 27. |
| 1350000. | 946. | 946. | 70. | 21. | 1169. | 779. | 70. | 21. | 1210. | 756. | 70. | 21. | 1372. | 686. | 70. | 22. | 2445. | 489. | 61. | 27. |
| 1400000. | 960. | 960. | 70. | 21. | 1187. | 791. | 70. | 22. | 1229. | 768. | 70. | 22. | 1392. | 696. | 70. | 22. | 2475. | 495. | 62. | 28. |
| 1450000. | 974. | 974. | 70. | 22. | 1203. | 802. | 70. | 22. | 1246. | 779. | 70. | 22. | 1412. | 706. | 70. | 23. | 2505. | 501. | 63. | 29. |
| 1500000. | 988. | 988. | 70. | 22. | 1220. | 813. | 70. | 23. | 1264. | 790. | 70. | 23. | 1430. | 715. | 70. | 23. | 2535. | 507. | 63. | 30. |

STOCKPILE DIMENSIONS

STOCKPILE LIMITED TO 75. FT. HIGH

STOCKPILE SHAPE

| | SQUARE | | | | 3-2 | | | | 8-5 | | | | 2-1 | | | | 5-1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VOLUME | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA | LONG | WIDE | HIGH | AREA |
| 50000. | 279. | 279. | 35. | 2. | 366. | 244. | 31. | 2. | 382. | 239. | 30. | 2. | 444. | 222. | 28. | 2. | 815. | 163. | 20. | 3. |
| 100000. | 351. | 351. | 44. | 3. | 461. | 307. | 38. | 3. | 480. | 300. | 38. | 3. | 558. | 279. | 35. | 4. | 1030. | 206. | 26. | 5. |
| 150000. | 402. | 402. | 50. | 4. | 627. | 351. | 44. | 4. | 550. | 344. | 43. | 4. | 638. | 319. | 40. | 5. | 1175. | 235. | 29. | 6. |
| 200000. | 443. | 443. | 55. | 5. | 581. | 387. | 48. | 5. | 605. | 378. | 47. | 5. | 702. | 351. | 44. | 6. | 1295. | 259. | 32. | 8. |
| 250000. | 477. | 477. | 60. | 5. | 626. | 417. | 52. | 6. | 653. | 408. | 51. | 6. | 756. | 378. | 47. | 7. | 1395. | 279. | 35. | 9. |
| 300000. | 507. | 507. | 63. | 6. | 665. | 443. | 55. | 7. | 693. | 433. | 54. | 7. | 804. | 402. | 50. | 7. | 1480. | 296. | 37. | 10. |
| 350000. | 533. | 533. | 67. | 7. | 699. | 466. | 58. | 7. | 730. | 456. | 57. | 8. | 846. | 423. | 53. | 8. | 1560. | 312. | 39. | 11. |
| 400000. | 557. | 557. | 70. | 7. | 731. | 487. | 61. | 8. | 763. | 477. | 60. | 8. | 886. | 443. | 55. | 9. | 1630. | 326. | 41. | 12. |
| 450000. | 580. | 580. | 73. | 8. | 761. | 507. | 63. | 9. | 794. | 496. | 62. | 9. | 920. | 460. | 58. | 10. | 1695. | 339. | 42. | 13. |
| 500000. | 600. | 600. | 75. | 8. | 788. | 525. | 66. | 9. | 821. | 513. | 64. | 10. | 954. | 477. | 60. | 10. | 1755. | 351. | 44. | 14. |
| 550000. | 629. | 629. | 75. | 9. | 813. | 542. | 68. | 10. | 848. | 530. | 66. | 10. | 984. | 492. | 62. | 11. | 1815. | 363. | 45. | 15. |
| 600000. | 655. | 655. | 75. | 10. | 836. | 557. | 70. | 11. | 874. | 546. | 68. | 11. | 1014. | 507. | 63. | 12. | 1865. | 373. | 47. | 16. |
| 650000. | 680. | 680. | 75. | 11. | 860. | 573. | 72. | 11. | 896. | 560. | 70. | 12. | 1040. | 520. | 65. | 12. | 1915. | 383. | 48. | 17. |
| 700000. | 703. | 703. | 75. | 11. | 881. | 587. | 73. | 12. | 918. | 574. | 72. | 12. | 1066. | 533. | 67. | 13. | 1965. | 393. | 49. | 18. |
| 750000. | 725. | 725. | 75. | 12. | 900. | 600. | 75. | 12. | 941. | 588. | 74. | 13. | 1092. | 546. | 68. | 14. | 2010. | 402. | 50. | 19. |
| 800000. | 745. | 745. | 75. | 13. | 925. | 617. | 75. | 13. | 960. | 600. | 75. | 13. | 1114. | 557. | 70. | 14. | 2055. | 411. | 51. | 19. |
| 850000. | 765. | 765. | 75. | 13. | 950. | 633. | 75. | 14. | 986. | 616. | 75. | 14. | 1138. | 569. | 71. | 15. | 2095. | 419. | 52. | 20. |
| 900000. | 784. | 784. | 75. | 14. | 974. | 649. | 75. | 15. | 1010. | 631. | 75. | 15. | 1160. | 580. | 73. | 15. | 2135. | 427. | 53. | 21. |
| 950000. | 802. | 802. | 75. | 15. | 995. | 663. | 75. | 15. | 1032. | 645. | 75. | 15. | 1180. | 590. | 74. | 16. | 2175. | 435. | 54. | 22. |
| 1000000. | 820. | 820. | 75. | 15. | 1017. | 678. | 75. | 16. | 1054. | 659. | 75. | 16. | 1200. | 600. | 75. | 17. | 2215. | 443. | 55. | 23. |
| 1050000. | 837. | 837. | 75. | 16. | 1038. | 692. | 75. | 16. | 1075. | 672. | 75. | 17. | 1224. | 612. | 75. | 17. | 2250. | 450. | 56. | 23. |
| 1100000. | 854. | 854. | 75. | 17. | 1058. | 705. | 75. | 17. | 1096. | 685. | 75. | 17. | 1248. | 624. | 75. | 18. | 2285. | 457. | 57. | 24. |
| 1150000. | 870. | 870. | 75. | 17. | 1077. | 718. | 75. | 18. | 1117. | 698. | 75. | 18. | 1270. | 635. | 75. | 19. | 2320. | 464. | 58. | 25. |
| 1200000. | 885. | 885. | 75. | 18. | 1097. | 731. | 75. | 18. | 1136. | 710. | 75. | 19. | 1292. | 646. | 75. | 19. | 2350. | 470. | 59. | 25. |
| 1250000. | 900. | 900. | 75. | 19. | 1115. | 743. | 75. | 19. | 1155. | 722. | 75. | 19. | 1312. | 656. | 75. | 20. | 2385. | 477. | 60. | 26. |
| 1300000. | 915. | 915. | 75. | 19. | 1133. | 755. | 75. | 20. | 1174. | 734. | 75. | 20. | 1334. | 667. | 75. | 20. | 2415. | 483. | 60. | 27. |
| 1350000. | 930. | 930. | 75. | 20. | 1151. | 767. | 75. | 20. | 1192. | 745. | 75. | 20. | 1354. | 677. | 75. | 21. | 2445. | 489. | 61. | 27. |
| 1400000. | 944. | 944. | 75. | 20. | 1167. | 778. | 75. | 21. | 1210. | 756. | 75. | 21. | 1374. | 687. | 75. | 22. | 2475. | 495. | 62. | 28. |
| 1450000. | 958. | 958. | 75. | 21. | 1184. | 789. | 75. | 21. | 1227. | 767. | 75. | 22. | 1392. | 696. | 75. | 22. | 2505. | 501. | 63. | 29. |
| 1500000. | 971. | 971. | 75. | 22. | 1200. | 800. | 75. | 22. | 1245. | 778. | 75. | 22. | 1412. | 706. | 75. | 23. | 2535. | 507. | 63. | 30. |

# CHAPTER 16

## ESTIMATE OF DIKING COSTS

### INTRODUCTION

Construction of dikes to contain material dredged hydraulically, as well as the slurry transport water, is necessary in some portions of the GREAT I study area. Dikes are defined here as major earth walls intended to contain dredged material and slurry on a given site. Complete or limited time containment of the slurry is desirable when water quality of the slurry is exceptionally poor or when adjacent habitat is exceptionally valuable.

The following table of diking cost estimates is meant to provide the user with a general range of earthwork volumes and costs requirẽd to build containment dikes of native material.

### DIKING INFORMATION

Four primary factors affect the size of a containment structure: volume of material being dredged, number of days retention desired, rate at which dredged material slurry is delivered to the containment area, and rate at which slurry water seeps through the dikes and substrata.

To use the table, select the dredge production rate closest to what you are assuming and the location of the placement site (above or below Lake Pepin). Turn to the appropriate table and locate the nearest dredging volume and days retention for which you wish information. The table will provide the cubic yards of earthwork required to construct the dikes by excavation from inside the diked area, the length of dike required measured along the center of the dike at the top, the approximate height of dike above the surrounding landscape, the average depth of the basin inside the dike measured from the top of the dike, the area needed to build the dike measured around the toe of the outside slope, and ar approximate cost to construct the dike shown.

Average dredging production rates for 20-, 16-, and 12-inch cutterhead suction dredges are shown (600, 450, and 200 cubic yards per hour, respectively), plus an average delivery rate for a 12-inch dredge operating as a device to rehandle material delivered by dump scow (275 cubic yards per hour).

## APPROXIMATE DIKING COSTS AND AREAS

20-INCH DREDGE (600. CU. YDS. PER HOUR 20 HRS. PER DAY)
ABOVE LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $25953. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 2 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 3 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 4 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 5 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 6 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 7 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| 7500. | 0 | $15238. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| | 2 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| | 3 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| | 4 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| | 5 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| | 6 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| | 7 | $ 7201. | 6. | 8. | 6. | 1684. | 12960.* |
| 10000. | 0 | $11219. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| | 2 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| | 3 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| | 4 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| | 5 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| | 6 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| | 7 | $ 8375. | 7. | 9. | 7. | 1852. | 16836.* |
| 12500. | 0 | $ 9325. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $15653. | 7. | 10. | 7. | 1968. | 20022. |
| | 2 | $ 9116. | 8. | 10. | 7. | 1996. | 20843.* |
| | 3 | $ 9116. | 8. | 10. | 7. | 1996. | 20843.* |
| | 4 | $ 9116. | 8. | 10. | 7. | 1996. | 20843.* |
| | 5 | $ 9116. | 8. | 10. | 7. | 1996. | 20843.* |
| | 6 | $ 9116. | 8. | 10. | 7. | 1996. | 20843.* |
| | 7 | $ 9116. | 8. | 10. | 7. | 1996. | 20843.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 8363. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $14322. | 8. | 10. | 7. | 1988. | 20568. |
| | 2 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 3 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 4 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 5 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 6 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 7 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| 17500. | 0 | $ 7823. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $13459. | 8. | 10. | 7. | 2008. | 21123. |
| | 2 | $ 9219. | 9. | 11. | 8. | 2224. | 28224.* |
| | 3 | $ 9219. | 9. | 11. | 8. | 2224. | 28224.* |
| | 4 | $ 9219. | 9. | 11. | 8. | 2224. | 28224.* |
| | 5 | $ 9219. | 9. | 11. | 8. | 2224. | 28224.* |
| | 6 | $ 9219. | 9. | 11. | 8. | 2224. | 28224.* |
| | 7 | $ 9219. | 9. | 11. | 8. | 2224. | 28224.* |
| 20000. | 0 | $ 7568. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $12861. | 8. | 10. | 7. | 2024. | 21685. |
| | 2 | $ 9580. | 10. | 12. | 9. | 2324. | 31932.* |
| | 3 | $ 9580. | 10. | 12. | 9. | 2324. | 31932.* |
| | 4 | $ 9580. | 10. | 12. | 9. | 2324. | 31932.* |
| | 5 | $ 9580. | 10. | 12. | 9. | 2324. | 31932.* |
| | 6 | $ 9580. | 10. | 12. | 9. | 2324. | 31932.* |
| | 7 | $ 9580. | 10. | 12. | 9. | 2324. | 31932.* |
| 22500. | 0 | $ 7467. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $12424. | 8. | 10. | 7. | 2044. | 22260. |
| | 2 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 3 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 4 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 5 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 6 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 7 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 7419. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $12081. | 8. | 10. | 8. | 2060. | 22698. |
| | 2 | $14178. | 12. | 12. | 9. | 2472. | 37974. |
| | 3 | $11768. | 12. | 13. | 9. | 2500. | 39226.* |
| | 4 | $11768. | 12. | 13. | 9. | 2500. | 39226.* |
| | 5 | $11768. | 12. | 13. | 9. | 2500. | 39226.* |
| | 6 | $11768. | 12. | 13. | 9. | 2500. | 39226.* |
| | 7 | $11768. | 12. | 13. | 9. | 2500. | 39226.* |
| 27500. | 0 | $ 7487. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $11826. | 8. | 10. | 8. | 2080. | 23438. |
| | 2 | $14068. | 12. | 12. | 9. | 2484. | 38602. |
| | 3 | $12808. | 13. | 13. | 10. | 2576. | 42694.* |
| | 4 | $12808. | 13. | 13. | 10. | 2576. | 42694.* |
| | 5 | $12808. | 13. | 13. | 10. | 2576. | 42694.* |
| | 6 | $12808. | 13. | 13. | 10. | 2576. | 42694.* |
| | 7 | $12808. | 13. | 13. | 10. | 2576. | 42694.* |
| 30000. | 0 | $ 7588. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $11603. | 8. | 10. | 8. | 2096. | 23890. |
| | 2 | $13950. | 12. | 12. | 9. | 2496. | 39014. |
| | 3 | $13837. | 13. | 13. | 10. | 2648. | 46123.* |
| | 4 | $13837. | 13. | 13. | 10. | 2648. | 46123.* |
| | 5 | $13837. | 13. | 13. | 10. | 2648. | 46123.* |
| | 6 | $13837. | 13. | 13. | 10. | 2648. | 46123.* |
| | 7 | $13837. | 13. | 13. | 10. | 2648. | 46123.* |
| 32500. | 0 | $ 7691. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $11418. | 9. | 11. | 8. | 2116. | 24503. |
| | 2 | $13943. | 12. | 13. | 9. | 2508. | 39653. |
| | 3 | $14999. | 14. | 14. | 10. | 2720. | 49996.* |
| | 4 | $14999. | 14. | 14. | 10. | 2720. | 49996.* |
| | 5 | $14999. | 14. | 14. | 10. | 2720. | 49996.* |
| | 6 | $14999. | 14. | 14. | 10. | 2720. | 49996.* |
| | 7 | $14999. | 14. | 14. | 10. | 2720. | 49996.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 7833. | 5. | 8. | 5. | 1528. | 9697. |
| | 1 | $11251. | 9. | 11. | 8. | 2132. | 25125. |
| | 2 | $13901. | 12. | 13. | 9. | 2520. | [illegible] |
| | 3 | $15982. | 15. | 14. | 10. | 2784. | 53273.* |
| | 4 | $15982. | 15. | 14. | 10. | 2784. | 53273.* |
| | 5 | $15982. | 15. | 14. | 10. | 2784. | 53273.* |
| | 6 | $15982. | 15. | 14. | 10. | 2784. | 53273.* |
| | 7 | $15982. | 15. | 14. | 10. | 2784. | 53273.* |
| 40000. | 0 | $ 8106. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $10967. | 9. | 11. | 8. | 2168. | 26239. |
| | 2 | $13963. | 12. | 13. | 9. | 2540. | 41161. |
| | 3 | $18221. | 15. | 14. | 11. | 2824. | 55355. |
| | 4 | $18308. | 16. | 15. | 11. | 2908. | 60267.* |
| | 5 | $18308. | 16. | 15. | 11. | 2908. | 60267.* |
| | 6 | $18308. | 16. | 15. | 11. | 2908. | 60267.* |
| | 7 | $18308. | 16. | 15. | 11. | 2908. | 60267.* |
| 45000. | 0 | $ 8431. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $10704. | 9. | 11. | 8. | 2200. | 27385. |
| | 2 | $14092. | 12. | 13. | 10. | 2564. | 42258. |
| | 3 | $18345. | 15. | 14. | 11. | 2840. | 56437. |
| | 4 | $23583. | 17. | 15. | 11. | 3020. | 67259.* |
| | 5 | $23583. | 17. | 15. | 11. | 3020. | 67259.* |
| | 6 | $23583. | 17. | 15. | 11. | 3020. | 67259.* |
| | 7 | $23583. | 17. | 15. | 11. | 3020. | 67259.* |
| 50000. | 0 | $ 8746. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $10442. | 10. | 11. | 8. | 2232. | 28565. |
| | 2 | $14270. | 13. | 13. | 10. | 2588. | 43374. |
| | 3 | $18511. | 15. | 14. | 11. | 2860. | 57511. |
| | 4 | $28408. | 18. | 15. | 12. | 3088. | 71555. |
| | 5 | $29391. | 18. | 16. | 12. | 3124. | 74114.* |
| | 6 | $29391. | 18. | 16. | 12. | 3124. | 74114.* |
| | 7 | $29391. | 18. | 16. | 12. | 3124. | 74114.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 9002. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $10190. | 10. | 11. | 8. | 2264. | 29600. |
| | 2 | $14416. | 13. | 13. | 10. | 2608. | 44278. |
| | 3 | $18628. | 16. | 14. | 11. | 2876. | 58320. |
| | 4 | $29400. | 18. | 16. | 12. | 3104. | 72845. |
| | 5 | $35928. | 20. | 16. | 12. | 3224. | 81070.* |
| | 6 | $35928. | 20. | 16. | 12. | 3224. | 81070.* |
| | 7 | $35928. | 20. | 16. | 12. | 3224. | 81070.* |
| 60000. | 0 | $ 9254. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $10282. | 10. | 11. | 8. | 2296. | 30841. |
| | 2 | $14658. | 13. | 13. | 10. | 2632. | 45429. |
| | 3 | $18947. | 16. | 14. | 11. | 2896. | 59724. |
| | 4 | $30129. | 18. | 16. | 12. | 3120. | 73787. |
| | 5 | $42772. | 21. | 17. | 13. | 3316. | 87709.* |
| | 6 | $42772. | 21. | 17. | 13. | 3316. | 87709.* |
| | 7 | $42772. | 21. | 17. | 13. | 3316. | 87709.* |
| 65000. | 0 | $ 9489. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $10579. | 10. | 12. | 9. | 2328. | 32117. |
| | 2 | $14923. | 13. | 13. | 10. | 2656. | 46599. |
| | 3 | $19455. | 16. | 15. | 11. | 2912. | 60552. |
| | 4 | $30599. | 18. | 16. | 12. | 3132. | 74409. |
| | 5 | $44915. | 21. | 17. | 13. | 3328. | 88617. |
| | 6 | $48718. | 22. | 17. | 13. | 3400. | 94358.* |
| | 7 | $48718. | 22. | 17. | 13. | 3400. | 94358.* |
| 70000. | 0 | $ 9675. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $10843. | 11. | 12. | 9. | 2356. | 33239. |
| | 2 | $15135. | 14. | 13. | 10. | 2676. | 47546. |
| | 3 | $19982. | 16. | 15. | 11. | 2928. | 61389. |
| | 4 | $31724. | 19. | 16. | 12. | 3148. | 75731. |
| | 5 | $45608. | 21. | 17. | 13. | 3340. | 89516. |
| | 6 | $55290. | 23. | 17. | 13. | 3484. | 101336.* |
| | 7 | $55290. | 23. | 17. | 13. | 3484. | 101336.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTH K VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9812. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $11124. | 11. | 12. | 9. | 2384. | 34385. |
| | 2 | $15361. | 14. | 13. | 10. | 2696. | 48507. |
| | 3 | $20984. | 16. | 15. | 11. | 2948. | 62843. |
| | 4 | $32243. | 19. | 16. | 12. | 3160. | 76364. |
| | 5 | $46190. | 21. | 17. | 13. | 3352. | 90639. |
| | 6 | $58811. | 23. | 18. | 13. | 3520. | 104095. |
| | 7 | $61745. | 24. | 18. | 13. | 3560. | 107802.* |
| 80000. | 0 | $ 9920. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $11422. | 11. | 12. | 9. | 2412. | 35558. |
| | 2 | $15754. | 14. | 14. | 10. | 2720. | 49996. |
| | 3 | $21570. | 17. | 15. | 11. | 2964. | 63699. |
| | 4 | $33444. | 19. | 16. | 12. | 3176. | 77710. |
| | 5 | $46763. | 21. | 17. | 13. | 3364. | 91348. |
| | 6 | $60000. | 23. | 18. | 13. | 3532. | 105339. |
| | 7 | $68366. | 25. | 18. | 14. | 3632. | 114196.* |
| 85000. | 0 | $ 9992. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $11671. | 11. | 12. | 9. | 2440. | 36546. |
| | 2 | $16004. | 14. | 14. | 10. | 2740. | 50988. |
| | 3 | $22179. | 17. | 15. | 11. | 2980. | 64563. |
| | 4 | $34004. | 19. | 16. | 12. | 3188. | 78352. |
| | 5 | $47731. | 21. | 17. | 13. | 3376. | 92486. |
| | 6 | $60318. | 24. | 18. | 13. | 3540. | 105702. |
| | 7 | $74761. | 26. | 18. | 14. | 3692. | 119266. |
| 90000. | 0 | $10017. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $11996. | 12. | 12. | 9. | 2468. | 37767. |
| | 2 | $16264. | 14. | 14. | 10. | 2760. | 51993. |
| | 3 | $23067. | 17. | 15. | 11. | 2996. | [illegible] |
| | 4 | $35277. | 19. | 16. | 12. | [illegible] | [illegible] |
| | 5 | [illegible] | 22. | 17. | [illegible] | [illegible] | [illegible] |
| | 6 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

* [illegible] IDES

## APPROXIMATE DIKING COSTS AND AREAS

20-INCH DREDGE (600. CU. YDS. PER HOUR, 20 HRS. PER DAY)
BELOW LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $25953. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| | 2 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| | 3 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| | 4 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| | 5 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| | 6 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| | 7 | $ 4627. | 4. | 7. | 5. | 1360. | 7210.* |
| 7500. | 0 | $15238. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| | 2 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| | 3 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| | 4 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| | 5 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| | 6 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| | 7 | $ 6066. | 5. | 8. | 5. | 1540. | 10148.* |
| 10000. | 0 | $11219. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| | 2 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| | 3 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| | 4 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| | 5 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| | 6 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| | 7 | $ 7092. | 5. | 8. | 6. | 1672. | 12664.* |
| 12500. | 0 | $ 9325. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $14450. | 6. | 9. | 6. | 1764. | 14757. |
| | 2 | $ 7936. | 6. | 9. | 6. | 1784. | 15204.* |
| | 3 | $ 7936. | 6. | 9. | 6. | 1784. | 15204.* |
| | 4 | $ 7936. | 6. | 9. | 6. | 1784. | 15204.* |
| | 5 | $ 7936. | 6. | 9. | 6. | 1784. | 15204.* |
| | 6 | $ 7936. | 6. | 9. | 6. | 1784. | 15204.* |
| | 7 | $ 7936. | 6. | 9. | 6. | 1784. | 15204.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 8363. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $13111. | 6. | 9. | 6. | 1776. | 14983. |
| | 2 | $ 8545. | 7. | 9. | 7. | 1876. | 17563.* |
| | 3 | $ 8545. | 7. | 9. | 7. | 1876. | 17563.* |
| | 4 | $ 8545. | 7. | 9. | 7. | 1876. | 17563.* |
| | 5 | $ 8545. | 7. | 9. | 7. | 1876. | 17563.* |
| | 6 | $ 8545. | 7. | 9. | 7. | 1876. | 17563.* |
| | 7 | $ 8545. | 7. | 9. | 7. | 1876. | 17563.* |
| 17500. | 0 | $ 7823. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $12245. | 6. | 9. | 6. | 1784. | 15204. |
| | 2 | $ 8941. | 7. | 10. | 7. | 1956. | 19622.* |
| | 3 | $ 8941. | 7. | 10. | 7. | 1956. | 19622.* |
| | 4 | $ 8941. | 7. | 10. | 7. | 1956. | 19622.* |
| | 5 | $ 8941. | 7. | 10. | 7. | 1956. | 19622.* |
| | 6 | $ 8941. | 7. | 10. | 7. | 1956. | 19622.* |
| | 7 | $ 8941. | 7. | 10. | 7. | 1956. | 19622.* |
| 20000. | 0 | $ 7568. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $11685. | 6. | 9. | 7. | 1800. | 15548. |
| | 2 | $ 9224. | 8. | 10. | 7. | 2028. | 21828.* |
| | 3 | $ 9224. | 8. | 10. | 7. | 2028. | 21828.* |
| | 4 | $ 9224. | 8. | 10. | 7. | 2028. | 21828.* |
| | 5 | $ 9224. | 8. | 10. | 7. | 2028. | 21828.* |
| | 6 | $ 9224. | 8. | 10. | 7. | 2028. | 21828.* |
| | 7 | $ 9224. | 8. | 10. | 7. | 2028. | 21828.* |
| 22500. | 0 | $ 7467. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $11291. | 6. | 9. | 7. | 1812. | 15889. |
| | 2 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 3 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 4 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 5 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 6 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 7 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 7419. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $11010. | 6. | 9. | 7. | 1828. | 16241. |
| | 2 | $12160. | 9. | 11. | 8. | 2132. | 25125. |
| | 3 | $ 9366. | 9. | 11. | 8. | 2152. | 25758.* |
| | 4 | $ 9366. | 9. | 11. | 8. | 2152. | 25758.* |
| | 5 | $ 9366. | 9. | 11. | 8. | 2152. | 25758.* |
| | 6 | $ 9366. | 9. | 11. | 8. | 2152. | 25758.* |
| | 7 | $ 9366. | 9. | 11. | 8. | 2152. | 25758.* |
| 27500. | 0 | $ 7487. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $10803. | 7. | 9. | 7. | 1840. | 16593. |
| | 2 | $11862. | 9. | 11. | 8. | 2136. | 25125. |
| | 3 | $ 9277. | 9. | 11. | 8. | 2204. | 27552.* |
| | 4 | $ 9277. | 9. | 11. | 8. | 2204. | 27552.* |
| | 5 | $ 9277. | 9. | 11. | 8. | 2204. | 27552.* |
| | 6 | $ 9277. | 9. | 11. | 8. | 2204. | 27552.* |
| | 7 | $ 9277. | 9. | 11. | 8. | 2204. | 27552.* |
| 30000. | 0 | $ 7588. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $10651. | 7. | 9. | 7. | 1856. | 16956. |
| | 2 | $11620. | 9. | 11. | 8. | 2140. | 25282. |
| | 3 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 4 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 5 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 6 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 7 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| 32500. | 0 | $ 7691. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $10565. | 7. | 9. | 7. | 1872. | 17440. |
| | 2 | $11419. | 9. | 11. | 8. | 2144. | 25440. |
| | 3 | $ 9252. | 10. | 11. | 8. | 2296. | 30841.* |
| | 4 | $ 9252. | 10. | 11. | 8. | 2296. | 30841.* |
| | 5 | $ 9252. | 10. | 11. | 8. | 2296. | 30841.* |
| | 6 | $ 9252. | 10. | 11. | 8. | 2296. | 30841.* |
| | 7 | $ 9252. | 10. | 11. | 8. | 2296. | 30841.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 7833. | 5. | 8. | 5. | 1528. | 9897. |
| | 1 | $10480. | 7. | 9. | 7. | 1888. | 17814. |
| | 2 | $11249. | 9. | 11. | 8. | 2148. | 25598. |
| | 3 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| | 4 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| | 5 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| | 6 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| | 7 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| 40000. | 0 | $ 8106. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $10370. | 7. | 10. | 7. | 1916. | 18574. |
| | 2 | $10977. | 9. | 11. | 8. | 2160. | 25917. |
| | 3 | $11586. | 11. | 12. | 9. | 2356. | 33239. |
| | 4 | $10668. | 11. | 12. | 9. | 2412. | 35558.* |
| | 5 | $10668. | 11. | 12. | 9. | 2412. | 35558.* |
| | 6 | $10668. | 11. | 12. | 9. | 2412. | 35558.* |
| | 7 | $10668. | 11. | 12. | 9. | 2412. | 35558.* |
| 45000. | 0 | $ 8431. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $10333. | 7. | 10. | 7. | 1948. | 19486. |
| | 2 | $10753. | 9. | 11. | 8. | 2176. | 26563. |
| | 3 | $11443. | 11. | 12. | 9. | 2360. | 33429. |
| | 4 | $11517. | 12. | 12. | 9. | 2480. | 38391.* |
| | 5 | $11517. | 12. | 12. | 9. | 2480. | 38391.* |
| | 6 | $11517. | 12. | 12. | 9. | 2480. | 38391.* |
| | 7 | $11517. | 12. | 12. | 9. | 2480. | 38391.* |
| 50000. | 0 | $ 8746. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $10301. | 8. | 10. | 7. | 1980. | 20286. |
| | 2 | $10570. | 9. | 11. | 8. | 2192. | 27054. |
| | 3 | $11285. | 11. | 12. | 9. | 2364. | 33423. |
| | 4 | $13283. | 12. | 13. | 9. | 2516. | 40083. |
| | 5 | $12282. | 12. | 13. | 9. | 2536. | 40942.* |
| | 6 | $12282. | 12. | 13. | 9. | 2536. | 40942.* |
| | 7 | $12282. | 12. | 13. | 9. | 2536. | 40942.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 9002. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $10298. | 8. | 10. | 7. | 2012. | 21262. |
| | 2 | $10396. | 9. | 11. | 8. | 2208. | 27720. |
| | 3 | $11217. | 11. | 12. | 9. | 2368. | 33614. |
| | 4 | $13093. | 12. | 13. | 9. | 2512. | 39868. |
| | 5 | $13012. | 13. | 13. | 10. | 2588. | 43374.* |
| | 6 | $13012. | 13. | 13. | 10. | 2588. | 43374.* |
| | 7 | $13012. | 13. | 13. | 10. | 2588. | 43374.* |
| 60000. | 0 | $ 9254. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $10292. | 8. | 10. | 7. | 2044. | 22260. |
| | 2 | $10249. | 9. | 11. | 8. | 2224. | 28224. |
| | 3 | $11229. | 11. | 12. | 9. | 2376. | 33998. |
| | 4 | $12990. | 12. | 13. | 9. | 2512. | 39868. |
| | 5 | $13699. | 13. | 13. | 10. | 2636. | 45664.* |
| | 6 | $13699. | 13. | 13. | 10. | 2636. | 45664.* |
| | 7 | $13699. | 13. | 13. | 10. | 2636. | 45664.* |
| 65000. | 0 | $ 9489. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $10267. | 8. | 10. | 8. | 2072. | 23140. |
| | 2 | $10090. | 10. | 11. | 8. | 2244. | 28906. |
| | 3 | $11259. | 11. | 12. | 9. | 2384. | 34385. |
| | 4 | $12969. | 12. | 13. | 9. | 2516. | 40083. |
| | 5 | $14572. | 13. | 13. | 10. | 2632. | 45429. |
| | 6 | $14264. | 14. | 13. | 10. | 2676. | 47546.* |
| | 7 | $14264. | 14. | 13. | 10. | 2676. | 47546.* |
| 70000. | 0 | $ 9675. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $10236. | 8. | 11. | 8. | 2104. | 24195. |
| | 2 | $ 9928. | 10. | 11. | 8. | 2260. | 29603. |
| | 3 | $11302. | 11. | 12. | 9. | 2396. | 34769. |
| | 4 | $12896. | 12. | 13. | 9. | 2516. | 40083. |
| | 5 | $14429. | 13. | 13. | 10. | 2628. | 45194. |
| | 6 | $14849. | 14. | 14. | 10. | 2712. | 49496.* |
| | 7 | $14849. | 14. | 14. | 10. | 2712. | 49496.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9812. | 7. | 10. | 7. | 1966. | 20022. |
| | 1 | $10183. | 9. | 11. | 8. | 2132. | 25125. |
| | 2 | $ 9901. | 10. | 11. | 8. | 228[illegible]. | 30307. |
| | 3 | $11357. | 11. | 12. | 9. | 2404. | 35162. |
| | 4 | $12830. | 12. | 13. | 9. | 252[illegible]. | 40072. |
| | 5 | $14367. | 13. | 13. | 10. | 2626. | 45194. |
| | 6 | $15878. | 14. | 14. | 10. | 2726. | 50222. |
| | 7 | $15367. | 14. | 14. | 10. | 2746. | 51225.* |
| 80000. | 0 | $ 9920. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $10112. | 9. | 11. | 8. | 2164. | 26077. |
| | 2 | $10007. | 10. | 11. | 8. | 2296. | 30841. |
| | 3 | $11420. | 11. | 12. | 9. | 2416. | 35551. |
| | 4 | $12841. | 12. | 13. | 9. | 2524. | 40288. |
| | 5 | $14313. | 13. | 13. | 10. | 2628. | 45194. |
| | 6 | $15754. | 14. | 14. | 10. | 2720. | 49996. |
| | 7 | $15825. | 15. | 14. | 10. | 2776. | 52751.* |
| 85000. | 0 | $ 9992. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $10019. | 9. | 11. | 8. | 2192. | 27054. |
| | 2 | $10177. | 10. | 12. | 9. | 2316. | 31564. |
| | 3 | $11552. | 11. | 12. | 9. | 2428. | 36150. |
| | 4 | $12924. | 12. | 13. | 9. | 2532. | 40723. |
| | 5 | $14266. | 13. | 13. | 10. | 2628. | 45194. |
| | 6 | $15631. | 14. | 14. | 10. | 2716. | 49746. |
| | 7 | $16920. | 15. | 14. | 11. | 2800. | 54042. |
| 90000. | 0 | $10017. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $ 9901. | 9. | 11. | 8. | 222[illegible]. | 28054. |
| | 2 | $10413. | 10. | 12. | 9. | 2336. | 32491. |
| | 3 | $11629. | 11. | 12. | 9. | 2440. | 36546. |
| | 4 | $13014. | 12. | 13. | 9. | 2540. | 41161. |
| | 5 | $14224. | 13. | 13. | 10. | 2628. | 45194. |
| | 6 | $15514. | 14. | 14. | 10. | 2712. | 49496. |
| | 7 | $16805. | 15. | 14. | 10. | 2792. | 53799. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

APPROXIMATE DIKING COSTS AND AREAS

16-INCH DREDGE (450. CU. YDS. PER HOUR, 20 HRS. PER DAY)
ABOVE LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $14718. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| | 2 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| | 3 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| | 4 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| | 5 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| | 6 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| | 7 | $ 5458. | 4. | 7. | 5. | 1468. | 8840.* |
| 7500. | 0 | $ 9325. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| | 2 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| | 3 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| | 4 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| | 5 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| | 6 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| | 7 | $ 7129. | 5. | 8. | 6. | 1676. | 12762.* |
| 10000. | 0 | $ 7375. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $13077. | 6. | 9. | 6. | 1784. | 15204. |
| | 2 | $ 8345. | 7. | 9. | 7. | 1844. | 16712.* |
| | 3 | $ 8345. | 7. | 9. | 7. | 1844. | 16712.* |
| | 4 | $ 8345. | 7. | 9. | 7. | 1844. | 16712.* |
| | 5 | $ 8345. | 7. | 9. | 7. | 1844. | 16712.* |
| | 6 | $ 8345. | 7. | 9. | 7. | 1844. | 16712.* |
| | 7 | $ 8345. | 7. | 9. | 7. | 1844. | 16712.* |
| 12500. | 0 | $ 6534. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $11956. | 6. | 9. | 7. | 1808. | 15774. |
| | 2 | $ 9043. | 8. | 10. | 7. | 1976. | 20292.* |
| | 3 | $ 9043. | 8. | 10. | 7. | 1976. | 20292.* |
| | 4 | $ 9043. | 8. | 10. | 7. | 1976. | 20292.* |
| | 5 | $ 9043. | 8. | 10. | 7. | 1976. | 20292.* |
| | 6 | $ 9043. | 8. | 10. | 7. | 1976. | 20292.* |
| | 7 | $ 9043. | 8. | 10. | 7. | 1976. | 20292.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 6195. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $11328. | 6. | 9. | 7. | 1832. | 16358. |
| | 2 | $ 9361. | 8. | 11. | 8. | 2100. | 24043.* |
| | 3 | $ 9361. | 8. | 11. | 8. | 2100. | 24043.* |
| | 4 | $ 9361. | 8. | 11. | 8. | 2100. | 24043.* |
| | 5 | $ 9361. | 8. | 11. | 8. | 2100. | 24043.* |
| | 6 | $ 9361. | 8. | 11. | 8. | 2100. | 24043.* |
| | 7 | $ 9361. | 8. | 11. | 8. | 2100. | 24043.* |
| 17500. | 0 | $ 6061. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $10923. | 7. | 9. | 7. | 1852. | 16836. |
| | 2 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| | 3 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| | 4 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| | 5 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| | 6 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| | 7 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| 20000. | 0 | $ 6090. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $10717. | 7. | 9. | 7. | 1876. | 17563. |
| | 2 | $11338. | 10. | 11. | 8. | 2240. | 28734. |
| | 3 | $ 9361. | 10. | 12. | 8. | 2304. | 31204.* |
| | 4 | $ 9361. | 10. | 12. | 8. | 2304. | 31204.* |
| | 5 | $ 9361. | 10. | 12. | 8. | 2304. | 31204.* |
| | 6 | $ 9361. | 10. | 12. | 8. | 2304. | 31204.* |
| | 7 | $ 9361. | 10. | 12. | 8. | 2304. | 31204.* |
| 22500. | 0 | $ 6196. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $10545. | 7. | 9. | 7. | 1896. | 18064. |
| | 2 | $10995. | 10. | 11. | 8. | 2252. | 29253. |
| | 3 | $10372. | 11. | 12. | 9. | 2392. | 34573.* |
| | 4 | $10372. | 11. | 12. | 9. | 2392. | 34573.* |
| | 5 | $10372. | 11. | 12. | 9. | 2392. | 34573.* |
| | 6 | $10372. | 11. | 12. | 9. | 2392. | 34573.* |
| | 7 | $10372. | 11. | 12. | 9. | 2392. | 34573.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 6307. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $10454. | 7. | 10. | 7. | 1920. | 18702. |
| | 2 | $10707. | 10. | 11. | 8. | 2268. | 29775. |
| | 3 | $11455. | 12. | 12. | 9. | 2476. | 38182.* |
| | 4 | $11455. | 12. | 12. | 9. | 2476. | 38182.* |
| | 5 | $11455. | 12. | 12. | 9. | 2476. | 38182.* |
| | 6 | $11455. | 12. | 12. | 9. | 2476. | 38182.* |
| | 7 | $11455. | 12. | 12. | 9. | 2476. | 38182.* |
| 27500. | 0 | $ 6500. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $10375. | 7. | 10. | 7. | 1940. | 19224. |
| | 2 | $10593. | 10. | 11. | 8. | 2280. | 30307. |
| | 3 | $13849. | 12. | 13. | 9. | 2540. | 41161. |
| | 4 | $12477. | 12. | 13. | 10. | 2552. | 41590.* |
| | 5 | $12477. | 12. | 13. | 10. | 2552. | 41590.* |
| | 6 | $12477. | 12. | 13. | 10. | 2552. | 41590.* |
| | 7 | $12477. | 12. | 13. | 10. | 2552. | 41590.* |
| 30000. | 0 | $ 6701. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $10322. | 7. | 10. | 7. | 1960. | 19755. |
| | 2 | $10612. | 10. | 11. | 8. | 2296. | 30841. |
| | 3 | $13770. | 12. | 13. | 10. | 2548. | 41369. |
| | 4 | $13488. | 13. | 13. | 10. | 2624. | 44960.* |
| | 5 | $13488. | 13. | 13. | 10. | 2624. | 44960.* |
| | 6 | $13488. | 13. | 13. | 10. | 2624. | 44960.* |
| | 7 | $13488. | 13. | 13. | 10. | 2624. | 44960.* |
| 32500. | 0 | $ 6886. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $10285. | 8. | 10. | 7. | 1980. | 20296. |
| | 2 | $10658. | 10. | 12. | 8. | 2308. | 31386. |
| | 3 | $13853. | 12. | 13. | 10. | 2560. | 42035. |
| | 4 | $14557. | 14. | 13. | 10. | 2692. | 48523.* |
| | 5 | $14557. | 14. | 13. | 10. | 2692. | 48523.* |
| | 6 | $14557. | 14. | 13. | 10. | 2692. | 48523.* |
| | 7 | $14557. | 14. | 13. | 10. | 2692. | 48523.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 7097. | 5. | 8. | 5. | 1528. | 9897. |
| | 1 | $10276. | 8. | 10. | 7. | 2000. | 20981. |
| | 2 | $10723. | 10. | 12. | 9. | 2324. | 31932. |
| | 3 | $13817. | 13. | 13. | 10. | 2568. | 42246. |
| | 4 | $15521. | 14. | 14. | 10. | 2756. | 51736.* |
| | 5 | $15521. | 14. | 14. | 10. | 2756. | 51736.* |
| | 6 | $15521. | 14. | 14. | 10. | 2756. | 51736.* |
| | 7 | $15521. | 14. | 14. | 10. | 2756. | 51736.* |
| 40000. | 0 | $ 7478. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $10236. | 8. | 10. | 7. | 2040. | 22116. |
| | 2 | $10844. | 11. | 12. | 9. | 2348. | 32860. |
| | 3 | $14067. | 13. | 13. | 10. | 2592. | 43603. |
| | 4 | $17205. | 15. | 14. | 10. | 2796. | 54063. |
| | 5 | $17496. | 16. | 14. | 11. | 2876. | 58320.* |
| | 6 | $17496. | 16. | 14. | 11. | 2876. | 58320.* |
| | 7 | $17496. | 16. | 14. | 11. | 2876. | 58320.* |
| 45000. | 0 | $ 7883. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $10198. | 8. | 10. | 8. | 2076. | 23289. |
| | 2 | $11066. | 11. | 12. | 9. | 2376. | 33998. |
| | 3 | $14220. | 13. | 13. | 10. | 2612. | 44509. |
| | 4 | $17319. | 15. | 14. | 11. | 2812. | 54839. |
| | 5 | $21932. | 17. | 15. | 11. | 2988. | 65162.* |
| | 6 | $21932. | 17. | 15. | 11. | 2988. | 65162.* |
| | 7 | $21932. | 17. | 15. | 11. | 2988. | 65162.* |
| 50000. | 0 | $ 8261. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $10142. | 9. | 11. | 8. | 2112. | 24349. |
| | 2 | $11322. | 11. | 12. | 9. | 2404. | 35162. |
| | 3 | $14402. | 13. | 13. | 10. | 2632. | 45429. |
| | 4 | $17460. | 15. | 14. | 11. | 2828. | 55624. |
| | 5 | $23411. | 17. | 15. | 11. | 3000. | 66068. |
| | 6 | $27150. | 18. | 15. | 12. | 3088. | 71555.* |
| | 7 | $27150. | 18. | 15. | 12. | 3088. | 71555.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 8567. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $10067. | 9. | 11. | 8. | 2148. | 25598. |
| | 2 | $11543. | 11. | 12. | 9. | 2428. | 36150. |
| | 3 | $14606. | 13. | 13. | 10. | 2652. | 46360. |
| | 4 | $17710. | 15. | 14. | 11. | 2844. | 56710. |
| | 5 | $24036. | 17. | 15. | 11. | 3016. | 66952. |
| | 6 | $32754. | 19. | 16. | 12. | 3168. | 77034. |
| | 7 | $32975. | 19. | 16. | 12. | 3184. | 78013.* |
| 60000. | 0 | $ 8860. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $ 9966. | 9. | 11. | 8. | 2184. | 26726. |
| | 2 | $11844. | 11. | 12. | 9. | 2456. | 37363. |
| | 3 | $14827. | 14. | 13. | 10. | 2672. | 47305. |
| | 4 | $17889. | 15. | 14. | 11. | 2860. | 57511. |
| | 5 | $24691. | 17. | 15. | 11. | 3032. | 67845. |
| | 6 | $33645. | 19. | 16. | 12. | 3180. | 78049. |
| | 7 | $39416. | 20. | 16. | 12. | 3272. | 84526.* |
| 65000. | 0 | $ 9129. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $ 9833. | 9. | 11. | 8. | 2216. | 27886. |
| | 2 | $12101. | 12. | 12. | 9. | 2480. | 38391. |
| | 3 | $15140. | 14. | 13. | 10. | 2692. | 48523. |
| | 4 | $18163. | 16. | 14. | 11. | 2880. | 58599. |
| | 5 | $25397. | 17. | 15. | 11. | 3044. | 68775. |
| | 6 | $34204. | 19. | 16. | 12. | 3192. | 78693. |
| | 7 | $44554. | 21. | 17. | 13. | 3328. | 88817. |
| 70000. | 0 | $ 9343. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $ 9665. | 10. | 11. | 8. | 2248. | 29079. |
| | 2 | $12371. | 12. | 13. | 9. | 2504. | 39439. |
| | 3 | $15388. | 14. | 14. | 10. | 2712. | 49496. |
| | 4 | $18456. | 16. | 14. | 11. | 2896. | 59724. |
| | 5 | $26105. | 18. | 15. | 12. | 3060. | 69684. |
| | 6 | $35150. | 19. | 16. | 12. | 3204. | 79723. |
| | 7 | $45276. | 21. | 17. | 13. | 3340. | 89516. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9504. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $ 9593. | 10. | 11. | 8. | 2280. | 30307. |
| | 2 | $12653. | 12. | 13. | 9. | 2528. | 40505. |
| | 3 | $15646. | 14. | 14. | 10. | 2732. | 50481. |
| | 4 | $19012. | 16. | 15. | 11. | 2912. | 60552. |
| | 5 | $26863. | 18. | 15. | 12. | 3072. | 70631. |
| | 6 | $35747. | 19. | 16. | 12. | 3216. | 80375. |
| | 7 | $45553. | 21. | 17. | 13. | 3348. | 90264. |
| 80000. | 0 | $ 9634. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $ 9883. | 10. | 12. | 9. | 2312. | 31382. |
| | 2 | $12945. | 12. | 13. | 10. | 2552. | 41590. |
| | 3 | $15912. | 14. | 14. | 10. | 2752. | 51480. |
| | 4 | $19579. | 16. | 15. | 11. | 2928. | 61389. |
| | 5 | $27618. | 18. | 15. | 12. | 3088. | 71555. |
| | 6 | $36742. | 20. | 16. | 12. | 3228. | 81420. |
| | 7 | $46143. | 21. | 17. | 13. | 3360. | 90971. |
| 85000. | 0 | $ 9724. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $10185. | 10. | 12. | 9. | 2340. | 32485. |
| | 2 | $13248. | 13. | 13. | 10. | 2576. | 42694. |
| | 3 | $16187. | 15. | 14. | 10. | 2772. | 52401. |
| | 4 | $20398. | 16. | 15. | 11. | 2944. | 62550. |
| | 5 | $28424. | 18. | 16. | 12. | 3100. | 72521. |
| | 6 | $37724. | 20. | 16. | 12. | 3244. | 82433. |
| | 7 | $47123. | 21. | 17. | 13. | 3372. | 92106. |
| 90000. | 0 | $ 9765. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $10555. | 11. | 12. | 9. | 2372. | 33805. |
| | 2 | $13559. | 13. | 13. | 10. | 2600. | 43818. |
| | 3 | $16553. | 15. | 14. | 10. | 2792. | 53799. |
| | 4 | $21229. | 17. | 15. | 11. | 2964. | 63609. |
| | 5 | $29224. | 18. | 16. | 12. | 3116. | 73460. |
| | 6 | $38773. | 20. | 16. | 12. | 3256. | 83496. |
| | 7 | $48126. | 21. | 17. | 13. | 3384. | 93251. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

## APPROXIMATE DIKING COSTS AND AREAS

16-INCH DREDGE (450. CU. YDS. PER HOUR, 20 HRS. PER DAY)
BELOW LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $14718. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 2 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 3 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 4 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 5 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 6 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 7 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| 7500. | 0 | $ 9325. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 2 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 3 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 4 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 5 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 6 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| | 7 | $ 5495. | 4. | 7. | 5. | 1472. | 8917.* |
| 10000. | 0 | $ 7375. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $11250. | 5. | 8. | 6. | 1548. | 10243. |
| | 2 | $ 6450. | 5. | 8. | 6. | 1588. | 11036.* |
| | 3 | $ 6450. | 5. | 8. | 6. | 1588. | 11036.* |
| | 4 | $ 6450. | 5. | 8. | 6. | 1588. | 11036.* |
| | 5 | $ 6450. | 5. | 8. | 6. | 1588. | 11036.* |
| | 6 | $ 6450. | 5. | 8. | 6. | 1588. | 11036.* |
| | 7 | $ 6450. | 5. | 8. | 6. | 1588. | 11036.* |
| 12500. | 0 | $ 6534. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $10079. | 5. | 8. | 6. | 1560. | 10499. |
| | 2 | $ 7165. | 5. | 8. | 6. | 1680. | 12861.* |
| | 3 | $ 7165. | 5. | 8. | 6. | 1680. | 12861.* |
| | 4 | $ 7165. | 5. | 8. | 6. | 1680. | 12861.* |
| | 5 | $ 7165. | 5. | 8. | 6. | 1680. | 12861.* |
| | 6 | $ 7165. | 5. | 8. | 6. | 1680. | 12861.* |
| | 7 | $ 7165. | 5. | 8. | 6. | 1680. | 12861.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 6195. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $ 9373. | 5. | 8. | 6. | 1572. | 10683. |
| | 2 | $ 7768. | 6. | 9. | 6. | 1760. | 14648.* |
| | 3 | $ 7768. | 6. | 9. | 6. | 1760. | 14648.* |
| | 4 | $ 7768. | 6. | 9. | 6. | 1760. | 14648.* |
| | 5 | $ 7768. | 6. | 9. | 6. | 1760. | 14648.* |
| | 6 | $ 7768. | 6. | 9. | 6. | 1760. | 14648.* |
| | 7 | $ 7768. | 6. | 9. | 6. | 1760. | 14648.* |
| 17500. | 0 | $ 6061. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $ 8960. | 5. | 8. | 6. | 1584. | 10947. |
| | 2 | $ 8223. | 6. | 9. | 7. | 1824. | 16236.* |
| | 3 | $ 8223. | 6. | 9. | 7. | 1824. | 16236.* |
| | 4 | $ 8223. | 6. | 9. | 7. | 1824. | 16236.* |
| | 5 | $ 8223. | 6. | 9. | 7. | 1824. | 16236.* |
| | 6 | $ 8223. | 6. | 9. | 7. | 1824. | 16236.* |
| | 7 | $ 8223. | 6. | 9. | 7. | 1824. | 16236.* |
| 20000. | 0 | $ 6090. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $ 8701. | 5. | 8. | 6. | 1600. | 11225. |
| | 2 | $10487. | 7. | 9. | 7. | 1840. | 16593. |
| | 3 | $ 8546. | 7. | 9. | 7. | 1880. | 17568.* |
| | 4 | $ 8546. | 7. | 9. | 7. | 1880. | 17568.* |
| | 5 | $ 8546. | 7. | 9. | 7. | 1880. | 17568.* |
| | 6 | $ 8546. | 7. | 9. | 7. | 1880. | 17568.* |
| | 7 | $ 8546. | 7. | 9. | 7. | 1880. | 17568.* |
| 22500. | 0 | $ 6196. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $ 8569. | 5. | 8. | 6. | 1616. | 11590. |
| | 2 | $10206. | 7. | 9. | 7. | 1840. | 16593. |
| | 3 | $ 8804. | 7. | 10. | 7. | 1924. | 18830.* |
| | 4 | $ 8804. | 7. | 10. | 7. | 1924. | 18830.* |
| | 5 | $ 8804. | 7. | 10. | 7. | 1924. | 18830.* |
| | 6 | $ 8804. | 7. | 10. | 7. | 1924. | 18830.* |
| | 7 | $ 8804. | 7. | 10. | 7. | 1924. | 18830.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 6307. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $ 8503. | 5. | 8. | 6. | 1636. | 11973. |
| | 2 | $10018. | 7. | 9. | 7. | 1844. | 16712. |
| | 3 | $ 9023. | 7. | 10. | 7. | 1972. | 20157.* |
| | 4 | $ 9023. | 7. | 10. | 7. | 1972. | 20157.* |
| | 5 | $ 9023. | 7. | 10. | 7. | 1972. | 20157.* |
| | 6 | $ 9023. | 7. | 10. | 7. | 1972. | 20157.* |
| | 7 | $ 9023. | 7. | 10. | 7. | 1972. | 20157.* |
| 27500. | 0 | $ 6500. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $ 8480. | 5. | 8. | 6. | 1656. | 12363. |
| | 2 | $ 9874. | 7. | 9. | 7. | 1848. | 16831. |
| | 3 | $10633. | 8. | 10. | 7. | 2000. | 20981. |
| | 4 | $ 9150. | 8. | 10. | 7. | 2008. | 21123.* |
| | 5 | $ 9150. | 8. | 10. | 7. | 2008. | 21123.* |
| | 6 | $ 9150. | 8. | 10. | 7. | 2008. | 21123.* |
| | 7 | $ 9150. | 8. | 10. | 7. | 2008. | 21123.* |
| 30000. | 0 | $ 6701. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $ 8452. | 5. | 8. | 6. | 1672. | 12664. |
| | 2 | $ 9735. | 7. | 9. | 7. | 1852. | 16836. |
| | 3 | $10475. | 8. | 10. | 7. | 1996. | 20843. |
| | 4 | $ 9250. | 8. | 10. | 7. | 2040. | 22116.* |
| | 5 | $ 9250. | 8. | 10. | 7. | 2040. | 22116.* |
| | 6 | $ 9250. | 8. | 10. | 7. | 2040. | 22116.* |
| | 7 | $ 9250. | 8. | 10. | 7. | 2040. | 22116.* |
| 32500. | 0 | $ 6886. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $ 8515. | 6. | 8. | 6. | 1692. | 13161. |
| | 2 | $ 9646. | 7. | 9. | 7. | 1856. | 16956. |
| | 3 | $10358. | 8. | 10. | 7. | 1996. | 20843. |
| | 4 | $ 9323. | 8. | 10. | 8. | 2072. | 23140.* |
| | 5 | $ 9323. | 8. | 10. | 8. | 2072. | 23140.* |
| | 6 | $ 9323. | 8. | 10. | 8. | 2072. | 23140.* |
| | 7 | $ 9323. | 8. | 10. | 8. | 2072. | 23140.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 7097. | 5. | 8. | 5. | 1528. | 9897. |
| | 1 | $ 8561. | 6. | 9. | 6. | 1712. | 13577. |
| | 2 | $ 9605. | 7. | 9. | 7. | 1864. | 17196. |
| | 3 | $10242. | 8. | 10. | 7. | 1992. | 20705. |
| | 4 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 5 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 6 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| | 7 | $ 9351. | 8. | 10. | 8. | 2092. | 23739.* |
| 40000. | 0 | $ 7478. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $ 8684. | 6. | 9. | 6. | 1748. | 14426. |
| | 2 | $ 9533. | 7. | 9. | 7. | 1880. | 17568. |
| | 3 | $10085. | 8. | 10. | 7. | 1992. | 20705. |
| | 4 | $10343. | 8. | 10. | 8. | 2096. | 23890. |
| | 5 | $ 9375. | 9. | 11. | 8. | 2136. | 25125.* |
| | 6 | $ 9375. | 9. | 11. | 8. | 2136. | 25125.* |
| | 7 | $ 9375. | 9. | 11. | 8. | 2136. | 25125.* |
| 45000. | 0 | $ 7883. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $ 8835. | 6. | 9. | 6. | 1788. | 15316. |
| | 2 | $ 9546. | 7. | 10. | 7. | 1900. | 18189. |
| | 3 | $ 9983. | 8. | 10. | 7. | 1996. | 20843. |
| | 4 | $10212. | 8. | 10. | 8. | 2088. | 23589. |
| | 5 | $ 9346. | 9. | 11. | 8. | 2172. | 26401.* |
| | 6 | $ 9352. | 9. | 11. | 8. | 2168. | 26239.* |
| | 7 | $ 9352. | 9. | 11. | 8. | 2168. | 26239.* |
| 50000. | 0 | $ 8261. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $ 8996. | 6. | 9. | 7. | 1824. | 16236. |
| | 2 | $ 9553. | 7. | 10. | 7. | 1920. | 18702. |
| | 3 | $ 9922. | 8. | 10. | 7. | 2004. | 21121. |
| | 4 | $10111. | 8. | 10. | 8. | 2080. | 23438. |
| | 5 | $10135. | 9. | 11. | 8. | 2156. | 25918. |
| | 6 | $ 9312. | 9. | 11. | 8. | 2192. | 27054.* |
| | 7 | $ 9312. | 9. | 11. | 8. | 2192. | 27054.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 8567. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $ 9131. | 7. | 9. | 7. | 1860. | 17076. |
| | 2 | $ 9572. | 7. | 10. | 7. | 1940. | 19224. |
| | 3 | $ 9863. | 8. | 10. | 7. | 2012. | 21262. |
| | 4 | $10036. | 8. | 10. | 8. | 2080. | 23438. |
| | 5 | $10070. | 9. | 11. | 8. | 2144. | 25440. |
| | 6 | $ 9975. | 9. | 11. | 8. | 2204. | 27552. |
| | 7 | $ 9264. | 9. | 11. | 8. | 2208. | 27720.* |
| 60000. | 0 | $ 8860. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $ 9289. | 7. | 9. | 7. | 1896. | 18064. |
| | 2 | $ 9598. | 7. | 10. | 7. | 1960. | 19755. |
| | 3 | $ 9831. | 8. | 10. | 7. | 2020. | 21544. |
| | 4 | $ 9974. | 8. | 10. | 8. | 2080. | 23438. |
| | 5 | $10010. | 9. | 11. | 8. | 2132. | 25125. |
| | 6 | $ 9966. | 9. | 11. | 8. | 2184. | 26726. |
| | 7 | $ 9250. | 9. | 11. | 8. | 2216. | 27886.* |
| 65000. | 0 | $ 9129. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $ 9412. | 7. | 10. | 7. | 1932. | 18964. |
| | 2 | $ 9645. | 8. | 10. | 7. | 1984. | 20431. |
| | 3 | $ 9821. | 8. | 10. | 7. | 2036. | 21972. |
| | 4 | $ 9922. | 8. | 10. | 8. | 2084. | 23439. |
| | 5 | $ 9958. | 9. | 11. | 8. | 2128. | 24968. |
| | 6 | $ 9929. | 9. | 11. | 8. | 2172. | 26401. |
| | 7 | $ 9833. | 9. | 11. | 8. | 2216. | 27886. |
| 70000. | 0 | $ 9343. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $ 9542. | 7. | 10. | 7. | 1968. | 20022. |
| | 2 | $ 9689. | 8. | 10. | 7. | 2008. | 21123. |
| | 3 | $ 9813. | 8. | 10. | 7. | 2048. | 22405. |
| | 4 | $ 9878. | 8. | 10. | 8. | 2084. | 23439. |
| | 5 | $ 9914. | 9. | 11. | 8. | 2124. | 24812. |
| | 6 | $ 9902. | 9. | 11. | 8. | 2160. | 25917. |
| | 7 | $ 9851. | 9. | 11. | 8. | 2192. | 27054. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9504. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $ 9634. | 8. | 10. | 7. | 2000. | 20981. |
| | 2 | $ 9725. | 8. | 10. | 7. | 2032. | 21830. |
| | 3 | $ 9797. | 8. | 10. | 8. | 2060. | 22698. |
| | 4 | $ 9852. | 8. | 10. | 8. | 2092. | 23739. |
| | 5 | $ 9874. | 9. | 11. | 8. | 2120. | 24657. |
| | 6 | $ 9871. | 9. | 11. | 8. | 2148. | 25598. |
| | 7 | $ 9840. | 9. | 11. | 8. | 2176. | 26563. |
| 80000. | 0 | $ 9634. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $ 9692. | 8. | 10. | 7. | 2032. | 21830. |
| | 2 | $ 9753. | 8. | 10. | 8. | 2056. | 22552. |
| | 3 | $ 9799. | 8. | 10. | 8. | 2076. | 23289. |
| | 4 | $ 9825. | 8. | 10. | 8. | 2096. | 23890. |
| | 5 | $ 9841. | 9. | 11. | 8. | 2120. | 24657. |
| | 6 | $ 9842. | 9. | 11. | 8. | 2140. | 25282. |
| | 7 | $ 9831. | 9. | 11. | 8. | 2160. | 25917. |
| 85000. | 0 | $ 9724. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $ 9745. | 8. | 10. | 8. | 2064. | 22844. |
| | 2 | $ 9778. | 8. | 10. | 8. | 2080. | 23438. |
| | 3 | $ 9790. | 8. | 10. | 8. | 2092. | 23739. |
| | 4 | $ 9805. | 9. | 11. | 8. | 2108. | 24196. |
| | 5 | $ 9812. | 9. | 11. | 8. | 2120. | 24657. |
| | 6 | $ 9814. | 9. | 11. | 8. | 2132. | 25125. |
| | 7 | $ 9811. | 9. | 11. | 8. | 2144. | 25440. |
| 90000. | 0 | $ 9765. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $ 9770. | 8. | 10. | 8. | 2096. | 23890. |
| | 2 | $ 9779. | 8. | 11. | 8. | 2104. | 24195. |
| | 3 | $ 9779. | 9. | 11. | 8. | 2108. | 24196. |
| | 4 | $ 9785. | 9. | 11. | 8. | 2116. | 24503. |
| | 5 | $ 9787. | 9. | 11. | 8. | 2120. | 24657. |
| | 6 | $ 9789. | 9. | 11. | 8. | 2128. | 24968. |
| | 7 | $ 9788. | 9. | 11. | 8. | 2132. | 25125. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

## APPROXIMATE DIKING COSTS AND AREAS

12-INCH DREDGE (200. CU. YDS. PER HOUR, 20 HRS. PER DAY)
ABOVE LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $ 3745. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 6988. | 4. | 7. | 5. | 1344. | 6946. |
| | 2 | $ 5152. | 4. | 7. | 5. | 1428. | 8220.* |
| | 3 | $ 5152. | 4. | 7. | 5. | 1428. | 8220.* |
| | 4 | $ 5152. | 4. | 7. | 5. | 1428. | 8220.* |
| | 5 | $ 5152. | 4. | 7. | 5. | 1428. | 8220.* |
| | 6 | $ 5152. | 4. | 7. | 5. | 1428. | 8220.* |
| | 7 | $ 5152. | 4. | 7. | 5. | 1428. | 8220.* |
| 7500. | 0 | $ 3269. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 6286. | 4. | 7. | 5. | 1380. | 7491. |
| | 2 | $ 6718. | 5. | 8. | 6. | 1624. | 11692.* |
| | 3 | $ 6718. | 5. | 8. | 6. | 1624. | 11692.* |
| | 4 | $ 6718. | 5. | 8. | 6. | 1624. | 11692.* |
| | 5 | $ 6718. | 5. | 8. | 6. | 1624. | 11692.* |
| | 6 | $ 6718. | 5. | 8. | 6. | 1624. | 11692.* |
| | 7 | $ 6718. | 5. | 8. | 6. | 1624. | 11692.* |
| 10000. | 0 | $ 3306. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $ 6114. | 4. | 7. | 5. | 1416. | 8004. |
| | 2 | $ 8201. | 5. | 8. | 6. | 1676. | 12762. |
| | 3 | $ 7870. | 6. | 9. | 6. | 1776. | 14983.* |
| | 4 | $ 7870. | 6. | 9. | 6. | 1776. | 14983.* |
| | 5 | $ 7870. | 6. | 9. | 6. | 1776. | 14983.* |
| | 6 | $ 7870. | 6. | 9. | 6. | 1776. | 14983.* |
| | 7 | $ 7870. | 6. | 9. | 6. | 1776. | 14983.* |
| 12500. | 0 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $ 6171. | 4. | 7. | 5. | 1452. | 8602. |
| | 2 | $ 8138. | 6. | 8. | 6. | 1696. | 13262. |
| | 3 | $ 9403. | 7. | 9. | 7. | 1884. | 17691. |
| | 4 | $ 8680. | 7. | 10. | 7. | 1904. | 18194.* |
| | 5 | $ 8680. | 7. | 10. | 7. | 1904. | 18194.* |
| | 6 | $ 8680. | 7. | 10. | 7. | 1904. | 18194.* |
| | 7 | $ 8680. | 7. | 10. | 7. | 1904. | 18194.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

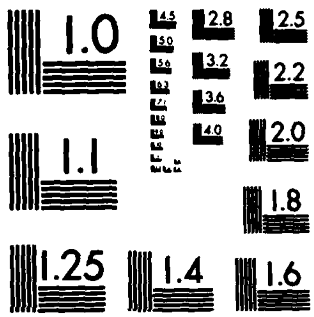
| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $ 6320. | 4. | 7. | 5. | 1488. | 9229. |
| | 2 | $ 8163. | 6. | 9. | 6. | 1720. | 13784. |
| | 3 | $ 9354. | 7. | 10. | 7. | 1900. | 18189. |
| | 4 | $ 9181. | 8. | 10. | 7. | 2016. | 21403.* |
| | 5 | $ 9181. | 8. | 10. | 7. | 2016. | 21403.* |
| | 6 | $ 9181. | 8. | 10. | 7. | 2016. | 21403.* |
| | 7 | $ 9181. | 8. | 10. | 7. | 2016. | 21403.* |
| 17500. | 0 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $ 6448. | 5. | 8. | 5. | 1520. | 9733. |
| | 2 | $ 8198. | 6. | 9. | 6. | 1740. | 14212. |
| | 3 | $ 9325. | 7. | 10. | 7. | 1916. | 18574. |
| | 4 | $ 9865. | 8. | 10. | 8. | 2060. | 22698. |
| | 5 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 6 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| | 7 | $ 9369. | 9. | 11. | 8. | 2112. | 24349.* |
| 20000. | 0 | $ 4409. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $ 6637. | 5. | 8. | 6. | 1552. | 10328. |
| | 2 | $ 8293. | 6. | 9. | 6. | 1764. | 14757. |
| | 3 | $ 9320. | 7. | 10. | 7. | 1932. | 18964. |
| | 4 | $ 9815. | 8. | 10. | 8. | 2072. | 23140. |
| | 5 | $ 9290. | 9. | 11. | 8. | 2200. | 27385.* |
| | 6 | $ 9290. | 9. | 11. | 8. | 2200. | 27385.* |
| | 7 | $ 9290. | 9. | 11. | 8. | 2200. | 27385.* |
| 22500. | 0 | $ 4737. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $ 6845. | 5. | 8. | 6. | 1584. | 10947. |
| | 2 | $ 8368. | 6. | 9. | 6. | 1784. | 15204. |
| | 3 | $ 9351. | 7. | 10. | 7. | 1948. | 19486. |
| | 4 | $ 9778. | 8. | 10. | 8. | 2088. | 23589. |
| | 5 | $ 9697. | 9. | 11. | 8. | 2212. | 27718. |
| | 6 | $ 9092. | 10. | 11. | 8. | 2280. | 30307.* |
| | 7 | $ 9092. | 10. | 11. | 8. | 2280. | 30307.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

AD-A127 094 GREAT I STUDY OF THE UPPER MISSISSIPPI RIVER TECHNICAL APPENDIXES VOLUME 8 CHANNEL MAINTENANCE PART I NARRATIVE(U) GREAT RIVER ENVIRONMENTAL ACTION TEAM SEP 80 4/4

UNCLASSIFIED F/G 13/2 NL

END
DATE
FILMED
5-83
DTIC




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 5020. | 4. | 7. | 5. | 1564. | 7221. |
| | 1 | $ 7064. | 5. | 8. | 6. | 1616. | 11590. |
| | 2 | $ 8484. | 6. | 9. | 7. | 1808. | 15774. |
| | 3 | $ 9369. | 7. | 10. | 7. | 1964. | 19888. |
| | 4 | $ 9747. | 8. | 11. | 8. | 2100. | 24043. |
| | 5 | $ 9621. | 9. | 11. | 8. | 2220. | 28058. |
| | 6 | $10021. | 10. | 12. | 9. | 2328. | 32117. |
| | 7 | $ 9915. | 11. | 12. | 9. | 2352. | 33049.* |
| 27500. | 0 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $ 7252. | 5. | 8. | 6. | 1644. | 12163. |
| | 2 | $ 8573. | 6. | 9. | 7. | 1828. | 16241. |
| | 3 | $ 9392. | 8. | 10. | 7. | 1980. | 20296. |
| | 4 | $ 9717. | 9. | 11. | 8. | 2112. | 24349. |
| | 5 | $ 9533. | 10. | 11. | 8. | 2232. | 28565. |
| | 6 | $10096. | 10. | 12. | 9. | 2336. | 32491. |
| | 7 | $10725. | 11. | 12. | 9. | 2420. | 35750.* |
| 30000. | 0 | $ 5659. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $ 7410. | 5. | 8. | 6. | 1672. | 12664. |
| | 2 | $ 8693. | 7. | 9. | 7. | 1852. | 16836. |
| | 3 | $ 9433. | 8. | 10. | 7. | 1996. | 20843. |
| | 4 | $ 9692. | 9. | 11. | 8. | 2124. | 24812. |
| | 5 | $ 9484. | 10. | 11. | 8. | 2240. | 28734. |
| | 6 | $10119. | 10. | 12. | 9. | 2344. | 32672. |
| | 7 | $11282. | 11. | 12. | 9. | 2440. | 36546. |
| 32500. | 0 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $ 7603. | 6. | 9. | 6. | 1700. | 13270. |
| | 2 | $ 8810. | 7. | 9. | 7. | 1872. | 17440. |
| | 3 | $ 9457. | 8. | 10. | 7. | 2012. | 21262. |
| | 4 | $ 9666. | 9. | 11. | 8. | 2140. | 25282. |
| | 5 | $ 9396. | 10. | 11. | 8. | 2252. | 29253. |
| | 6 | $10263. | 11. | 12. | 9. | 2356. | 33239. |
| | 7 | $11378. | 11. | 12. | 9. | 2448. | 36953. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 6223. | 5. | 8. | 5. | 1528. | 9897. |
| | 1 | $ 7795. | 6. | 9. | 6. | 1728. | 13896. |
| | 2 | $ 8897. | 7. | 9. | 7. | 1892. | 17939. |
| | 3 | $ 9494. | 8. | 10. | 7. | 2028. | 21828. |
| | 4 | $ 9636. | 9. | 11. | 8. | 2152. | 25758. |
| | 5 | $ 9328. | 10. | 11. | 8. | 2264. | 29600. |
| | 6 | $10297. | 11. | 12. | 9. | 2364. | 33423. |
| | 7 | $11479. | 11. | 12. | 9. | 2456. | 37363. |
| 40000. | 0 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $ 8138. | 6. | 9. | 6. | 1780. | 15094. |
| | 2 | $ 9063. | 7. | 10. | 7. | 1932. | 18964. |
| | 3 | $ 9540. | 8. | 10. | 8. | 2064. | 22844. |
| | 4 | $ 9565. | 9. | 11. | 8. | 2180. | 26727. |
| | 5 | $ 9380. | 10. | 11. | 8. | 2284. | 30486. |
| | 6 | $10550. | 11. | 12. | 9. | 2384. | 34385. |
| | 7 | $11627. | 12. | 12. | 9. | 2472. | 37974. |
| 45000. | 0 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $ 8432. | 6. | 9. | 7. | 1828. | 16241. |
| | 2 | $ 9231. | 7. | 10. | 7. | 1972. | 20157. |
| | 3 | $ 9564. | 8. | 10. | 8. | 2096. | 23890. |
| | 4 | $ 9471. | 9. | 11. | 8. | 2208. | 27720. |
| | 5 | $ 9623. | 10. | 12. | 8. | 2308. | 31386. |
| | 6 | $10697. | 11. | 1[illegible]. | 9. | 2400. | 34965. |
| | 7 | $11851. | 12. | 12. | 9. | 2488. | 38813. |
| 50000. | 0 | $ 7674. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $ 8731. | 7. | 9. | 7. | 1876. | 17563. |
| | 2 | $ 9351. | 8. | 10. | 7. | 2012. | 21262. |
| | 3 | $ 9561. | 9. | 11. | 8. | 2128. | 24968. |
| | 4 | $ 9370. | 10. | 11. | 8. | 2232. | 28565. |
| | 5 | $ 9877. | 10. | 12. | 9. | 2332. | 32304. |
| | 6 | $10911. | 11. | 12. | 9. | 2420. | 35750. |
| | 7 | $12018. | 12. | 13. | 9. | 2504. | 39439. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 8038. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $ 8948. | 7. | 10. | 7. | 1920. | 18702. |
| | 2 | $ 9442. | 8. | 10. | 7. | 2048. | 22405. |
| | 3 | $ 9531. | 9. | 11. | 8. | 2160. | 25917. |
| | 4 | $ 9226. | 10. | 11. | 8. | 2260. | 29603. |
| | 5 | $10140. | 11. | 12. | 9. | 2356. | 33239. |
| | 6 | $11132. | 11. | 12. | 9. | 2440. | 36546. |
| | 7 | $12190. | 12. | 13. | 9. | 2520. | 40072. |
| 60000. | 0 | $ 8378. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $ 9137. | 7. | 10. | 7. | 1964. | 19888. |
| | 2 | $ 9492. | 8. | 10. | 8. | 2084. | 23439. |
| | 3 | $ 9475. | 9. | 11. | 8. | 2188. | 26889. |
| | 4 | $ 9298. | 10. | 11. | 8. | 2288. | 30482. |
| | 5 | $10353. | 11. | 12. | 9. | 2376. | 33998. |
| | 6 | $11425. | 12. | 12. | 9. | 2460. | 37569. |
| | 7 | $12502. | 12. | 13. | 9. | 2540. | 41161. |
| 65000. | 0 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $ 9291. | 8. | 10. | 7. | 2004. | 21121. |
| | 2 | $ 9515. | 9. | 11. | 8. | 2120. | 24657. |
| | 3 | $ 9377. | 9. | 11. | 8. | 2220. | 28054. |
| | 4 | $ 9556. | 10. | 12. | 9. | 2312. | 31382. |
| | 5 | $10631. | 11. | 12. | 9. | 2400. | 34965. |
| | 6 | $11722. | 12. | 12. | 9. | 2484. | 38602. |
| | 7 | $12685. | 12. | 13. | 10. | 2556. | 41812. |
| 70000. | 0 | $ 8935. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $ 9394. | 8. | 10. | 7. | 2044. | 22260. |
| | 2 | $ 9498. | 9. | 11. | 8. | 2152. | 25758. |
| | 3 | $ 9257. | 10. | 11. | 8. | 2248. | 29079. |
| | 4 | $ 9877. | 10. | 12. | 9. | 2340. | 32485. |
| | 5 | $10916. | 11. | 12. | 9. | 2424. | 35950. |
| | 6 | $11963. | 12. | 13. | 9. | 2504. | 39439. |
| | 7 | $12940. | 13. | 13. | 10. | 2576. | 42694. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9126. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $ 9361. | 8. | 10. | 8. | 2084. | 23438. |
| | 2 | $ 9453. | 9. | 11. | 8. | 2184. | 26726. |
| | 3 | $ 9214. | 10. | 11. | 8. | 2280. | 30307. |
| | 4 | $10149. | 11. | 12. | 9. | 2364. | 33423. |
| | 5 | $11208. | 11. | 12. | 9. | 2448. | 36953. |
| | 6 | $12209. | 12. | 13. | 9. | 2524. | 40288. |
| | 7 | $13199. | 13. | 13. | 10. | 2596. | 43589. |
| 80000. | 0 | $ 9260. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $ 9486. | 9. | 11. | 8. | 2116. | 24503. |
| | 2 | $ 9365. | 9. | 11. | 8. | 2216. | 27886. |
| | 3 | $ 9532. | 10. | 12. | 8. | 2308. | 31386. |
| | 4 | $10086. | 11. | 12. | 9. | 2392. | 34573. |
| | 5 | $11440. | 12. | 12. | 9. | 2468. | 37767. |
| | 6 | $12059. | 12. | 13. | 10. | 2544. | 41150. |
| | 7 | $13467. | 13. | 13. | 10. | 2612. | 44509. |
| 85000. | 0 | $ 9393. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $ 9479. | 9. | 11. | 8. | 2152. | 25758. |
| | 2 | $ 9233. | 10. | 11. | 8. | 2248. | 29079. |
| | 3 | $ 9855. | 10. | 12. | 9. | 2336. | 32491. |
| | 4 | $10773. | 11. | 12. | 9. | 2416. | 35551. |
| | 5 | $11748. | 12. | 12. | 9. | 2492. | 38803. |
| | 6 | $12785. | 12. | 13. | 10. | 2564. | 42258. |
| | 7 | $13736. | 13. | 13. | 10. | 2632. | 45429. |
| 90000. | 0 | $ 9453. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $ 9423. | 9. | 11. | 8. | 2188. | 26889. |
| | 2 | $ 9194. | 10. | 11. | 8. | 2280. | 30307. |
| | 3 | $10128. | 11. | 12. | 9. | 2364. | 33423. |
| | 4 | $11065. | 11. | 12. | 9. | 2440. | 36546. |
| | 5 | $12127. | 12. | 13. | 9. | 2516. | 40083. |
| | 6 | $13045. | 13. | 13. | 10. | 2584. | 43147. |
| | 7 | $13938. | 13. | 13. | 10. | 2648. | 46123. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

APPROXIMATE DIKING COSTS AND AREAS

12-INCH DREDGE (200. CU. YDS. PER HOUR, 20 HRS. PER DAY)
BELOW LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $ 3745. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 4434. | 2. | 5. | 3. | 952. | 2724. |
| | 2 | $ 2071. | 2. | 5. | 3. | 976. | 2934.* |
| | 3 | $ 2071. | 2. | 5. | 3. | 976. | 2934.* |
| | 4 | $ 2071. | 2. | 5. | 3. | 976. | 2934.* |
| | 5 | $ 2071. | 2. | 5. | 3. | 976. | 2934.* |
| | 6 | $ 2071. | 2. | 5. | 3. | 976. | 2934.* |
| | 7 | $ 2071. | 2. | 5. | 3. | 976. | 2934.* |
| 7500. | 0 | $ 3269. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 3388. | 2. | 5. | 3. | 940. | 2644. |
| | 2 | $ 1955. | 2. | 5. | 3. | 956. | 2758.* |
| | 3 | $ 1955. | 2. | 5. | 3. | 956. | 2758.* |
| | 4 | $ 1955. | 2. | 5. | 3. | 956. | 2758.* |
| | 5 | $ 1955. | 2. | 5. | 3. | 956. | 2758.* |
| | 6 | $ 1955. | 2. | 5. | 3. | 956. | 2758.* |
| | 7 | $ 1955. | 2. | 5. | 3. | 956. | 2758.* |
| 10000. | 0 | $ 3306. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| | 2 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| | 3 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| | 4 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| | 5 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| | 6 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| | 7 | $ 3281. | 2. | 5. | 4. | 1004. | 3143. |
| 12500. | 0 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 2 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 3 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 4 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 5 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 6 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |
| | 7 | $ 3505. | 2. | 5. | 4. | 1084. | 3867. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 2 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 3 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 4 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 5 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 6 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| | 7 | $ 3797. | 3. | 6. | 4. | 1152. | 4582. |
| 17500. | 0 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 2 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 3 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 4 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 5 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 6 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| | 7 | $ 4083. | 3. | 6. | 4. | 1212. | 5233. |
| 20000. | 0 | $ 4409. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| | 2 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| | 3 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| | 4 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| | 5 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| | 6 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| | 7 | $ 4376. | 3. | 6. | 4. | 1264. | 5868. |
| 22500. | 0 | $ 4737. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |
| | 2 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |
| | 3 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |
| | 4 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |
| | 5 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |
| | 6 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |
| | 7 | $ 4703. | 3. | 7. | 5. | 1316. | 6553. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 2 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 3 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 4 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 5 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 6 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| | 7 | $ 5020. | 4. | 7. | 5. | 1364. | 7221. |
| 27500. | 0 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 2 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 3 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 4 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 5 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 6 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| | 7 | $ 5348. | 4. | 7. | 5. | 1408. | 7921. |
| 30000. | 0 | $ 5659. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| | 2 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| | 3 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| | 4 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| | 5 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| | 6 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| | 7 | $ 5622. | 4. | 7. | 5. | 1448. | 8527. |
| 32500. | 0 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 2 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 3 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 4 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 5 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | 6 | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |
| | * | $ 5936. | 4. | 7. | 5. | 1488. | 9229. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 6223. | 5. | 8. | 5. | 1528. | 9897. |
| | 1 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| | 2 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| | 3 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| | 4 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| | 5 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| | 6 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| | 7 | $ 6186. | 5. | 8. | 5. | 1524. | 9815. |
| 40000. | 0 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 2 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 3 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 4 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 5 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 6 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| | 7 | $ 6726. | 5. | 8. | 6. | 1596. | 11135. |
| 45000. | 0 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 2 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 3 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 4 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 5 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 6 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| | 7 | $ 7224. | 5. | 8. | 6. | 1660. | 12460. |
| 50000. | 0 | $ 7674. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |
| | 2 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |
| | 3 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |
| | 4 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |
| | 5 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |
| | 6 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |
| | 7 | $ 7639. | 6. | 9. | 6. | 1716. | 13680. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 8038. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| | 2 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| | 3 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| | 4 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| | 5 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| | 6 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| | 7 | $ 8036. | 6. | 9. | 6. | 1772. | 14977. |
| 60000. | 0 | $ 8378. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| | 2 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| | 3 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| | 4 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| | 5 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| | 6 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| | 7 | $ 8377. | 6. | 9. | 7. | 1824. | 16236. |
| 65000. | 0 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 2 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 3 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 4 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 5 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 6 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| | 7 | $ 8687. | 7. | 9. | 7. | 1876. | 17563. |
| 70000. | 0 | $ 8935. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |
| | 2 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |
| | 3 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |
| | 4 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |
| | 5 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |
| | 6 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |
| | 7 | $ 8911. | 7. | 10. | 7. | 1920. | 18702. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9126. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| | 2 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| | 3 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| | 4 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| | 5 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| | 6 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| | 7 | $ 9105. | 7. | 10. | 7. | 1964. | 19888. |
| 80000. | 0 | $ 9280. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| | 2 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| | 3 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| | 4 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| | 5 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| | 6 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| | 7 | $ 9264. | 8. | 10. | 7. | 2008. | 21123. |
| 85000. | 0 | $ 9393. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| | 2 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| | 3 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| | 4 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| | 5 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| | 6 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| | 7 | $ 9382. | 8. | 10. | 7. | 2048. | 22405. |
| 90000. | 0 | $ 9453. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |
| | 2 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |
| | 3 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |
| | 4 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |
| | 5 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |
| | 6 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |
| | 7 | $ 9447. | 8. | 10. | 8. | 2088. | 23589. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

# APPROXIMATE DIKING COSTS AND AREAS

12-INCH DREDGE (275. CU. YDS. PER HOUR, 20 HRS. PER DAY)
REHANDLING MATERIAL FROM DUMP SCOWS
ABOVE LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $ 5052. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| | 2 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| | 3 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| | 4 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| | 5 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| | 6 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| | 7 | $ 5304. | 4. | 7. | 5. | 1448. | 8527.* |
| 7500. | 0 | $ 3999. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 8113. | 4. | 8. | 5. | 1516. | 9723. |
| | 2 | $ 6943. | 5. | 8. | 6. | 1652. | 12267.* |
| | 3 | $ 6943. | 5. | 8. | 6. | 1652. | 12267.* |
| | 4 | $ 6943. | 5. | 8. | 6. | 1652. | 12267.* |
| | 5 | $ 6943. | 5. | 8. | 6. | 1652. | 12267.* |
| | 6 | $ 6943. | 5. | 8. | 6. | 1652. | 12267.* |
| | 7 | $ 6943. | 5. | 8. | 6. | 1652. | 12267.* |
| 10000. | 0 | $ 3800. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $ 7675. | 5. | 8. | 6. | 1548. | 10243. |
| | 2 | $ 8098. | 6. | 9. | 7. | 1808. | 15774.* |
| | 3 | $ 8098. | 6. | 9. | 7. | 1808. | 15774.* |
| | 4 | $ 8098. | 6. | 9. | 7. | 1808. | 15774.* |
| | 5 | $ 8098. | 6. | 9. | 7. | 1808. | 15774.* |
| | 6 | $ 8098. | 6. | 9. | 7. | 1808. | 15774.* |
| | 7 | $ 8098. | 6. | 9. | 7. | 1808. | 15774.* |
| 12500. | 0 | $ 3875. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $ 7537. | 5. | 8. | 6. | 1576. | 10770. |
| | 2 | $ 9745. | 7. | 9. | 7. | 1876. | 17563. |
| | 3 | $ 8897. | 7. | 10. | 7. | 1944. | 19355.* |
| | 4 | $ 8897. | 7. | 10. | 7. | 1944. | 19355.* |
| | 5 | $ 8897. | 7. | 10. | 7. | 1944. | 19355.* |
| | 6 | $ 8897. | 7. | 10. | 7. | 1944. | 19355.* |
| | 7 | $ 8897. | 7. | 10. | 7. | 1944. | 19355.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 4091. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $ 7573. | 5. | 8. | 6. | 1608. | 11406. |
| | 2 | $ 9623. | 7. | 9. | 7. | 1896. | 18064. |
| | 3 | $ 9285. | 8. | 10. | 8. | 2056. | 22552.* |
| | 4 | $ 9285. | 8. | 10. | 8. | 2056. | 22552.* |
| | 5 | $ 9285. | 8. | 10. | 8. | 2056. | 22552.* |
| | 6 | $ 9285. | 8. | 10. | 8. | 2056. | 22552.* |
| | 7 | $ 9285. | 8. | 10. | 8. | 2056. | 22552.* |
| 17500. | 0 | $ 4326. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $ 7642. | 5. | 8. | 6. | 1636. | 11973. |
| | 2 | $ 9543. | 7. | 10. | 7. | 1912. | 18446. |
| | 3 | $10187. | 9. | 11. | 8. | 2124. | 24812. |
| | 4 | $ 9362. | 9. | 11. | 8. | 2160. | 25917.* |
| | 5 | $ 9362. | 9. | 11. | 8. | 2160. | 25917.* |
| | 6 | $ 9362. | 9. | 11. | 8. | 2160. | 25917.* |
| | 7 | $ 9362. | 9. | 11. | 8. | 2160. | 25917.* |
| 20000. | 0 | $ 4617. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $ 7752. | 5. | 8. | 6. | 1664. | 12558. |
| | 2 | $ 9527. | 7. | 10. | 7. | 1932. | 18964. |
| | 3 | $10073. | 9. | 11. | 8. | 2140. | 25282. |
| | 4 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 5 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 6 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| | 7 | $ 9104. | 10. | 11. | 8. | 2252. | 29253.* |
| 22500. | 0 | $ 4918. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $ 7885. | 6. | 8. | 6. | 1692. | 13161. |
| | 2 | $ 9553. | 7. | 10. | 7. | 1952. | 19619. |
| | 3 | $ 9979. | 9. | 11. | 8. | 2152. | 25758. |
| | 4 | $10137. | 10. | 12. | 9. | 2320. | 31748. |
| | 5 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| | 6 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |
| | 7 | $ 9747. | 10. | 12. | 9. | 2336. | 32491.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $ 7998. | 6. | 9. | 6. | 1716. | 13680. |
| | 2 | $ 9549. | 7. | 10. | 7. | 1968. | 20022. |
| | 3 | $ 9903. | 9. | 11. | 8. | 2164. | 26077. |
| | 4 | $10237. | 10. | 12. | 9. | 2332. | 32304. |
| | 5 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 6 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| | 7 | $10665. | 11. | 12. | 9. | 2416. | 35551.* |
| 27500. | 0 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $ 8155. | 6. | 9. | 6. | 1744. | 14318. |
| | 2 | $ 9572. | 8. | 10. | 7. | 1988. | 20568. |
| | 3 | $ 9822. | 9. | 11. | 8. | 2180. | 26727. |
| | 4 | $10293. | 10. | 12. | 9. | 2344. | 32672. |
| | 5 | $11644. | 12. | 12. | 9. | 2488. | 38813.* |
| | 6 | $11644. | 12. | 12. | 9. | 2488. | 38813.* |
| | 7 | $11644. | 12. | 12. | 9. | 2488. | 38813.* |
| 30000. | 0 | $ 5788. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $ 8282. | 6. | 9. | 6. | 1768. | 14866. |
| | 2 | $ 9596. | 8. | 10. | 7. | 2004. | 21121. |
| | 3 | $ 9759. | 9. | 11. | 8. | 2192. | 27054. |
| | 4 | $10362. | 11. | 12. | 9. | 2352. | 33049. |
| | 5 | $12151. | 12. | 12. | 9. | 2496. | 39014. |
| | 6 | $12544. | 12. | 13. | 10. | 2556. | 41812.* |
| | 7 | $12544. | 12. | 13. | 10. | 2556. | 41812.* |
| 32500. | 0 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $ 8411. | 6. | 9. | 6. | 1792. | 15428. |
| | 2 | $ 9620. | 8. | 10. | 7. | 2024. | 21685. |
| | 3 | $ 9674. | 9. | 11. | 8. | 2208. | 27720. |
| | 4 | $10437. | 11. | 12. | 9. | 2364. | 33423. |
| | 5 | $12306. | 12. | 13. | 9. | 2508. | 39653. |
| | 6 | $13418. | 13. | 13. | 10. | 2620. | 44728.* |
| | 7 | $13418. | 13. | 13. | 10. | 2620. | 44728.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | | $ 6332. | 5. | 8. | 5. | 1528. | 9807. |
| | 1 | $ 8540. | 6. | 9. | 7. | 1816. | 16004. |
| | 2 | $ 9629. | 8. | 10. | 7. | 2040. | 22116. |
| | 3 | $ 9614. | 9. | 11. | 8. | 2220. | 28054. |
| | 4 | $10578. | 11. | 12. | 9. | 2376. | 33998. |
| | 5 | $12404. | 12. | 13. | 9. | 2516. | 40083. |
| | 6 | $14149. | 13. | 13. | 10. | 2640. | 45901. |
| | 7 | $14337. | 14. | 13. | 10. | 2680. | 47789.* |
| 40000. | 0 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $ 8790. | 7. | 9. | 7. | 1864. | 17196. |
| | 2 | $ 9659. | 8. | 10. | 8. | 2076. | 23289. |
| | 3 | $ 9454. | 10. | 11. | 8. | 2248. | 29079. |
| | 4 | $10818. | 11. | 12. | 9. | 2400. | 34965. |
| | 5 | $12545. | 12. | 13. | 9. | 2532. | 40723. |
| | 6 | $14236. | 13. | 13. | 10. | 2652. | 46360. |
| | 7 | $16304. | 14. | 14. | 10. | 2764. | 52252. |
| 45000. | 0 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $ 8995. | 7. | 10. | 7. | 1908. | 18320. |
| | 2 | $ 9655. | 9. | 11. | 8. | 2108. | 24196. |
| | 3 | $ 9328. | 10. | 11. | 8. | 2276. | 30129. |
| | 4 | $11015. | 11. | 12. | 9. | 2420. | 35750. |
| | 5 | $12767. | 12. | 13. | 10. | 2552. | 41590. |
| | 6 | $14486. | 13. | 13. | 10. | 2668. | 47321. |
| | 7 | $16115. | 15. | 14. | 10. | 2776. | 52751. |
| 50000. | 0 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $ 9200. | 7. | 10. | 7. | 1952. | 19619. |
| | 2 | $ 9631. | 9. | 11. | 8. | 2144. | 25440. |
| | 3 | $ 9620. | 10. | 12. | 8. | 2304. | 31204. |
| | 4 | $11284. | 11. | 12. | 9. | 2444. | 36749. |
| | 5 | $13000. | 13. | 13. | 10. | 2572. | 42470. |
| | 6 | $14669. | 14. | 13. | 10. | 2684. | 48033. |
| | 7 | $16399. | 15. | 14. | 10. | 2792. | 53799. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 8105. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $ 9333. | 8. | 10. | 7. | 1992. | 20705. |
| | 2 | $ 9573. | 9. | 11. | 8. | 2176. | 26563. |
| | 3 | $ 9870. | 10. | 12. | 9. | 2328. | 32117. |
| | 4 | $11567. | 12. | 12. | 9. | 2464. | 37776. |
| | 5 | $13247. | 13. | 13. | 10. | 2588. | 43374. |
| | 6 | $14860. | 14. | 14. | 10. | 2700. | 48752. |
| | 7 | $16527. | 15. | 14. | 11. | 2804. | 54307. |
| 60000. | 0 | $ 8438. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $ 9438. | 8. | 10. | 7. | 2032. | 21830. |
| | 2 | $ 9478. | 9. | 11. | 8. | 2208. | 27720. |
| | 3 | $10186. | 11. | 12. | 9. | 2356. | 33239. |
| | 4 | $11858. | 12. | 12. | 9. | 2488. | 38813. |
| | 5 | $13498. | 13. | 13. | 10. | 2608. | 44278. |
| | 6 | $15213. | 14. | 14. | 10. | 2720. | 49996. |
| | 7 | $16827. | 15. | 14. | 11. | 2820. | 55376. |
| 65000. | 0 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $ 9520. | 8. | 10. | 8. | 2072. | 23140. |
| | 2 | $ 9363. | 10. | 11. | 8. | 2240. | 28734. |
| | 3 | $10454. | 11. | 12. | 9. | 2380. | 34191. |
| | 4 | $12157. | 12. | 13. | 9. | 2512. | 39868. |
| | 5 | $13755. | 13. | 13. | 10. | 2628. | 45194. |
| | 6 | $15417. | 14. | 14. | 10. | 2736. | 50734. |
| | 7 | $17046. | 15. | 14. | 11. | 2836. | 56165. |
| 70000. | 0 | $ 8986. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $ 9548. | 9. | 11. | 8. | 2108. | 24196. |
| | 2 | $ 9215. | 10. | 11. | 8. | 2268. | 29775. |
| | 3 | $10790. | 11. | 12. | 9. | 2408. | 35360. |
| | 4 | $12399. | 12. | 13. | 9. | 2532. | 40723. |
| | 5 | $14019. | 13. | 13. | 10. | 2648. | 46123. |
| | 6 | $15626. | 14. | 14. | 10. | 2752. | 51480. |
| | 7 | $17278. | 15. | 14. | 11. | 2848. | 56984. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $ 9542. | 9. | 11. | 8. | 2144. | 25440. |
| | 2 | $ 9476. | 10. | 12. | 8. | 2300. | 31022. |
| | 3 | $11075. | 11. | 12. | 9. | 2432. | 36352. |
| | 4 | $12713. | 12. | 13. | 10. | 2556. | 41812. |
| | 5 | $14366. | 13. | 13. | 10. | 2668. | 47321. |
| | 6 | $15923. | 14. | 14. | 10. | 2768. | 52511. |
| | 7 | $17506. | 15. | 14. | 11. | 2864. | 57787. |
| 80000. | 0 | $ 9324. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $ 9489. | 9. | 11. | 8. | 2180. | 26727. |
| | 2 | $ 9794. | 10. | 12. | 9. | 2328. | 32117. |
| | 3 | $11430. | 12. | 12. | 9. | 2460. | 37569. |
| | 4 | $12967. | 13. | 13. | 10. | 2576. | 42694. |
| | 5 | $14569. | 14. | 13. | 10. | 2684. | 48033. |
| | 6 | $16141. | 15. | 14. | 10. | 2784. | 53273. |
| | 7 | $17738. | 16. | 14. | 11. | 2880. | 58599. |
| 85000. | 0 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $ 9413. | 9. | 11. | 8. | 2212. | 27718. |
| | 2 | $10121. | 11. | 12. | 9. | 2356. | 33239. |
| | 3 | $11730. | 12. | 12. | 9. | 2484. | 38602. |
| | 4 | $13226. | 13. | 13. | 10. | 2596. | 43589. |
| | 5 | $14849. | 14. | 14. | 10. | 2704. | 48999. |
| | 6 | $16441. | 15. | 14. | 11. | 2804. | 54307. |
| | 7 | $18066. | 16. | 14. | 11. | 2896. | 59724. |
| 90000. | 0 | $ 9492. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $ 9266. | 10. | 11. | 8. | 2248. | 29079. |
| | 2 | $10456. | 11. | 12. | 9. | 2384. | 34385. |
| | 3 | $12037. | 12. | 13. | 9. | 2508. | 39653. |
| | 4 | $13559. | 13. | 13. | 10. | 2620. | 44728. |
| | 5 | $15134. | 14. | 14. | 10. | 2724. | 49978. |
| | 6 | $16753. | 15. | 14. | 11. | 2820. | 55376. |
| | 7 | $18449. | 16. | 15. | 11. | 2908. | 60267. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

APPROXIMATE DIKING COSTS AND AREAS

12-INCH DREDGE (275. CU. YDS. PER HOUR, 20 HRS. PER DAY)
REHANDLING MATERIAL FROM DUMP SCOWS
BELOW LAKE PEPIN
ALL AREAS ASSUMED SQUARE
AVERAGE 1978 PRICE LEVELS



| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 5000. | 0 | $ 5052. | 1. | 4. | 3. | 800. | 1716. |
| | 1 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| | 2 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| | 3 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| | 4 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| | 5 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| | 6 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| | 7 | $ 3220. | 3. | 6. | 4. | 1168. | 4743.* |
| 7500. | 0 | $ 3999. | 2. | 5. | 3. | 916. | 2469. |
| | 1 | $ 5620. | 3. | 6. | 4. | 1192. | 5010. |
| | 2 | $ 3885. | 3. | 6. | 4. | 1264. | 5868.* |
| | 3 | $ 3885. | 3. | 6. | 4. | 1264. | 5868.* |
| | 4 | $ 3885. | 3. | 6. | 4. | 1264. | 5868.* |
| | 5 | $ 3885. | 3. | 6. | 4. | 1264. | 5868.* |
| | 6 | $ 3885. | 3. | 6. | 4. | 1264. | 5868.* |
| | 7 | $ 3885. | 3. | 6. | 4. | 1264. | 5868.* |
| 10000. | 0 | $ 3800. | 2. | 5. | 4. | 1008. | 3180. |
| | 1 | $ 5010. | 3. | 6. | 4. | 1200. | 5114. |
| | 2 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 3 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 4 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 5 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 6 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 7 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| 12500. | 0 | $ 3875. | 2. | 5. | 4. | 1084. | 3867. |
| | 1 | $ 4745. | 3. | 6. | 4. | 1216. | 5286. |
| | 2 | $ 5539. | 3. | 7. | 5. | 1324. | 6678. |
| | 3 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 4 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 5 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 6 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 7 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 15000. | 0 | $ 4091. | 3. | 6. | 4. | 1152. | 4582. |
| | 1 | $ 4650. | 3. | 6. | 4. | 1236. | 5517. |
| | 2 | $ 5199. | 3. | 7. | 5. | 1308. | 6479. |
| | 3 | $ 4556. | 4. | 7. | 5. | 1352. | 7077.* |
| | 4 | $ 4556. | 4. | 7. | 5. | 1352. | 7077.* |
| | 5 | $ 4556. | 4. | 7. | 5. | 1352. | 7077.* |
| | 6 | $ 4556. | 4. | 7. | 5. | 1352. | 7077.* |
| | 7 | $ 4556. | 4. | 7. | 5. | 1352. | 7077.* |
| 17500. | 0 | $ 4326. | 3. | 6. | 4. | 1212. | 5233. |
| | 1 | $ 4690. | 3. | 6. | 4. | 1260. | 5856. |
| | 2 | $ 4973. | 3. | 7. | 5. | 1300. | 6356. |
| | 3 | $ 5263. | 4. | 7. | 5. | 1340. | 6882. |
| | 4 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 5 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 6 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| | 7 | $ 4486. | 4. | 7. | 5. | 1344. | 6946.* |
| 20000. | 0 | $ 4617. | 3. | 6. | 4. | 1268. | 5926. |
| | 1 | $ 4751. | 3. | 6. | 4. | 1284. | 6162. |
| | 2 | $ 4825. | 3. | 6. | 5. | 1296. | 6295. |
| | 3 | $ 4963. | 3. | 7. | 5. | 1312. | 6541. |
| | 4 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 5 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 6 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| | 7 | $ 4270. | 3. | 7. | 5. | 1316. | 6553.* |
| 22500. | 0 | $ 4918. | 3. | 7. | 5. | 1320. | 6615. |
| | 1 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |
| | 2 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |
| | 3 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |
| | 4 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |
| | 5 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |
| | 6 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |
| | 7 | $ 4883. | 3. | 7. | 5. | 1316. | 6553. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 25000. | 0 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 1 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 2 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 3 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 4 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 5 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 6 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| | 7 | $ 5179. | 4. | 7. | 5. | 1364. | 7221. |
| 27500. | 0 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 1 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 2 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 3 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 4 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 5 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 6 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| | 7 | $ 5491. | 4. | 7. | 5. | 1408. | 7921. |
| 30000. | 0 | $ 5788. | 4. | 7. | 5. | 1452. | 8602. |
| | 1 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| | 2 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| | 3 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| | 4 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| | 5 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| | 6 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| | 7 | $ 5752. | 4. | 7. | 5. | 1448. | 8527. |
| 32500. | 0 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 1 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 2 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 3 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 4 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 5 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 6 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |
| | 7 | $ 6054. | 4. | 7. | 5. | 1488. | 9229. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 35000. | 0 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 1 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 2 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 3 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 4 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 5 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 6 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| | 7 | $ 6332. | 5. | 8. | 5. | 1528. | 9897. |
| 40000. | 0 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 1 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 2 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 3 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 4 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 5 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 6 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| | 7 | $ 6820. | 5. | 8. | 6. | 1596. | 11135. |
| 45000. | 0 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 1 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 2 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 3 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 4 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 5 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 6 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| | 7 | $ 7306. | 5. | 8. | 6. | 1660. | 12460. |
| 50000. | 0 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 1 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 2 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 3 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 4 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 5 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 6 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |
| | 7 | $ 7747. | 6. | 9. | 6. | 1720. | 13784. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 55000. | 0 | $ 8105. | 6. | 9. | 6. | 1776. | 14983. |
| | 1 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| | 2 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| | 3 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| | 4 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| | 5 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| | 6 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| | 7 | $ 8103. | 6. | 9. | 6. | 1772. | 14977. |
| 60000. | 0 | $ 8438. | 6. | 9. | 7. | 1828. | 16241. |
| | 1 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| | 2 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| | 3 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| | 4 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| | 5 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| | 6 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| | 7 | $ 8437. | 6. | 9. | 7. | 1824. | 16236. |
| 65000. | 0 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 1 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 2 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 3 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 4 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 5 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 6 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| | 7 | $ 8742. | 7. | 9. | 7. | 1876. | 17563. |
| 70000. | 0 | $ 8986. | 7. | 10. | 7. | 1924. | 18830. |
| | 1 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |
| | 2 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |
| | 3 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |
| | 4 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |
| | 5 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |
| | 6 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |
| | 7 | $ 8962. | 7. | 10. | 7. | 1920. | 18702. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

| VOLUME DREDGED | DAYS RETENTION | COST | AREA | DEPTH OF BASIN | HEIGHT OF DIKE | LENGTH OF DIKE | EARTHWORK VOLUME |
|---|---|---|---|---|---|---|---|
| 75000. | 0 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 1 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 2 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 3 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 4 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 5 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 6 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| | 7 | $ 9173. | 7. | 10. | 7. | 1968. | 20022. |
| 80000. | 0 | $ 9324. | 8. | 10. | 7. | 2012. | 21262. |
| | 1 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| | 2 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| | 3 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| | 4 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| | 5 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| | 6 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| | 7 | $ 9308. | 8. | 10. | 7. | 2008. | 21123. |
| 85000. | 0 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 1 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 2 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 3 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 4 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 5 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 6 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| | 7 | $ 9434. | 8. | 10. | 7. | 2052. | 22550. |
| 90000. | 0 | $ 9492. | 8. | 10. | 8. | 2092. | 23739. |
| | 1 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |
| | 2 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |
| | 3 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |
| | 4 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |
| | 5 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |
| | 6 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |
| | 7 | $ 9486. | 8. | 10. | 8. | 2088. | 23589. |

* PROVIDES TOTAL CONTAINMENT OF SLURRY

# CHAPTER 17

## ESTIMATES OF BERMING COSTS

The assumption made about berming for the purpose of estimating dredging costs was that two dozers would be needed during dredging to help direct flow away from areas to be protected. Typical operation of this equipment would be two dozers intensively maintaining small dikes or berms to direct the flow or perhaps digging sink holes in the placement site which would collect slurry water.

The costs shown in the following table are for two appropriately sized dozers added to the dredge plant. The days shown in the first column are the actual days of dredging. The costs reflect total costs of adding the equipment to the fleet including mobilization and staffing. Average 1978 dollar values are used.

RENTING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| .5 | $ 419. | $ 419. | $ 303. | $ 242. |
| .6 | $ 503. | $ 503. | $ 364. | $ 290. |
| .7 | $ 587. | $ 587. | $ 424. | $ 339. |
| .8 | $ 670. | $ 670. | $ 485. | $ 387. |
| .9 | $ 754. | $ 754. | $ 545. | $ 436. |
| 1.0 | $ 838. | $ 838. | $ 606. | $ 484. |
| 1.1 | $ 922. | $ 922. | $ 667. | $ 532. |
| 1.2 | $ 1006. | $ 1006. | $ 727. | $ 581. |
| 1.3 | $ 1089. | $ 1089. | $ 788. | $ 629. |
| 1.4 | $ 1173. | $ 1173. | $ 848. | $ 678. |
| 1.5 | $ 1257. | $ 1257. | $ 909. | $ 726. |
| 1.6 | $ 1341. | $ 1341. | $ 970. | $ 774. |
| 1.7 | $ 1425. | $ 1425. | $ 1030. | $ 823. |
| 1.8 | $ 1508. | $ 1508. | $ 1091. | $ 871. |
| 1.9 | $ 1592. | $ 1592. | $ 1151. | $ 920. |
| 2.0 | $ 1676. | $ 1676. | $ 1212. | $ 968. |
| 2.1 | $ 1760. | $ 1760. | $ 1273. | $ 1016. |
| 2.2 | $ 1844. | $ 1844. | $ 1333. | $ 1065. |
| 2.3 | $ 1927. | $ 1927. | $ 1394. | $ 1113. |
| 2.4 | $ 2011. | $ 2011. | $ 1454. | $ 1162. |
| 2.5 | $ 2095. | $ 2095. | $ 1515. | $ 1210. |
| 2.6 | $ 2179. | $ 2179. | $ 1576. | $ 1258. |
| 2.7 | $ 2263. | $ 2263. | $ 1636. | $ 1307. |
| 2.8 | $ 2346. | $ 2346. | $ 1697. | $ 1355. |
| 2.9 | $ 2430. | $ 2430. | $ 1757. | $ 1404. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 3.0 | $ 2514. | $ 2514. | $ 1818. | $ 1452. |
| 3.1 | $ 2598. | $ 2598. | $ 1879. | $ 1500. |
| 3.2 | $ 2682. | $ 2682. | $ 1939. | $ 1549. |
| 3.3 | $ 2765. | $ 2765. | $ 2000. | $ 1597. |
| 3.4 | $ 2849. | $ 2849. | $ 2060. | $ 1646. |
| 3.5 | $ 2933. | $ 2933. | $ 2121. | $ 1694. |
| 3.6 | $ 3017. | $ 3017. | $ 2182. | $ 1742. |
| 3.7 | $ 3101. | $ 3101. | $ 2242. | $ 1791. |
| 3.8 | $ 3184. | $ 3184. | $ 2303. | $ 1839. |
| 3.9 | $ 3268. | $ 3268. | $ 2363. | $ 1888. |
| 4.0 | $ 3352. | $ 3352. | $ 2424. | $ 1936. |
| 4.1 | $ 3436. | $ 3436. | $ 2485. | $ 1984. |
| 4.2 | $ 3520. | $ 3520. | $ 2545. | $ 2033. |
| 4.3 | $ 3603. | $ 3603. | $ 2606. | $ 2081. |
| 4.4 | $ 3687. | $ 3687. | $ 2666. | $ 2130. |
| 4.5 | $ 3771. | $ 3771. | $ 2727. | $ 2178. |
| 4.6 | $ 3855. | $ 3855. | $ 2788. | $ 2226. |
| 4.7 | $ 3939. | $ 3939. | $ 2848. | $ 2275. |
| 4.8 | $ 4022. | $ 4022. | $ 2909. | $ 2323. |
| 4.9 | $ 4106. | $ 4106. | $ 2969. | $ 2372. |
| 5.0 | $ 4190. | $ 4190. | $ 3030. | $ 2420. |
| 5.1 | $ 4274. | $ 4274. | $ 3091. | $ 2468. |
| 5.2 | $ 4358. | $ 4358. | $ 3151. | $ 2517. |
| 5.3 | $ 4441. | $ 4441. | $ 3212. | $ 2565. |
| 5.4 | $ 4525. | $ 4525. | $ 3272. | $ 2614. |

PERMITTING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 5.5 | $ 4609. | $ 4609. | $ 3333. | $ 2662. |
| 5.6 | $ 4693. | $ 4693. | $ 3394. | $ 2710. |
| 5.7 | $ 4777. | $ 4777. | $ 3454. | $ 2759. |
| 5.8 | $ 4860. | $ 4860. | $ 3515. | $ 2807. |
| 5.9 | $ 4944. | $ 4944. | $ 3575. | $ 2856. |
| 6.0 | $ 5028. | $ 5028. | $ 3636. | $ 2904. |
| 6.1 | $ 5112. | $ 5112. | $ 3697. | $ 2952. |
| 6.2 | $ 5196. | $ 5196. | $ 3757. | $ 3001. |
| 6.3 | $ 5279. | $ 5279. | $ 3818. | $ 3049. |
| 6.4 | $ 5363. | $ 5363. | $ 3878. | $ 3098. |
| 6.5 | $ 5447. | $ 5447. | $ 3939. | $ 3146. |
| 6.6 | $ 5531. | $ 5531. | $ 4000. | $ 3194. |
| 6.7 | $ 5615. | $ 5615. | $ 4060. | $ 3243. |
| 6.8 | $ 5698. | $ 5698. | $ 4121. | $ 3291. |
| 6.9 | $ 5782. | $ 5782. | $ 4181. | $ 3340. |
| 7.0 | $ 5866. | $ 5866. | $ 4242. | $ 3388. |
| 7.1 | $ 5950. | $ 5950. | $ 4303. | $ 3436. |
| 7.2 | $ 6034. | $ 6034. | $ 4363. | $ 3485. |
| 7.3 | $ 6117. | $ 6117. | $ 4424. | $ 3533. |
| 7.4 | $ 6201. | $ 6201. | $ 4484. | $ 3582. |
| 7.5 | $ 6285. | $ 6285. | $ 4545. | $ 3630. |
| 7.6 | $ 6369. | $ 6369. | $ 4606. | $ 3678. |
| 7.7 | $ 6453. | $ 6453. | $ 4666. | $ 3727. |
| 7.8 | $ 6536. | $ 6536. | $ 4727. | $ 3775. |
| 7.9 | $ 6620. | $ 6620. | $ 4787. | $ 3824. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 8.0 | $ 6704. | $ 6704. | $ 4848. | $ 3872. |
| 8.1 | $ 6788. | $ 6788. | $ 4909. | $ 3920. |
| 8.2 | $ 6872. | $ 6872. | $ 4969. | $ 3969. |
| 8.3 | $ 6955. | $ 6955. | $ 5030. | $ 4017. |
| 8.4 | $ 7039. | $ 7039. | $ 5090. | $ 4066. |
| 8.5 | $ 7123. | $ 7123. | $ 5151. | $ 4114. |
| 8.6 | $ 7207. | $ 7207. | $ 5212. | $ 4162. |
| 8.7 | $ 7291. | $ 7291. | $ 5272. | $ 4211. |
| 8.8 | $ 7374. | $ 7374. | $ 5333. | $ 4259. |
| 8.9 | $ 7458. | $ 7458. | $ 5393. | $ 4308. |
| 9.0 | $ 7542. | $ 7542. | $ 5454. | $ 4356. |
| 9.1 | $ 7626. | $ 7626. | $ 5515. | $ 4404. |
| 9.2 | $ 7710. | $ 7710. | $ 5575. | $ 4453. |
| 9.3 | $ 7793. | $ 7793. | $ 5636. | $ 4501. |
| 9.4 | $ 7877. | $ 7877. | $ 5696. | $ 4550. |
| 9.5 | $ 7961. | $ 7961. | $ 5757. | $ 4598. |
| 9.6 | $ 8045. | $ 8045. | $ 5818. | $ 4646. |
| 9.7 | $ 8129. | $ 8129. | $ 5878. | $ 4695. |
| 9.8 | $ 8212. | $ 8212. | $ 5939. | $ 4743. |
| 9.9 | $ 8296. | $ 8296. | $ 5999. | $ 4792. |
| 10.0 | $ 8380. | $ 8380. | $ 6060. | $ 4840. |
| 10.1 | $ 8464. | $ 8464. | $ 6121. | $ 4888. |
| 10.2 | $ 8548. | $ 8548. | $ 6181. | $ 4937. |
| 10.3 | $ 8631. | $ 8631. | $ 6242. | $ 4985. |
| 10.4 | $ 8715. | $ 8715. | $ 6302. | $ 5034. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 10.5 | $ 8799. | $ 8799. | $ 6363. | $ 5082. |
| 10.6 | $ 8883. | $ 8883. | $ 6424. | $ 5130. |
| 10.7 | $ 8967. | $ 8967. | $ 6484. | $ 5179. |
| 10.8 | $ 9050. | $ 9050. | $ 6545. | $ 5227. |
| 10.9 | $ 9134. | $ 9134. | $ 6605. | $ 5276. |
| 11.0 | $ 9218. | $ 9218. | $ 6666. | $ 5324. |
| 11.1 | $ 9302. | $ 9302. | $ 6727. | $ 5372. |
| 11.2 | $ 9386. | $ 9386. | $ 6787. | $ 5421. |
| 11.3 | $ 9469. | $ 9469. | $ 6848. | $ 5469. |
| 11.4 | $ 9553. | $ 9553. | $ 6908. | $ 5518. |
| 11.5 | $ 9637. | $ 9637. | $ 6969. | $ 5566. |
| 11.6 | $ 9721. | $ 9721. | $ 7030. | $ 5614. |
| 11.7 | $ 9805. | $ 9805. | $ 7090. | $ 5663. |
| 11.8 | $ 9888. | $ 9888. | $ 7151. | $ 5711. |
| 11.9 | $ 9972. | $ 9972. | $ 7211. | $ 5760. |
| 12.0 | $ 10056. | $ 10056. | $ 7272. | $ 5808. |
| 12.1 | $ 10140. | $ 10140. | $ 7333. | $ 5856. |
| 12.2 | $ 10224. | $ 10224. | $ 7393. | $ 5905. |
| 12.3 | $ 10307. | $ 10307. | $ 7454. | $ 5953. |
| 12.4 | $ 10391. | $ 10391. | $ 7514. | $ 6002. |
| 12.5 | $ 10475. | $ 10475. | $ 7575. | $ 6050. |
| 12.6 | $ 10559. | $ 10559. | $ 7636. | $ 6098. |
| 12.7 | $ 10643. | $ 10643. | $ 7696. | $ 6147. |
| 12.8 | $ 10726. | $ 10726. | $ 7757. | $ 6195. |
| 12.9 | $ 10810. | $ 10810. | $ 7817. | $ 6244. |

RENTING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 13.0 | $ 10894. | $ 10894. | $ 7878. | $ 6292. |
| 13.1 | $ 10978. | $ 10978. | $ 7939. | $ 6340. |
| 13.2 | $ 11062. | $ 11062. | $ 7999. | $ 6389. |
| 13.3 | $ 11145. | $ 11145. | $ 8060. | $ 6437. |
| 13.4 | $ 11229. | $ 11229. | $ 8120. | $ 6486. |
| 13.5 | $ 11313. | $ 11313. | $ 8181. | $ 6534. |
| 13.6 | $ 11397. | $ 11397. | $ 8242. | $ 6582. |
| 13.7 | $ 11481. | $ 11481. | $ 8302. | $ 6631. |
| 13.8 | $ 11564. | $ 11564. | $ 8363. | $ 6679. |
| 13.9 | $ 11648. | $ 11648. | $ 8423. | $ 6728. |
| 14.0 | $ 11732. | $ 11732. | $ 8484. | $ 6776. |
| 14.1 | $ 11816. | $ 11816. | $ 8545. | $ 6824. |
| 14.2 | $ 11900. | $ 11900. | $ 8605. | $ 6873. |
| 14.3 | $ 11983. | $ 11983. | $ 8666. | $ 6921. |
| 14.4 | $ 12067. | $ 12067. | $ 8726. | $ 6970. |
| 14.5 | $ 12151. | $ 12151. | $ 8787. | $ 7018. |
| 14.6 | $ 12235. | $ 12235. | $ 8848. | $ 7066. |
| 14.7 | $ 12319. | $ 12319. | $ 8908. | $ 7115. |
| 14.8 | $ 12402. | $ 12402. | $ 8969. | $ 7163. |
| 14.9 | $ 12486. | $ 12486. | $ 9029. | $ 7212. |
| 15.0 | $ 12570. | $ 12570. | $ 9090. | $ 7260. |
| 15.1 | $ 12654. | $ 12654. | $ 9151. | $ 7308. |
| 15.2 | $ 12738. | $ 12738. | $ 9211. | $ 7357. |
| 15.3 | $ 12821. | $ 12821. | $ 9272. | $ 7405. |
| 15.4 | $ 12905. | $ 12905. | $ 9332. | $ 7454. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 15.5 | $ 12989. | $ 12989. | $ 9393. | $ 7502. |
| 15.6 | $ 13073. | $ 13073. | $ 9454. | $ 7550. |
| 15.7 | $ 13157. | $ 13157. | $ 9514. | $ 7599. |
| 15.8 | $ 13240. | $ 13240. | $ 9575. | $ 7647. |
| 15.9 | $ 13324. | $ 13324. | $ 9635. | $ 7696. |
| 16.0 | $ 13408. | $ 13408. | $ 9696. | $ 7744. |
| 16.1 | $ 13492. | $ 13492. | $ 9757. | $ 7792. |
| 16.2 | $ 13576. | $ 13576. | $ 9817. | $ 7841. |
| 16.3 | $ 13659. | $ 13659. | $ 9878. | $ 7889. |
| 16.4 | $ 13743. | $ 13743. | $ 9938. | $ 7938. |
| 16.5 | $ 13827. | $ 13827. | $ 9999. | $ 7986. |
| 16.6 | $ 13911. | $ 13911. | $ 10060. | $ 8034. |
| 16.7 | $ 13995. | $ 13995. | $ 10120. | $ 8083. |
| 16.8 | $ 14078. | $ 14078. | $ 10181. | $ 8131. |
| 16.9 | $ 14162. | $ 14162. | $ 10241. | $ 8180. |
| 17.0 | $ 14246. | $ 14246. | $ 10302. | $ 8228. |
| 17.1 | $ 14330. | $ 14330. | $ 10363. | $ 8276. |
| 17.2 | $ 14414. | $ 14414. | $ 10423. | $ 8325. |
| 17.3 | $ 14497. | $ 14497. | $ 10484. | $ 8373. |
| 17.4 | $ 14581. | $ 14581. | $ 10544. | $ 8422. |
| 17.5 | $ 14665. | $ 14665. | $ 10605. | $ 8470. |
| 17.6 | $ 14749. | $ 14749. | $ 10666. | $ 8518. |
| 17.7 | $ 14833. | $ 14833. | $ 10726. | $ 8567. |
| 17.8 | $ 14916. | $ 14916. | $ 10787. | $ 8615. |
| 17.9 | $ 15000. | $ 15000. | $ 10847. | $ 8664. |

## RENTING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 18.0 | $ 15084. | $ 15084. | $ 10908. | $ 8712. |
| 18.1 | $ 15168. | $ 15168. | $ 10969. | $ 8760. |
| 18.2 | $ 15252. | $ 15252. | $ 11029. | $ 8809. |
| 18.3 | $ 15335. | $ 15335. | $ 11090. | $ 8857. |
| 18.4 | $ 15419. | $ 15419. | $ 11150. | $ 8906. |
| 18.5 | $ 15503. | $ 15503. | $ 11211. | $ 8954. |
| 18.6 | $ 15587. | $ 15587. | $ 11272. | $ 9002. |
| 18.7 | $ 15671. | $ 15671. | $ 11332. | $ 9051. |
| 18.8 | $ 15754. | $ 15754. | $ 11393. | $ 9099. |
| 18.9 | $ 15838. | $ 15838. | $ 11453. | $ 9148. |
| 19.0 | $ 15922. | $ 15922. | $ 11514. | $ 9196. |
| 19.1 | $ 16006. | $ 16006. | $ 11575. | $ 9244. |
| 19.2 | $ 16090. | $ 16090. | $ 11635. | $ 9293. |
| 19.3 | $ 16173. | $ 16173. | $ 11696. | $ 9341. |
| 19.4 | $ 16257. | $ 16257. | $ 11756. | $ 9390. |
| 19.5 | $ 16341. | $ 16341. | $ 11817. | $ 9438. |
| 19.6 | $ 16425. | $ 16425. | $ 11878. | $ 9486. |
| 19.7 | $ 16509. | $ 16509. | $ 11938. | $ 9535. |
| 19.8 | $ 16592. | $ 16592. | $ 11999. | $ 9583. |
| 19.9 | $ 16676. | $ 16676. | $ 12059. | $ 9632. |
| 20.0 | $ 16760. | $ 16760. | $ 12120. | $ 9680. |
| 20.1 | $ 16844. | $ 16844. | $ 12181. | $ 9728. |
| 20.2 | $ 16928. | $ 16928. | $ 12241. | $ 9777. |
| 20.3 | $ 17011. | $ 17011. | $ 12302. | $ 9825. |
| 20.4 | $ 17095. | $ 17095. | $ 12362. | $ 9874. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 20.5 | $ 17179. | $ 17179. | $ 12423. | $ 9922. |
| 20.6 | $ 17263. | $ 17263. | $ 12484. | $ 9970. |
| 20.7 | $ 17347. | $ 17347. | $ 12544. | $ 10019. |
| 20.8 | $ 17430. | $ 17430. | $ 12605. | $ 10067. |
| 20.9 | $ 17514. | $ 17514. | $ 12665. | $ 10116. |
| 21.0 | $ 17598. | $ 17598. | $ 12726. | $ 10164. |
| 21.1 | $ 17682. | $ 17682. | $ 12787. | $ 10212. |
| 21.2 | $ 17766. | $ 17766. | $ 12847. | $ 10261. |
| 21.3 | $ 17849. | $ 17849. | $ 12908. | $ 10309. |
| 21.4 | $ 17933. | $ 17933. | $ 12968. | $ 10358. |
| 21.5 | $ 18017. | $ 18017. | $ 13029. | $ 10406. |
| 21.6 | $ 18101. | $ 18101. | $ 13090. | $ 10454. |
| 21.7 | $ 18185. | $ 18185. | $ 13150. | $ 10503. |
| 21.8 | $ 18268. | $ 18268. | $ 13211. | $ 10551. |
| 21.9 | $ 18352. | $ 18352. | $ 13271. | $ 10600. |
| 22.0 | $ 18436. | $ 18436. | $ 13332. | $ 10648. |
| 22.1 | $ 18520. | $ 18520. | $ 13393. | $ 10696. |
| 22.2 | $ 18604. | $ 18604. | $ 13453. | $ 10745. |
| 22.3 | $ 18687. | $ 18687. | $ 13514. | $ 10793. |
| 22.4 | $ 18771. | $ 18771. | $ 13574. | $ 10842. |
| 22.5 | $ 18855. | $ 18855. | $ 13635. | $ 10890. |
| 22.6 | $ 18939. | $ 18939. | $ 13696. | $ 10938. |
| 22.7 | $ 19023. | $ 19023. | $ 13756. | $ 10987. |
| 22.8 | $ 19106. | $ 19106. | $ 13817. | $ 11035. |
| 22.9 | $ 19190. | $ 19190. | $ 13877. | $ 11084. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 23.0 | $ 19274. | $ 19274. | $ 13938. | $ 11132. |
| 23.1 | $ 19358. | $ 19358. | $ 13999. | $ 11180. |
| 23.2 | $ 19442. | $ 19442. | $ 14059. | $ 11229. |
| 23.3 | $ 19525. | $ 19525. | $ 14120. | $ 11277. |
| 23.4 | $ 19609. | $ 19609. | $ 14180. | $ 11326. |
| 23.5 | $ 19693. | $ 19693. | $ 14241. | $ 11374. |
| 23.6 | $ 19777. | $ 19777. | $ 14302. | $ 11422. |
| 23.7 | $ 19861. | $ 19861. | $ 14362. | $ 11471. |
| 23.8 | $ 19944. | $ 19944. | $ 14423. | $ 11519. |
| 23.9 | $ 20028. | $ 20028. | $ 14483. | $ 11568. |
| 24.0 | $ 20112. | $ 20112. | $ 14544. | $ 11616. |
| 24.1 | $ 20196. | $ 20196. | $ 14605. | $ 11664. |
| 24.2 | $ 20280. | $ 20280. | $ 14665. | $ 11713. |
| 24.3 | $ 20363. | $ 20363. | $ 14726. | $ 11761. |
| 24.4 | $ 20447. | $ 20447. | $ 14786. | $ 11810. |
| 24.5 | $ 20531. | $ 20531. | $ 14847. | $ 11858. |
| 24.6 | $ 20615. | $ 20615. | $ 14908. | $ 11906. |
| 24.7 | $ 20699. | $ 20699. | $ 14968. | $ 11955. |
| 24.8 | $ 20782. | $ 20782. | $ 15029. | $ 12003. |
| 24.9 | $ 20866. | $ 20866. | $ 15089. | $ 12052. |
| 25.0 | $ 20950. | $ 20950. | $ 15150. | $ 12100. |
| 25.1 | $ 21034. | $ 21034. | $ 15211. | $ 12148. |
| 25.2 | $ 21118. | $ 21118. | $ 15271. | $ 12197. |
| 25.3 | $ 21201. | $ 21201. | $ 15332. | $ 12245. |
| 25.4 | $ 21285. | $ 21285. | $ 15392. | $ 12294. |

[illegible] COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 25.5 | $ 21369. | $ 21369. | $ 15453. | $ 12342. |
| 25.6 | $ 21453. | $ 21453. | $ 15514. | $ 12390. |
| 25.7 | $ 21537. | $ 21537. | $ 15574. | $ 12439. |
| 25.8 | $ 21620. | $ 21620. | $ 15635. | $ 12487. |
| 25.9 | $ 21704. | $ 21704. | $ 15695. | $ 12536. |
| 26.0 | $ 21788. | $ 21788. | $ 15756. | $ 12584. |
| 26.1 | $ 21872. | $ 21872. | $ 15817. | $ 12632. |
| 26.2 | $ 21956. | $ 21956. | $ 15877. | $ 12681. |
| 26.3 | $ 22039. | $ 22039. | $ 15938. | $ 12729. |
| 26.4 | $ 22123. | $ 22123. | $ 15998. | $ 12778. |
| 26.5 | $ 22207. | $ 22207. | $ 16059. | $ 12826. |
| 26.6 | $ 22291. | $ 22291. | $ 16120. | $ 12874. |
| 26.7 | $ 22375. | $ 22375. | $ 16180. | $ 12923. |
| 26.8 | $ 22458. | $ 22458. | $ 16241. | $ 12971. |
| 26.9 | $ 22542. | $ 22542. | $ 16301. | $ 13020. |
| 27.0 | $ 22626. | $ 22626. | $ 16362. | $ 13068. |
| 27.1 | $ 22710. | $ 22710. | $ 16423. | $ 13116. |
| 27.2 | $ 22794. | $ 22794. | $ 16483. | $ 13165. |
| 27.3 | $ 22877. | $ 22877. | $ 16544. | $ 13213. |
| 27.4 | $ 22961. | $ 22961. | $ 16604. | $ 13262. |
| 27.5 | $ 23045. | $ 23045. | $ 16665. | $ 13310. |
| 27.6 | $ 23129. | $ 23129. | $ 16726. | $ 13358. |
| 27.7 | $ 23213. | $ 23213. | $ 16786. | $ 13407. |
| 27.8 | $ 23296. | $ 23296. | $ 16847. | $ 13455. |
| 27.9 | $ 23380. | $ 23380. | $ 16907. | $ 13504. |

BERMING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 28.0 | $ 23464. | $ 23464. | $ 16968. | $ 13552. |
| 28.1 | $ 23548. | $ 23548. | $ 17029. | $ 13600. |
| 28.2 | $ 23632. | $ 23632. | $ 17089. | $ 13649. |
| 28.3 | $ 23715. | $ 23715. | $ 17150. | $ 13697. |
| 28.4 | $ 23799. | $ 23799. | $ 17210. | $ 13746. |
| 28.5 | $ 23883. | $ 23883. | $ 17271. | $ 13794. |
| 28.6 | $ 23967. | $ 23967. | $ 17332. | $ 13842. |
| 28.7 | $ 24051. | $ 24051. | $ 17392. | $ 13891. |
| 28.8 | $ 24134. | $ 24134. | $ 17453. | $ 13939. |
| 28.9 | $ 24218. | $ 24218. | $ 17513. | $ 13988. |
| 29.0 | $ 24302. | $ 24302. | $ 17574. | $ 14036. |
| 29.1 | $ 24386. | $ 24386. | $ 17635. | $ 14084. |
| 29.2 | $ 24470. | $ 24470. | $ 17695. | $ 14133. |
| 29.3 | $ 24553. | $ 24553. | $ 17756. | $ 14181. |
| 29.4 | $ 24637. | $ 24637. | $ 17816. | $ 14230. |
| 29.5 | $ 24721. | $ 24721. | $ 17877. | $ 14278. |
| 29.6 | $ 24805. | $ 24805. | $ 17938. | $ 14326. |
| 29.7 | $ 24889. | $ 24889. | $ 17998. | $ 14375. |
| 29.8 | $ 24972. | $ 24972. | $ 18059. | $ 14423. |
| 29.9 | $ 25056. | $ 25056. | $ 18119. | $ 14472. |
| 30.0 | $ 25140. | $ 25140. | $ 18180. | $ 14520. |
| 30.1 | $ 25224. | $ 25224. | $ 18241. | $ 14568. |
| 30.2 | $ 25308. | $ 25308. | $ 18301. | $ 14617. |
| 30.3 | $ 25391. | $ 25391. | $ 18362. | $ 14665. |
| 30.4 | $ 25475. | $ 25475. | $ 18422. | $ 14714. |

RENTING COSTS FOR PIPELINE DREDGES

| DAYS | 20-IN | 16-IN | 12-IN | MUDCAT |
|---|---|---|---|---|
| 30.5 | $ 25559. | $ 25559. | $ 18483. | $ 14762. |
| 30.6 | $ 25643. | $ 25643. | $ 18544. | $ 14810. |
| 30.7 | $ 25727. | $ 25727. | $ 18604. | $ 14859. |
| 30.8 | $ 25810. | $ 25810. | $ 18665. | $ 14907. |
| 30.9 | $ 25894. | $ 25894. | $ 18725. | $ 14956. |
| 31.0 | $ 25978. | $ 25978. | $ 18786. | $ 15004. |
| 31.1 | $ 26062. | $ 26062. | $ 18847. | $ 15052. |
| 31.2 | $ 26146. | $ 26146. | $ 18907. | $ 15101. |
| 31.3 | $ 26229. | $ 26229. | $ 18968. | $ 15149. |
| 31.4 | $ 26313. | $ 26313. | $ 19028. | $ 15198. |
| 31.5 | $ 26397. | $ 26397. | $ 19089. | $ 15246. |
| 31.6 | $ 26481. | $ 26481. | $ 19150. | $ 15294. |
| 31.7 | $ 26565. | $ 26565. | $ 19210. | $ 15343. |
| 31.8 | $ 26648. | $ 26648. | $ 19271. | $ 15391. |
| 31.9 | $ 26732. | $ 26732. | $ 19331. | $ 15440. |
| 32.0 | $ 26816. | $ 26816. | $ 19392. | $ 15488. |
| 32.1 | $ 26900. | $ 26900. | $ 19453. | $ 15536. |
| 32.2 | $ 26984. | $ 26984. | $ 19513. | $ 15585. |
| 32.3 | $ 27067. | $ 27067. | $ 19574. | $ 15633. |
| 32.4 | $ 27151. | $ 27151. | $ 19634. | $ 15682. |
| 32.5 | $ 27235. | $ 27235. | $ 19695. | $ 15730. |
| 32.6 | $ 27319. | $ 27319. | $ 19756. | $ 15778. |
| 32.7 | $ 27403. | $ 27403. | $ 19816. | $ 15827. |
| 32.8 | $ 27486. | $ 27486. | $ 19877. | $ 15875. |
| 32.9 | $ 27570. | $ 27570. | $ 19937. | $ 15924. |

# CHAPTER 18

## TRUCKING COSTS

Trucking costs are the costs of moving dredged material from one on-land placement site to another using front-end loaders and trucks. The costs would be the responsibility of the Corps of Engineers when normal channel maintenance equipment could not place the material directly at an environmentally sound or large enough placement site. For example, material is trucked from site 4.49 to site 4.38 at Red Wing because the quality of the dredged material is poor at Wacouta Point and site 4.49 is too small. If a beneficial use for the material is available some distance from the original placement site, trucking costs would be estimated in the same manner. However, the user of the material would be responsible for the costs. For example, the Fish and Wildlife Service would be responsible for trucking costs to move material from site 9.15 at Genoa or site 9.37 at Blackhawk Park to the Genoa National Fish Hatchery (site 9.24).

Trucking costs have been included in CMP cost estimates where trucking would be the Corps of Engineers responsibility. If trucking is needed to provide beneficial use, trucking costs were not included. This procedure was used even when trucking material from a site for beneficial use is necessary to ensure adequate capacity of the original placement site.

Some of the assumptions made in estimating trucking costs are:

1. For small volumes trucked over short distances:

   a. One truck and driver would be used.
   b. One loader and operator would be used.
   c. No access improvements would be needed.
   d. The rate of removal of material would not be critical.

2. For large volumes trucked over long distances:

   a. A large fleet of trucks would be used.
   b. Two loaders would be used.
   c. Some maintenance of access roads would be needed.
   d. The rate of removal of material is important.

3. For frequently used sites with large volumes:

a. Loading equipment would be permanently on the site.
b. No restoration work would be done on the site.

4. For sites which are infrequently used, restoration would be required.

To use the following trucking cost tables:

1. Determine the one-way distance (up to 20 miles) dredged material would be trucked and find the sheet in the table with the corresponding distance labeled at the top.

2. Determine the total volume of material to be trucked and find the closest corresponding volume in the left column.

3. Determine the frequency of use of the placement site. To do so, determine which cuts will use the site, find that cut and placement site combination in the pool plan descriptions (see Parts II-V of this volume), and find the dredging frequency listed for that cut on page two of the three-page description. Find the corresponding frequency across the top of the table.

4. Locate the dollar figure in the frequency column at the appropriate volume line. The cost given is for doing one trucking job and is also given as a cost per cubic yard.

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 0.5 Mile

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 1.00 Mile

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 1.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| Volume | 10% $/Job | 10% $/cy | 20% $/Job | 20% $/cy | 30% $/Job | 30% $/cy | 40% $/Job | 40% $/cy | 50% $/Job | 50% $/cy | 60% $/Job | 60% $/cy | 70% $/Job | 70% $/cy | 80% $/Job | 80% $/cy | 90% $/Job | 90% $/cy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 2.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | |
|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 |

| | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 182362. | 1.92 | 182642. | [illegible] | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 2.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 3.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 3.50 Miles

<u>Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)</u>

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12850. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 4.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 4.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.45 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 20150 | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 21200 | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 5.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12050. | 2.41 | 12600. | 2.52 | 12750. | 2.55 | 10400. | 2.08 | 10550. | 2.11 | 10700. | 2.14 | 10850. | 2.17 | 11000. | 2.20 | 11150. | 2.23 |
| 10000. | 23100. | 2.31 | 23000. | 2.30 | 23250. | 2.33 | 33052. | 3.31 | 33332. | 3.33 | 33612. | 3.36 | 33892. | 3.39 | 34172. | 3.42 | 34452. | 3.[illegible]5 |
| 15000. | 33100. | 2.21 | 33500. | 2.23 | 33750. | 2.25 | 41802. | 2.79 | 42082. | 2.81 | 42362. | 2.82 | 42642. | 2.84 | 42922. | 2.86 | 43202. | 2.88 |
| 20000. | 43100. | 2.16 | 44000. | 2.20 | 44250. | 2.21 | 50552. | 2.53 | 50832. | 2.54 | 51112. | 2.56 | 51392. | 2.57 | 51672. | 2.58 | 51952. | 2.60 |
| 25000. | 53100. | 2.12 | 54500. | 2.18 | 54750. | 2.19 | 59302. | 2.37 | 59582. | 2.38 | 59862. | 2.39 | 60142. | 2.41 | 60422. | 2.42 | 60702. | 2.43 |
| 30000. | 63100. | 2.10 | 65000. | 2.17 | 65250. | 2.18 | 68052. | 2.27 | 68332. | 2.28 | 68612. | 2.29 | 68892. | 2.30 | 69172. | 2.31 | 69452. | 2.32 |
| 35000. | 73100. | 2.09 | 75500. | 2.16 | 75750. | 2.16 | 76802. | 2.19 | 77082. | 2.20 | 77362. | 2.21 | 77642. | 2.22 | 77922. | 2.23 | 78202. | 2.23 |
| 40000. | 83100. | 2.08 | 86000. | 2.15 | 86250. | 2.16 | 85552. | 2.14 | 85832. | 2.15 | 86112. | 2.15 | 86392. | 2.16 | 86672. | 2.17 | 86952. | 2.17 |
| 45000. | 93100. | 2.07 | 96500. | 2.14 | 96750. | 2.15 | 94302. | 2.10 | 94582. | 2.10 | 94862. | 2.11 | 95142. | 2.11 | 95422. | 2.12 | 95702. | 2.13 |
| 50000. | 103100. | 2.06 | 107000. | 2.14 | 107250. | 2.15 | 103052. | 2.06 | 103332. | 2.07 | 103612. | 2.07 | 103892. | 2.08 | 104172. | 2.08 | 104452. | 2.09 |
| 55000. | 113100. | 2.06 | 117500. | 2.14 | 117750. | 2.14 | 111802. | 2.03 | 112082. | 2.04 | 112362. | 2.04 | 112642. | 2.05 | 112922. | 2.05 | 113202. | 2.06 |
| 60000. | 123100. | 2.05 | 128000. | 2.13 | 128250. | 2.14 | 120552. | 2.01 | 120832. | 2.01 | 121112. | 2.02 | 121392. | 2.02 | 121672. | 2.03 | 121952. | 2.03 |
| 65000. | 133100. | 2.05 | 138500. | 2.13 | 138750. | 2.13 | 129302. | 1.99 | 129582. | 1.99 | 129862. | 2.00 | 130142. | 2.00 | 130422. | 2.01 | 130702. | 2.01 |
| 70000. | 143100. | 2.04 | 149000. | 2.13 | 149250. | 2.13 | 138052. | 1.97 | 138332. | 1.98 | 138612. | 1.98 | 138892. | 1.98 | 139172. | 1.99 | 139452. | 1.99 |
| 75000. | 153100. | 2.04 | 159500. | 2.13 | 159750. | 2.13 | 146802. | 1.96 | 147082. | 1.96 | 147362. | 1.96 | 147642. | 1.97 | 147922. | 1.97 | 148202. | 1.98 |
| 80000. | 163100. | 2.04 | 170000. | 2.13 | 170250. | 2.13 | 155552. | 1.94 | 155832. | 1.95 | 156112. | 1.95 | 156392. | 1.95 | 156672. | 1.96 | 156952. | 1.96 |
| 85000. | 173100. | 2.04 | 180500. | 2.12 | 180750. | 2.13 | 164302. | 1.93 | 164582. | 1.94 | 164862. | 1.94 | 165142. | 1.94 | 165422. | 1.95 | 165702. | 1.95 |
| 90000. | 183100. | 2.03 | 191000. | 2.12 | 191250. | 2.13 | 173052. | 1.92 | 173332. | 1.93 | 173612. | 1.93 | 173892. | 1.93 | 174172. | 1.94 | 174452. | 1.94 |
| 95000. | 193100. | 2.03 | 201500. | 2.12 | 201750. | 2.12 | 181802. | 1.91 | 182082. | 1.92 | 182362. | 1.92 | 182642. | 1.92 | 182922. | 1.93 | 183202. | 1.93 |
| 100000. | 203100. | 2.03 | 212000. | 2.12 | 212250. | 2.12 | 190552. | 1.91 | 190832. | 1.91 | 191112. | 1.91 | 191392. | 1.91 | 191672. | 1.92 | 191952. | 1.92 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 5.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12175. | 2.44 | 12725. | 2.55 | 12875. | 2.58 | 10525. | 2.11 | 10675. | 2.14 | 10825. | 2.17 | 10975. | 2.20 | 11125. | 2.23 | 11275. | 2.26 |
| 10000. | 23350. | 2.34 | 23250. | 2.33 | 23500. | 2.35 | 33302. | 3.33 | 33582. | 3.36 | 33862. | 3.39 | 34142. | 3.41 | 34422. | 3.44 | 34702. | 3.47 |
| 15000. | 33675. | 2.25 | 33875. | 2.26 | 34125. | 2.28 | 42177. | 2.81 | 42457. | 2.83 | 42737. | 2.85 | 43017. | 2.87 | 43297. | 2.89 | 43577. | 2.91 |
| 20000. | 43600. | 2.18 | 44500. | 2.23 | 44750. | 2.24 | 51052. | 2.55 | 51332. | 2.57 | 51612. | 2.58 | 51892. | 2.59 | 52172. | 2.61 | 52452. | 2.62 |
| 25000. | 53725. | 2.15 | 55125. | 2.21 | 55375. | 2.22 | 59927. | 2.40 | 60207. | 2.41 | 60487. | 2.42 | 60767. | 2.43 | 61047. | 2.44 | 61327. | 2.45 |
| 30000. | 63850. | 2.13 | 65750. | 2.19 | 66000. | 2.20 | 68802. | 2.29 | 69082. | 2.30 | 69362. | 2.31 | 69642. | 2.32 | 69922. | 2.33 | 70202. | 2.34 |
| 35000. | 73975. | 2.11 | 76375. | 2.18 | 76625. | 2.19 | 77677. | 2.22 | 77957. | 2.23 | 78237. | 2.24 | 78517. | 2.24 | 78797. | 2.25 | 79077. | 2.26 |
| 40000. | 84100. | 2.10 | 87000. | 2.18 | 87250. | 2.18 | 86552. | 2.16 | 86832. | 2.17 | 87112. | 2.18 | 87392. | 2.18 | 87672. | 2.19 | 87952. | 2.20 |
| 45000. | 94225. | 2.09 | 97625. | 2.17 | 97875. | 2.18 | 95427. | 2.12 | 95707. | 2.13 | 95987. | 2.13 | 96267. | 2.14 | 96547. | 2.15 | 96827. | 2.15 |
| 50000. | 104350. | 2.09 | 108250. | 2.17 | 108500. | 2.17 | 104302. | 2.09 | 104582. | 2.09 | 104862. | 2.10 | 105142. | 2.10 | 105422. | 2.11 | 105702. | 2.11 |
| 55000. | 114475. | 2.08 | 118875. | 2.16 | 119125. | 2.17 | 113177. | 2.06 | 113457. | 2.06 | 113737. | 2.07 | 114017. | 2.07 | 114297. | 2.08 | 114577. | 2.08 |
| 60000. | 124600. | 2.08 | 129500. | 2.16 | 129750. | 2.16 | 122052. | 2.03 | 122332. | 2.04 | 122612. | 2.04 | 122892. | 2.05 | 123172. | 2.05 | 123452. | 2.06 |
| 65000. | 134725. | 2.07 | 140125. | 2.16 | 140375. | 2.16 | 130927. | 2.01 | 131207. | 2.02 | 131487. | 2.02 | 131767. | 2.03 | 132047. | 2.03 | 132327. | 2.04 |
| 70000. | 144850. | 2.07 | 150750. | 2.15 | 151000. | 2.16 | 139802. | 2.00 | 140082. | 2.00 | 140362. | 2.01 | 140642. | 2.01 | 140922. | 2.01 | 141202. | 2.02 |
| 75000. | 154975. | 2.07 | 161375. | 2.15 | 161625. | 2.16 | 148677. | 1.98 | 148957. | 1.99 | 149237. | 1.99 | 149517. | 1.99 | 149797. | 2.00 | 150077. | 2.00 |
| 80000. | 165100. | 2.06 | 172000. | 2.15 | 172250. | 2.15 | 157552. | 1.97 | 157832. | 1.97 | 158112. | 1.98 | 158392. | 1.98 | 158672. | 1.98 | 158952. | 1.99 |
| 85000. | 175225. | 2.06 | 182625. | 2.15 | 182875. | 2.15 | 166427. | 1.96 | 166707. | 1.96 | 166987. | 1.96 | 167267. | 1.97 | 167547. | 1.97 | 167827. | 1.97 |
| 90000. | 185350. | 2.06 | 193250. | 2.15 | 193500. | 2.15 | 175302. | 1.95 | 175582. | 1.95 | 175862. | 1.95 | 176142. | 1.96 | 176422. | 1.96 | 176702. | 1.96 |
| 95000. | 195475. | 2.06 | 203875. | 2.15 | 204125. | 2.15 | 184177. | 1.94 | 184457. | 1.94 | 184737. | 1.94 | 185017. | 1.95 | 185297. | 1.95 | 185577. | 1.95 |
| 100000. | 205600. | 2.06 | 214500. | 2.15 | 214750. | 2.15 | 193052. | 1.93 | 193332. | 1.93 | 193612. | 1.94 | 193892. | 1.94 | 194172. | 1.94 | 194452. | 1.94 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 6.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12300. | 2.46 | 12850. | 2.57 | 13000. | 2.60 | 10650. | 2.13 | 10800. | 2.16 | 10950. | 2.19 | 11100. | 2.22 | 11250. | 2.25 | 11400. | 2.28 |
| 10000. | 23600. | 2.36 | 23500. | 2.35 | 23750. | 2.38 | 33552. | 3.36 | 33832. | 3.38 | 34112. | 3.41 | 34392. | 3.44 | 34672. | 3.47 | 34952. | 3.50 |
| 15000. | 33850. | 2.26 | 34250. | 2.28 | 34500. | 2.30 | 42552. | 2.84 | 42832. | 2.86 | 43112. | 2.87 | 43392. | 2.89 | 43672. | 2.91 | 43952. | 2.93 |
| 20000. | 44100. | 2.21 | 45000. | 2.25 | 45250. | 2.26 | 51552. | 2.58 | 51832. | 2.59 | 52112. | 2.61 | 52392. | 2.62 | 52672. | 2.63 | 52952. | 2.65 |
| 25000. | 54350. | 2.17 | 55750. | 2.23 | 56000. | 2.24 | 60552. | 2.42 | 60832. | 2.43 | 61112. | 2.44 | 61392. | 2.46 | 61672. | 2.47 | 61952. | 2.48 |
| 30000. | 64600. | 2.15 | 66500. | 2.22 | 66750. | 2.23 | 69552. | 2.32 | 69832. | 2.33 | 70112. | 2.34 | 70392. | 2.35 | 70672. | 2.36 | 70952. | 2.37 |
| 35000. | 74850. | 2.14 | 77250. | 2.21 | 77500. | 2.21 | 78552. | 2.24 | 78832. | 2.25 | 79112. | 2.26 | 79392. | 2.27 | 79672. | 2.28 | 79952. | 2.28 |
| 40000. | 85100. | 2.13 | 88000. | 2.20 | 88250. | 2.21 | 87552. | 2.19 | 87832. | 2.20 | 88112. | 2.20 | 88392. | 2.21 | 88672. | 2.22 | 88952. | 2.22 |
| 45000. | 95350. | 2.12 | 98750. | 2.19 | 99000. | 2.20 | 96552. | 2.15 | 96832. | 2.15 | 97112. | 2.16 | 97392. | 2.16 | 97672. | 2.17 | 97952. | 2.18 |
| 50000. | 105600. | 2.11 | 109500. | 2.19 | 109750. | 2.20 | 105552. | 2.11 | 105832. | 2.12 | 106112. | 2.12 | 106392. | 2.13 | 106672. | 2.13 | 106952. | 2.14 |
| 55000. | 115850. | 2.11 | 120250. | 2.19 | 120500. | 2.19 | 114552. | 2.08 | 114832. | 2.09 | 115112. | 2.09 | 115392. | 2.10 | 115672. | 2.10 | 115952. | 2.11 |
| 60000. | 126100. | 2.10 | 131000. | 2.18 | 131250. | 2.19 | 123552. | 2.06 | 123832. | 2.06 | 124112. | 2.07 | 124392. | 2.07 | 124672. | 2.08 | 124952. | 2.08 |
| 65000. | 136350. | 2.10 | 141750. | 2.18 | 142000. | 2.18 | 132552. | 2.04 | 132832. | 2.04 | 133112. | 2.05 | 133392. | 2.05 | 133672. | 2.06 | 133952. | 2.06 |
| 70000. | 146600. | 2.09 | 152500. | 2.18 | 152750. | 2.18 | 141552. | 2.02 | 141832. | 2.03 | 142112. | 2.03 | 142392. | 2.03 | 142672. | 2.04 | 142952. | 2.04 |
| 75000. | 156850. | 2.09 | 163250. | 2.18 | 163500. | 2.18 | 150552. | 2.01 | 150832. | 2.01 | 151112. | 2.01 | 151392. | 2.02 | 151672. | 2.02 | 151952. | 2.03 |
| 80000. | 167100. | 2.09 | 174000. | 2.18 | 174250. | 2.18 | 159552. | 1.99 | 159832. | 2.00 | 160112. | 2.00 | 160392. | 2.00 | 160672. | 2.01 | 160952. | 2.01 |
| 85000. | 177350. | 2.09 | 184750. | 2.17 | 185000. | 2.18 | 168552. | 1.98 | 168832. | 1.99 | 169112. | 1.99 | 169392. | 1.99 | 169672. | 2.00 | 169952. | 2.00 |
| 90000. | 187600. | 2.08 | 195500. | 2.17 | 195750. | 2.18 | 177552. | 1.97 | 177832. | 1.98 | 178112. | 1.98 | 178392. | 1.98 | 178672. | 1.99 | 178952. | 1.99 |
| 95000. | 197850. | 2.08 | 206250. | 2.17 | 206500. | 2.17 | 186552. | 1.96 | 186832. | 1.97 | 187112. | 1.97 | 187392. | 1.97 | 187672. | 1.98 | 187952. | 1.98 |
| 100000. | 208100. | 2.08 | 217000. | 2.17 | 217250. | 2.17 | 195552. | 1.96 | 195832. | 1.96 | 196112. | 1.96 | 196392. | 1.96 | 196672. | 1.97 | 196952. | 1.97 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 6.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12425. | 2.49 | 12975. | 2.60 | 13125. | 2.63 | 10775. | 2.16 | 10925. | 2.19 | 11075. | 2.22 | 11225. | 2.25 | 11375. | 2.28 | 11525. | 2.31 |
| 10000. | 23850. | 2.39 | 23750. | 2.38 | 24000. | 2.40 | 33802. | 3.38 | 34082. | 3.41 | 34362. | 3.44 | 34642. | 3.46 | 34922. | 3.49 | 35202. | 3.52 |
| 15000. | 34225. | 2.28 | 34625. | 2.31 | 34875. | 2.33 | 42927. | 2.86 | 43207. | 2.88 | 43487. | 2.90 | 43767. | 2.92 | 44047. | 2.94 | 44327. | 2.96 |
| 20000. | 44600. | 2.23 | 45500. | 2.28 | 45750. | 2.29 | 52052. | 2.60 | 52332. | 2.62 | 52612. | 2.63 | 52892. | 2.64 | 53172. | 2.66 | 53452. | 2.67 |
| 25000. | 54975. | 2.20 | 56375. | 2.26 | 56625. | 2.27 | 61177. | 2.45 | 61457. | 2.46 | 61737. | 2.47 | 62017. | 2.48 | 62297. | 2.49 | 62577. | 2.50 |
| 30000. | 65350. | 2.18 | 67250. | 2.24 | 67500. | 2.25 | 70302. | 2.34 | 70582. | 2.35 | 70862. | 2.36 | 71142. | 2.37 | 71422. | 2.38 | 71702. | 2.39 |
| 35000. | 75725. | 2.16 | 78125. | 2.23 | 78375. | 2.24 | 79427. | 2.27 | 79707. | 2.28 | 79987. | 2.29 | 80267. | 2.29 | 80547. | 2.30 | 80827. | 2.31 |
| 40000. | 86100. | 2.15 | 89000. | 2.23 | 89250. | 2.23 | 88552. | 2.21 | 88832. | 2.22 | 89112. | 2.23 | 89392. | 2.23 | 89672. | 2.24 | 89952. | 2.25 |
| 45000. | 96475. | 2.14 | 99875. | 2.22 | 100125. | 2.23 | 97677. | 2.17 | 97957. | 2.18 | 98237. | 2.18 | 98517. | 2.19 | 98797. | 2.20 | 99077. | 2.20 |
| 50000. | 106850. | 2.14 | 110750. | 2.22 | 111000. | 2.22 | 106802. | 2.14 | 107082. | 2.14 | 107362. | 2.15 | 107642. | 2.15 | 107922. | 2.16 | 108202. | 2.16 |
| 55000. | 117225. | 2.13 | 121625. | 2.21 | 121875. | 2.22 | 115927. | 2.11 | 116207. | 2.11 | 116487. | 2.12 | 116767. | 2.12 | 117047. | 2.13 | 117327. | 2.13 |
| 60000. | 127600. | 2.13 | 132500. | 2.21 | 132750. | 2.21 | 125052. | 2.08 | 125332. | 2.09 | 125612. | 2.09 | 125892. | 2.10 | 126172. | 2.10 | 126452. | 2.11 |
| 65000. | 137975. | 2.12 | 143375. | 2.21 | 143625. | 2.21 | 134177. | 2.06 | 134457. | 2.07 | 134737. | 2.07 | 135017. | 2.08 | 135297. | 2.08 | 135577. | 2.09 |
| 70000. | 148350. | 2.12 | 154250. | 2.20 | 154500. | 2.21 | 143302. | 2.05 | 143582. | 2.05 | 143862. | 2.06 | 144142. | 2.06 | 144422. | 2.06 | 144702. | 2.07 |
| 75000. | 158725. | 2.12 | 165125. | 2.20 | 165375. | 2.21 | 152427. | 2.03 | 152707. | 2.04 | 152987. | 2.04 | 153267. | 2.04 | 153547. | 2.05 | 153827. | 2.05 |
| 80000. | 169100. | 2.11 | 176000. | 2.20 | 176250. | 2.20 | 161552. | 2.02 | 161832. | 2.02 | 162112. | 2.03 | 162392. | 2.03 | 162672. | 2.03 | 162952. | 2.04 |
| 85000. | 179475. | 2.11 | 186875. | 2.20 | 187125. | 2.20 | 170677. | 2.01 | 170957. | 2.01 | 171237. | 2.01 | 171517. | 2.02 | 171797. | 2.02 | 172077. | 2.02 |
| 90000. | 189850. | 2.11 | 197750. | 2.20 | 198000. | 2.20 | 179802. | 2.00 | 180082. | 2.00 | 180362. | 2.00 | 180642. | 2.01 | 180922. | 2.01 | 181202. | 2.01 |
| 95000. | 200225. | 2.11 | 208625. | 2.20 | 208875. | 2.20 | 188927. | 1.99 | 189207. | 1.99 | 189487. | 1.99 | 189767. | 2.00 | 190047. | [illegible].00 | 190327. | 2.00 |
| 100000. | 210600. | 2.11 | 219500. | 2.20 | 219750. | 2.20 | 198052. | 1.98 | 198332. | 1.98 | 198612. | 1.99 | 198892. | 1.99 | 199172. | 1.99 | 199452. | 1.99 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 7.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12550. | 2.51 | 13100. | 2.62 | 13250. | 2.65 | 10900. | 2.18 | 11050. | 2.21 | 11200. | 2.24 | 11350. | 2.27 | 11500. | 2.30 | 11650. | 2.33 |
| 10000. | 24100. | 2.41 | 24000. | 2.40 | 24250. | 2.43 | 34052. | 3.41 | 34332. | 3.43 | 34612. | 3.46 | 34892. | 3.49 | 35172. | 3.52 | 35452. | 3.55 |
| 15000. | 34600. | 2.31 | 35000. | 2.33 | 35250. | 2.35 | 43302. | 2.89 | 43582. | 2.91 | 43862. | 2.92 | 44142. | 2.94 | 44422. | 2.96 | 44702. | 2.98 |
| 20000. | 45100. | 2.26 | 46000. | 2.30 | 46250. | 2.31 | 52552. | 2.63 | 52832. | 2.64 | 53112. | 2.66 | 53392. | 2.67 | 53672. | 2.68 | 53952. | 2.70 |
| 25000. | 55600. | 2.22 | 57000. | 2.28 | 57250. | 2.29 | 61802. | 2.47 | 62082. | 2.48 | 62362. | 2.49 | 62642. | 2.51 | 62922. | 2.52 | 63202. | 2.53 |
| 30000. | 66100. | 2.20 | 68000. | 2.27 | 68250. | 2.28 | 71052. | 2.37 | 71332. | 2.38 | 71612. | 2.39 | 71892. | 2.40 | 72172. | 2.41 | 72452. | 2.42 |
| 35000. | 76600. | 2.19 | 79000. | 2.26 | 79250. | 2.26 | 80302. | 2.29 | 80582. | 2.30 | 80862. | 2.31 | 81142. | 2.32 | 81422. | 2.33 | 81702. | 2.33 |
| 40000. | 87100. | 2.18 | 90000. | 2.25 | 90250. | 2.26 | 89552. | 2.24 | 89832. | 2.25 | 90112. | 2.25 | 90392. | 2.26 | 90672. | 2.27 | 90952. | 2.27 |
| 45000. | 97600. | 2.17 | 101000. | 2.24 | 101250. | 2.25 | 98802. | 2.20 | 99082. | 2.20 | 99362. | 2.21 | 99642. | 2.21 | 99922. | 2.22 | 100202. | 2.23 |
| 50000. | 108100. | 2.16 | 112000. | 2.24 | 112250. | 2.25 | 108052. | 2.16 | 108332. | 2.17 | 108612. | 2.17 | 108892. | 2.18 | 109172. | 2.18 | 109452. | 2.19 |
| 55000. | 118600. | 2.16 | 123000. | 2.24 | 123250. | 2.24 | 117302. | 2.13 | 117582. | 2.14 | 117862. | 2.14 | 118142. | 2.15 | 118422. | 2.15 | 118702. | 2.16 |
| 60000. | 129100. | 2.15 | 134000. | 2.23 | 134250. | 2.24 | 126552. | 2.11 | 126832. | 2.11 | 127112. | 2.12 | 127392. | 2.12 | 127672. | 2.13 | 127952. | 2.13 |
| 65000. | 139600. | 2.15 | 145000. | 2.23 | 145250. | 2.23 | 135802. | 2.09 | 136082. | 2.09 | 136362. | 2.10 | 136642. | 2.10 | 136922. | 2.11 | 137202. | 2.11 |
| 70000. | 150100. | 2.14 | 156000. | 2.23 | 156250. | 2.23 | 145052. | 2.07 | 145332. | 2.08 | 145612. | 2.08 | 145892. | 2.08 | 146172. | 2.09 | 146452. | 2.09 |
| 75000. | 160600. | 2.14 | 167000. | 2.23 | 167250. | 2.23 | 154302. | 2.06 | 154582. | 2.06 | 154862. | 2.06 | 155142. | 2.07 | 155422. | 2.07 | 155702. | 2.08 |
| 80000. | 171100. | 2.14 | 178000. | 2.23 | 178250. | 2.23 | 163552. | 2.04 | 163832. | 2.05 | 164112. | 2.05 | 164392. | 2.05 | 164672. | 2.06 | 164952. | 2.06 |
| 85000. | 181600. | 2.14 | 189000. | 2.22 | 189250. | 2.23 | 172802. | 2.03 | 173082. | 2.04 | 173362. | 2.04 | 173642. | 2.04 | 173922. | 2.05 | 174202. | 2.05 |
| 90000. | 192100. | 2.13 | 200000. | 2.22 | 200250. | 2.23 | 182052. | 2.02 | 182332. | 2.03 | 182612. | 2.03 | 182892. | 2.03 | 183172. | 2.04 | 183452. | 2.04 |
| 95000. | 202600. | 2.13 | 211000. | 2.22 | 211250. | 2.22 | 191302. | 2.01 | 191582. | 2.02 | 191862. | 2.02 | 192142. | 2.02 | 192422. | 2.03 | 192702. | 2.03 |
| 100000. | 213100. | 2.13 | 222000. | 2.22 | 222250. | 2.22 | 200552. | 2.01 | 200832. | 2.01 | 201112. | 2.01 | 201392. | 2.01 | 201672. | 2.02 | 201952. | 2.02 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 7.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12675. | 2.54 | 13225. | 2.65 | 13375. | 2.68 | 11025. | 2.21 | 11175. | 2.24 | 11325. | 2.27 | 11475. | 2.30 | 11625. | 2.33 | 11775. | 2.36 |
| 10000. | 24350. | 2.44 | 24250. | 2.43 | 24500. | 2.45 | 34302. | 3.43 | 34582. | 3.46 | 34862. | 3.49 | 35142. | 3.51 | 35422. | 3.54 | 35702. | 3.57 |
| 15000. | 34975. | 2.33 | 35375. | 2.36 | 35625. | 2.38 | 43677. | 2.91 | 43957. | 2.93 | 44237. | 2.95 | 44517. | 2.97 | 44797. | 2.99 | 45077. | 3.01 |
| 20000. | 45600. | 2.28 | 46500. | 2.33 | 46750. | 2.34 | 53052. | 2.65 | 53332. | 2.67 | 53612. | 2.68 | 53892. | 2.69 | 54172. | 2.71 | 54452. | 2.72 |
| 25000. | 56225. | 2.25 | 57625. | 2.31 | 57875. | 2.32 | 62427. | 2.50 | 62707. | 2.51 | 62987. | 2.52 | 63267. | 2.53 | 63547. | 2.54 | 63827. | 2.55 |
| 30000. | 66850. | 2.23 | 68750. | 2.29 | 69000. | 2.30 | 71802. | 2.39 | 72082. | 2.40 | 72362. | 2.41 | 72642. | 2.42 | 72922. | 2.43 | 73202. | 2.44 |
| 35000. | 77475. | 2.21 | 79875. | 2.28 | 80125. | 2.29 | 81177. | 2.32 | 81457. | 2.33 | 81737. | 2.34 | 82017. | 2.34 | 82297. | 2.35 | 82577. | 2.36 |
| 40000. | 88100. | 2.20 | 91000. | 2.28 | 91250. | 2.28 | 90552. | 2.26 | 90832. | 2.27 | 91112. | 2.28 | 91392. | 2.28 | 91672. | 2.29 | 91952. | 2.30 |
| 45000. | 98725. | 2.19 | 102125. | 2.27 | 102375. | 2.28 | 99927. | 2.22 | 100207. | 2.23 | 100487. | 2.23 | 100767. | 2.24 | 101047. | 2.25 | 101327. | 2.25 |
| 50000. | 109350. | 2.19 | 113250. | 2.27 | 113500. | 2.27 | 109302. | 2.19 | 109582. | 2.19 | 109862. | 2.20 | 110142. | 2.20 | 110422. | 2.21 | 110702. | 2.21 |
| 55000. | 119975. | 2.18 | 124375. | 2.26 | 124625. | 2.27 | 118677. | 2.16 | 118957. | 2.16 | 119237. | 2.17 | 119517. | 2.17 | 119797. | 2.18 | 120077. | 2.18 |
| 60000. | 130600. | 2.18 | 135500. | 2.26 | 135750. | 2.26 | 128052. | 2.13 | 128332. | 2.14 | 128612. | 2.14 | 128892. | 2.15 | 129172. | 2.15 | 129452. | 2.16 |
| 65000. | 141225. | 2.17 | 146625. | 2.26 | 146875. | 2.26 | 137427. | 2.11 | 137707. | 2.12 | 137987. | 2.12 | 138267. | 2.13 | 138547. | 2.13 | 138827. | 2.14 |
| 70000. | 151850. | 2.17 | 157750. | 2.25 | 158000. | 2.26 | 146802. | 2.10 | 147082. | 2.10 | 147362. | 2.11 | 147642. | 2.11 | 147922. | 2.11 | 148202. | 2.12 |
| 75000. | 162475. | 2.17 | 168875. | 2.25 | 169125. | 2.26 | 156177. | 2.08 | 156457. | 2.09 | 156737. | 2.09 | 157017. | 2.09 | 157297. | 2.10 | 157577. | 2.10 |
| 80000. | 173100. | 2.16 | 180000. | 2.25 | 180250. | 2.25 | 165552. | 2.07 | 165832. | 2.07 | 166112. | 2.08 | 166392. | 2.08 | 166672. | 2.08 | 166952. | 2.09 |
| 85000. | 183725. | 2.16 | 191125. | 2.25 | 191375. | 2.25 | 174927. | 2.06 | 175207. | 2.06 | 175487. | 2.06 | 175767. | 2.07 | 176047. | 2.07 | 176327. | 2.07 |
| 90000. | 194350. | 2.16 | 202250. | 2.25 | 202500. | 2.25 | 184302. | 2.05 | 184582. | 2.05 | 184862. | 2.05 | 185142. | 2.06 | 185422. | 2.06 | 185702. | 2.06 |
| 95000. | 204975. | 2.16 | 213375. | 2.25 | 213625. | 2.25 | 193677. | 2.04 | 193957. | 2.04 | 194237. | 2.04 | 194517. | 2.05 | 194797. | 2.05 | 195077. | 2.05 |
| 100000. | 215600. | 2.16 | 224500. | 2.25 | 224750. | 2.25 | 203052. | 2.03 | 203332. | 2.03 | 203612. | 2.04 | 203892. | 2.04 | 204172. | 2.04 | 204452. | 2.04 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

**Trucking Distance:** 8.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12800. | 2.56 | 13350. | 2.67 | 13500. | 2.70 | 11150. | 2.23 | 11300. | 2.26 | 11450. | 2.29 | 11600. | 2.32 | 11750. | 2.35 | 11900. | 2.38 |
| 10000. | 24600. | 2.46 | 24500. | 2.45 | 24750. | 2.48 | 34552. | 3.46 | 34832. | 3.48 | 35112. | 3.51 | 35392. | 3.54 | 35672. | 3.57 | 35952. | 3.60 |
| 15000. | 35350. | 2.36 | 35750. | 2.38 | 36000. | 2.40 | 44052. | 2.94 | 44332. | 2.96 | 44612. | 2.97 | 44892. | 2.99 | 45172. | 3.01 | 45452. | 3.03 |
| 20000. | 46100. | 2.31 | 47000. | 2.35 | 47250. | 2.36 | 53552. | 2.68 | 53832. | 2.69 | 54112. | 2.71 | 54392. | 2.72 | 54672. | 2.73 | 54952. | 2.75 |
| 25000. | 56850. | 2.27 | 58250. | 2.33 | 58500. | 2.34 | 63052. | 2.52 | 63332. | 2.53 | 63612. | 2.54 | 63892. | 2.56 | 64172. | 2.57 | 64452. | 2.58 |
| 30000. | 67600. | 2.25 | 69500. | 2.32 | 69750. | 2.33 | 72552. | 2.42 | 72832. | 2.43 | 73112. | 2.44 | 73392. | 2.45 | 73672. | 2.46 | 73952. | 2.47 |
| 35000. | 78350. | 2.24 | 80750. | 2.31 | 81000. | 2.31 | 82052. | 2.34 | 82332. | 2.35 | 82612. | 2.36 | 82892. | 2.37 | 83172. | 2.38 | 83452. | 2.38 |
| 40000. | 89100. | 2.23 | 92000. | 2.30 | 92250. | 2.31 | 91552. | 2.29 | 91832. | 2.30 | 92112. | 2.30 | 92392. | 2.31 | 92672. | 2.32 | 92952. | 2.32 |
| 45000. | 99850. | 2.22 | 103250. | 2.29 | 103500. | 2.30 | 101052. | 2.25 | 101332. | 2.25 | 101612. | 2.26 | 101892. | 2.26 | 102172. | 2.27 | 102452. | 2.28 |
| 50000. | 110600. | 2.21 | 114500. | 2.29 | 114750. | 2.30 | 110552. | 2.21 | 110832. | 2.22 | 111112. | 2.22 | 111392. | 2.23 | 111672. | 2.23 | 111952. | 2.24 |
| 55000. | 121350. | 2.21 | 125750. | 2.29 | 126000. | 2.29 | 120052. | 2.18 | 120332. | 2.19 | 120612. | 2.19 | 120892. | 2.20 | 121172. | 2.20 | 121452. | 2.21 |
| 60000. | 132100. | 2.20 | 137000. | 2.28 | 137250. | 2.29 | 129552. | 2.16 | 129832. | 2.16 | 130112. | 2.17 | 130392. | 2.17 | 130672. | 2.18 | 130952. | 2.18 |
| 65000. | 142850. | 2.20 | 148250. | 2.28 | 148500. | 2.28 | 139052. | 2.14 | 139332. | 2.14 | 139612. | 2.15 | 139892. | 2.15 | 140172. | 2.16 | 140452. | 2.16 |
| 70000. | 153600. | 2.19 | 159500. | 2.28 | 159750. | 2.28 | 148552. | 2.12 | 148832. | 2.13 | 149112. | 2.13 | 149392. | 2.13 | 149672. | 2.14 | 149952. | 2.14 |
| 75000. | 164350. | 2.19 | 170750. | 2.28 | 171000. | 2.28 | 158052. | 2.11 | 158332. | 2.11 | 158612. | 2.11 | 158892. | 2.12 | 159172. | 2.12 | 159452. | 2.13 |
| 80000. | 175100. | 2.19 | 182000. | 2.28 | 182250. | 2.28 | 167552. | 2.09 | 167832. | 2.10 | 168112. | 2.10 | 168392. | 2.10 | 168672. | 2.11 | 168952. | 2.11 |
| 85000. | 185850. | 2.19 | 193250. | 2.27 | 193500. | 2.28 | 177052. | 2.08 | 177332. | 2.09 | 177612. | 2.09 | 177892. | 2.09 | 178172. | 2.10 | 178452. | 2.10 |
| 90000. | 196600. | 2.18 | 204500. | 2.27 | 204750. | 2.28 | 186552. | 2.07 | 186832. | 2.08 | 187112. | 2.08 | 187392. | 2.08 | 187672. | 2.09 | 187952. | 2.09 |
| 95000. | 207350. | 2.18 | 215750. | 2.27 | 216000. | 2.27 | 196052. | 2.06 | 196332. | 2.07 | 196612. | 2.07 | 196892. | 2.07 | 197172. | 2.08 | 197452. | 2.08 |
| 100000. | 218100. | 2.18 | 227000. | 2.27 | 227250. | 2.27 | 205552. | 2.06 | 205832. | 2.06 | 206112. | 2.06 | 206392. | 2.06 | 206672. | 2.07 | 206952. | 2.07 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

**Trucking Distance:** 8.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 12925. | 2.59 | 13475. | 2.70 | 13625. | 2.73 | 11275. | 2.26 | 11425. | 2.29 | 11575. | 2.32 | 11725. | 2.35 | 11875. | 2.38 | 12025. | 2.41 |
| 10000. | 24850. | 2.49 | 24750. | 2.48 | 25000. | 2.50 | 34802. | 3.48 | 35082. | 3.51 | 35362. | 3.54 | 35642. | 3.56 | 35922. | 3.59 | 36202. | 3.62 |
| 15000. | 35725. | 2.38 | 36125. | 2.41 | 36375. | 2.43 | 44427. | 2.96 | 44707. | 2.98 | 44987. | 3.00 | 45267. | 3.02 | 45547. | 3.04 | 45827. | 3.06 |
| 20000. | 46600. | 2.33 | 47500. | 2.38 | 47750. | 2.39 | 54052. | 2.70 | 54332. | 2.72 | 54612. | 2.73 | 54892. | 2.74 | 55172. | 2.76 | 55452. | 2.77 |
| 25000. | 57475. | 2.30 | 58875. | 2.36 | 59125. | 2.37 | 63677. | 2.55 | 63957. | 2.56 | 64237. | 2.57 | 64517. | 2.58 | 64797. | 2.59 | 65077. | 2.60 |
| 30000. | 68350. | 2.28 | 70250. | 2.34 | 70500. | 2.35 | 73302. | 2.44 | 73582. | 2.45 | 73862. | 2.46 | 74142. | 2.47 | 74422. | 2.48 | 74702. | 2.49 |
| 35000. | 79225. | 2.26 | 81625. | 2.33 | 81875. | 2.34 | 82927. | 2.37 | 83207. | 2.38 | 83487. | 2.39 | 83767. | 2.39 | 84047. | 2.40 | 84327. | 2.41 |
| 40000. | 90100. | 2.25 | 93000. | 2.33 | 93250. | 2.33 | 92552. | 2.31 | 92832. | 2.32 | 93112. | 2.33 | 93392. | 2.33 | 93672. | 2.34 | 93952. | 2.35 |
| 45000. | 100975. | 2.24 | 104375. | 2.32 | 104625. | 2.33 | 102177. | 2.27 | 102457. | 2.28 | 102737. | 2.28 | 103017. | 2.29 | 103297. | 2.30 | 103577. | 2.30 |
| 50000. | 111850. | 2.24 | 115750. | 2.32 | 116000. | 2.32 | 111802. | 2.24 | 112082. | 2.24 | 112362. | 2.25 | 112642. | 2.25 | 112922. | 2.26 | 113202. | 2.26 |
| 55000. | 122725. | 2.23 | 127125. | 2.31 | 127375. | 2.32 | 121427. | 2.21 | 121707. | 2.21 | 121987. | 2.22 | 122267. | 2.22 | 122547. | 2.23 | 122827. | 2.23 |
| 60000. | 133600. | 2.23 | 138500. | 2.31 | 138750. | 2.31 | 131052. | 2.18 | 131332. | 2.19 | 131612. | 2.19 | 131892. | 2.20 | 132172. | 2.20 | 132452. | 2.21 |
| 65000. | 144475. | 2.22 | 149875. | 2.31 | 150125. | 2.31 | 140677. | 2.16 | 140957. | 2.17 | 141237. | 2.17 | 141517. | 2.18 | 141797. | 2.18 | 142077. | 2.19 |
| 70000. | 155350. | 2.22 | 161250. | 2.30 | 161500. | 2.31 | 150302. | 2.15 | 150582. | 2.15 | 150862. | 2.16 | 151142. | 2.16 | 151422. | 2.16 | 151702. | 2.17 |
| 75000. | 166225. | 2.22 | 172625. | 2.30 | 172875. | 2.31 | 159927. | 2.13 | 160207. | 2.14 | 160487. | 2.14 | 160767. | 2.14 | 161047. | 2.15 | 161327. | 2.15 |
| 80000. | 177100. | 2.21 | 184000. | 2.30 | 184250. | 2.30 | 169552. | 2.12 | 169832. | 2.12 | 170112. | 2.13 | 170392. | 2.13 | 170672. | 2.13 | 170952. | 2.14 |
| 85000. | 187975. | 2.21 | 195375. | 2.30 | 195625. | 2.30 | 179177. | 2.11 | 179457. | 2.11 | 179737. | 2.11 | 180017. | 2.12 | 180297. | 2.12 | 180577. | 2.12 |
| 90000. | 198850. | 2.21 | 206750. | 2.30 | 207000. | 2.30 | 188802. | 2.10 | 189082. | 2.10 | 189362. | 2.10 | 189642. | 2.11 | 189922. | 2.11 | 190202. | 2.11 |
| 95000. | 209725. | 2.21 | 218125. | 2.30 | 218375. | 2.30 | 198427. | 2.09 | 198707. | 2.09 | 198987. | 2.09 | 199267. | 2.10 | 199547. | 2.10 | 199827. | 2.10 |
| 100000. | 220600. | 2.21 | 229500 | 2.30 | 229750. | 2.30 | 208052. | 2.08 | 208332. | 2.08 | 208612. | 2.09 | 208892. | 2.09 | 209172. | 2.09 | 209452. | 2.09 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 9.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13050. | 2.61 | 13600. | 2.72 | 13750. | 2.75 | 11400. | 2.28 | 11550. | 2.31 | 11700. | 2.34 | 11850. | 2.37 | 12000. | 2.40 | 12150. | 2.43 |
| 10000. | 25100. | 2.51 | 25000. | 2.50 | 25250. | 2.53 | 35052. | 3.51 | 35332. | 3.53 | 35612. | 3.56 | 35892. | 3.59 | 36172. | 3.62 | 36452. | 3.65 |
| 15000. | 36100. | 2.41 | 36500. | 2.43 | 36750. | 2.45 | 44802. | 2.99 | 45082. | 3.01 | 45362. | 3.02 | 45642. | 3.04 | 45922. | 3.06 | 46202. | 3.08 |
| 20000. | 47100. | 2.36 | 48000. | 2.40 | [illegible]250. | 2.41 | 54552. | 2.73 | 54832. | 2.74 | 55112. | 2.76 | 55392. | 2.77 | 55672. | 2.78 | 55952. | 2.80 |
| 25000. | 58100. | 2.32 | 59500. | 2.38 | 59750. | 2.39 | 64302. | 2.57 | 64582. | 2.58 | 64862. | 2.59 | 65142. | 2.61 | 65422. | 2.62 | 65702. | 2.63 |
| 30000. | 69100. | 2.30 | 71000. | 2.37 | 71250. | 2.38 | 74052. | 2.47 | 74332. | 2.48 | 74612. | 2.49 | 74892. | 2.50 | 75172. | 2.51 | 75452. | 2.52 |
| 35000. | 80100. | 2.29 | 82500. | 2.36 | 82750. | 2.36 | 83802. | 2.39 | 84082. | 2.40 | 84362. | 2.41 | 84642. | 2.42 | 84922. | 2.43 | 85202. | 2.43 |
| 40000. | 91100. | 2.28 | 94000. | 2.35 | 94250. | 2.36 | 93552. | 2.34 | 93832. | 2.35 | 94112. | 2.35 | 94392. | 2.36 | 94672. | 2.37 | 94952. | 2.37 |
| 45000. | 102100. | 2.27 | 105500. | 2.34 | 105750. | 2.35 | 103302. | 2.30 | 103582. | 2.30 | 103862. | 2.31 | 104142. | 2.31 | 104422. | 2.32 | 104702. | 2.33 |
| 50000. | 113100. | 2.26 | 117000. | 2.34 | 117250. | 2.35 | 113052. | 2.26 | 113332. | 2.27 | 113612. | 2.27 | 113892. | 2.28 | 114172. | 2.28 | 114452. | 2.29 |
| 55000. | 124100. | 2.26 | 128500. | 2.34 | 128750. | 2.34 | 122802. | 2.23 | 123082. | 2.24 | 123362. | 2.24 | 123642. | 2.25 | 123922. | 2.25 | 124202. | 2.26 |
| 60000. | 135100. | 2.25 | 140000. | 2.33 | 140250. | 2.34 | 132552. | 2.21 | 132832. | 2.21 | 133112. | 2.22 | 133392. | 2.22 | 133672. | 2.23 | 133952. | 2.23 |
| 65000. | 146100. | 2.25 | 151500. | 2.33 | 151750. | 2.33 | 142302. | 2.19 | 142582. | 2.19 | 142862. | 2.20 | 143142. | 2.20 | 143422. | 2.21 | 143702. | 2.21 |
| 70000. | 157100. | 2.24 | 163000. | 2.33 | 163250. | 2.33 | 152052. | 2.17 | 152332. | 2.18 | 152612. | 2.18 | 152892. | 2.18 | 153172. | 2.19 | 153452. | 2.19 |
| 75000. | 168100. | 2.24 | 174500. | 2.33 | 174750. | 2.33 | 161802. | 2.16 | 162082. | 2.16 | 162362. | 2.16 | 162642. | 2.17 | 162922. | 2.17 | 163202. | 2.18 |
| 80000. | 179100. | 2.24 | 186000. | 2.33 | 186250. | 2.33 | 171552. | 2.14 | 171832. | 2.15 | 172112. | 2.15 | 172392. | 2.15 | 172672. | 2.16 | 172952. | 2.16 |
| 85000. | 190100. | 2.24 | 197500. | 2.32 | 197750. | 2.33 | 181302. | 2.13 | 181582. | 2.14 | 181862. | 2.14 | 182142. | 2.14 | 182422. | 2.15 | 182702. | 2.15 |
| 90000. | 201100. | 2.23 | 209000. | 2.32 | 209250. | 2.33 | 191052. | 2.12 | 191332. | 2.13 | 191612. | 2.13 | 191892. | 2.13 | 192172. | 2.14 | 192452. | 2.14 |
| 95000. | 212100. | 2.23 | 220500. | 2.32 | 220750. | 2.32 | 200802. | 2.11 | 201082. | 2.12 | 201362. | 2.12 | 201642. | 2.12 | 201922. | 2.13 | 202202. | 2.13 |
| 100000. | 223100. | 2.23 | 232000. | 2.32 | 232250. | 2.32 | 210552. | 2.11 | 210832. | 2.11 | 211112. | 2.11 | 211392. | 2.11 | 211672. | 2.12 | 211952. | 2.12 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis
(1978 Dollars, GREAT I Area).

**Trucking Distance:** 9.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13175. | 2.64 | 13725. | 2.75 | 13875. | 2.78 | 11525. | 2.31 | 11675. | 2.34 | 11825. | 2.37 | 11975. | 2.40 | 12125. | 2.43 | 12275. | 2.46 |
| 10000. | 25350. | 2.54 | 25250. | 2.53 | 25500. | 2.55 | 35302. | 3.53 | 35582. | 3.56 | 35862. | 3.59 | 36142. | 3.61 | 36422. | 3.64 | 36702. | 3.67 |
| 15000. | 36475. | 2.43 | 36875. | 2.46 | 37125. | 2.48 | 45177. | 3.01 | 45457. | 3.03 | 45737. | 3.05 | 46017. | 3.07 | 46297. | 3.09 | 46577. | 3.11 |
| 20000. | 47600. | 2.38 | 48500. | 2.43 | 48750. | 2.44 | 55052. | 2.75 | 55332. | 2.77 | 55612. | 2.78 | 55892. | 2.79 | 56172. | 2.81 | 56452. | 2.82 |
| 25000. | 58725. | 2.35 | 60125. | 2.41 | 60375. | 2.42 | 64927. | 2.60 | 65207. | 2.61 | 65487. | 2.62 | 65767. | 2.63 | 66047. | 2.64 | 66327. | 2.65 |
| 30000. | 69850. | 2.33 | 71750. | 2.39 | 72000. | 2.40 | 74802. | 2.49 | 75082. | 2.50 | 75362. | 2.51 | 75642. | 2.52 | 75922. | 2.53 | 76202. | 2.54 |
| 35000. | 80975. | 2.31 | 83375. | 2.38 | 83625. | 2.39 | 84677. | 2.42 | 84957. | 2.43 | 85237. | 2.44 | 85517. | 2.44 | 85797. | 2.45 | 86077. | 2.46 |
| 40000. | 92100. | 2.30 | 95000. | 2.38 | 95250. | 2.38 | 94552. | 2.36 | 94832. | 2.37 | 95112. | 2.38 | 95392. | 2.38 | 95672. | 2.39 | 95952. | 2.40 |
| 45000. | 103225. | 2.29 | 106625. | 2.37 | 106875. | 2.38 | 104427. | 2.32 | 104707. | 2.33 | 104987. | 2.33 | 105267. | 2.34 | 105547. | 2.35 | 105827. | 2.35 |
| 50000. | 114350. | 2.29 | 118250. | 2.37 | 118500. | 2.37 | 114302. | 2.29 | 114582. | 2.29 | 114862. | 2.30 | 115142. | 2.30 | 115422. | 2.31 | 115702. | 2.31 |
| 55000. | 125475. | 2.28 | 129875. | 2.36 | 130125. | 2.37 | 124177. | 2.26 | 124457. | 2.26 | 124737. | 2.27 | 125017. | 2.27 | 125297. | 2.28 | 125577. | 2.28 |
| 60000. | 136600. | 2.28 | 141500. | 2.36 | 141750. | 2.36 | 134052. | 2.23 | 134332. | 2.24 | 134612. | 2.24 | 134892. | 2.25 | 135172. | 2.25 | 135452. | 2.26 |
| 65000. | 147725. | 2.27 | 153125. | 2.36 | 153375. | 2.36 | 143927. | 2.21 | 144207. | 2.22 | 144487. | 2.22 | 144767. | 2.23 | 145047. | 2.23 | 145327. | 2.24 |
| 70000. | 158850. | 2.27 | 164750. | 2.35 | 165000. | 2.36 | 153802. | 2.20 | 154082. | 2.20 | 154362. | 2.21 | 154642. | 2.21 | 154922. | 2.21 | 155202. | 2.22 |
| 75000. | 169975. | 2.27 | 176375. | 2.35 | 176625. | 2.36 | 163677. | 2.18 | 163957. | 2.19 | 164237. | 2.19 | 164517. | 2.19 | 164797. | 2.20 | 165077. | 2.20 |
| 80000. | 181100. | 2.26 | 188000. | 2.35 | 188250. | 2.35 | 173552. | 2.17 | 173832. | 2.17 | 174112. | 2.18 | 174392. | 2.18 | 174672. | 2.18 | 174952. | 2.19 |
| 85000. | 192225. | 2.26 | 199625. | 2.35 | 199875. | 2.35 | 183427. | 2.16 | 183707. | 2.16 | 183987. | 2.16 | 184267. | 2.17 | 184547. | 2.17 | 184827. | 2.17 |
| 90000. | 203350. | 2.26 | 211250. | 2.35 | 211500. | 2.35 | 193302. | 2.15 | 193582. | 2.15 | 193862. | 2.15 | 194142. | 2.16 | 194422. | 2.16 | 194702. | 2.16 |
| 95000. | 214475. | 2.26 | 222875. | 2.35 | 223125. | 2.35 | 203177. | 2.14 | 203457. | 2.14 | 203737. | 2.14 | 204017. | 2.15 | 204297. | 2.15 | 204577. | 2.15 |
| 100000. | 225600. | 2.26 | 234500. | 2.35 | 234750. | 2.35 | 213052. | 2.13 | 213332. | 2.13 | 213612. | 2.14 | 213892. | 2.14 | 214172. | 2.14 | 214452. | 2.14 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 10.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13300. | 2.66 | 13850. | 2.77 | 14000. | 2.80 | 11650. | 2.33 | 11800. | 2.36 | 11950. | 2.39 | 12100. | 2.42 | 12250. | 2.45 | 12400. | 2.48 |
| 10000. | 25600. | 2.56 | 25500. | 2.55 | 25750. | 2.58 | 35552. | 3.56 | 35832. | 3.58 | 36112. | 3.61 | 36392. | 3.64 | 36672. | 3.67 | 36952. | 3.70 |
| 15000. | 36450. | 2.46 | 37250. | 2.48 | 37500. | 2.50 | 45552. | 3.00 | 45832. | 3.06 | 46112. | 3.07 | 46392. | 3.09 | 46672. | 3.11 | 46952. | 3.13 |
| 20000. | 48100. | 2.41 | 49000. | 2.45 | 49250. | 2.46 | 55552. | 2.78 | 55832. | 2.79 | 56112. | 2.81 | 56392. | 2.82 | 56672. | 2.83 | 56952. | 2.85 |
| 25000. | 59350. | 2.37 | 60750. | 2.43 | 61000. | 2.44 | 65552. | 2.62 | 65832. | 2.63 | 66112. | 2.64 | 66392. | 2.66 | 66672. | 2.67 | 66952. | 2.68 |
| 30000. | 70600. | 2.35 | 72500. | 2.42 | 72750. | 2.43 | 75552. | 2.52 | 75832. | 2.53 | 76112. | 2.54 | 76392. | 2.55 | 76672. | 2.56 | 76952. | 2.57 |
| 35000. | 81850. | 2.34 | 84250. | 2.41 | 84500. | 2.41 | 85552. | 2.44 | 85832. | 2.45 | 86112. | 2.46 | 86392. | 2.47 | 86672. | 2.48 | 86952. | 2.48 |
| 40000. | 93100. | 2.33 | 96000. | 2.40 | 96250. | 2.41 | 95552. | 2.39 | 95832. | 2.40 | 96112. | 2.40 | 96392. | 2.41 | 96672. | 2.42 | 96952. | 2.42 |
| 45000. | 104350. | 2.32 | 107750. | 2.39 | 108000. | 2.40 | 105552. | 2.35 | 105832. | 2.35 | 106112. | 2.36 | 106392. | 2.36 | 106672. | 2.37 | 106952. | 2.38 |
| 50000. | 115600. | [illegible] | 119500. | 2.39 | 119750. | 2.40 | 115552. | 2.31 | 115832. | 2.32 | 116112. | 2.32 | 116392. | 2.33 | 116672. | 2.33 | 116952. | 2.34 |
| 55000. | 126850. | 2.31 | 131250. | 2.39 | 131500. | 2.39 | 125552. | 2.28 | 125832. | 2.29 | 126112. | 2.29 | 126392. | 2.30 | 126672. | 2.30 | 126952. | 2.31 |
| 60000. | 138100. | 2.30 | 143000. | 2.38 | 143250. | 2.39 | 135552. | 2.26 | 135832. | 2.26 | 136112. | 2.27 | 136392. | 2.27 | 136672. | 2.28 | 136952. | 2.28 |
| 65000. | 149350. | 2.30 | 154750. | 2.38 | 155000. | 2.38 | 145552. | 2.24 | 145832. | 2.24 | 146112. | 2.25 | 146392. | 2.25 | 146672. | 2.26 | 146952. | 2.26 |
| 70000. | 160600. | 2.29 | 166500. | 2.38 | 166750. | 2.38 | 155552. | 2.22 | 155832. | 2.23 | 156112. | 2.23 | 156392. | 2.23 | 156672. | 2.24 | 156952. | 2.24 |
| 75000. | 171850. | 2.29 | 178250. | 2.38 | 178500. | 2.38 | 165552. | 2.21 | 165832. | 2.21 | 166112. | 2.21 | 166392. | 2.22 | 166672. | 2.22 | 166952. | 2.23 |
| 80000. | 183100. | 2.29 | 190000. | 2.38 | 190250. | 2.38 | 175552. | 2.19 | 175832. | 2.20 | 176112. | 2.20 | 176392. | 2.20 | 176672. | 2.21 | 176952. | 2.21 |
| 85000. | 194350. | 2.29 | 201750. | 2.37 | 202000. | 2.38 | 185552. | 2.18 | 185832. | 2.19 | 186112. | 2.19 | 186392. | 2.19 | 186672. | 2.20 | 186952. | 2.20 |
| 90000. | 205600. | 2.28 | 213500. | 2.37 | 213750. | 2.38 | 195552. | 2.17 | 195832. | 2.18 | 196112. | 2.18 | 196392. | 2.18 | 196672. | 2.19 | 196952. | 2.19 |
| 95000. | 216850. | 2.28 | 225250. | 2.37 | 225500. | 2.37 | 205552. | 2.16 | 205832. | 2.17 | 206112. | 2.17 | 206392. | 2.17 | 206672. | 2.18 | 206952. | 2.18 |
| 100000. | 228100. | 2.28 | 237000. | 2.37 | 237250. | 2.37 | 215552. | 2.16 | 215832. | 2.16 | 216112. | 2.16 | 216392. | 2.16 | 216672. | 2.17 | 216952. | 2.17 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 10.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13425. | 2.69 | 13975. | 2.80 | 14125. | 2.83 | 11775. | 2.36 | 11925. | 2.39 | 12075. | 2.42 | 12225. | 2.45 | 12375. | 2.48 | 12525. | 2.51 |
| 10000. | 25850. | 2.59 | 25750. | 2.58 | 26000. | 2.60 | 35802. | 3.58 | 36082. | 3.61 | 36362. | 3.64 | 36642. | 3.66 | 36922. | 3.69 | 37202. | 3.72 |
| 15000. | 37225. | 2.48 | 37625. | 2.51 | 37875. | 2.53 | 45927. | 3.06 | 46207. | 3.08 | 46487. | 3.10 | 46767. | 3.12 | 47047. | 3.14 | 47327. | 3.16 |
| 20000. | 48600. | 2.43 | 49500. | 2.48 | 49750. | 2.49 | 56052. | 2.80 | 56332. | 2.82 | 56612. | 2.83 | 56892. | 2.84 | 57172. | 2.86 | 57452. | 2.87 |
| 25000. | 59975. | 2.40 | 61375. | 2.46 | 61625. | 2.47 | 66177. | 2.65 | 66457. | 2.66 | 66737. | 2.67 | 67017. | 2.68 | 67297. | 2.69 | 67577. | 2.70 |
| 30000. | 71350. | 2.38 | 73250. | 2.44 | 73500. | 2.45 | 76302. | 2.54 | 76582. | 2.55 | 76862. | 2.56 | 77142. | 2.57 | 77422. | 2.58 | 77702. | 2.59 |
| 35000. | 82725. | 2.36 | 85125. | 2.43 | 85375. | 2.44 | 86427. | 2.47 | 86707. | 2.48 | 86987. | 2.49 | 87267. | 2.49 | 87547. | 2.50 | 87827. | 2.51 |
| 40000. | 94100. | 2.35 | 97000. | 2.43 | 97250. | 2.43 | 96552. | 2.41 | 96832. | 2.42 | 97112. | 2.43 | 97392. | 2.43 | 97672. | 2.44 | 97952. | 2.45 |
| 45000. | 105475. | 2.34 | 108875. | 2.42 | 109125. | 2.43 | 106677. | 2.37 | 106957. | 2.38 | 107237. | 2.38 | 107517. | 2.39 | 107797. | 2.40 | 108077. | 2.40 |
| 50000. | 116850. | 2.34 | 120750. | 2.42 | 121000. | 2.42 | 116802. | 2.34 | 117082. | 2.34 | 117362. | 2.35 | 117642. | 2.35 | 117922. | 2.36 | 118202. | 2.36 |
| 55000. | 128225. | 2.33 | 132625. | 2.41 | 132875. | 2.42 | 126927. | 2.31 | 127207. | 2.31 | 127487. | 2.32 | 127767. | 2.32 | 128047. | 2.33 | 128327. | 2.33 |
| 60000. | 139600. | 2.33 | 144500. | 2.41 | 144750. | 2.41 | 137052. | 2.28 | 137332. | 2.29 | 137612. | 2.29 | 137892. | 2.30 | 138172. | 2.30 | 138452. | 2.31 |
| 65000. | 150975. | 2.32 | 156375. | 2.41 | 156625. | 2.41 | 147177. | 2.26 | 147457. | 2.27 | 147737. | 2.27 | 148017. | 2.28 | 148297. | 2.28 | 148577. | 2.29 |
| 70000. | 162350. | 2.32 | 168250. | 2.40 | 168500. | 2.41 | 157302. | 2.25 | 157582. | 2.25 | 157862. | 2.26 | 158142. | 2.26 | 158422. | 2.26 | 158702. | 2.27 |
| 75000. | 173725. | 2.32 | 180125. | 2.40 | 180375. | 2.41 | 167427. | 2.23 | 167707. | 2.24 | 167987. | 2.24 | 168267. | 2.24 | 168547. | 2.25 | 168827. | 2.25 |
| 80000. | 185100. | 2.31 | 192000. | 2.40 | 192250. | 2.40 | 177552. | 2.22 | 177832. | 2.22 | 178112. | 2.23 | 178392. | 2.23 | 178672. | 2.23 | 178952. | 2.24 |
| 85000. | 196475. | 2.31 | 203875. | 2.40 | 204125. | 2.40 | 187677. | 2.21 | 187957. | 2.21 | 188237. | 2.21 | 188517. | 2.22 | 188797. | 2.22 | 189077. | 2.22 |
| 90000. | 207850. | 2.31 | 215750. | 2.40 | 216000. | 2.40 | 197802. | 2.20 | 198082. | 2.20 | 198362. | 2.20 | 198642. | 2.21 | 198922. | 2.21 | 199202. | 2.21 |
| 95000. | 219225. | 2.31 | 227625. | 2.40 | 227875. | 2.40 | 207927. | 2.19 | 208207. | 2.19 | 208487. | 2.19 | 208767. | 2.20 | 209047. | 2.20 | 209327. | 2.20 |
| 100000. | 230600. | 2.31 | 239500. | 2.40 | 239750. | 2.40 | 218052. | 2.18 | 218332. | 2.18 | 218612. | 2.19 | 218892. | 2.19 | 219172. | 2.19 | 219452. | 2.19 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 11.00 Miles

<u>Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)</u>

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13550. | 2.71 | 14100. | 2.82 | 14250. | 2.85 | 11900. | 2.38 | 12050. | 2.41 | 12200. | 2.44 | 12350. | 2.47 | 12500. | 2.50 | 12650. | 2.53 |
| 10000. | 26100. | 2.61 | 26000. | 2.60 | 26250. | 2.63 | 36052. | 3.61 | 36332. | 3.63 | 36612. | 3.66 | 36892. | 3.69 | 37172. | 3.72 | 37452. | 3.75 |
| 15000. | 37600. | 2.51 | 38000. | 2.53 | 38250. | 2.55 | 46302. | 3.09 | 46582. | 3.11 | 46862. | 3.12 | 47142. | 3.14 | 47422. | 3.16 | 47702. | 3.18 |
| 20000. | 49100. | 2.46 | 50000. | 2.50 | 50250. | 2.51 | 56552. | 2.83 | 56832. | 2.84 | 57112. | 2.86 | 57392. | 2.87 | 57672. | 2.88 | 57952. | 2.90 |
| 25000. | 60600. | 2.42 | 62000. | 2.48 | 62250. | 2.49 | 66802. | 2.67 | 67082. | 2.68 | 67362. | 2.69 | 67642. | 2.71 | 67922. | 2.72 | 68202. | 2.73 |
| 30000. | 72100. | 2.40 | 74000. | 2.47 | 74250. | 2.48 | 77052. | 2.57 | 77332. | 2.58 | 77612. | 2.59 | 77892. | 2.60 | 78172. | 2.61 | 78452. | 2.62 |
| 35000. | 83600. | 2.39 | 86000. | 2.46 | 86250. | 2.46 | 87302. | 2.49 | 87582. | 2.50 | 87862. | 2.51 | 88142. | 2.52 | 88422. | 2.53 | 88702. | 2.53 |
| 40000. | 95100. | 2.38 | 98000. | 2.45 | 98250. | 2.46 | 97552. | [illegible] | 97832. | 2.45 | 98112. | 2.45 | 98392. | 2.46 | 98672. | 2.47 | 98952. | 2.47 |
| 45000. | 106600. | 2.37 | 110000. | 2.44 | 110250. | 2.45 | 107802. | 2.40 | 108082. | 2.40 | 108362. | 2.41 | 108642. | 2.41 | 108922. | 2.42 | 109202. | 2.43 |
| 50000. | 118100. | 2.36 | 122000. | 2.44 | 122250. | 2.45 | 118052. | 2.36 | 118332. | 2.37 | 118612. | 2.37 | 118892. | 2.38 | 119172. | 2.38 | 119452. | 2.39 |
| 55000. | 129600. | 2.36 | 134000. | 2.44 | 134250. | 2.44 | 128302. | 2.33 | 128582. | 2.34 | 128862. | 2.34 | 129142. | 2.35 | 129422. | 2.35 | 129702. | 2.36 |
| 60000. | 141100. | 2.35 | 146000. | 2.43 | 146250. | 2.44 | 138552. | 2.31 | 138832. | 2.31 | 139112. | 2.32 | 139392. | 2.32 | 139672. | 2.33 | 139952. | 2.33 |
| 65000. | 152600. | 2.35 | 158000. | 2.43 | 158250. | 2.43 | 148802. | 2.29 | 149082. | 2.29 | 149362. | 2.30 | 149642. | 2.30 | 149922. | 2.31 | 150202. | 2.31 |
| 70000. | 164100. | 2.34 | 170000. | 2.43 | 170250. | 2.43 | 159052. | 2.27 | 159332. | 2.28 | 159612. | 2.28 | 159892. | 2.28 | 160172. | 2.29 | 160452. | 2.29 |
| 75000. | 175600. | 2.34 | 182000. | 2.43 | 182250. | 2.43 | 169302. | 2.26 | 169582. | 2.26 | 169862. | 2.26 | 170142. | 2.27 | 170422. | 2.27 | 170702. | 2.28 |
| 80000. | 187100. | 2.34 | 194000. | 2.43 | 194250. | 2.43 | 179552. | 2.24 | 179832. | 2.25 | 180112. | 2.25 | 180392. | 2.25 | 180672. | 2.26 | 180952. | 2.26 |
| 85000. | 198600. | 2.34 | 206000. | 2.42 | 206250. | 2.43 | 189802. | 2.23 | 190082. | 2.24 | 190362. | 2.24 | 190642. | 2.24 | 190922. | 2.25 | 191202. | 2.25 |
| 90000. | 210100. | 2.33 | 218000. | 2.42 | 218250. | 2.43 | 200052. | 2.22 | 200332. | 2.23 | 200612. | 2.23 | 200892. | 2.23 | 201172. | 2.24 | 201452. | 2.24 |
| 95000. | 221600. | 2.33 | 230000. | 2.42 | 230250. | 2.42 | 210302. | 2.21 | 210582. | 2.22 | 210862. | 2.22 | 211142. | 2.22 | 211422. | 2.23 | 211702. | 2.23 |
| 100000. | 233100. | 2.33 | 242000. | 2.42 | 242250. | 2.42 | 220552. | 2.21 | 220832. | 2.21 | 221112. | 2.21 | 221392. | 2.21 | 221672. | 2.22 | 221952. | 2.22 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 11.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13675. | 2.74 | 14225. | 2.85 | 14375. | 2.88 | 12025. | 2.41 | 12175. | 2.44 | 12325. | 2.47 | 12475. | 2.50 | 12625. | 2.53 | 12775. | 2.56 |
| 10000. | 26350. | 2.64 | 26250. | 2.63 | 26500. | 2.65 | 36302. | 3.63 | 36582. | 3.66 | 36862. | 3.69 | 37142. | 3.71 | 37422. | 3.74 | 37702. | 3.77 |
| 15000. | 37975. | 2.53 | 38375. | 2.56 | 38625. | 2.58 | 46677. | 3.11 | 46957. | 3.13 | 47237. | 3.15 | 47517. | 3.17 | 47797. | 3.19 | 48077. | 3.21 |
| 20000. | 48600. | 2.43 | 50500. | 2.53 | 50750. | 2.54 | 57052. | 2.85 | 57332. | 2.87 | 57612. | 2.88 | 57892. | 2.89 | 58172. | 2.91 | 58452. | 2.92 |
| 25000. | 61225. | 2.45 | 62625. | 2.51 | 62875. | 2.52 | 67427. | 2.70 | 67707. | 2.71 | 67987. | 2.72 | 68267. | 2.73 | 68547. | 2.74 | 68827. | 2.75 |
| 30000. | 72850. | 2.43 | 74750. | 2.49 | 75000. | 2.50 | 77802. | 2.59 | 78082. | 2.60 | 78362. | 2.61 | 78642. | 2.62 | 78922. | 2.63 | 79202. | 2.64 |
| 35000. | 84475. | 2.41 | 86875. | 2.48 | 87125. | 2.49 | 88177. | 2.52 | 88457. | 2.53 | 88737. | 2.54 | 89017. | 2.54 | 89297. | 2.55 | 89577. | 2.56 |
| 40000. | 96100. | 2.40 | 99000. | 2.48 | 99250. | 2.48 | 98552. | 2.46 | 98832. | 2.47 | 99112. | 2.48 | 99392. | 2.48 | 99672. | 2.49 | 99952. | 2.50 |
| 45000. | 107725. | 2.39 | 111125. | 2.47 | 111375. | 2.48 | 108927. | 2.42 | 109207. | 2.43 | 109487. | 2.43 | 109767. | 2.44 | 110047. | 2.45 | 110327. | 2.45 |
| 50000. | 119350. | 2.39 | 123250. | 2.47 | 123500. | 2.47 | 119302. | 2.39 | 119582. | 2.39 | 119862. | 2.40 | 120142. | 2.40 | 120422. | 2.41 | 120702. | 2.41 |
| 55000. | 130975. | 2.38 | 135375. | 2.46 | 135625. | 2.47 | 129677. | 2.36 | 129957. | 2.36 | 130237. | 2.37 | 130517. | 2.37 | 130797. | 2.38 | 131077. | 2.38 |
| 60000. | 142600. | 2.38 | 147500. | 2.46 | 147750. | 2.46 | 140052. | 2.33 | 140332. | 2.34 | 140612. | 2.34 | 140892. | 2.35 | 141172. | 2.35 | 141452. | 2.36 |
| 65000. | 154225. | 2.37 | 159625. | 2.46 | 159875. | 2.46 | 150427. | 2.31 | 150707. | 2.32 | 150987. | 2.32 | 151267. | 2.33 | 151547. | 2.33 | 151827. | 2.34 |
| 70000. | 165850. | 2.37 | 171750. | 2.45 | 172000. | 2.46 | 160802. | 2.30 | 161082. | 2.30 | 161362. | 2.31 | 161642. | 2.31 | 161922. | 2.31 | 162202. | 2.32 |
| 75000. | 177475. | 2.37 | 183875. | 2.45 | 184125. | 2.46 | 171177. | 2.28 | 171457. | 2.29 | 171737. | 2.29 | 172017. | 2.29 | 172297. | 2.30 | 172577. | 2.30 |
| 80000. | 189100. | 2.36 | 196000. | 2.45 | 196250. | 2.45 | 181552. | 2.27 | 181832. | 2.27 | 182112. | 2.28 | 182392. | 2.28 | 182672. | 2.28 | 182952. | 2.29 |
| 85000. | 200725. | 2.36 | 208125. | 2.45 | 208375. | 2.45 | 191927. | 2.26 | 192207. | 2.26 | 192487. | 2.26 | 192767. | 2.27 | 193047. | 2.27 | 193327. | 2.27 |
| 90000. | 212350. | 2.36 | 220250. | 2.45 | 220500. | 2.45 | 202302. | 2.25 | 202582. | 2.25 | 202862. | 2.25 | 203142. | 2.26 | 203422. | 2.26 | 203702. | 2.26 |
| 95000. | 223975. | 2.36 | 232375. | 2.45 | 232625. | 2.45 | 212677. | 2.24 | 212957. | 2.24 | 213237. | 2.24 | 213517. | 2.25 | 213797. | 2.25 | 214077. | 2.25 |
| 100000. | 235600. | 2.36 | 244500. | 2.45 | 244750. | 2.45 | 223052. | 2.23 | 223332. | 2.23 | 223612. | 2.24 | 223892. | 2.24 | 224172. | 2.24 | 224452. | 2.24 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 12.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13800. | 2.76 | 14350. | 2.87 | 14500. | 2.90 | 12150. | 2.43 | 12300. | 2.46 | 12450. | 2.49 | 12600. | 2.52 | 12750. | 2.55 | 12900. | 2.58 |
| 10000. | 26600. | 2.66 | 26500. | 2.65 | 26750. | 2.68 | 36552. | 3.66 | 36832. | 3.68 | 37112. | 3.71 | 37392. | 3.74 | 37672. | 3.77 | 37952. | 3.80 |
| 15000. | 38350. | 2.56 | 38750. | 2.58 | 39000. | 2.60 | 47052. | 3.14 | 47332. | 3.16 | 47612. | 3.17 | 47892. | 3.19 | 48172. | 3.21 | 48452. | 3.23 |
| 20000. | 50100. | 2.51 | 51000. | 2.55 | 51250. | 2.56 | 57552. | 2.88 | 57832. | 2.89 | 58112. | 2.91 | 58392. | 2.92 | 58672. | 2.93 | 58952. | 2.95 |
| 25000. | 61850. | 2.47 | 63250. | 2.53 | 63500. | 2.54 | 68052. | 2.72 | 68332. | 2.73 | 68612. | 2.74 | 68892. | 2.76 | 69172. | 2.77 | 69452. | 2.78 |
| 30000. | 73600. | 2.45 | 75500. | 2.52 | 75750. | 2.53 | 78552. | 2.62 | 78832. | 2.63 | 79112. | 2.64 | 79392. | 2.65 | 79672. | 2.66 | 79952. | 2.67 |
| 35000. | 85350. | 2.44 | 87750. | 2.51 | 88000. | 2.51 | 89052. | 2.54 | 89332. | 2.55 | 89612. | 2.56 | 89892. | 2.57 | 90172. | 2.58 | 90452. | 2.58 |
| 40000. | 97100. | 2.43 | 100000. | 2.50 | 100250. | 2.51 | 99552. | 2.49 | 99832. | 2.50 | 100112. | 2.50 | 100392. | 2.51 | 100672. | 2.52 | 100952. | 2.52 |
| 45000. | 108850. | 2.42 | 112250. | 2.49 | 112500. | 2.50 | 110052. | 2.45 | 110332. | 2.45 | 110612. | 2.46 | 110892. | 2.46 | 111172. | 2.47 | 111452. | 2.48 |
| 50000. | 120600. | 2.41 | 124500. | 2.49 | 124750. | 2.50 | 120552. | 2.41 | 120832. | 2.42 | 121112. | 2.42 | 121392. | 2.43 | 121672. | 2.43 | 121952. | 2.44 |
| 55000. | 132350. | 2.41 | 136750. | 2.49 | 137000. | 2.49 | 131052. | 2.38 | 131332. | 2.39 | 131612. | 2.39 | 131892. | 2.40 | 132172. | 2.40 | 132452. | 2.41 |
| 60000. | 144100. | 2.40 | 149000. | 2.48 | 149250. | 2.49 | 141552. | 2.36 | 141832. | 2.36 | 142112. | 2.37 | 142392. | 2.37 | 142672. | 2.38 | 142952. | 2.38 |
| 65000. | 155850. | 2.40 | 161250. | 2.48 | 161500. | 2.48 | 152052. | 2.34 | 152332. | 2.34 | 152612. | 2.35 | 152892. | 2.35 | 153172. | 2.36 | 153452. | 2.36 |
| 70000. | 167600. | 2.39 | 173500. | 2.48 | 173750. | 2.48 | 162552. | 2.32 | 162832. | 2.33 | 163112. | 2.33 | 163392. | 2.33 | 163672. | 2.34 | 163952. | 2.34 |
| 75000. | 179350. | 2.39 | 185750. | 2.48 | 186000. | 2.48 | 173052. | 2.31 | 173332. | 2.31 | 173612. | 2.31 | 173892. | 2.32 | 174172. | 2.32 | 174452. | 2.33 |
| 80000. | 191100. | 2.39 | 198000. | 2.48 | 198250. | 2.48 | 183552. | 2.29 | 183832. | 2.30 | 184112. | 2.30 | 184392. | 2.30 | 184672. | 2.31 | 184952. | 2.31 |
| 85000. | 202850. | 2.39 | 210250. | 2.47 | 210500. | 2.48 | 194052. | 2.28 | 194332. | 2.29 | 194612. | 2.29 | 194892. | 2.29 | 195172. | 2.30 | 195452. | 2.30 |
| 90000. | 214600. | 2.38 | 222500. | 2.47 | 222750. | 2.48 | 204552. | 2.27 | 204832. | 2.28 | 205112. | 2.28 | 205392. | 2.28 | 205672. | 2.29 | 205952. | 2.29 |
| 95000. | 226350. | 2.38 | 234750. | 2.47 | 235000. | 2.47 | 215052. | 2.26 | 215332. | 2.27 | 215612. | 2.27 | 215892. | 2.27 | 216172. | 2.28 | 216452. | 2.28 |
| 00000. | 238100. | 2.38 | 247000. | 2.47 | 247250. | 2.47 | 225552. | 2.26 | 225832. | 2.26 | 226112. | 2.26 | 226392. | 2.26 | 226672. | 2.27 | 226952. | 2.27 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 12.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volume** | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 13925. | 2.79 | 14475. | 2.90 | 14625. | 2.93 | 12275. | 2.46 | 12425. | 2.49 | 12575. | 2.52 | 12725. | 2.55 | 12875. | 2.58 | 13025. | 2.61 |
| 10000. | 26850. | 2.69 | 26750. | 2.68 | 27000. | 2.70 | 36802. | 3.68 | 37082. | 3.71 | 37362. | 3.74 | 37642. | 3.76 | 37922. | 3.79 | 38202. | 3.82 |
| 15000. | 38725. | 2.58 | 39125. | 2.61 | 39375. | 2.63 | 47427. | 3.16 | 47707. | 3.18 | 47987. | 3.20 | 48267. | 3.22 | 48547. | 3.24 | 48827. | 3.26 |
| 20000. | 50600. | 2.53 | 51500. | 2.58 | 51750. | 2.59 | 58052. | 2.90 | 58332. | 2.92 | 58612. | 2.93 | 58892. | 2.94 | 59172. | 2.96 | 59452. | 2.97 |
| 25000. | 62475. | 2.50 | 63875. | 2.56 | 64125. | 2.57 | 68677. | 2.75 | 68957. | 2.76 | 69237. | 2.77 | 69517. | 2.78 | 69797. | 2.79 | 70077. | 2.80 |
| 30000. | 74350. | 2.48 | 76250. | 2.54 | 76500. | 2.55 | 79302. | 2.64 | 79582. | 2.65 | 79862. | 2.66 | 80142. | 2.67 | 80422. | 2.68 | 80702. | 2.69 |
| 35000. | 86225. | 2.46 | 88625. | 2.53 | 88875. | 2.54 | 89927. | 2.57 | 90207. | 2.58 | 90487. | 2.59 | 90767. | 2.59 | 91047. | 2.60 | 91327. | 2.61 |
| 40000. | 98100. | 2.45 | 101000. | 2.53 | 101250. | 2.53 | 100552. | 2.51 | 100832. | 2.52 | 101112. | 2.53 | 101392. | 2.53 | 101672. | 2.54 | 101952. | 2.55 |
| 45000. | 109975. | 2.44 | 113375. | 2.52 | 113625. | 2.53 | 111177. | 2.47 | 111457. | 2.48 | 111737. | 2.48 | 112017. | 2.49 | 112297. | 2.50 | 112577. | 2.50 |
| 50000. | 121850. | 2.44 | 125750. | 2.52 | 126000. | 2.52 | 121802. | 2.44 | 122082. | 2.44 | 122362. | 2.45 | 122642. | 2.45 | 122922. | 2.46 | 123202. | 2.46 |
| 55000. | 133725. | 2.43 | 138125. | 2.51 | 138375. | 2.52 | 132427. | 2.41 | 132707. | 2.41 | 132987. | 2.42 | 133267. | 2.42 | 133547. | 2.43 | 133827. | 2.43 |
| 60000. | 145600. | 2.43 | 150500. | 2.51 | 150750. | 2.51 | 143052. | 2.38 | 143332. | 2.39 | 143612. | 2.39 | 143892. | 2.40 | 144172. | 2.40 | 144452. | 2.41 |
| 65000. | 157475. | 2.42 | 162875. | 2.51 | 163125. | 2.51 | 153677. | 2.36 | 153957. | 2.37 | 154237. | 2.37 | 154517. | 2.38 | 154797. | 2.38 | 155077. | 2.39 |
| 70000. | 169350. | 2.42 | 175250. | 2.50 | 175500. | 2.51 | 164302. | 2.35 | 164582. | 2.35 | 164862. | 2.36 | 165142. | 2.36 | 165422. | 2.36 | 165702. | 2.37 |
| 75000. | 181225. | 2.42 | 187625. | 2.50 | 187875. | 2.51 | 174927. | 2.33 | 175207. | 2.34 | 175487. | 2.34 | 175767. | 2.34 | 176047. | 2.35 | 176327. | 2.35 |
| 80000. | 193100. | 2.41 | 200000. | 2.50 | 200250. | 2.50 | 185552. | 2.32 | 185832. | 2.32 | 186112. | 2.33 | 186392. | 2.33 | 186672. | 2.33 | 186952. | 2.34 |
| 85000. | 204975. | 2.41 | 212375. | 2.50 | 212625. | 2.50 | 196177. | 2.31 | 196457. | 2.31 | 196737. | 2.31 | 197017. | 2.32 | 197297. | 2.32 | 197577. | 2.32 |
| 90000. | 216850. | 2.41 | 224750. | 2.50 | 225000. | 2.50 | 206802. | 2.30 | 207082. | 2.30 | 207362. | 2.30 | 207642. | 2.31 | 207922. | 2.31 | 208202. | 2.31 |
| 95000. | 228725. | 2.41 | 237125. | 2.50 | 237375. | 2.50 | 217427. | 2.29 | 217707. | 2.29 | 217987. | 2.29 | 218267. | 2.30 | 218547. | 2.30 | 218827. | 2.30 |
| 100000. | 240600. | 2.41 | 249500. | 2.50 | 249750. | 2.50 | 228052. | 2.28 | 228332. | 2.28 | 228612. | 2.29 | 228892. | 2.29 | 229172. | 2.29 | 229452. | 2.29 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 13.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14050. | 2.81 | 14600. | 2.92 | 14750. | 2.95 | 12400. | 2.48 | 12550. | 2.51 | 12700. | 2.54 | 12850. | 2.57 | 13000. | 2.60 | 13150. | 2.63 |
| 10000. | 27100. | 2.71 | 27000. | 2.70 | 27250. | 2.73 | 37052. | 3.71 | 37332. | 3.73 | 37612. | 3.76 | 37892. | 3.79 | 38172. | 3.82 | 38452. | 3.85 |
| 15000. | 39100. | 2.61 | 39500. | 2.63 | 39750. | 2.65 | 47802. | 3.19 | 48082. | 3.21 | 48362. | 3.22 | 48642. | 3.24 | 48922. | 3.26 | 49202. | 3.28 |
| 20000. | 51100. | 2.56 | 52000. | 2.60 | 52250. | 2.61 | 58552. | 2.93 | 58832. | 2.94 | 59112. | 2.96 | 59392. | 2.97 | 59672. | 2.98 | 59952. | 3.00 |
| 25000. | 63100. | 2.52 | 64500. | 2.58 | 64750. | 2.59 | 69302. | 2.77 | 69582. | 2.78 | 69862. | 2.79 | 70142. | 2.81 | 70422. | 2.82 | 70702. | 2.83 |
| 30000. | 75100. | 2.50 | 77000. | 2.57 | 77250. | 2.58 | 80052. | 2.67 | 80332. | 2.68 | 80612. | 2.69 | 80892. | 2.70 | 81172. | 2.71 | 81452. | 2.72 |
| 35000. | 87100. | 2.49 | 89500. | 2.56 | 89750. | 2.56 | 90802. | 2.59 | 91082. | 2.60 | 91362. | 2.61 | 91642. | 2.62 | 91922. | 2.63 | 92202. | 2.63 |
| 40000. | 99100. | 2.48 | 102000. | 2.55 | 102250. | 2.56 | 101552. | 2.54 | 101832. | 2.55 | 102112. | 2.55 | 102392. | 2.56 | 102672. | 2.57 | 102952. | 2.57 |
| 45000. | 111100. | 2.47 | 114500. | 2.54 | 114750. | 2.55 | 112302. | 2.50 | 112582. | 2.50 | 112862. | 2.51 | 113142. | 2.51 | 113422. | 2.52 | 113702. | 2.53 |
| 50000. | 123100. | 2.46 | 127000. | 2.54 | 127250. | 2.55 | 123052. | 2.46 | 123332. | 2.47 | 123612. | 2.47 | 123892. | 2.48 | 124172. | 2.48 | 124452. | 2.49 |
| 55000. | 135100. | 2.46 | 139500. | 2.54 | 139750. | 2.54 | 133802. | 2.43 | 134082. | 2.44 | 134362. | 2.44 | 134642. | 2.45 | 134922. | 2.45 | 135202. | 2.46 |
| 60000. | 147100. | 2.45 | 152000. | 2.53 | 152250. | 2.54 | 144552. | 2.41 | 144832. | 2.41 | 145112. | 2.42 | 145392. | 2.42 | 145672. | 2.43 | 145952. | 2.43 |
| 65000. | 159100. | 2.45 | 164500. | 2.53 | 164750. | 2.53 | 155302. | 2.39 | 155582. | 2.39 | 155862. | 2.40 | 156142. | 2.40 | 156422. | 2.41 | 156702. | 2.41 |
| 70000. | 171100. | 2.44 | 177000. | 2.53 | 177250. | 2.53 | 166052. | 2.37 | 166332. | 2.38 | 166612. | 2.38 | 166892. | 2.38 | 167172. | 2.39 | 167452. | 2.39 |
| 75000. | 183100. | 2.44 | 189500. | 2.53 | 189750. | 2.53 | 176802. | 2.36 | 177082. | 2.36 | 177362. | 2.36 | 177642. | 2.37 | 177922. | 2.37 | 178202. | 2.38 |
| 80000. | 195100. | 2.44 | 202000. | 2.53 | 202250. | 2.53 | 187552. | 2.34 | 187832. | 2.35 | 188112. | 2.35 | 188392. | 2.35 | 188672. | 2.36 | 188952. | 2.36 |
| 85000. | 207100. | 2.44 | 214500. | 2.52 | 214750. | 2.53 | 198302. | 2.33 | 198582. | 2.34 | 198862. | 2.34 | 199142. | 2.34 | 199422. | 2.35 | 199702. | 2.35 |
| 90000. | 219100. | 2.43 | 227000. | 2.52 | 227250. | 2.53 | 209052. | 2.32 | 209332. | 2.33 | 209612. | 2.33 | 209892. | 2.33 | 210172. | 2.34 | 210452. | 2.34 |
| 95000. | 231100. | 2.43 | 239500. | 2.52 | 239750. | 2.52 | 219802. | 2.31 | 220082. | 2.32 | 220362. | 2.32 | 220642. | 2.32 | 220922. | 2.33 | 221202. | 2.33 |
| 100000. | 243100. | 2.43 | 252000. | 2.52 | 252250. | 2.52 | 230552. | 2.31 | 230832. | 2.31 | 231112. | 2.31 | 231392. | 2.31 | 231672. | 2.32 | 231952. | 2.32 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 13.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14175. | 2.84 | 14725. | 2.95 | 14875. | 2.98 | 12525. | 2.51 | 12675. | 2.54 | 12825. | 2.57 | 12975. | 2.60 | 13125. | 2.63 | 13275. | 2.66 |
| 10000. | 27350. | 2.74 | 27250. | 2.73 | 27500. | 2.75 | 37302. | 3.73 | 37582. | 3.76 | 37862. | 3.79 | 38142. | 3.81 | 38422. | 3.84 | 38702. | 3.87 |
| 15000. | 39475. | 2.63 | 39875. | 2.66 | 40125. | 2.68 | 48177. | 3.21 | 48457. | 3.23 | 48737. | 3.25 | 49017. | 3.27 | 49297. | 3.29 | 49577. | 3.31 |
| 20000. | 51600. | 2.58 | 52500. | 2.63 | 52750. | 2.64 | 59052. | 2.95 | 59332. | 2.97 | 59612. | 2.98 | 59892. | 2.99 | 60172. | 3.01 | 60452. | 3.02 |
| 25000. | 63725. | 2.55 | 65125. | 2.61 | 65375. | 2.62 | 69927. | 2.80 | 70207. | 2.81 | 70487. | 2.82 | 70767. | 2.83 | 71047. | 2.84 | 71327. | 2.85 |
| 30000. | 75850. | 2.53 | 77750. | 2.59 | 78000. | 2.60 | 80802. | 2.69 | 81082. | 2.70 | 81362. | 2.71 | 81642. | 2.72 | 81922. | 2.73 | 82202. | 2.74 |
| 35000. | 87975. | 2.51 | 90375. | 2.58 | 90625. | 2.59 | 91677. | 2.62 | 91957. | 2.63 | 92237. | 2.64 | 92517. | 2.64 | 92797. | 2.65 | 93077. | 2.66 |
| 40000. | 100100. | 2.50 | 103000. | 2.58 | 103250. | 2.58 | 102552. | 2.56 | 102832. | 2.57 | 103112. | 2.58 | 103392. | 2.58 | 103672. | 2.59 | 103952. | 2.60 |
| 45000. | 112225. | 2.49 | 115625. | 2.57 | 115875. | 2.58 | 113427. | 2.52 | 113707. | 2.53 | 113987. | 2.53 | 114267. | 2.54 | 114547. | 2.55 | 114827. | 2.55 |
| 50000. | 124350. | 2.49 | 128250. | 2.57 | 128500. | 2.57 | 124302. | 2.49 | 124582. | 2.49 | 124862. | 2.50 | 125142. | 2.50 | 125422. | 2.51 | 125702. | 2.51 |
| 55000. | 136475. | 2.48 | 140875. | 2.56 | 141125. | 2.57 | 135177. | 2.46 | 135457. | 2.46 | 135737. | 2.47 | 136017. | 2.47 | 136297. | 2.48 | 136577. | 2.48 |
| 60000. | 148600. | 2.48 | 153500. | 2.56 | 153750. | 2.56 | 146052. | 2.43 | 146332. | 2.44 | 146612. | 2.44 | 146892. | 2.45 | 147172. | 2.45 | 147452. | 2.46 |
| 65000. | 160725. | 2.47 | 166125. | 2.56 | 166375. | 2.56 | 156927. | 2.41 | 157207. | 2.42 | 157487. | 2.42 | 157767. | 2.43 | 158047. | 2.43 | 158327. | 2.44 |
| 70000. | 172850. | 2.47 | 178750. | 2.55 | 179000. | 2.56 | 167802. | 2.40 | 168082. | 2.40 | 168362. | 2.41 | 168642. | 2.41 | 168922. | 2.41 | 169202. | 2.42 |
| 75000. | 184975. | 2.47 | 191375. | 2.55 | 191625. | 2.56 | 178677. | 2.38 | 178957. | 2.39 | 179237. | 2.39 | 179517. | 2.39 | 179797. | 2.40 | 180077. | 2.40 |
| 80000. | 197100. | 2.46 | 204000. | 2.55 | 204250. | 2.55 | 189552. | 2.37 | 189832. | 2.37 | 190112. | 2.38 | 190392. | 2.38 | 190672. | 2.38 | 190952. | 2.39 |
| 85000. | 209225. | 2.46 | 216625. | 2.55 | 216875. | 2.55 | 200427. | 2.36 | 200707. | 2.36 | 200987. | 2.36 | 201267. | 2.37 | 201547. | 2.37 | 201827. | 2.37 |
| 90000. | 221350. | 2.46 | 229250. | 2.55 | 229500. | 2.55 | 211302. | 2.35 | 211582. | 2.35 | 211862. | 2.35 | 212142. | 2.36 | 212422. | 2.36 | 212702. | 2.36 |
| 95000. | 233475. | 2.46 | 241875. | 2.55 | 242125. | 2.55 | 222177. | 2.34 | 222457. | 2.34 | 222737. | 2.34 | 223017. | 2.35 | 223297. | 2.35 | 223577. | 2.35 |
| 100000. | 245600. | 2.46 | 254500. | 2.55 | 254750. | 2.55 | 233052. | 2.33 | 233332. | 2.33 | 233612. | 2.34 | 233892. | 2.34 | 234172. | 2.34 | 234452. | 2.34 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

**Trucking Distance:** 14.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volume** | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14300. | 2.86 | 14850. | 2.97 | 15000. | 3.00 | 12650. | 2.53 | 12800. | 2.56 | 12950. | 2.59 | 13100. | 2.62 | 13250. | 2.65 | 13400. | 2.68 |
| 10000. | 27600. | 2.76 | 27500. | 2.75 | 27750. | 2.78 | 37552. | 3.76 | 37832. | 3.78 | 38112. | 3.81 | 38392. | 3.84 | 38672. | 3.87 | 38952. | 3.90 |
| 15000. | 39850. | 2.66 | 40250. | 2.68 | 40500. | 2.70 | 48552. | 3.24 | 48832. | 3.26 | 49112. | 3.27 | 49392. | 3.29 | 49672. | 3.31 | 49952. | 3.33 |
| 20000. | 52100. | 2.61 | 53000. | 2.65 | 53250. | 2.66 | 59552. | 2.98 | 59832. | 2.99 | 60112. | 3.01 | 60392. | 3.02 | 60672. | 3.03 | 60952. | 3.05 |
| 25000. | 64350. | 2.57 | 65750. | 2.63 | 66000. | 2.64 | 70552. | 2.82 | 70832. | 2.83 | 71112. | 2.84 | 71392. | 2.86 | 71672. | 2.87 | 71952. | 2.88 |
| 30000. | 76600. | 2.55 | 78500. | 2.62 | 78750. | 2.63 | 81552. | 2.72 | 81832. | 2.73 | 82112. | 2.74 | 82392. | 2.75 | 82672. | 2.76 | 82952. | 2.77 |
| 35000. | 88850. | 2.54 | 91250. | 2.61 | 91500. | 2.61 | 92552. | 2.64 | 92832. | 2.65 | 93112. | 2.66 | 93392. | 2.67 | 93672. | 2.68 | 93952. | 2.68 |
| 40000. | 101100. | 2.53 | 104000. | 2.60 | 104250. | 2.61 | 103552. | 2.59 | 103832. | 2.60 | 104112. | 2.60 | 104392. | 2.61 | 104672. | 2.62 | 104952. | 2.62 |
| 45000. | 113350. | 2.52 | 116750. | 2.59 | 117000. | 2.60 | 114552. | 2.55 | 114832. | 2.55 | 115112. | 2.56 | 115392. | 2.56 | 115672. | 2.57 | 115952. | 2.58 |
| 50000. | 125600. | 2.51 | 129500. | 2.59 | 129750. | 2.60 | 125552. | 2.51 | 125832. | 2.52 | 126112. | 2.52 | 126392. | 2.53 | 126672. | 2.53 | 126952. | 2.54 |
| 55000. | 137850. | 2.51 | 142250. | 2.59 | 142500. | 2.59 | 136552. | 2.48 | 136832. | 2.49 | 137112. | 2.49 | 137392. | 2.50 | 137672. | 2.50 | 137952. | 2.51 |
| 60000. | 150100. | 2.50 | 155000. | 2.58 | 155250. | 2.59 | 147552. | 2.46 | 147832. | 2.46 | 148112. | 2.47 | 148392. | 2.47 | 148672. | 2.48 | 148952. | 2.48 |
| 65000. | 162350. | 2.50 | 167750. | 2.58 | 168000. | 2.58 | 158552. | 2.44 | 158832. | 2.44 | 159112. | 2.45 | 159392. | 2.45 | 159672. | 2.46 | 159952. | 2.46 |
| 70000. | 174600. | 2.49 | 180500. | 2.58 | 180750. | 2.58 | 169552. | 2.42 | 169832. | 2.43 | 170112. | 2.43 | 170392. | 2.43 | 170672. | 2.44 | 170952. | 2.44 |
| 75000. | 186850. | 2.49 | 193250. | 2.58 | 193500. | 2.58 | 180552. | 2.41 | 180832. | 2.41 | 181112. | 2.41 | 181392. | 2.42 | 181672. | 2.42 | 181952. | 2.43 |
| 80000. | 199100. | 2.49 | 206000. | 2.58 | 206250. | 2.58 | 191552. | 2.39 | 191832. | 2.40 | 192112. | 2.40 | 192392. | 2.40 | 192672. | 2.41 | 192952. | 2.41 |
| 85000. | 211350. | 2.49 | 218750. | 2.57 | 219000. | 2.58 | 202552. | 2.38 | 202832. | 2.39 | 203112. | 2.39 | 203392. | 2.39 | 203672. | 2.40 | 203952. | 2.40 |
| 90000. | 223600. | 2.48 | 231500. | 2.57 | 231750. | 2.58 | 213552. | 2.37 | 213832. | 2.38 | 214112. | 2.38 | 214392. | 2.38 | 214672. | 2.39 | 214952. | 2.39 |
| 95000. | 235850. | 2.48 | 244250. | 2.57 | 244500. | 2.57 | 224552. | 2.36 | 224832. | 2.37 | 225112. | 2.37 | 225392. | 2.37 | 225672. | 2.38 | 225952. | 2.38 |
| 100000. | 248100. | 2.48 | 257000. | 2.57 | 257250. | 2.57 | 235552. | 2.36 | 235832. | 2.36 | 236112. | 2.36 | 236392. | 2.36 | 236672. | 2.37 | 236952. | 2.37 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 14.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| Volume | 10% $/Job | 10% $/cy | 20% $/Job | 20% $/cy | 30% $/Job | 30% $/cy | 40% $/Job | 40% $/cy | 50% $/Job | 50% $/cy |
|---|---|---|---|---|---|---|---|---|---|---|
| 5000. | 14425. | 2.89 | 14975. | 3.00 | 15125. | 3.03 | 12775. | 2.56 | 12925. | 2.59 |
| 10000. | 27850. | 2.79 | 27750. | 2.78 | 28000. | 2.80 | 37802. | 3.78 | 38082. | 3.81 |
| 15000. | 40325. | 2.68 | 40625. | 2.71 | 40875. | 2.73 | 48927. | 3.26 | 49207. | 3.28 |
| 20000. | 52600. | 2.63 | 53500. | 2.68 | 53750. | 2.69 | 60052. | 3.00 | 60332. | 3.02 |
| 25000. | 64975. | 2.60 | 66375. | 2.66 | 66625. | 2.67 | 71177. | 2.85 | 71457. | 2.86 |
| 30000. | 77350. | 2.58 | 79250. | 2.64 | 79500. | 2.65 | 82302. | 2.74 | 82582. | 2.75 |
| 35000. | 89725. | 2.56 | 92125. | 2.63 | 92375. | 2.64 | 93427. | 2.67 | 93707. | 2.68 |
| 40000. | 102100. | 2.55 | 105000. | 2.63 | 105250. | 2.63 | 104552. | 2.61 | 104832. | 2.62 |
| 45000. | 114475. | 2.54 | 117875. | 2.62 | 118125. | 2.63 | 115677. | 2.57 | 115957. | 2.58 |
| 50000. | 126850. | 2.54 | 130750. | 2.62 | 131000. | 2.62 | 126802. | 2.54 | 127082. | 2.54 |
| 55000. | 139225. | 2.53 | 143625. | 2.61 | 143875. | 2.62 | 137927. | 2.51 | 138207. | 2.51 |
| 60000. | 151600. | 2.53 | 156500. | 2.61 | 156750. | 2.61 | 149052. | 2.48 | 149332. | 2.49 |
| 65000. | 163975. | 2.52 | 169375. | 2.61 | 169625. | 2.61 | 160177. | 2.46 | 160457. | 2.47 |
| 70000. | 176350. | 2.52 | 182250. | 2.60 | 182500. | 2.61 | 171302. | 2.45 | 171582. | 2.45 |
| 75000. | 188725. | 2.52 | 195125. | 2.60 | 195375. | 2.61 | 182427. | 2.43 | 182707. | 2.44 |
| 80000. | 201100. | 2.51 | 208000. | 2.60 | 208250. | 2.60 | 193552. | 2.42 | 193832. | 2.42 |
| 85000. | 213475. | 2.51 | 220875. | 2.60 | 221125. | 2.60 | 204677. | 2.41 | 204957. | 2.41 |
| 90000. | 225850. | 2.51 | 233750. | 2.60 | 234000. | 2.60 | 215802. | 2.40 | 216082. | 2.40 |
| 95000. | 238225. | 2.51 | 246625. | 2.60 | 246875. | 2.60 | 226927. | 2.39 | 227207. | 2.39 |
| 100000. | 250600. | 2.51 | 259500. | 2.60 | 259750. | 2.60 | 238052. | 2.38 | 238332. | 2.38 |

| Volume | 60% $/Job | 60% $/cy | 70% $/Job | 70% $/cy | 80% $/Job | 80% $/cy | 90% $/Job | 90% $/cy |
|---|---|---|---|---|---|---|---|---|
| 5000. | 13075. | 2.62 | 13225. | 2.65 | 13375. | 2.68 | 13525. | 2.71 |
| 10000. | 38362. | 3.84 | 38642. | 3.86 | 38922. | 3.89 | 39202. | 3.92 |
| 15000. | 49487. | 3.30 | 49767. | 3.32 | 50047. | 3.34 | 50327. | 3.36 |
| 20000. | 60612. | 3.03 | 60892. | 3.04 | 61172. | 3.06 | 61452. | 3.07 |
| 25000. | 71737. | 2.87 | 72017. | 2.88 | 72297. | 2.89 | 72577. | 2.90 |
| 30000. | 82862. | 2.76 | 83142. | 2.77 | 83422. | 2.78 | 83702. | 2.79 |
| 35000. | 93987. | 2.69 | 94267. | 2.69 | 94547. | 2.70 | 94827. | 2.71 |
| 40000. | 105112. | 2.63 | 105392. | 2.63 | 105672. | 2.64 | 105952. | 2.65 |
| 45000. | 116237. | 2.58 | 116517. | 2.59 | 116797. | 2.60 | 117077. | 2.60 |
| 50000. | 127362. | 2.55 | 127642. | 2.55 | 127922. | 2.56 | 128202. | 2.56 |
| 55000. | 138487. | 2.52 | 138767. | 2.52 | 139047. | 2.53 | 139327. | 2.53 |
| 60000. | 149612. | 2.49 | 149892. | 2.50 | 150172. | 2.50 | 150452. | 2.51 |
| 65000. | 160737. | 2.47 | 161017. | 2.48 | 161297. | 2.48 | 161577. | 2.49 |
| 70000. | 171862. | 2.46 | 172142. | 2.46 | 172422. | 2.46 | 172702. | 2.47 |
| 75000. | 182987. | 2.44 | 183267. | 2.44 | 183547. | 2.45 | 183827. | 2.45 |
| 80000. | 194112. | 2.43 | 194392. | 2.43 | 194672. | 2.43 | 194952. | 2.44 |
| 85000. | 205237. | 2.41 | 205517. | 2.42 | 205797. | 2.42 | 206077. | 2.42 |
| 90000. | 216362. | 2.40 | 216642. | 2.41 | 216922. | 2.41 | 217202. | 2.41 |
| 95000. | 227487. | 2.39 | 227767. | 2.40 | 228047. | 2.40 | 228327. | 2.40 |
| 100000. | 238612. | 2.39 | 238892. | 2.39 | 239172. | 2.39 | 239452. | 2.39 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT-I Area).**

**Trucking Distance:** 15.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14550. | 2.91 | 15100. | 3.02 | 15250. | 3.05 | 12900. | 2.58 | 13050. | 2.61 | 13200. | 2.64 | 13350. | 2.67 | 13500. | 2.70 | 13650. | 2.73 |
| 10000. | 28100. | 2.81 | 28000. | 2.80 | 28250. | 2.83 | 38052. | 3.81 | 38332. | 3.83 | 38612. | 3.86 | 38892. | 3.89 | 39172. | 3.92 | 39452. | 3.95 |
| 15000. | 40600. | 2.71 | 41000. | 2.73 | 41250. | 2.75 | 49302. | 3.29 | 49582. | 3.31 | 49862. | 3.32 | 50142. | 3.34 | 50422. | 3.36 | 50702. | 3.38 |
| 20000. | 53100. | 2.66 | 54000. | 2.70 | 54250. | 2.71 | 60552. | 3.03 | 60832. | 3.04 | 61112. | 3.06 | 61392. | 3.07 | 61672. | 3.08 | 61952. | 3.10 |
| 25000. | 65600. | 2.62 | 67000. | 2.68 | 67250. | 2.69 | 71802. | 2.87 | 72082. | 2.88 | 72362. | 2.89 | 72642. | 2.91 | 72922. | 2.92 | 73202. | 2.93 |
| 30000. | 78100. | 2.60 | 80000. | 2.67 | 80250. | 2.68 | 83052. | 2.77 | 83332. | 2.78 | 83612. | 2.79 | 83892. | 2.80 | 84172. | 2.81 | 84452. | 2.82 |
| 35000. | 90600. | 2.59 | 93000. | 2.66 | 93250. | 2.66 | 94302. | 2.69 | 94582. | 2.70 | 94862. | 2.71 | 95142. | 2.72 | 95422. | 2.73 | 95702. | 2.73 |
| 40000. | 103100. | 2.58 | 106000. | 2.65 | 106250. | 2.66 | 105552. | 2.64 | 105832. | 2.65 | 106112. | 2.65 | 106392. | 2.66 | 106672. | 2.67 | 106952. | 2.67 |
| 45000. | 115600. | 2.57 | 119000. | 2.64 | 119250. | 2.65 | 116802. | 2.60 | 117082. | 2.60 | 117362. | 2.61 | 117642. | 2.61 | 117922. | 2.62 | 118202. | 2.63 |
| 50000. | 128100. | 2.56 | 132000. | 2.64 | 132250. | 2.65 | 128052. | 2.56 | 128332. | 2.57 | 128612. | 2.57 | 128892. | 2.58 | 129172. | 2.58 | 129452. | 2.59 |
| 55000. | 140600. | 2.56 | 145000. | 2.64 | 145250. | 2.64 | 139302. | 2.53 | 139582. | 2.54 | 139862. | 2.54 | 140142. | 2.55 | 140422. | 2.55 | 140702. | 2.56 |
| 60000. | 153100. | 2.55 | 158000. | 2.63 | 158250. | 2.64 | 150552. | 2.51 | 150832. | 2.51 | 151112. | 2.52 | 151392. | 2.52 | 151672. | 2.53 | 151952. | 2.53 |
| 65000. | 165600. | 2.55 | 171000. | 2.63 | 171250. | 2.63 | 161802. | 2.49 | 162082. | 2.49 | 162362. | 2.50 | 162642. | 2.50 | 162922. | 2.51 | 163202. | 2.51 |
| 70000. | 178100. | 2.54 | 184000. | 2.63 | 184250. | 2.63 | 173052. | 2.47 | 173332. | 2.48 | 173612. | 2.48 | 173892. | 2.48 | 174172. | 2.49 | 174452. | 2.49 |
| 75000. | 190600. | 2.54 | 197000. | 2.63 | 197250. | 2.63 | 184302. | 2.46 | 184582. | 2.46 | 184862. | 2.46 | 185142. | 2.47 | 185422. | 2.47 | 185702. | 2.48 |
| 80000. | 203100. | 2.54 | 210000. | 2.63 | 210250. | 2.63 | 195552. | 2.44 | 195832. | 2.45 | 196112. | 2.45 | 196392. | 2.45 | 196672. | 2.46 | 196952. | 2.46 |
| 85000. | 215600. | 2.54 | 223000. | 2.62 | 223250. | 2.63 | 206802. | 2.43 | 207082. | 2.44 | 207362. | 2.44 | 207642. | 2.44 | 207922. | 2.45 | 208202. | 2.45 |
| 90000. | 228100. | 2.53 | 236000. | 2.62 | 236250. | 2.63 | 218052. | 2.42 | 218332. | 2.43 | 218612. | 2.43 | 218892. | 2.43 | 219172. | 2.44 | 219452. | 2.44 |
| 95000. | 240600. | 2.53 | 249000. | 2.62 | 249250. | 2.62 | 229302. | 2.41 | 229582. | 2.42 | 229862. | 2.42 | 230142. | 2.42 | 230422. | 2.43 | 230702. | 2.43 |
| 100000. | 253100. | 2.53 | 262000. | 2.62 | 262250. | 2.62 | 240552. | 2.41 | 240832. | 2.41 | 241112. | 2.41 | 241392. | 2.41 | 241672. | 2.42 | 241952. | 2.42 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT-I Area).**

**Trucking Distance:** 15.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14675. | 2.94 | 15225. | 3.05 | 15375. | 3.08 | 13025. | 2.61 | 13175. | 2.64 | 13325. | 2.67 | 13475. | 2.70 | 13625. | 2.73 | 13775. | 2.76 |
| 10000. | 28350. | 2.84 | 28250. | 2.83 | 28500. | 2.85 | 38302. | 3.83 | 38582. | 3.86 | 38862. | 3.89 | 39142. | 3.91 | 39422. | 3.94 | 39702. | 3.97 |
| 15000. | 40975. | 2.73 | 41375. | 2.76 | 41625. | 2.78 | 49677. | 3.31 | 49957. | 3.33 | 50237. | 3.35 | 50517. | 3.37 | 50797. | 3.39 | 51077. | 3.41 |
| 20000. | 53600. | 2.68 | 54500. | 2.73 | 54750. | 2.74 | 61052. | 3.05 | 61332. | 3.07 | 61612. | 3.08 | 61892. | 3.09 | 62172. | 3.11 | 62452. | 3.12 |
| 25000. | 66225. | 2.65 | 67625. | 2.71 | 67875. | 2.72 | 72427. | 2.90 | 72707. | 2.91 | 72987. | 2.92 | 73267. | 2.93 | 73547. | 2.94 | 73827. | 2.95 |
| 30000. | 78850. | 2.63 | 80750. | 2.69 | 81000. | 2.70 | 83802. | 2.79 | 84082. | 2.80 | 84362. | 2.81 | 84642. | 2.82 | 84922. | 2.83 | 85202. | 2.84 |
| 35000. | 91475. | 2.61 | 93875. | 2.68 | 94125. | 2.69 | 95177. | 2.72 | 95457. | 2.73 | 95737. | 2.74 | 96017. | 2.74 | 96297. | 2.75 | 96577. | 2.76 |
| 40000. | 104100. | 2.60 | 107000. | 2.68 | 107250. | 2.68 | 106552. | 2.66 | 106832. | 2.67 | 107112. | 2.68 | 107392. | 2.68 | 107672. | 2.69 | 107952. | 2.70 |
| 45000. | 116725. | 2.59 | 120125. | 2.67 | 120375. | 2.68 | 117927. | 2.62 | 118207. | 2.63 | 118487. | 2.63 | 118767. | 2.64 | 119047. | 2.65 | 119327. | 2.65 |
| 50000. | 129350. | 2.59 | 133250. | 2.67 | 133500. | 2.67 | 129302. | 2.59 | 129582. | 2.59 | 129862. | 2.60 | 130142. | 2.60 | 130422. | 2.61 | 130702. | 2.61 |
| 55000. | 141975. | 2.58 | 146375. | 2.66 | 146625. | 2.67 | 140677. | 2.56 | 140957. | 2.56 | 141237. | 2.57 | 141517. | 2.57 | 141797. | 2.58 | 142077. | 2.58 |
| 60000. | 154600. | 2.58 | 159500. | 2.66 | 159750. | 2.66 | 152052. | 2.53 | 152332. | 2.54 | 152612. | 2.54 | 152892. | 2.55 | 153172. | 2.55 | 153452. | 2.56 |
| 65000. | 167225. | 2.57 | 172625. | 2.66 | 172875. | 2.66 | 163427. | 2.51 | 163707. | 2.52 | 163987. | 2.52 | 164267. | 2.53 | 164547. | 2.53 | 164827. | 2.54 |
| 70000. | 179850. | 2.57 | 185750. | 2.65 | 186000. | 2.66 | 174802. | 2.50 | 175082. | 2.50 | 175362. | 2.51 | 175642. | 2.51 | 175922. | 2.51 | 176202. | 2.52 |
| 75000. | 192475. | 2.57 | 198875. | 2.65 | 199125. | 2.66 | 186177. | 2.48 | 186457. | 2.49 | 186737. | 2.49 | 187017. | 2.49 | 187297. | 2.50 | 187577. | 2.50 |
| 80000. | 205100. | 2.56 | 212000. | 2.65 | 212250. | 2.65 | 197552. | 2.47 | 197832. | 2.47 | 198112. | 2.48 | 198392. | 2.48 | 198672. | 2.48 | 198952. | 2.49 |
| 85000. | 217725. | 2.56 | 225125. | 2.65 | 225375. | 2.65 | 208927. | 2.46 | 209207. | 2.46 | 209487. | 2.46 | 209767. | 2.47 | 210047. | 2.47 | 210327. | 2.47 |
| 90000. | 230350. | 2.56 | 238250. | 2.65 | 238500. | 2.65 | 220302. | 2.45 | 220582. | 2.45 | 220862. | 2.45 | 221142. | 2.46 | 221422. | 2.46 | 221702. | 2.46 |
| 95000. | 242975. | 2.56 | 251375. | 2.65 | 251625. | 2.65 | 231677. | 2.44 | 231957. | 2.44 | 232237. | 2.44 | 232517. | 2.45 | 232797. | 2.45 | 233077. | 2.45 |
| 100000. | 255600. | 2.56 | 264500. | 2.65 | 264750. | 2.65 | 243052. | 2.43 | 243332. | 2.43 | 243612. | 2.44 | 243892. | 2.44 | 244172. | 2.44 | 244452. | 2.44 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 16.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14800. | 2.96 | 15350. | 3.07 | 15500. | 3.10 | 13150. | 2.63 | 13300. | 2.66 | 13450. | 2.69 | 13600. | 2.72 | 13750. | 2.75 | 13900. | 2.78 |
| 10000. | 28600. | 2.86 | 28500. | 2.85 | 28750. | 2.88 | 38552. | 3.86 | 38832. | 3.88 | 39112. | 3.91 | 39392. | 3.94 | 39672. | 3.97 | 39952. | 4.00 |
| 15000. | 41350. | 2.76 | 41750. | 2.78 | 42000. | 2.80 | 50052. | 3.34 | 50332. | 3.36 | 50612. | 3.37 | 50892. | 3.39 | 51172. | 3.41 | 51452. | 3.43 |
| 20000. | 54100. | 2.71 | 55000. | 2.75 | 55250. | 2.76 | 61552. | 3.08 | 61832. | 3.09 | 62112. | 3.11 | 62392. | 3.12 | 62672. | 3.13 | 62952. | 3.15 |
| 25000. | 66850. | 2.67 | 68250. | 2.73 | 68500. | 2.74 | 73052. | 2.92 | 73332. | 2.93 | 73612. | 2.94 | 73892. | 2.96 | 74172. | 2.97 | 74452. | 2.98 |
| 30000. | 79600. | 2.65 | 81500. | 2.72 | 81750. | 2.73 | 84552. | 2.82 | 84832. | 2.83 | 85112. | 2.84 | 85392. | 2.85 | 85672. | 2.86 | 85952. | 2.87 |
| 35000. | 92350. | 2.64 | 94750. | 2.71 | 95000. | 2.71 | 96052. | 2.74 | 96332. | 2.75 | 96612. | 2.76 | 96892. | 2.77 | 97172. | 2.78 | 97452. | 2.78 |
| 40000. | 105100. | 2.63 | 108000. | 2.70 | 108250. | 2.71 | 107552. | 2.69 | 107832. | 2.70 | 108112. | 2.70 | 108392. | 2.71 | 108672. | 2.72 | 108952. | 2.72 |
| 45000. | 117850. | 2.62 | 121250. | 2.69 | 121500. | 2.70 | 119052. | 2.65 | 119332. | 2.65 | 119612. | 2.66 | 119892. | 2.66 | 120172. | 2.67 | 120452. | 2.68 |
| 50000. | 130600. | 2.61 | 134500. | 2.69 | 134750. | 2.70 | 130552. | 2.61 | 130832. | 2.62 | 131112. | 2.62 | 131392. | 2.63 | 131672. | 2.63 | 131952. | 2.64 |
| 55000. | 143350. | 2.61 | 147750. | 2.69 | 148000. | 2.69 | 142052. | 2.58 | 142332. | 2.59 | 142612. | 2.59 | 142892. | 2.60 | 143172. | 2.60 | 143452. | 2.61 |
| 60000. | 156100. | 2.60 | 161000. | 2.68 | 161250. | 2.69 | 153552. | 2.56 | 153832. | 2.56 | 154112. | 2.57 | 154392. | 2.57 | 154672. | 2.58 | 154952. | 2.58 |
| 65000. | 168850. | 2.60 | 174250. | 2.68 | 174500. | 2.68 | 165052. | 2.54 | 165332. | 2.54 | 165612. | 2.55 | 165892. | 2.55 | 166172. | 2.56 | 166452. | 2.56 |
| 70000. | 181600. | 2.59 | 187500. | 2.68 | 187750. | 2.68 | 176552. | 2.52 | 176832. | 2.53 | 177112. | 2.53 | 177392. | 2.53 | 177672. | 2.54 | 177952. | 2.54 |
| 75000. | 194350. | 2.59 | 200750. | 2.68 | 201000. | 2.68 | 188052. | 2.51 | 188332. | 2.51 | 188612. | 2.51 | 188892. | 2.52 | 189172. | 2.52 | 189452. | 2.53 |
| 80000. | 207100. | 2.59 | 214000. | 2.68 | 214250. | 2.68 | 199552. | 2.49 | 199832. | 2.50 | 200112. | 2.50 | 200392. | 2.50 | 200672. | 2.51 | 200952. | 2.51 |
| 85000. | 219850. | 2.59 | 227250. | 2.67 | 227500. | 2.68 | 211052. | 2.48 | 211332. | 2.49 | 211612. | 2.49 | 211892. | 2.49 | 212172. | 2.50 | 212452. | 2.50 |
| 90000. | 232600. | 2.58 | 240500. | 2.67 | 240750. | 2.68 | 222552. | 2.47 | 222832. | 2.48 | 223112. | 2.48 | 223392. | 2.48 | 223672. | 2.49 | 223952. | 2.49 |
| 95000. | 245350. | 2.58 | 253750. | 2.67 | 254000. | 2.67 | 234052. | 2.46 | 234332. | 2.47 | 234612. | 2.47 | 234892. | 2.47 | 235172. | 2.48 | 235452. | 2.48 |
| 100000. | 258100. | 2.58 | 267000. | 2.67 | 267250. | 2.67 | 245552. | 2.46 | 245832. | 2.46 | 246112. | 2.46 | 246392. | 2.46 | 246672. | 2.47 | 246952. | 2.47 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 16.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 14925. | 2.99 | 15475. | 3.10 | 15625. | 3.13 | 13275. | 2.66 | 13425. | 2.69 | 13575. | 2.72 | 13725. | 2.75 | 13875. | 2.78 | 14025. | 2.81 |
| 10000. | 28850. | 2.89 | 28750. | 2.88 | 29000. | 2.90 | 38802. | 3.88 | 39082. | 3.91 | 39362. | 3.94 | 39642. | 3.96 | 39922. | 3.99 | 40202. | 4.02 |
| 15000. | 41725. | 2.78 | 42125. | 2.81 | 42375. | 2.83 | 50427. | 3.36 | 50707. | 3.38 | 50987. | 3.40 | 51267. | 3.42 | 51547. | 3.44 | 51827. | 3.46 |
| 20000. | 54600. | 2.73 | 55500. | 2.78 | 55750. | 2.79 | 62052. | 3.10 | 62332. | 3.12 | 62612. | 3.13 | 62892. | 3.14 | 63172. | 3.16 | 63452. | 3.17 |
| 25000. | 67475. | 2.70 | 68875. | 2.76 | 69125. | 2.77 | 73677. | 2.95 | 73957. | 2.96 | 74237. | 2.97 | 74517. | 2.98 | 74797. | 2.99 | 75077. | 3.00 |
| 30000. | 80350. | 2.68 | 82250. | 2.74 | 82500. | 2.75 | 85302. | 2.84 | 85582. | 2.85 | 85862. | 2.86 | 86142. | 2.87 | 86422. | 2.88 | 86702. | 2.89 |
| 35000. | 93225. | 2.66 | 95625. | 2.73 | 95875. | 2.74 | 96927. | 2.77 | 97207. | 2.78 | 97487. | 2.79 | 97767. | 2.79 | 98047. | 2.80 | 98327. | 2.81 |
| 40000. | 106100. | 2.65 | 109000. | 2.73 | 109250. | 2.73 | 108552. | 2.71 | 108832. | 2.72 | 109112. | 2.73 | 109392. | 2.73 | 109672. | 2.74 | 109952. | 2.75 |
| 45000. | 118975. | 2.64 | 122375. | 2.72 | 122625. | 2.73 | 120177. | 2.67 | 120457. | 2.68 | 120737. | 2.68 | 121017. | 2.69 | 121297. | 2.70 | 121577. | 2.70 |
| 50000. | 131850. | 2.64 | 135750. | 2.72 | 136000. | 2.72 | 131802. | 2.64 | 132082. | 2.64 | 132362. | 2.65 | 132642. | 2.65 | 132922. | 2.66 | 133202. | 2.66 |
| 55000. | 144725. | 2.63 | 149125. | 2.71 | 149375. | 2.72 | 143427. | 2.61 | 143707. | 2.61 | 143987. | 2.62 | 144267. | 2.62 | 144547. | 2.63 | 144827. | 2.63 |
| 60000. | 157600. | 2.63 | 162500. | 2.71 | 162750. | 2.71 | 155052. | 2.58 | 155332. | 2.59 | 155612. | 2.59 | 155892. | 2.60 | 156172. | 2.60 | 156452. | 2.61 |
| 65000. | 170475. | 2.62 | 175875. | 2.71 | 176125. | 2.71 | 166677. | 2.56 | 166957. | 2.57 | 167237. | 2.57 | 167517. | 2.58 | 167797. | 2.58 | 168077. | 2.59 |
| 70000. | 183350. | 2.62 | 189250. | 2.70 | 189500. | 2.71 | 178302. | 2.55 | 178582. | 2.55 | 178862. | 2.56 | 179142. | 2.56 | 179422. | 2.56 | 179702. | 2.57 |
| 75000. | 196225. | 2.62 | 202625. | 2.70 | 202875. | 2.71 | 189927. | 2.53 | 190207. | 2.54 | 190487. | 2.54 | 190767. | 2.54 | 191047. | 2.55 | 191327. | 2.55 |
| 80000. | 209100. | 2.61 | 216000. | 2.70 | 216250. | 2.70 | 201552. | 2.52 | 201832. | 2.52 | 202112. | 2.53 | 202392. | 2.53 | 202672. | 2.53 | 202952. | 2.54 |
| 85000. | 221975. | 2.61 | 229375. | 2.70 | 229625. | 2.70 | 213177. | 2.51 | 213457. | 2.51 | 213737. | 2.51 | 214017. | 2.52 | 214297. | 2.52 | 214577. | 2.52 |
| 90000. | 234850. | 2.61 | 242750. | 2.70 | 243000. | 2.70 | 224802. | 2.50 | 225082. | 2.50 | 225362. | 2.50 | 225642. | 2.51 | 225922. | 2.51 | 226202. | 2.51 |
| 95000. | 247725. | 2.61 | 256125. | 2.70 | 256375. | 2.70 | 236427. | 2.49 | 236707. | 2.49 | 236987. | 2.49 | 237267. | 2.50 | 237547. | 2.50 | 237827. | 2.50 |
| 100000. | 260600. | 2.61 | 269500. | 2.70 | 269750. | 2.70 | 248052. | 2.48 | 248332. | 2.48 | 248612. | 2.49 | 248892. | 2.49 | 249172. | 2.49 | 249452. | 2.49 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 17.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 15050. | 3.01 | 15600. | 3.12 | 15750. | 3.15 | 13400. | 2.68 | 13550. | 2.71 | 13700. | 2.74 | 13850. | 2.77 | 14000. | 2.80 | 14150. | 2.83 |
| 10000. | 29100. | 2.91 | 29000. | 2.90 | 29250. | 2.93 | 39052. | 3.91 | 39332. | 3.93 | 39612. | 3.96 | 39892. | 3.99 | 40172. | 4.02 | 40452. | 4.05 |
| 15000. | 42100. | 2.81 | 42500. | 2.83 | 42750. | 2.85 | 50802. | 3.39 | 51082. | 3.41 | 51362. | 3.42 | 51642. | 3.44 | 51922. | 3.46 | 52202. | 3.48 |
| 20000. | 55100. | 2.76 | 56000. | 2.80 | 56250. | 2.81 | 62552. | 3.13 | 62832. | 3.14 | 63112. | 3.16 | 63392. | 3.17 | 63672. | 3.18 | 63952. | 3.20 |
| 25000. | 68100. | 2.72 | 69500. | 2.78 | 69750. | 2.79 | 74302. | 2.97 | 74582. | 2.98 | 74862. | 2.99 | 75142. | 3.01 | 75422. | 3.02 | 75702. | 3.03 |
| 30000. | 81100. | 2.70 | 83000. | 2.77 | 83250. | 2.78 | 86052. | 2.87 | 86332. | 2.88 | 86612. | 2.89 | 86892. | 2.90 | 87172. | 2.91 | 87452. | 2.92 |
| 35000. | 94100. | 2.69 | 96500. | 2.76 | 96750. | 2.76 | 97802. | 2.79 | 98082. | 2.80 | 98362. | 2.81 | 98642. | 2.82 | 98922. | 2.83 | 99202. | 2.83 |
| 40000. | 107100. | 2.68 | 110000. | 2.75 | 110250. | 2.76 | 109552. | 2.74 | 109832. | 2.75 | 110112. | 2.75 | 110392. | 2.76 | 110672. | 2.77 | 110952. | 2.77 |
| 45000. | 120100. | 2.67 | 123500. | 2.74 | 123750. | 2.75 | 121302. | 2.70 | 121582. | 2.70 | 121862. | 2.71 | 122142. | 2.71 | 122422. | 2.72 | 122702. | 2.73 |
| 50000. | 133100. | 2.66 | 137000. | 2.74 | 137250. | 2.75 | 133052. | 2.66 | 133332. | 2.67 | 133612. | 2.67 | 133892. | 2.68 | 134172. | 2.68 | 134452. | 2.69 |
| 55000. | 146100. | 2.66 | 150500. | 2.74 | 150750. | 2.74 | 144802. | 2.63 | 145082. | 2.64 | 145362. | 2.64 | 145642. | 2.65 | 145922. | 2.65 | 146202. | 2.66 |
| 60000. | 159100. | 2.65 | 164000. | 2.73 | 164250. | 2.74 | 156552. | 2.61 | 156832. | 2.61 | 157112. | 2.62 | 157392. | 2.62 | 157672. | 2.63 | 157952. | 2.63 |
| 65000. | 172100. | 2.65 | 177500. | 2.73 | 177750. | 2.73 | 168302. | 2.59 | 168582. | 2.59 | 168862. | 2.60 | 169142. | 2.60 | 169422. | 2.61 | 169702. | 2.61 |
| 70000. | 185100. | 2.64 | 191000. | 2.73 | 191250. | 2.73 | 180052. | 2.57 | 180332. | 2.58 | 180612. | 2.58 | 180892. | 2.58 | 181172. | 2.59 | 181452. | 2.59 |
| 75000. | 198100. | 2.64 | 204500. | 2.73 | 204750. | 2.73 | 191802. | 2.56 | 192082. | 2.56 | 192362. | 2.56 | 192642. | 2.57 | 192922. | 2.57 | 193202. | 2.58 |
| 80000. | 211100. | 2.64 | 218000. | 2.73 | 218250. | 2.73 | 203552. | 2.54 | 203832. | 2.55 | 204112. | 2.55 | 204392. | 2.55 | 204672. | 2.56 | 204952. | 2.56 |
| 85000. | 224100. | 2.64 | 231500. | 2.72 | 231750. | 2.73 | 215302. | 2.53 | 215582. | 2.54 | 215862. | 2.54 | 216142. | 2.54 | 216422. | 2.55 | 216702. | 2.55 |
| 90000. | 237100. | 2.63 | 245000. | 2.72 | 245250. | 2.73 | 227052. | 2.52 | 227332. | 2.53 | 227612. | 2.53 | 227892. | 2.53 | 228172. | 2.54 | 228452. | 2.54 |
| 95000. | 250100. | 2.63 | 258500. | 2.72 | 258750. | 2.72 | 238802. | 2.51 | 239082. | 2.52 | 239362. | 2.52 | 239642. | 2.52 | 239922. | 2.53 | 240202. | 2.53 |
| 100000. | 263100. | 2.63 | 272000. | 2.72 | 272250. | 2.72 | 250552. | 2.51 | 250832. | 2.51 | 251112. | 2.51 | 251392. | 2.51 | 251672. | 2.52 | 251952. | 2.52 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 17.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 15175. | 3.04 | 15725. | 3.15 | 15875. | 3.18 | 13525. | 2.71 | 13675. | 2.74 | 13825. | 2.77 | 13975. | 2.80 | 14125. | 2.83 | 14275. | 2.86 |
| 10000. | 29350. | 2.94 | 29250. | 2.93 | 29500. | 2.95 | 39302. | 3.93 | 39582. | 3.96 | 39862. | 3.99 | 40142. | 4.01 | 40422. | 4.04 | 40702. | 4.07 |
| 15000. | 42075. | 2.83 | 42875. | 2.86 | 43125. | 2.88 | 51177. | 3.41 | 51457. | 3.43 | 51737. | 3.45 | 52017. | 3.47 | 52297. | 3.49 | 52577. | 3.51 |
| 20000. | 55400. | 2.78 | 56500. | 2.83 | 56750. | 2.84 | 63052. | 3.15 | 63332. | 3.17 | 63612. | 3.18 | 63892. | 3.19 | 64172. | 3.21 | 64452. | 3.22 |
| 25000. | 68725. | 2.75 | 70125. | 2.81 | 70375. | 2.82 | 74927. | 3.00 | 75207. | 3.01 | 75487. | 3.02 | 75767. | 3.03 | 76047. | 3.04 | 76327. | 3.05 |
| 30000. | 81850. | 2.73 | 83750. | 2.79 | 84000. | 2.80 | 86802. | 2.89 | 87082. | 2.90 | 87362. | 2.91 | 87642. | 2.92 | 87922. | 2.93 | 88202. | 2.94 |
| 35000. | 94975. | 2.71 | 97375. | 2.78 | 97625. | 2.79 | 98677. | 2.82 | 98957. | 2.83 | 99237. | 2.84 | 99517. | 2.84 | 99797. | 2.85 | 100077. | 2.86 |
| 40000. | 108100. | 2.70 | 111000. | 2.78 | 111250. | 2.78 | 110552. | 2.76 | 110832. | 2.77 | 111112. | 2.78 | 111392. | 2.78 | 111672. | 2.79 | 111952. | 2.80 |
| 45000. | 121225. | 2.69 | 124625. | 2.77 | 124875. | 2.78 | 122427. | 2.72 | 122707. | 2.73 | 122987. | 2.73 | 123267. | 2.74 | 123547. | 2.75 | 123827. | 2.75 |
| 50000. | 134350. | 2.69 | 138250. | 2.77 | 138500. | 2.77 | 134302. | 2.69 | 134582. | 2.69 | 134862. | 2.70 | 135142. | 2.70 | 135422. | 2.71 | 135702. | 2.71 |
| 55000. | 147475. | 2.68 | 151875. | 2.76 | 152125. | 2.77 | 146177. | 2.66 | 146457. | 2.66 | 146737. | 2.67 | 147017. | 2.67 | 147297. | 2.68 | 147577. | 2.68 |
| 60000. | 160600. | 2.68 | 165500. | 2.76 | 165750. | 2.76 | 158052. | 2.63 | 158332. | 2.64 | 158612. | 2.64 | 158892. | 2.65 | 159172. | 2.65 | 159452. | 2.66 |
| 65000. | 173725. | 2.67 | 179125. | 2.76 | 179375. | 2.76 | 169927. | 2.61 | 170207. | 2.62 | 170487. | 2.62 | 170767. | 2.63 | 171047. | 2.63 | 171327. | 2.64 |
| 70000. | 186850. | 2.67 | 192750. | 2.75 | 193000. | 2.76 | 181802. | 2.60 | 182082. | 2.60 | 182362. | 2.61 | 182642. | 2.61 | 182922. | 2.61 | 183202. | 2.62 |
| 75000. | 199975. | 2.67 | 206375. | 2.75 | 206625. | 2.76 | 193677. | 2.58 | 193957. | 2.59 | 194237. | 2.59 | 194517. | 2.59 | 194797. | 2.60 | 195077. | 2.60 |
| 80000. | 213100. | 2.66 | 220000. | 2.75 | 220250. | 2.75 | 205552. | 2.57 | 205832. | 2.57 | 206112. | 2.58 | 206392. | 2.58 | 206672. | 2.58 | 206952. | 2.59 |
| 85000. | 226225. | 2.66 | 233625. | 2.75 | 233875. | 2.75 | 217427. | 2.56 | 217707. | 2.56 | 217987. | 2.56 | 218267. | 2.57 | 218547. | 2.57 | 218827. | 2.57 |
| 90000. | 239350. | 2.66 | 247250. | 2.75 | 247500. | 2.75 | 229302. | 2.55 | 229582. | 2.55 | 229862. | 2.55 | 230142. | 2.56 | 230422. | 2.56 | 230702. | 2.56 |
| 95000. | 252475. | 2.66 | 260875. | 2.75 | 261125. | 2.75 | 241177. | 2.54 | 241457. | 2.54 | 241737. | 2.54 | 242017. | 2.55 | 242297. | 2.55 | 242577. | 2.55 |
| 100000. | 265600. | 2.66 | 274500. | 2.75 | 274750. | 2.75 | 253052. | 2.53 | 253332. | 2.53 | 253612. | 2.54 | 253892. | 2.54 | 254172. | 2.54 | 254452. | 2.54 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

**Trucking Distance:** 18.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volume** | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 15300. | 3.06 | 15850. | 3.17 | 16000. | 3.20 | 13650. | 2.73 | 13800. | 2.76 | 13950. | 2.79 | 14100. | 2.82 | 14250. | 2.85 | 14400. | 2.88 |
| 10000. | 29600. | 2.96 | 29500. | 2.95 | 29750. | 2.98 | 39552. | 3.96 | 39832. | 3.98 | 40112. | 4.01 | 40392. | 4.04 | 40672. | 4.07 | 40952. | 4.10 |
| 15000. | 42850. | 2.86 | 43250. | 2.88 | 43500. | 2.90 | 51552. | 3.44 | 51832. | 3.46 | 52112. | 3.47 | 52392. | 3.49 | 52672. | 3.51 | 52952. | 3.53 |
| 20000. | 56100. | 2.81 | 57000. | 2.85 | 57250. | 2.86 | 63552. | 3.18 | 63832. | 3.19 | 64112. | 3.21 | 64392. | 3.22 | 64672. | 3.23 | 64952. | 3.25 |
| 25000. | 69350. | 2.77 | 70750. | 2.83 | 71000. | 2.84 | 75552. | 3.02 | 75832. | 3.03 | 76112. | 3.04 | 76392. | 3.06 | 76672. | 3.07 | 76952. | 3.08 |
| 30000. | 82600. | 2.75 | 84500. | 2.82 | 84750. | 2.83 | 87552. | 2.92 | 87832. | 2.93 | 88112. | 2.94 | 88392. | 2.95 | 88672. | 2.96 | 88952. | 2.97 |
| 35000. | 95850. | 2.74 | 98250. | 2.81 | 98500. | 2.81 | 99552. | 2.84 | 99832. | 2.85 | 100112. | 2.86 | 100392. | 2.87 | 100672. | 2.88 | 100952. | 2.88 |
| 40000. | 109100. | 2.73 | 112000. | 2.80 | 112250. | 2.81 | 111552. | 2.79 | 111832. | 2.80 | 112112. | 2.80 | 112392. | 2.81 | 112672. | 2.82 | 112952. | 2.82 |
| 45000. | 122350. | 2.72 | 125750. | 2.79 | 126000. | 2.80 | 123552. | 2.75 | 123832. | 2.75 | 124112. | 2.76 | 124392. | 2.76 | 124672. | 2.77 | 124952. | 2.78 |
| 50000. | 135600. | 2.71 | 139500. | 2.79 | 139750. | 2.80 | 135552. | 2.71 | 135832. | 2.72 | 136112. | 2.72 | 136392. | 2.73 | 136672. | 2.73 | 136952. | 2.74 |
| 55000. | 148850. | 2.71 | 153250. | 2.79 | 153500. | 2.79 | 147552. | 2.68 | 147832. | 2.69 | 148112. | 2.69 | 148392. | 2.70 | 148672. | 2.70 | 148952. | 2.71 |
| 60000. | 162100. | 2.70 | 167000. | 2.78 | 167250. | 2.79 | 159552. | 2.66 | 159832. | 2.66 | 160112. | 2.67 | 160392. | 2.67 | 160672. | 2.68 | 160952. | 2.68 |
| 65000. | 175350. | 2.70 | 180750. | 2.78 | 181000. | 2.78 | 171552. | 2.64 | 171832. | 2.64 | 172112. | 2.65 | 172392. | 2.65 | 172672. | 2.66 | 172952. | 2.66 |
| 70000. | 188600. | 2.69 | 194500. | 2.78 | 194750. | 2.78 | 183552. | 2.62 | 183832. | 2.63 | 184112. | 2.63 | 184392. | 2.63 | 184672. | 2.64 | 184952. | 2.64 |
| 75000. | 201850. | 2.69 | 208250. | 2.78 | 208500. | 2.78 | 195552. | 2.61 | 195832. | 2.61 | 196112. | 2.61 | 196392. | 2.62 | 196672. | 2.62 | 196952. | 2.63 |
| 80000. | 215100. | 2.69 | 222000. | 2.78 | 222250. | 2.78 | 207552. | 2.59 | 207832. | 2.60 | 208112. | 2.60 | 208392. | 2.60 | 208672. | 2.61 | 208952. | 2.61 |
| 85000. | 228350. | 2.69 | 235750. | 2.77 | 236000. | 2.78 | 219552. | 2.58 | 219832. | 2.59 | 220112. | 2.59 | 220392. | 2.59 | 220672. | 2.60 | 220952. | 2.60 |
| 90000. | 241600. | 2.68 | 249500. | 2.77 | 249750. | 2.78 | 231552. | 2.57 | 231832. | 2.58 | 232112. | 2.58 | 232392. | 2.58 | 232672. | 2.59 | 232952. | 2.59 |
| 95000. | 254850. | 2.68 | 263250. | 2.77 | 263500. | 2.77 | 243552. | 2.56 | 243832. | 2.57 | 244112. | 2.57 | 244392. | 2.57 | 244672. | 2.58 | 244952. | 2.58 |
| 100000. | 268100. | 2.68 | 277000. | 2.77 | 277250. | 2.77 | 255552. | 2.56 | 255832. | 2.56 | 256112. | 2.56 | 256392. | 2.56 | 256672. | 2.57 | 256952. | 2.57 |

Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).

Trucking Distance: 18.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| Volume | 10% $/Job | 10% $/cy | 20% $/Job | 20% $/cy | 30% $/Job | 30% $/cy | 40% $/Job | 40% $/cy | 50% $/Job | 50% $/cy | 60% $/Job | 60% $/cy | 70% $/Job | 70% $/cy | 80% $/Job | 80% $/cy | 90% $/Job | 90% $/cy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5000. | 15625. | 3.09 | 15875. | 3.20 | 16125. | 3.23 | 13775. | 2.76 | 13925. | 2.79 | 14075. | 2.82 | 14225. | 2.85 | 14375. | 2.88 | 14525. | 2.91 |
| 10000. | 29850. | 2.99 | 29750. | 2.98 | 30000. | 3.00 | 39802. | 3.98 | 40082. | 4.01 | 40362. | 4.04 | 40642. | 4.06 | 40922. | 4.09 | 41202. | 4.12 |
| 15000. | 43225. | 2.88 | 43625. | 2.91 | 43875. | 2.93 | 51927. | 3.46 | 52207. | 3.48 | 52487. | 3.50 | 52767. | 3.52 | 53047. | 3.54 | 53327. | 3.56 |
| 20000. | 56600. | 2.83 | 57500. | 2.88 | 57750. | 2.89 | 64052. | 3.20 | 64332. | 3.22 | 64612. | 3.23 | 64892. | 3.24 | 65172. | 3.26 | 65452. | 3.27 |
| 25000. | 69975. | 2.80 | 71375. | 2.86 | 71625. | 2.87 | 76177. | 3.05 | 76457. | 3.06 | 76737. | 3.07 | 77017. | 3.08 | 77297. | 3.09 | 77577. | 3.10 |
| 30000. | 83350. | 2.78 | 85250. | 2.84 | 85500. | 2.85 | 88302. | 2.94 | 88582. | 2.95 | 88862. | 2.96 | 89142. | 2.97 | 89422. | 2.98 | 89702. | 2.99 |
| 35000. | 96725. | 2.76 | 99125. | 2.83 | 99375. | 2.84 | 100427. | 2.87 | 100707. | 2.88 | 100987. | 2.89 | 101267. | 2.89 | 101547. | 2.90 | 101827. | 2.91 |
| 40000. | 110100. | 2.75 | 113000. | 2.83 | 113250. | 2.83 | 112552. | 2.81 | 112832. | 2.82 | 113112. | 2.83 | 113392. | 2.83 | 113672. | 2.84 | 113952. | 2.85 |
| 45000. | 123475. | 2.74 | 126875. | 2.82 | 127125. | 2.83 | 124677. | 2.77 | 124957. | 2.78 | 125237. | 2.78 | 125517. | 2.79 | 125797. | 2.80 | 126077. | 2.80 |
| 50000. | 136850. | 2.74 | 140750. | 2.82 | 141000. | 2.82 | 136802. | 2.74 | 137082. | 2.74 | 137362. | 2.75 | 137642. | 2.75 | 137922. | 2.76 | 138202. | 2.76 |
| 55000. | 150225. | 2.73 | 154625. | 2.81 | 154875. | 2.82 | 148927. | 2.71 | 149207. | 2.71 | 149487. | 2.72 | 149767. | 2.72 | 150047. | 2.73 | 150327. | 2.73 |
| 60000. | 163600. | 2.73 | 168500. | 2.81 | 168750. | 2.81 | 161052. | 2.68 | 161332. | 2.69 | 161612. | 2.69 | 161892. | 2.70 | 162172. | 2.70 | 162452. | 2.71 |
| 65000. | 176975. | 2.72 | 182375. | 2.81 | 182625. | 2.81 | 173177. | 2.66 | 173457. | 2.67 | 173737. | 2.67 | 174017. | 2.68 | 174297. | 2.68 | 174577. | 2.69 |
| 70000. | 190350. | 2.72 | 196250. | 2.80 | 196500. | 2.81 | 185302. | 2.65 | 185582. | 2.65 | 185862. | 2.66 | 186142. | 2.66 | 186422. | 2.66 | 186702. | 2.67 |
| 75000. | 203725. | 2.72 | 210125. | 2.80 | 210375. | 2.81 | 197427. | 2.63 | 197707. | 2.64 | 197987. | 2.64 | 198267. | 2.64 | 198547. | 2.65 | 198827. | 2.65 |
| 80000. | 217100. | 2.71 | 224000. | 2.80 | 224250. | 2.80 | 209552. | 2.62 | 209832. | 2.62 | 210112. | 2.63 | 210392. | 2.63 | 210672. | 2.63 | 210952. | 2.64 |
| 85000. | 230475. | 2.71 | 237875. | 2.80 | 238125. | 2.80 | 221677. | 2.61 | 221957. | 2.61 | 222237. | 2.61 | 222517. | 2.62 | 222797. | 2.62 | 223077. | 2.62 |
| 90000. | 243850. | 2.71 | 251750. | 2.80 | 252000. | 2.80 | 233802. | 2.60 | 234082. | 2.60 | 234362. | 2.60 | 234642. | 2.61 | 234922. | 2.61 | 235202. | 2.61 |
| 95000. | 257225. | 2.71 | 265625. | 2.80 | 265875. | 2.80 | 245927. | 2.59 | 246207. | 2.59 | 246487. | 2.59 | 246767. | 2.60 | 247047. | 2.60 | 247327. | 2.60 |
| 100000. | 270600. | 2.71 | 279500. | 2.80 | 279750. | 2.80 | 258052. | 2.58 | 258332. | 2.58 | 258612. | 2.59 | 258892. | 2.59 | 259172. | 2.59 | 259452. | 2.59 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 19.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 15550. | 3.11 | 16100. | 3.22 | 16250. | 3.25 | 13900. | 2.78 | 14050. | 2.81 | 14200. | 2.84 | 14350. | 2.87 | 14500. | 2.90 | 14650. | 2.93 |
| 10000. | 30100. | 3.01 | 30000. | 3.00 | 30250. | 3.03 | 40052. | 4.01 | 40332. | 4.03 | 40612. | 4.06 | 40892. | 4.09 | 41172. | 4.12 | 41452. | 4.15 |
| 15000. | 43600. | 2.91 | 44000. | 2.93 | 44250. | 2.95 | 52302. | 3.49 | 52582. | 3.51 | 52862. | 3.52 | 53142. | 3.54 | 53422. | 3.56 | 53702. | 3.58 |
| 20000. | 57100. | 2.86 | 58000. | 2.90 | 58250. | 2.91 | 64552. | 3.23 | 64832. | 3.24 | 65112. | 3.26 | 65392. | 3.27 | 65672. | 3.28 | 65952. | 3.30 |
| 25000. | 70600. | 2.82 | 72000. | 2.88 | 72250. | 2.89 | 76802. | 3.07 | 77082. | 3.08 | 77362. | 3.09 | 77642. | 3.11 | 77922. | 3.12 | 78202. | 3.13 |
| 30000. | 84100. | 2.80 | 86000. | 2.87 | 86250. | 2.88 | 89052. | 2.97 | 89332. | 2.98 | 89612. | 2.99 | 89892. | 3.00 | 90172. | 3.01 | 90452. | 3.02 |
| 35000. | 97600. | 2.79 | 100000. | 2.86 | 100250. | 2.86 | 101302. | 2.89 | 101582. | 2.90 | 101862. | 2.91 | 102142. | 2.92 | 102422. | 2.93 | 102702. | 2.93 |
| 40000. | 111100. | 2.78 | 114000. | 2.85 | 114250. | 2.86 | 113552. | 2.84 | 113832. | 2.85 | 114112. | 2.85 | 114392. | 2.86 | 114672. | 2.87 | 114952. | 2.87 |
| 45000. | 124600. | 2.77 | 128000. | 2.84 | 128250. | 2.85 | 125802. | 2.80 | 126082. | 2.80 | 126362. | 2.81 | 126642. | 2.81 | 126922. | 2.82 | 127202. | 2.83 |
| 50000. | 138100. | 2.76 | 142000. | 2.84 | 142250. | 2.85 | 138052. | 2.76 | 138332. | 2.77 | 138612. | 2.77 | 138892. | 2.78 | 139172. | 2.78 | 139452. | 2.79 |
| 55000. | 151600. | 2.76 | 156000. | 2.84 | 156250. | 2.84 | 150302. | 2.73 | 150582. | 2.74 | 150862. | 2.74 | 151142. | 2.75 | 151422. | 2.75 | 151702. | 2.76 |
| 60000. | 165100. | 2.75 | 170000. | 2.83 | 170250. | 2.84 | 162552. | 2.71 | 162832. | 2.71 | 163112. | 2.72 | 163392. | 2.72 | 163672. | 2.73 | 163952. | 2.73 |
| 65000. | 178600. | 2.75 | 184000. | 2.83 | 184250. | 2.83 | 174802. | 2.69 | 175082. | 2.69 | 175362. | 2.70 | 175642. | 2.70 | 175922. | 2.71 | 176202. | 2.71 |
| 70000. | 192100. | 2.74 | 198000. | 2.83 | 198250. | 2.83 | 187052. | 2.67 | 187332. | 2.68 | 187612. | 2.68 | 187892. | 2.68 | 188172. | 2.69 | 188452. | 2.69 |
| 75000. | 205600. | 2.74 | 212000. | 2.83 | 212250. | 2.83 | 199302. | 2.66 | 199582. | 2.66 | 199862. | 2.66 | 200142. | 2.67 | 200422. | [illegible] | 200702. | 2.68 |
| 80000. | 219100. | 2.74 | 226000. | 2.83 | 226250. | 2.83 | 211552. | 2.64 | 211832. | 2.65 | 212112. | 2.65 | 212392. | 2.65 | 212672. | 2.66 | 212952. | 2.66 |
| 85000. | 232600. | 2.74 | 240000. | 2.82 | 240250. | 2.83 | 223802. | 2.63 | 224082. | 2.64 | 224362. | 2.64 | 224642. | 2.64 | 224922. | 2.65 | 225202. | 2.65 |
| 90000. | 246100. | 2.73 | 254000. | 2.82 | 254250. | 2.83 | 236052. | 2.62 | 236332. | 2.63 | 236612. | 2.63 | 236892. | 2.63 | 237172. | 2.64 | 237452. | 2.64 |
| 95000. | 259600. | 2.73 | 268000. | 2.82 | 268250. | 2.82 | 248302. | 2.61 | 248582. | 2.62 | 248862. | 2.62 | 249142. | 2.62 | 249422. | 2.63 | 249702. | 2.63 |
| 100000. | 273100. | 2.73 | 282000. | 2.82 | 282250. | 2.82 | 260552. | 2.61 | 260832. | 2.61 | 261112. | 2.61 | 261392. | 2.61 | 261672. | 2.62 | 261952. | 2.62 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 19.50 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Volume** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** | **$/Job** | **$/cy** |
| 5000. | 15675. | 3.14 | 16225. | 3.25 | 16375. | 3.28 | 14025. | 2.81 | 14175. | 2.84 | 14325. | 2.87 | 14475. | 2.90 | 14625. | 2.93 | 14775. | 2.96 |
| 10000. | 30350. | 3.04 | 30250. | 3.03 | 30500. | 3.05 | 40302. | 4.03 | 40582. | 4.06 | 40862. | 4.09 | 41142. | 4.11 | 41422. | 4.14 | 41702. | 4.17 |
| 15000. | 43975. | 2.93 | 44375. | 2.96 | 44625. | 2.98 | 52677. | 3.51 | 52957. | 3.53 | 53237. | 3.55 | 53517. | 3.57 | 53797. | 3.59 | 54077. | 3.61 |
| 20000. | 57600. | 2.88 | 58500. | 2.93 | 58750. | 2.94 | 65052. | 3.25 | 65332. | 3.27 | 65612. | 3.28 | 65892. | 3.29 | 66172. | 3.31 | 66452. | 3.32 |
| 25000. | 71225. | 2.85 | 72625. | 2.91 | 72875. | 2.92 | 77427. | 3.10 | 77707. | 3.11 | 77987. | 3.12 | 78267. | 3.13 | 78547. | 3.14 | 78827. | 3.15 |
| 30000. | 84850. | 2.83 | 86750. | 2.89 | 87000. | 2.90 | 89802. | 2.99 | 90082. | 3.00 | 90362. | 3.01 | 90642. | 3.02 | 90922. | 3.03 | 91202. | 3.04 |
| 35000. | 98475. | 2.81 | 100875. | 2.88 | 101125. | 2.89 | 102177. | 2.92 | 102457. | 2.93 | 102737. | 2.94 | 103017. | 2.94 | 103297. | 2.95 | 103577. | 2.96 |
| 40000. | 112100. | 2.80 | 115000. | 2.88 | 115250. | 2.88 | 114552. | 2.86 | 114832. | 2.87 | 115112. | 2.88 | 115392. | 2.88 | 115672. | 2.89 | 115952. | 2.90 |
| 45000. | 125725. | 2.79 | 129125. | 2.87 | 129375. | 2.88 | 126927. | 2.82 | 127207. | 2.83 | 127487. | 2.83 | 127767. | 2.84 | 128047. | 2.85 | 128327. | 2.85 |
| 50000. | 139350. | 2.79 | 143250. | 2.87 | 143500. | 2.87 | 139302. | 2.79 | 139582. | 2.79 | 139862. | 2.80 | 140142. | 2.80 | 140422. | 2.81 | 140702. | 2.81 |
| 55000. | 152975. | 2.78 | 157375. | 2.86 | 157625. | 2.87 | 151677. | 2.76 | 151957. | 2.76 | 152237. | 2.77 | 152517. | 2.77 | 152797. | 2.78 | 153077. | 2.78 |
| 60000. | 166600. | 2.78 | 171500. | 2.86 | 171750. | 2.86 | 164052. | 2.73 | 164332. | 2.74 | 164612. | 2.74 | 164892. | 2.75 | 165172. | 2.75 | 165452. | 2.76 |
| 65000. | 180225. | 2.77 | 185625. | 2.86 | 185875. | 2.86 | 176427. | 2.71 | 176707. | 2.72 | 176987. | 2.72 | 177267. | 2.73 | 177547. | 2.73 | 177827. | 2.74 |
| 70000. | 193850. | 2.77 | 199750. | 2.85 | 200000. | 2.86 | 188802. | 2.70 | 189082. | 2.70 | 189362. | 2.71 | 189642. | 2.71 | 189922. | 2.71 | 190202. | 2.72 |
| 75000. | 207475. | 2.77 | 213875. | 2.85 | 214125. | 2.86 | 201177. | 2.68 | 201457. | 2.69 | 201737. | 2.69 | 202017. | 2.69 | 202297. | 2.70 | 202577. | 2.70 |
| 80000. | 221100. | 2.76 | 228000. | 2.85 | 228250. | 2.85 | 213552. | 2.67 | 213832. | 2.67 | 214112. | 2.68 | 214392. | 2.68 | 214672. | 2.68 | 214952. | 2.69 |
| 85000. | 234725. | 2.76 | 242125. | 2.85 | 242375. | 2.85 | 225927. | 2.66 | 226207. | 2.66 | 226487. | 2.66 | 226767. | 2.67 | 227047. | 2.67 | 227327. | 2.67 |
| 90000. | 248350. | 2.76 | 256250. | 2.85 | 256500. | 2.85 | 238302. | 2.65 | 238582. | 2.65 | 238862. | 2.65 | 239142. | 2.66 | 239422. | 2.66 | 239702. | 2.66 |
| 95000. | 261975. | 2.76 | 270375. | 2.85 | 270625. | 2.85 | 250677. | 2.64 | 250957. | 2.64 | 251237. | 2.64 | 251517. | 2.65 | 251797. | 2.65 | 252077. | 2.65 |
| 100000. | 275600. | 2.76 | 284500. | 2.85 | 284750. | 2.85 | 263052. | 2.63 | 263332. | 2.63 | 263612. | 2.64 | 263892. | 2.64 | 264172. | 2.64 | 264452. | 2.64 |

**Costs of Trucking Dredged Material, Including Loading and Unloading Cost, on a Per-Dredging-Job Basis (1978 Dollars, GREAT I Area).**

**Trucking Distance:** 20.00 Miles

Frequency of dredging at subject cut (% ; 20 jobs in 40 years = 50%)

| | 10% | | 20% | | 30% | | 40% | | 50% | | 60% | | 70% | | 80% | | 90% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Volume | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy | $/Job | $/cy |
| 5000. | 15800. | 3.16 | 16350. | 3.27 | 16500. | 3.30 | 14150. | 2.83 | 14300. | 2.86 | 14450. | 2.89 | 14600. | 2.92 | 14750. | 2.95 | 14900. | 2.98 |
| 10000. | 30600. | 3.06 | 30500. | 3.05 | 30750. | 3.08 | 40552. | 4.06 | 40832. | 4.08 | 41112. | 4.11 | 41392. | 4.14 | 41672. | 4.17 | 41952. | 4.20 |
| 15000. | 44350. | 2.96 | 44750. | 2.98 | 45000. | 3.00 | 53052. | 3.54 | 53332. | 3.56 | 53612. | 3.57 | 53892. | 3.59 | 54172. | 3.61 | 54452. | 3.63 |
| 20000. | 58100. | 2.91 | 59000. | 2.95 | 59250. | 2.96 | 65552. | 3.28 | 65832. | 3.29 | 66112. | 3.31 | 66392. | 3.32 | 66672. | 3.33 | 66952. | 3.35 |
| 25000. | 71850. | 2.87 | 73250. | 2.93 | 73500. | 2.94 | 78052. | 3.12 | 78332. | 3.13 | 78612. | 3.14 | 78892. | 3.16 | 79172. | 3.17 | 79452. | 3.18 |
| 30000. | 85600. | 2.85 | 87500. | 2.92 | 87750. | 2.93 | 90552. | 3.02 | 90832. | 3.03 | 91112. | 3.04 | 91392. | 3.05 | 91672. | 3.06 | 91952. | 3.07 |
| 35000. | 99350. | 2.84 | 101750. | 2.91 | 102000. | 2.91 | 103052. | 2.94 | 103332. | 2.95 | 103612. | 2.96 | 103892. | 2.97 | 104172. | 2.98 | 104452. | 2.98 |
| 40000. | 113100. | 2.83 | 116000. | 2.90 | 116250. | 2.91 | 115552. | 2.89 | 115832. | 2.90 | 116112. | 2.90 | 116392. | 2.91 | 116672. | 2.92 | 116952. | 2.92 |
| 45000. | 126850. | 2.82 | 130250. | 2.89 | 130500. | 2.90 | 128052. | 2.85 | 128332. | 2.85 | 128612. | 2.86 | 128892. | 2.86 | 129172. | 2.87 | 129452. | 2.88 |
| 50000. | 140600. | 2.81 | 144500. | 2.89 | 144750. | 2.90 | 140552. | 2.81 | 140832. | 2.82 | 141112. | 2.82 | 141392. | 2.83 | 141672. | 2.83 | 141952. | 2.84 |
| 55000. | 154350. | 2.81 | 158750. | 2.89 | 159000. | 2.89 | 153052. | 2.78 | 153332. | 2.79 | 153612. | 2.79 | 153892. | 2.80 | 154172. | 2.80 | 154452. | 2.81 |
| 60000. | 168100. | 2.80 | 173000. | 2.88 | 173250. | 2.89 | 165552. | 2.76 | 165832. | 2.76 | 166112. | 2.77 | 166392. | 2.77 | 166672. | 2.78 | 166952. | 2.78 |
| 65000. | 181850. | 2.80 | 187250. | 2.88 | 187500. | 2.88 | 178052. | 2.74 | 178332. | 2.74 | 178612. | 2.75 | 178892. | 2.75 | 179172. | 2.76 | 179452. | 2.76 |
| 70000. | 195600. | 2.79 | 201500. | 2.88 | 201750. | 2.88 | 190552. | 2.72 | 190832. | 2.73 | 191112. | 2.73 | 191392. | 2.73 | 191672. | 2.74 | 191952. | 2.74 |
| 75000. | 209350. | 2.79 | 215750. | 2.88 | 216000. | 2.88 | 203052. | 2.71 | 203332. | 2.71 | 203612. | 2.71 | 203892. | 2.72 | 204172. | 2.72 | 204452. | 2.73 |
| 80000. | 223100. | 2.79 | 230000. | 2.88 | 230250. | 2.88 | 215552. | 2.69 | 215832. | 2.70 | 216112. | 2.70 | 216392. | 2.70 | 216672. | 2.71 | 216952. | 2.71 |
| 85000. | 236850. | 2.79 | 244250. | 2.87 | 244500. | 2.88 | 228052. | 2.68 | 228332. | 2.69 | 228612. | 2.69 | 228892. | 2.69 | 229172. | 2.70 | 229452. | 2.70 |
| 90000. | 250600. | 2.78 | 258500. | 2.87 | 258750. | 2.88 | 240952. | 2.67 | 240832. | 2.68 | 241112. | 2.68 | 241392. | 2.68 | 241672. | 2.69 | 241952. | 2.69 |
| 95000. | 264350. | 2.78 | 272750. | 2.87 | 273000. | 2.87 | 253052. | 2.66 | 253332. | 2.67 | 253612. | 2.67 | 253892. | 2.67 | 254172. | 2.68 | 254452. | 2.68 |
| 100000. | 278100. | 2.78 | 287000. | 2.87 | 287250. | 2.87 | 265552. | 2.66 | 265832. | 2.66 | 266112. | 2.66 | 266392. | 2.66 | 266672. | 2.67 | 266952. | 2.67 |

EXHIBIT 1

TECHNICAL ASSISTANCE MEMO FOR THE RECORD REGARDING
SPRING LAKE, POOL 2

# DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

| REFERENCE OR OFFICE SYMBOL | SUBJECT |
|---|---|
| NCSED-HF | Technical Assistance to Local Interests - C.F. Industries - Mississippi River, R.M. 823.8 |

TO MEMO FOR THE RECORD

FROM Levee & Channels Design Section

DATE 31 Jul 79 Westall/jg/7593

CMT 1

1. On 25 July 1979, I met with Mr. Joe Robinson and Mr. Don Seiford of C.F. Industries in Rosemont Township, Minnesota, to discuss a sedimentation problem in the company's barge channel on the right side of the Mississippi River at mile post 823.8, just across from Gray Cloud Island. Inclosure 1 is a copy of Navigation Chart No. 154 showing the location of the barge channel. Inclosure 2 is a copy of a map traced from a 1970 aerial photograph showing the C.F. Industries barge slips, entrance channel, and the upper end of Spring Lake. This map with soundings (taken 1 and 25 July 1979) was supplied by Mr. Joe Robinson.

2. The problem at C.F. Industries is shoaling in the barge channel. Inclosure 3 is a copy of a map showing the condition of the barge channel on 26 September 1978. Inclosure 4 shows the condition of the channel on 1 July 1979, and Inclosure 5 shows the channel condition as of 20 July 1979.

3. The problem at C.F. Industries is produced by the fact that the entrance to the barge channel is on the upstream end of Spring Lake. The elevation of the lake is governed primarily by the elevation of the Mississippi River about 2.5 miles downstream from the entrance to the barge channel. As the slope of the river increases with increasing discharge, the elevation difference between Spring Lake and the Mississippi River at barge channel entrance increases. More water flows into Spring Lake via the barge channel and the other two openings carrying river sediment with it.

4. This problem is also related to maintenance dredging on the Mississippi River. Inclosure 6 is a copy of Navigation Chart 154 showing the historical dredging locations on the Mississippi in the vicinity of Spring Lake. Inclosure 7 is a table summarizing dredging statistics on the Mississippi. The average annual dredging volume at the three sites adjacent to Spring Lake is about 36,000 cubic yards.

5. It is fairly obvious that part of the dredging problem on the Mississippi is caused by escape of water from the main channel through the three openings at the upper end of Spring Lake. Inspection of the upper end of Spring Lake indicated that most of the escape flow went through the barge channel entrance (marked 1 on Inclosure 2) and the next opening downstream (marked 2). The third opening (marked 3) is small and is affected by large sediment deposits in the upper end of the lake. Since the barge channel is maintained for barge traffic, more and more of the flow is being concentrated through this opening. Also, the rock revetment at the outside of the bend on the main channel is gone and the channel opening is eroding and getting larger. The approximate erosion

line is shown on Inclosure 5. A sand spit is forming on the left side of the barge channel and sediment is being deposited closer to the barge slips. Sediment is also collecting in the upper end of Spring Lake, and the two small islands, marked 1 and 2 on Inclosure 2, are now connected.

6. The following recommendations are offered to: a) relieve sedimentation in the barge channel; b) retard sediment accumulation in Spring Lake; and c) keep more flow in the Mississippi River and possibly reduce maintenance dredging in the vicinity of Spring Lake:

a) Reconstruct the damaged rock revetment at the barge channel entrance (Inclosure 2).

b) Build a low, notched rock structure across the opening at the head of Spring Lake (Inclosure 2).

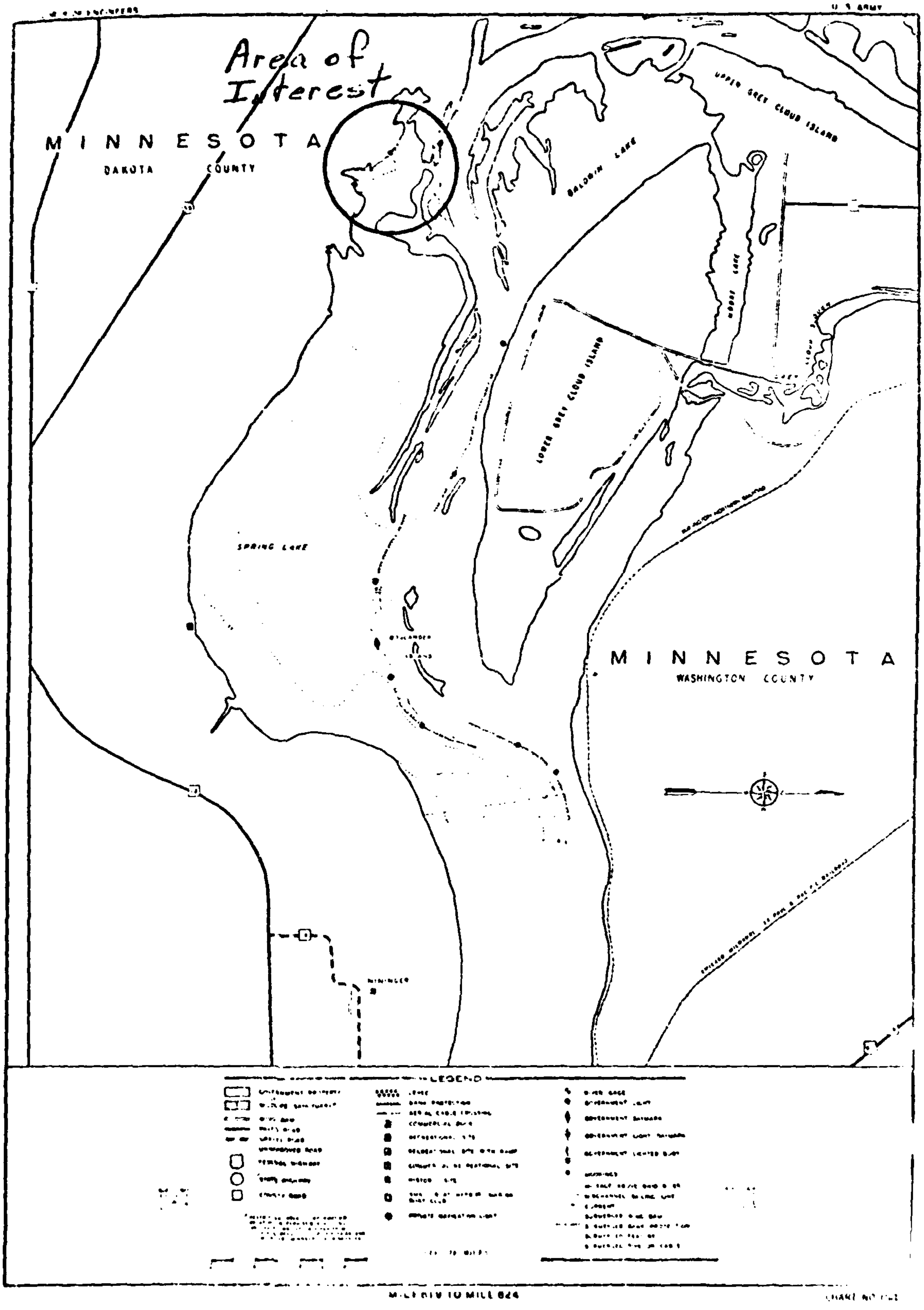
c) Riprap the bottom of the small inlet channel to prevent it from getting larger (Inclosure 2).

The details of the above three recommendations are to be designed by the Engineering Division, St. Paul District.

7. The benefits of preventing sediment from accumulating bear directly on the concerns of industry and navigation, flood plain management and the environmental setting of the area. This would appear to be within the purview of the GREAT team. I recommend that the above be implemented, possibly in coordination with the maintenance force of C.F. Industries.

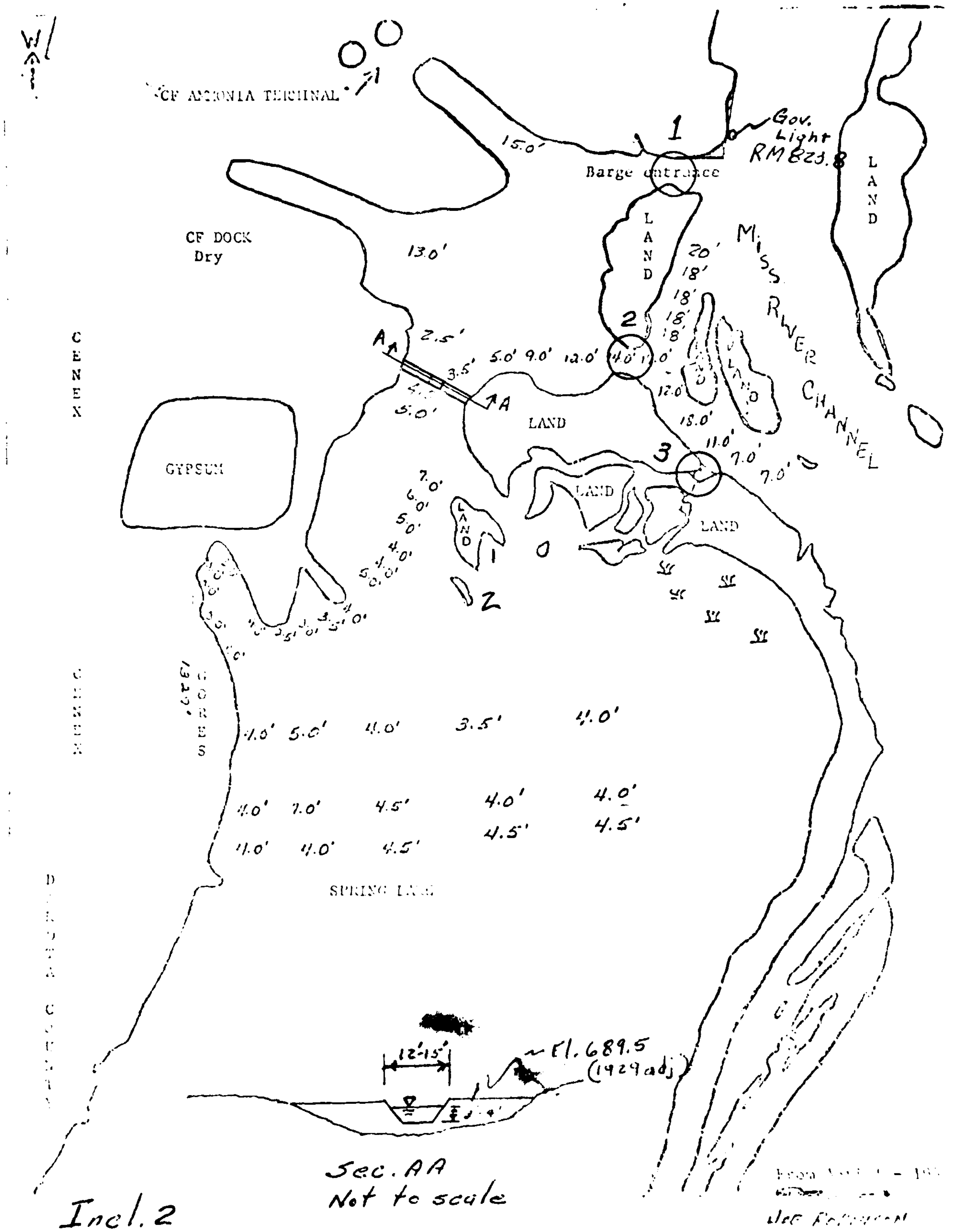
7 Incl
as

WILLIAM G. WESTALL

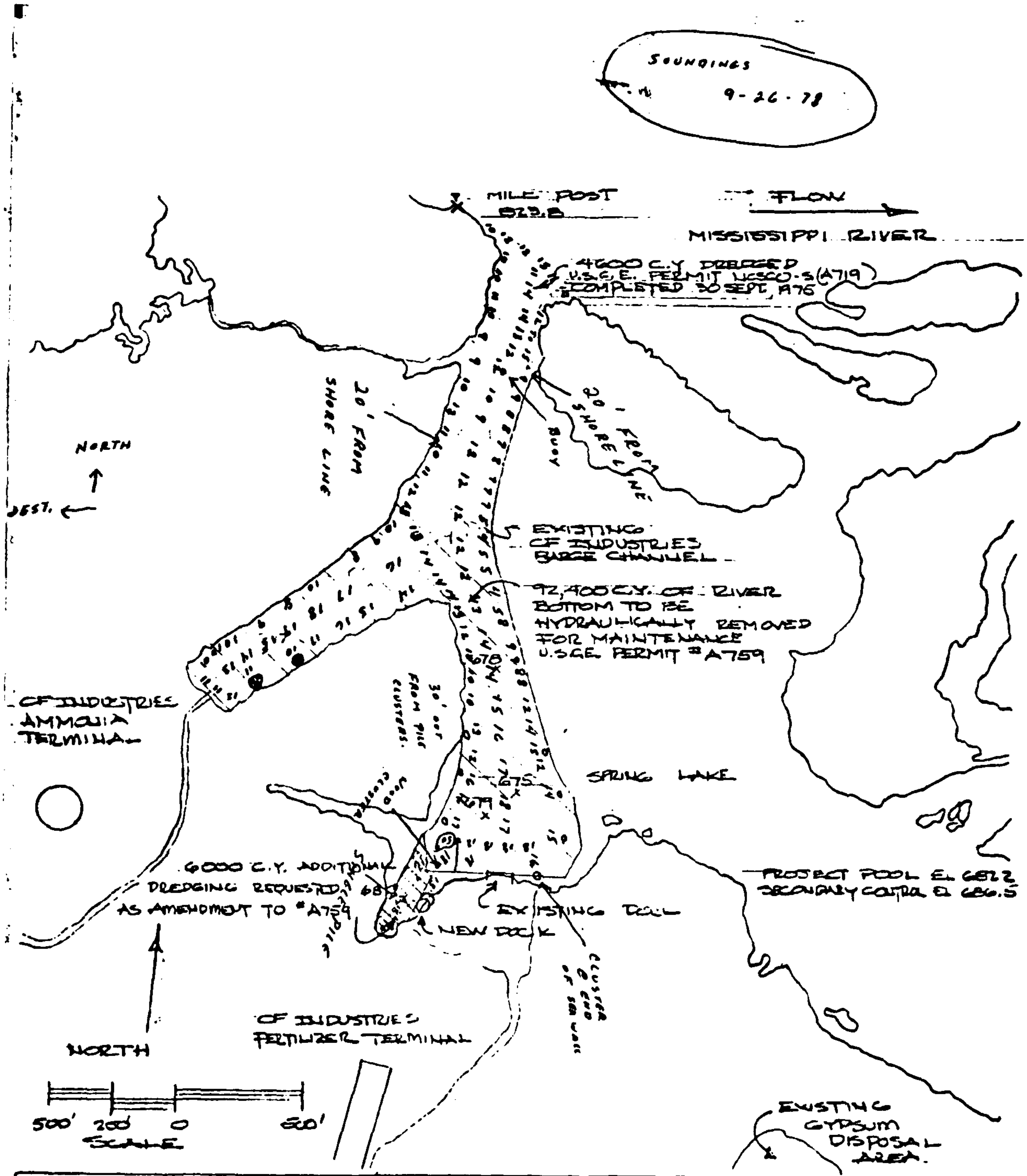


U. S. ARMY
Area of Interest
MINNESOTA
DAKOTA COUNTY
UPPER GREY CLOUD ISLAND
BALDWIN LAKE
LOWER GREY CLOUD ISLAND
SPRING LAKE
MINNESOTA
WASHINGTON COUNTY
LEGEND


Incl. 1


W
CF AMMONIA TERMINAL
15.0'
1
Gov. Light RM 823.8
Barge entrance
LAND
CF DOCK Dry
13.0'
MISS RIVER CHANNEL
20'
18'
18'
18'
18
2
2.5'
3.5'
5.0'
9.0'
12.0'
4.0'
A
A
5.0'
12.0'
18.0'
11.0'
7.0'
7.0'
3
LAND
CENEX
GYPSUM
LAND
LAND
7.0'
6.0'
5.0'
4.0'
1
2
CORES 1329'
CENEX
4.0'
5.0'
4.0'
3.5'
4.0'
4.0'
7.0'
4.5'
4.0'
4.0'
4.5'
4.5'
4.0'
4.0'
4.5'
SPRING LAKE
DAKOTA COUNTY
12'-15'
El. 689.5 (1929 adj)
Sec. AA
Not to scale

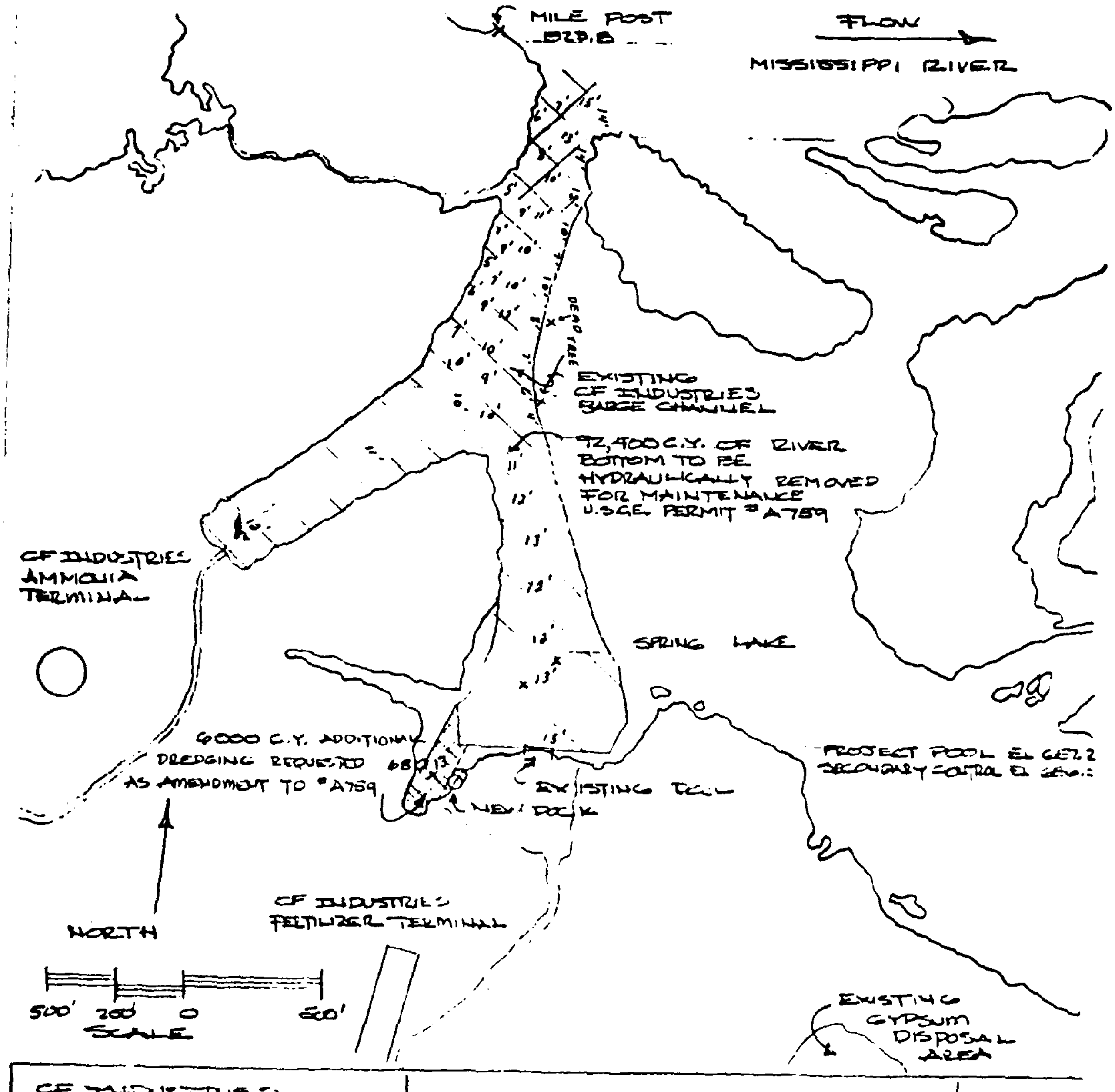
Incl. 2




| | | |
|---|---|---|
| CF INDUSTRIES PINE BEND FACILITY | DREDGING AREA | SHEET A1 |

Incl. 3

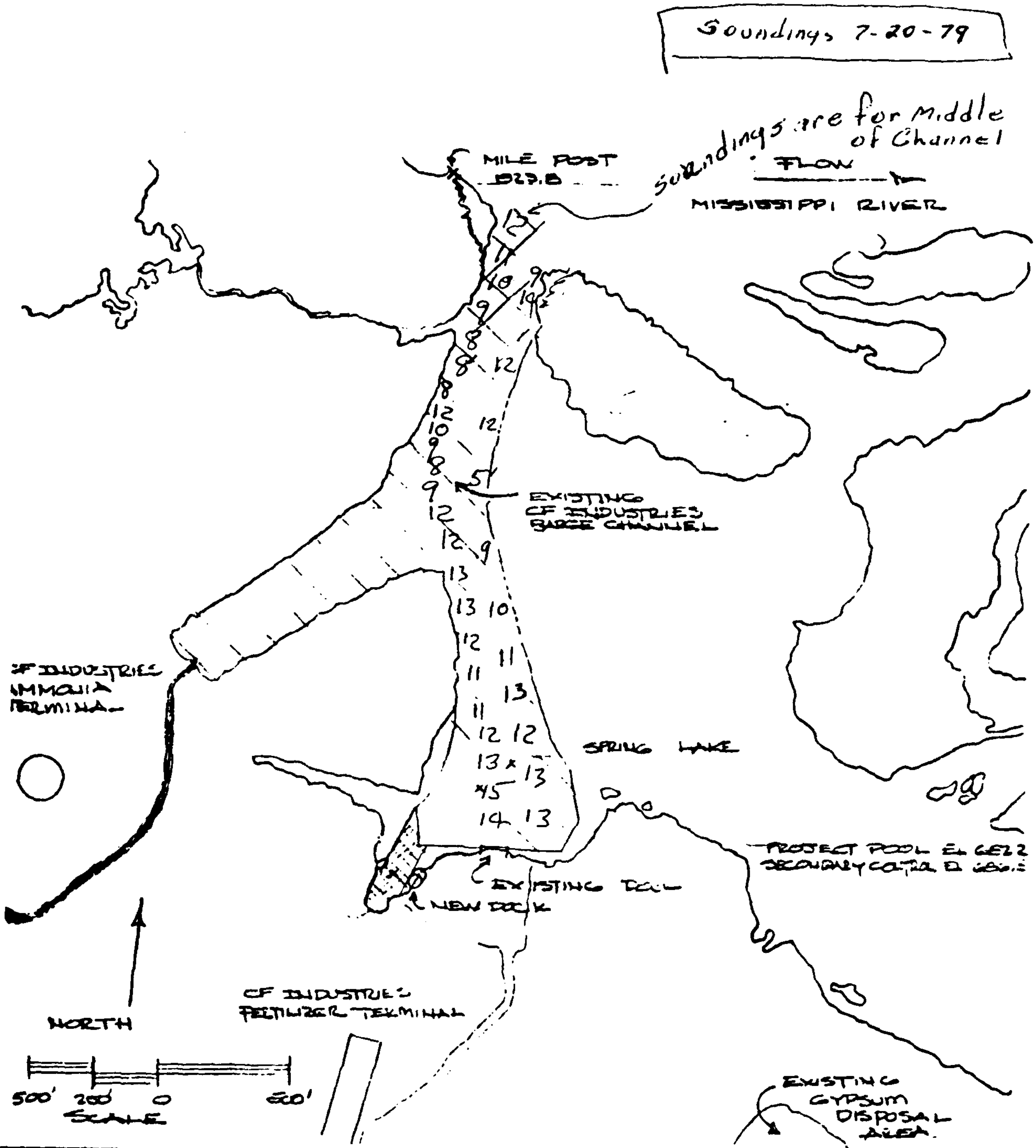
Soundings 7-1-74




| | | |
|---|---|---|
| CF INDUSTRIES PINE BEND FACILITY | DREDGING AREA | SHEET A1 |

USE CHANNEL CLOSE TO ISLAND TO MAKE YOUR APROACH - SWING TO CENTER OF CHANNEL AT FIRST DEAD TREE LAYING ON SHORE AND CENTER YOUR BARGE 30 FEET TO THE RIGHT OF MILE MARKER AT POINT WHERE THE TWO BARGE SLIPS SPLIT. AT THIS POINT PULL DOWN RIVER OR TO YOUR LEFT TO STAY IN CHANNEL AS MARKED.

Incl. 4

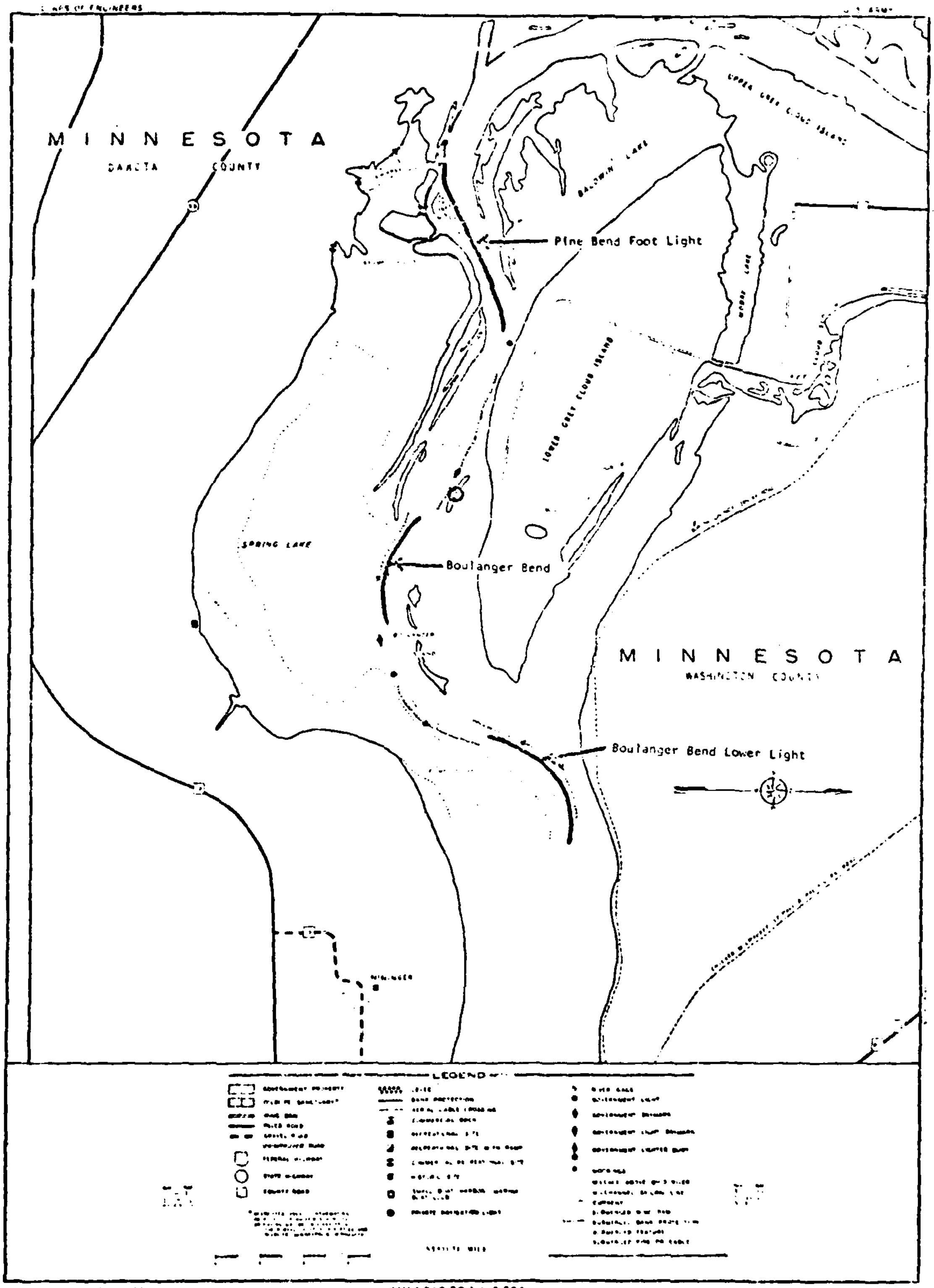



CF INDUSTRIES PINE BEND FACILITY

DREDGING AREA

A1

Incl. 5




MILE 818 TO MILE 824

Incl. 6

SUMMARY OF DREDGING LOCATIONS ON UPPER MISSISSIPPI RIVER
9-FOOT CHANNEL PROJECT WITHIN THE ST. PAUL DISTRICT

| Pool | River Mile | Name of Site | Lgth. Site Mile | Volume Dredged per Job (1,000 cubic yards) Min. | Avg. | Max. | Average Annual | Frequency of Dredging Events | Percent | Events to 11 Feet | Events to 12 Feet |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Minn. R. | .2 | Mouth of Minnesota River | .5 | 8 | 19.8 | 29 | 6.6 | 4 | 33 | | |
| Minn. R. | 4.3 | 4-Mile Cutoff | .7 | 34 | 34 | 34 | 2.8 | 1 | 8 | | |
| Minn. R. | 12.0 | Above & Below Peterson's Bar | 1.6 | 5 | 28.0 | 55 | 11.7 | 5 | 42 | | |
| Minn. R. | 13.2 | Above & Below Cargill Slip | .8 | 3 | 12.3 | 27 | 3.1 | 3 | 25 | | |
| Minn. R. | 14.5 | Above Savage R.R. Bridge | .4 | 13 | 24.5 | 34 | 4.0 | 2 | 17 | | |
| St. Croix | 17.0 | Hudson | 1.6 | 117 | 172 | 216 | 22.5 | 3 | 13 | | |
| St. Croix | 6.0 | Kinnikinnic Bar | .4 | 20 | 42.2 | 90 | 16.5 | 9 | 39 | | |
| USAF | 857.2 | Below M.St. P. & S.Ste.M.R.R. Bridge | .9 | 4 | 38.4 | 85 | 11.7 | 7 | 47 | | 3 |
| USAF | 856.2 | Above & Below Lowry Ave. Bridge | 1.0 | 9 | 35.8 | 130 | 14.0 | 9 | 60 | | 3 |
| USAF | 854.8 | Ab. & Be. Broadw. Av. & Plmth. Av. Bridges | 1.6 | 5 | 16.3 | 50 | 7.8 | 11 | 73 | | 4 |
| 1 | 852.8 | Above & Below Washington Av. Bridge | .5 | 1 | 26.3 | 65 | 18.3 | 16 | 70 | | |
| 1 | 852.0 | Above Franklin Av. Bridge | .8 | 5 | 37.0 | 159 | 17.7 | 11 | 48 | | 1 |
| 1 | 851.0 | Below Franklin Av. Bridge | .7 | 8 | 37.2 | 150 | 17.8 | 11 | 48 | | 2 |
| 1 | 850.2 | Above Lake St. Bridge | .6 | 4 | 33.2 | 99 | 20.2 | 14 | 61 | | 4 |
| 1 | 849.4 | Below Lake St. Bridge | 1.0 | 2 | 26.8 | 75 | 14.0 | 12 | 52 | 1 | 1 |
| 1 | 848.7 | Below St. Paul Daymark 849.1 | .4 | 4 | 11.2 | 16 | 2.4 | 5 | 22 | 1 | |
| 1 | 848.0 | Upper Approach L&D 1 | .7 | 6 | 26.6 | 57 | 10.4 | 9 | 39 | 2 | 1 |
| 2 | 840.7 | Above & Below Smith Av. Bridge | 1.3 | 2 | 16.5 | 56 | 12.2 | 17 | 74 | | |
| 2 | 839.0 | Harriet Island | 1.3 | 8 | 15.7 | 31 | 6.1 | 9 | 39 | | |
| 2 | 837.2 | St. Paul Barge Terminal | 1.2 | 1 | 139.2 | 382 | 72.6 | 12 | 52 | 1 | |
| 2 | 827.9 | Grey Cloud Slough | .8 | 27 | 41.4 | 58 | 9.0 | 5 | 22 | | |
| 2 | 823.2 | Pine Bend Foot Light | 1.0 | 15 | 57.7 | 133 | 15.0 | 6 | 26 | | 1 |
| 2 | 821.1 | Boulanger Bend | .6 | 5 | 121 | 237 | 10.5 | 2 | 9 | | |
| 2 | 819.4 | Boulanger Bend Lower Light | .8 | 13 | 78.3 | 137 | 10.2 | 3 | 13 | | |
| 3 | 815.0 | Lower Approach L/D 2 | | 4 | 18.5 | 33 | 1.6 | 2 | 9 | | |
| 3 | 811.0 | Prescott | 1.4 | 13 | 41.7 | 110 | 10.9 | 6 | 26 | | |
| 3 | 807.8 | Four Mile Island - Truedale Slough | 1.6 | 22 | 62.6 | 95 | 13.6 | 5 | 22 | | |
| 3 | 805.1 | Big River | 1.9 | 9 | 53.8 | 90 | 11.7 | 5 | 22 | | |
| 3 | 801.9 | Coulters Island - Morgans Coulee | 2.2 | 29 | 70.9 | 173 | 24.7 | 8 | 35 | | |
| 3 | 799.6 | Below Diamond Bluff | 1.6 | 41 | 90.5 | 148 | 15.8 | 4 | 17 | | |
| 4 | 794.3 | Trenton | .6 | 33 | 57.3 | 83 | 7.5 | 3 | 13 | | |
| 4 | 732.8 | Cannon River | 1.4 | 57 | 85.5 | 137 | 14.8 | 4 | 17 | | |
| 4 | 790.6 | Above & Below Red Wing Hwy. Bridge | 1.7 | 27 | 52.9 | 99 | 16.1 | 7 | 30 | | |
| 4 | 784.6 | Wacouta Point | 1.6 | 105 | 252.5 | 400 | [illegible] | 2 | 9 | | |
| 4 | 762.8 | Reads Landing | 2.0 | 11 | 109.8 | 314 | [illegible] | 16 | 70 | | 3 |
| 4 | 759.0 | Above Crats Island | 1.0 | 18 | 75.0 | 123 | 58.7 | 18 | 78 | 1 | 3 |
| 4 | 757.5 | Above Teepeeota Point | .9 | 24 | 61.1 | 143 | 39.8 | 15 | 65 | | |
| 4 | 756.3 | Grand Encampment | 1.1 | 4 | 60.7 | 67 | 18.5 | 7 | 30 | 1 | |
| 4 | 754.2 | Beef Slough | .7 | 12 | 21.4 | 41 | 6.5 | 7 | 30 | 1 | |
| 5 | 752.7 | Lower Approach L&D 4 | .2 | 6 | 9.0 | 15 | 2.4 | 6 | 26 | | |
| 5 | 749.1 | Mule Bend | 1.0 | 8 | 34.3 | 46 | 9.0 | 6 | 26 | 1 | |
| 5 | 747.7 | West Newton | 1.0 | 23 | 54.9 | 87 | 16.7 | 7 | 30 | | 1 |
| 5 | 746.4 | Below West Newton | .8 | 8 | 48.2 | 135 | 27.3 | 13 | 57 | | |
| 5 | 745.4 | Fisher Island | 1.2 | 7 | 59.5 | 140 | 38.8 | 15 | 65 | 1 | 3 |
| 5 | 744.3 | Lower Zumbro | .6 | 14 | 48.2 | 121 | 27.3 | 13 | 57 | | 2 |
| 5 | 743.2 | Sommerfield Island | 1.3 | 50 | 65.4 | 89 | 14.3 | 5 | 22 | | |
| 5 | 741.5 | Mount Vernon Light | .4 | 34 | 46.7 | 63 | 6.1 | 3 | 13 | | |
| 5A | 734.6 | Island 58 | 1.2 | 4 | 47.8 | 103 | 27.0 | 13 | 57 | 2 | 1 |
| 5A | 733.6 | Fountain City | .5 | 18 | 59.6 | 183 | 12.9 | 5 | 22 | | |