Interim Dredged Material Management Plan

Sheboygan Harbor Strategic Navigation Dredging, WI

December 2011

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US Army Corps of Engineers
Detroit District
BUILDING STRONG®

Report Prepared by:

US Army Corps of Engineers
Detroit District

In Cooperation with:

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Wisconsin Department of Natural Resources

Sheboygan County Chamber

City of Sheboygan
spirit on the lake.

EXECUTIVE SUMMARY

This study is conducted under the guidance of the National Harbors Program, Dredged Material Management Plan. The purpose of this Management Plan is to evaluate the existing conditions at Sheboygan Harbor, Sheboygan, WI and develop a base plan for routine dredging within the project area and disposal of the sediments.

For the Sheboygan Harbor project, the District has developed an Interim Dredged Material Management Plan (DMMP). The interim plan utilizes a single project-based approach in lieu of the continual 20-year management approach of the typical DMMP. The interim plan is reserved for projects with an advanced schedule and immediate need for implementation, and only when a standard DMMP does not exist for the project harbor. This study is funded through the Great Lakes Restoration Initiative (GLRI) in order to determine the feasibility of maintenance dredging from the Federal channel at Sheboygan Harbor that might support other actions to remove contaminated sediments from the River that are impairing beneficial uses of the waters.

Sheboygan Harbor is located on the western shore of Lake Michigan at the mouth of the Sheboygan River, Sheboygan, Wisconsin. The City of Sheboygan is approximately 45 miles north of Milwaukee and about 55 miles southeast of Green Bay, Wisconsin. The Sheboygan River drains an area of roughly 400 square miles. The headwaters of the river begin near the southern tip of Lake Winnebago, and meander 80 miles before reaching Lake Michigan.

Several dredging projects under way as part of a multi-phase cleanup project located in the Sheboygan River Area of Concern are being coordinated by the Great Lakes National Program Office of the EPA. Cleanup of the most highly contaminated sediments is completed or will be concurrent to the project discussed in this Interim DMMP, if the project is implemented. This project is supported by Federal and state agencies involved with these cleanup efforts.

The management measures for this study fall into to the categories that are generally required to complete a dredging project. Those categories are Dredging Depths and Areas, Dredging Method /Equipment, Disposal of Sediments, Transport of Sediments, and a general category of Other. After evaluation of the management measures, the retained measures were formulated into alternatives.

This study identifies a dredging and disposal solution that is the least costly, engineeringly, economically and environmentally feasible project alternative.

Based upon the investigation presented in this Interim Dredged Material Management Plan document, Alternative 2: Chemical Dewatering and Placement in the Locally Provided Dredged Material Placement Facility (DMPF), is designated as the "Base Plan". For this alternative, the sediments would be mechanically dredged with an enclosed clamshell bucket and placed into the barge. Once the material is in the barge, a lime-reaction additive would be mixed with the sediment to dewater the material. The material would then be transported to the placement facility, or placed on a dewatering pad at the transfer site prior to transport and disposal as the situation dictates.

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This approach is engineeringly feasible, environmentally acceptable and the least costly alternative evaluated. The cost of the dredging, transportation and disposal will be fully Federal funded.

For this project, the non-Federal partners will construct a dredged material placement facility for disposal of the sediment dredged during the project. This represents a non-Federal investment of approximately $1,800,000.00.

The completion of this project would meet the local community's navigation needs, improve the aquatic environment, and remove the dredging restrictions from the harbor to the dredged depth. By removing the dredging restrictions, the Beneficial Use Impairment would be removed to the dredged depth. This would help the EPA move towards delisting the Sheboygan River as an Area of Concern. It is therefore recommended that the Detroit District proceed with detailed design, plans and specifications, and implementation of the Base Plan presented in this Interim DMMP document to provide management of dredged material for Sheboygan Harbor provided that GLRI funds are available.

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INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

CONTENTS

1. STUDY DESCRIPTION 1
1.1 Study Purpose 1
1.2 USACE Policies on Dredged Material Management 1
2. AUTHORIZATION 2
2.1 Study Authority 2
2.2 Federal Navigation Project Authority 2
3. SHEBOYGAN HARBOR AREA OF CONCERN 3
3.1 AOC Background 3
3.2 Beneficial Use Impairments 3
3.3 Dredging Restrictions 4
3.4 Ongoing Cleanup Effort at Sheboygan Harbor 5
3.5 Sheboygan Strategic Navigation Project Location and the AOC 6
4. LOCATION OF PROJECT 8
4.1 Geographic Location 8
4.2 Congressional District 8
5. DREDGING HISTORY AND PRIOR STUDIES & REPORTS 9
5.1 Dredging History 9
5.2 Prior Studies and Reports 9
6. EXISTING CONDITIONS & PROJECTED FUTURE WITHOUT PROJECT CONDITIONS 11
6.1 Sheboygan Harbor Description 11
6.2 Shoaling 12
6.3 Economic Sector Shifts & Land Use Patterns 12
6.4 Sheboygan County Employment and Output by Industry Sector 13
6.5 Projected Future Without Project Conditions 14
7. SEDIMENT CHARACTERIZATION 14
7.1 Soil Properties 14
7.2 Contaminants Characterization 15
8. PROBLEMS AND OPPORTUNITIES 18
8.1 Problems 18
8.2 Opportunities 18
9. PLANNING OBJECTIVES & CONSTRAINTS 18
9.1 Planning Objectives 18
9.2 Planning Constraints 19

DRAFT

INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

CONTENTS

10. MANAGEMENT MEASURES IDENTIFICATION 19
10.1 General 19
10.2 Dredging Depths and Areas 19
10.2.1 Recreational Navigation Draft 19
10.2.2 Federal Channel to Authorized Depth 20
10.3 Dredging Methods/Equipment 21
10.3.1 Mechanical Dredging 21
10.3.2 Hydraulic Dredging 23
10.4 Disposal of Dredged Material 24
10.4.1 Open Water Placement 24
10.4.2 Beach/Littoral Nourishment 24
10.4.3 Upland Unrestricted 25
10.4.4 Upland Restricted 25
10.5 Transport of Dredged Materials 25
10.5.1 Barge 25
10.5.2 Commercial Trucking 25
10.5.3 Hydraulic Pipeline 26
10.5.4 Railroad 26
10.6 Other Measures to Consider 26
10.6.1 Dewatering 26
10.6.2 Beneficial uses 27
11. EVALUATION OF MANAGEMENT MEASURES 27
11.1 Dredging Depths and Areas 27
11.2 Dredging Methods/Equipment 28
11.2.1 Selection Criteria for Dredging Equipment 28
11.2.2 Mechanical Dredging Equipment 30
11.2.3 Hydraulic Dredging Equipment 31
11.3 Disposal Methods 37
11.3.1 Disposal Requirements 37
11.3.2 Open Water Placement 37
11.3.3 Beach Nourishment 37
11.3.4 Upland Unrestricted 38
11.3.5 Upland Restricted 38
11.4 Transport of Dredge Material 39
11.4.1 Transport Method 39
11.4.2 Transfer Site 39

DRAFT

INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

CONTENTS

11.5 Other Measures to Consider 40
11.5.1 Dewatering 40
11.5.2 Mechanical Dewatering 42
11.5.3 Chemical Dewatering 42
11.5.4 Beneficial Uses 44
12. THE NO ACTION ALTERNATIVE 47
13. PLACEMENT IN LOCALLY PROVIDED PLACEMENT FACILITY ALTERNATIVES 47
13.1 DMPF Description 47
13.2 Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF 48
13.3 Alternative 3: Mechanical Dewatering and Placement in the Locally Provided DMPF 48
14. LICENSED LANDFILL ALTERNATIVES 48
14.1 Alternative 4: Chemical Dewatering and Placement in a Licensed Landfill 48
14.2 Alternative 5: Mechanical Dewatering and Placement in a Licensed Landfill 48
15. SHEBOYGAN INNER HARBOR DREDGING BENEFITS AND DIRECT COSTS 50
16. EVALUATION OF ALTERNATIVE PLANS 51
16.1 Alternative 1: No Action 51
16.2 Alternatives 2-5 51
17. TRADE-OFF ANALYSIS 51
17.1 Alternative 1: No Action 51
17.2 Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF 52
17.3 Alternative 3: Mechanical Dewatering and Placement in the Locally Provided DMPF 52
17.4 Alternative 4: Chemical Dewatering and Placement in a Licensed Landfill 52
17.5 Alternative 5: Mechanical Dewatering and Placement in a Licensed Landfill 52
17.6 Alternative Evaluation with the USACE Alternative Formulation Criteria 53
18. FEDERAL STANDARD AND BASE PLAN 53
18.1 Federal Standard 53
18.2 Base Plan 54
18.3 Project Advantages 54
18.4 Project Impact on Dredging Restriction BUI 54
18.5 Real Estate 54
18.6 Project Construction 55
18.7 Project Cost 55
18.8 HTRW Evaluation 56
18.8.1 Existing Environment 56
18.8.2 Environmental Consequences 57

DRAFT

INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

CONTENTS

19. COST SHARING AND FINANCING....58
19.1 Management Plan Studies....58
19.2 Implementation....58
20. RESULTS OF COORDINATION WITH LOCAL, STATE AND FEDERAL AGENCIES....58
21. RECOMMENDATIONS....60
22. REFERENCES....61

LIST OF TABLES

Table 1: Authorizing Legislation....2
Table 2: Known Dredging History at Sheboygan Harbor....9
Table 3: Sheboygan Employment Profile....13
Table 4: Top Industry Sectors for Generating Output in Sheboygan County....14
Table 5: Sheboygan Grain Size Summary....15
Table 6: Sheboygan Harbor Analytical Results Summary - July 2011....17
Table 7: Summary of Mechanical Dredge Operating Characteristics [a]....33
Table 8: Summary of Hydraulic Dredge Characteristics [a]....34
Table 9: Quantitative Comparison of the Conventional Clamshell vs. the Enclosed....35
Table 10: Qualitative Comparison of the Conventional Clamshell vs. the Enclosed....36
Table 11: Summary of Measure Elimination (Depths and Equipment)....45
Table 12: Summary of Measure Elimination (Disposal, Transport, & Other)....46
Table 13: Alternatives Summary....49
Table 14: Costs of Proposed Project Plans....50
Table 15: Alternative Evaluation with the USACE Alternative Formulation Criteria....53
Table 16: Cost Estimate for Base Plan....55

LIST OF FIGURES

Figure 1: Sheboygan River, WI AOC Map....7
Figure 2: Sheboygan Harbor Location Map....8
Figure 3: Recreational Navigation Draft Plan....20
Figure 4: Depiction of Mechanical Dredging....21
Figure 5: Open Clamshell Bucket....22
Figure 6: Depiction of Hydraulic Dredging....22
Figure 7: Depiction of Hydraulic Dredging....23
Figure 8: Truck Offloading Dredged Material at the Bay Port DMPF....26
Figure 9: Depiction of Sediment Disturbance during Dredging (Hydraulic Dredge)....30
Figure 10: Locally Provided DMPF Proximity Map....39
Figure 11: Proposed Transfer Site Location....40
Figure 12: EPA Superfund Dewatering Facility, Lower River segment in Sheboygan....42
Figure 13: Depiction of DMPF Site....47

DRAFT

INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

CONTENTS

APPENDICES

Appendix A	Cost Engineering Report
Appendix B	Real Estate Plan
Appendix C	DRAFT Dredging Plan
Appendix D	September 2010 Condition Surveys
Appendix E	Federal Navigation Project Map
Appendix F	Letters of Intent and Support

ATTACHMENTS

Environmental Assessment

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INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

ABBREVIATIONS

AOC	Area of Concern
ASTM	American Society for Testing and Materials
ATR	Agency Technical Review
BLWD	Below Low Water Datum
BUI	Beneficial Use Impairments
CY	Cubic Yard
DMMP	Dredged Material Management Plan
DMPF(s)	Dredged Material Placement Facility(s)
EM	Engineer Manual
EPA	Environmental Protection Agency
ER	Engineer Regulation
ER	Engineer Regulation
ERDC	Engineer Research and Design Center (USACE)
ERDC DOER	ERDC Dredging Operations and Environmental Research Program (USACE)
ERDC DOTS	ERDC Dredging Operations Technical Support (USACE)
ERDC EL	ERDC Environmental Laboratory (USACE)
ERDC TR	ERDC Technical Report (USACE)
GLNPO	Great Lakes National Program Office
GLRI	Great Lakes Restoration Initiative
HTRW	Hazardous, Toxic, and Radiological Waste
IJC	International Joint Commission
lb	pound
LERRD	Lands, Easements, Rights-of-Way, Relocations and Disposal
LRB	Buffalo District (USACE)
LRC	Chicago District (USACE)
LRD	Great Lakes and Ohio River Division (USACE)
LRE	Detroit District (USACE)
LS	Lump Sum
LWD	Low Water Datum
µg/L	microgram per liter
mg/L	milligram per liter
MI	Michigan
NEPA	National Environmental Policy Act
O & M	Operations and Maintenance
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRP	Principal Responsible Parties
psi	pounds per square inch
QA	Quality Assurance
RAP	Remedial Action Plan
SAP	Super Absorbent Polymers
SND	Strategic Navigation Dredging
SPLP	Synthetic Precipitation Leaching Procedure
sta	Station
TN	Ton
US	United Sates

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INTERIM DREDGED MATERIAL MANAGEMENT PLAN
SHEBOYGAN HARBOR, WISCONSIN

ABBREVIATIONS

USACE	United States Army Corps of Engineers
WDNR	Wisconsin Department of Natural Resources
WI	Wisconsin
WRDA	Water Resources Development Act

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1. STUDY DESCRIPTION

1.1 Study Purpose

This study is conducted under the guidance of the National Harbors Program, Dredged Material Management Plans, 21 July 1994 (EC 1165-2-200). The purpose of this Management Plan is to evaluate the existing conditions at Sheboygan Harbor and develop a base plan for routine strategic navigation dredging within the project area and appropriate disposal of the sediments. The base plan reflects the U.S. Army Corps of Engineers (USACE) policy to accomplish the disposal of dredged material associated with the construction or maintenance dredging of navigation projects in the least costly manner. Disposal is to be consistent with sound engineering practice and meet all Federal environmental standards including the environmental standards established by Section 404 of the Clean Water Act of 1972 or Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended. Each management plan study must establish this "Base Plan[1]". Management Plans are intended to cost effectively and expeditiously support environmentally acceptable channel and harbor maintenance.

For the Sheboygan Harbor project, the District will develop an Interim Dredged Material Management Plan (DMMP). The interim plan utilizes a single dredging event approach in lieu of the continual 20-year management approach of the typical DMMP. The interim plan is reserved for projects with an advanced schedule and immediate need for implementation, and only when a standard DMMP does not exist for the project harbor. Due to funding limitations and a lack of commercial use, Sheboygan Harbor does not have a standard DMMP in place. This study is being funded through the Great Lakes Restoration Initiative (GLRI) in order to determine the feasibility of maintenance dredging from the Federal channel at Sheboygan Harbor, Sheboygan, WI, that might support other actions to remove contaminated sediments from the River that are impairing beneficial uses of the waters.

1.2 USACE Policies on Dredged Material Management

1.2.1 Dredged Material Management Overview[2]

Harbor maintenance and development are priority missions of the USACE. These missions contribute directly to national economic development and international trade. Effective accomplishment of these missions usually requires dredging to achieve the navigable dimensions sufficient to meet the needs of water transportation. By extension, sound management of dredged materials is a priority mission of the USACE.

The USACE is committed to environmentally sound dredging and placement or management of dredged material as defined by applicable laws and policies. The interests of economic development and environmental sustainability will best be served when dredged material placement proceeds according to a management plan. Therefore, each harbor maintenance and development project will have a plan that ensures warranted and environmentally acceptable maintenance of the project.

[1] ER 1105-2-100, App E-15-3
[2] LRE website (http://www.lre.usace.army.mil/who/operationsofficehomepage/dredgedmaterialmanagementplans/policy/)

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Beneficial use of dredged material is a powerful tool for harmonizing environmental values and navigation purposes. It is the policy of the USACE that all dredged material management studies include an assessment of potential beneficial uses for environmental purposes including fish and wildlife habitat creation and restoration and/or hurricane and storm damage reduction. Every effort is to be made to ensure that partners and other interests understand the valuable contributions that beneficial uses can make to management plans. The use of regional forums to share experiences of opportunities for beneficial uses should be maximized.

1.2.2 USACE Project Management Objectives

The developed and natural resources at Civil Works projects are the public property of both present and future generations. USACE resource management activity is directed toward the continued enjoyment and maximum sustained use by the public of all USACE projects and associated recreational resources, consistent with their values and uses. Projects administered by the USACE have resource use objectives based on the expressed preferences of the residents of the region served and on the capabilities of the natural and man-made resources of the project. Maintenance and administration of recreation areas, where they remain under USACE jurisdiction, is part of the overall management objective to preserve and protect the quality of project resources.

2. AUTHORIZATION

2.1 Study Authority

Dredged material management is conducted under several authorities guiding various aspects of the planning and implementation. Section E-15 of the Planning Guidance Notebook (ER 1105-2-100) summarizes guidance, policy and procedures for conducting Dredged Material Management Plan Studies. Management of Dredged Material is provided for in Section 2326 of the U.S. Code (33 USC 2326, Regional Sediment Management), 33 USC 2326b (Sediment Management), and 33 USC 2326c (Dredged Material Marketing and Recycling).

2.2 Federal Navigation Project Authority

Authorizing legislation for dredging Sheboygan Harbor, WI has evolved over the years. Legislation specific to Sheboygan Harbor is shown on Table 1.

Table 1: Authorizing Legislation

ACT	WORK AUTHORIZED	DOCUMENTS
June 23, 1866	Original Project Adopted	Public Acts of the 39th Cong., Session I, Chap. 138
March 3, 1873	Original Project modified	Public Acts of the 42nd Cong., Session III, Chap. 233
March 3, 1881	Original Project modified	Public Acts of the 46th Cong., Session III, Chap. 136
August 18, 1894	Original Project modified	Public Acts of the 53rd Cong., Session II, Chap. 299
March 3, 1899	Original Project modified	Public Acts of the 55th Cong., Session III, Chap. 425
June 13, 1902	Original Project modified	Public Acts of the 57th Cong., Session I, Chap. 1079

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March 2, 1907	North Breakwater	H. Doc.62, 59st Cong.,1st Sess.
January 27, 1927	Preserving south pier as part of project, providing turning basin, and elimination of proposed south breakwaters	H. Doc. 475, 68th Cong., 2d Sess.
August 10, 1935	Present project dimensions of channel	Rivers and Harbors Committee Doc. H. Doc. 222, 1st Cong., 2d Sess.
September 3, 1954	Widen and deepen outer harbor entrance channel to 450 feet, widen and deepen river channel from present project limit to north side of Jefferson Avenue.	H. Doc. 554, 82nd Cong., 2d Sess.*
*Contains latest project map		

3. SHEBOYGAN HARBOR AREA OF CONCERN

3.1 AOC Background

Sheboygan Harbor is classified as an Area of Concern (AOC) under the Great Lakes Water Quality Agreement (1987 Protocol). Dredging restrictions on the harbor are one of the Beneficial Use Impairments (BUI) identified. The restrictions on the placement of dredged material and declined industrial activity have resulted in the Inner Harbor not being dredged since 1969. The Outer Harbor has not been dredged since 1991.

The Sheboygan River AOC encompasses the lower Sheboygan River downstream from the Sheboygan Falls Dam, including the entire harbor and nearshore waters of Lake Michigan (Figure 1). The Sheboygan River Basin is located in portions of five counties. Industrial, agricultural and residential areas line the rivers of the basin. Agriculture is the dominant land use in the area, totaling 67%. The Sheboygan, Onion and Mullet River Basins contain three cities, eleven villages and seven towns. The cities of Sheboygan and Sheboygan Falls and the Village of Kohler are all located within the AOC.

Multiple agencies have been working to delist Sheboygan Harbor as an AOC by the end of 2012 (Section 3.4). The project described in this DMMP would not only restore navigable draft to Sheboygan Harbor, but aide in the multi-agency delisting effort.

3.2 Beneficial Use Impairments

The Great Lakes Water Quality Agreement calls for Remedial Action Plans (RAPs) to restore and protect 14 beneficial uses in Areas of Concern. An impaired beneficial use means a change in the chemical, physical or biological integrity of the Great Lakes system sufficient to cause certain restrictions or degraded conditions.

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The Sheboygan River AOC has the following BUIs:

- Restrictions on fish and wildlife consumption
- Eutrophication or undesirable algae
- Degradation of fish and wildlife populations
- Fish tumors or other deformities
- Bird or animal deformities or reproduction problems
- Degradation of benthos
- Degradation of phytoplankton and zooplankton populations
- Restriction on dredging activities
- Loss of fish and wildlife habitat

3.3 Dredging Restrictions

The restriction on dredging BUI relates to special or additional handling and disposal requirements related to dredging contaminated sediment within the AOC, regardless of navigational dredging requirements. Additional handling means more than is required at minimally impacted reference site(s) without known sediment contamination sources. Additional sediment management activities become necessary when there is a potential human health or ecological risk (e.g. degradation of benthos BUI) associated with disturbing contaminated sediment. Examples of Restrictions on Dredging include the following:

- Additional sediment sampling costs (e.g. as required by Chapter NR 34 , Wisconsin Administrative Codes)
- Additional sediment management costs during the dredging action, such as specific equipment, dewatering, wastewater treatment to remove contaminants and contaminant monitoring costs, contaminated material transport, confirmation monitoring
- Additional disposal costs due to contamination levels
- Additional consulting expertise (costs) or training, sediment fate and transport modeling, risk assessments, contaminated sediment handling

Contaminated sediments are recognized as one of the primary sources of pollution n the Sheboygan River AOC. Implementation actions to remediate contaminated sediment sites need to be implemented and demonstrated to have met the remedial goals. Upon completion of the remedial action it is recommended that a sediment management plan be developed for the AOC. While sediment remediation is an important component in meeting RAP goals, an effective sediment strategy has a balance of pollution prevention activities and enhanced nonpoint source control in addition to clean-up of strategic sediment hot spots.

Delisting of this BUI can occur when:

- All remediation actions for contaminated sediments are completed and monitored according to the approved remediation plans; and
- A dredging alternatives plan is developed that includes an evaluation of the following:
    - Restrictions that must remain in place to protect human health and the environment
    - Restrictions that must remain in place due to Superfund requirements that are based upon state and federal law
    - Priority areas for navigational use
    - Priority areas where dredging is needed for other purposes (i.e. utilities)
    - Costs associated with removing dredging restrictions in priority areas
    - Funding available to address removing dredging restrictions in priority areas

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3.4 Ongoing Cleanup Effort at Sheboygan Harbor

Several dredging projects under way or being planned as part of a multi-phase cleanup effort located in the Sheboygan River Area of Concern are being developed and coordinated by the Great Lakes National Program Office of the EPA. Cleanup of the most highly contaminated sediments is completed or will be concurrent to the project discussed in this Interim DMMP, if the project is implemented. This project is supported by Federal and state agencies involved with these cleanup efforts. The current and planned projects include:

3.4.1 Superfund Upper River Tecumseh Dredging Project

The Superfund Upper River Tecumseh Dredging Project was completed in 2007. The project removed approximately 20,728 cubic yards of polychlorinated biphenyl (PCB) contaminated sediment. This Upper River project began in the City of Sheboygan Falls and extended to the Village of Kohler. Project Cost: $20 Million

3.4.2 Lower River Superfund Dredging Project

The Lower River Superfund Dredging Project is currently underway. Approximately 53,000 cubic yards of PCB contaminated sediment will be removed by Tecumseh Corporation. Tecumseh is considered the Principal Responsible Party (PRP). Pollution Risk Services is the contractor performing the dredging work. The Lower River project area is between the Chicago & Northwestern railroad bridge and the Pennsylvania Street Bridge in the City of Sheboygan. Project Cost: $12.5 - $15 Million

3.4.3 Camp Marina Superfund Dredging Project

The Camp Marina Superfund Dredging Project is currently underway. Approximately 28,500 cubic yards of polynuclear aromatic hydrocarbon (PAH) contaminated sediment will be removed and will be paid for by Wisconsin Public Service, the Principal Responsible Party. This project is located within the Superfund Lower River section in the City of Sheboygan adjacent to Boat Island. Project Cost: $9-$10.5 Million

3.4.4 The Legacy Act Dredging Project

The Legacy Act Dredging Project is currently in the feasibility and design phase with dredging set to begin in 2012. Approximately 240,000 cubic yards of PCB and PAH contaminated sediment is to be removed from the Lower River. The match or non-federal share of the project (40-50%) is the work being performed by Superfund and Camp Marina projects Principal Responsible Parties. The federal funds available for this project come entirely from the Great Lakes Legacy Act through the Great Lakes Restoration Initiative Program of EPA. This project is located in the Lower River area. Project Cost: $20 - $30 Million

3.4.5 Sheboygan River AOC Fish & Wildlife Restoration Projects

Several Sheboygan River AOC Fish & Wildlife Restoration Projects are currently in the planning phase and are anticipated to be implemented in 2012. Projects include Sheboygan River shoreline restoration stabilization projects, fish and wildlife restoration and assessment, Wildwood Island restoration, eroding riverbank stabilization and invasive species control in the Sheboygan River. These projects are located throughout the entire lower 14-mile section of the Sheboygan River AOC. Project Cost: $5.1 Million

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3.5 Sheboygan Strategic Navigation Project Location and the AOC

The projects described in Section 3.4 will address not only the sources of contamination in the river, but will also have removed the higher-level hot spots from the river. Through elaborate testing by the EPA, WDNR, and USACE conducted over the past several decades, the inner harbor sediment east of the 8th Street Bridge (Figure 2) has been identified as having only low-level contamination and is the focus of this DMMP. This area falls within the AOC and the EPA's Superfund Operational Unit.

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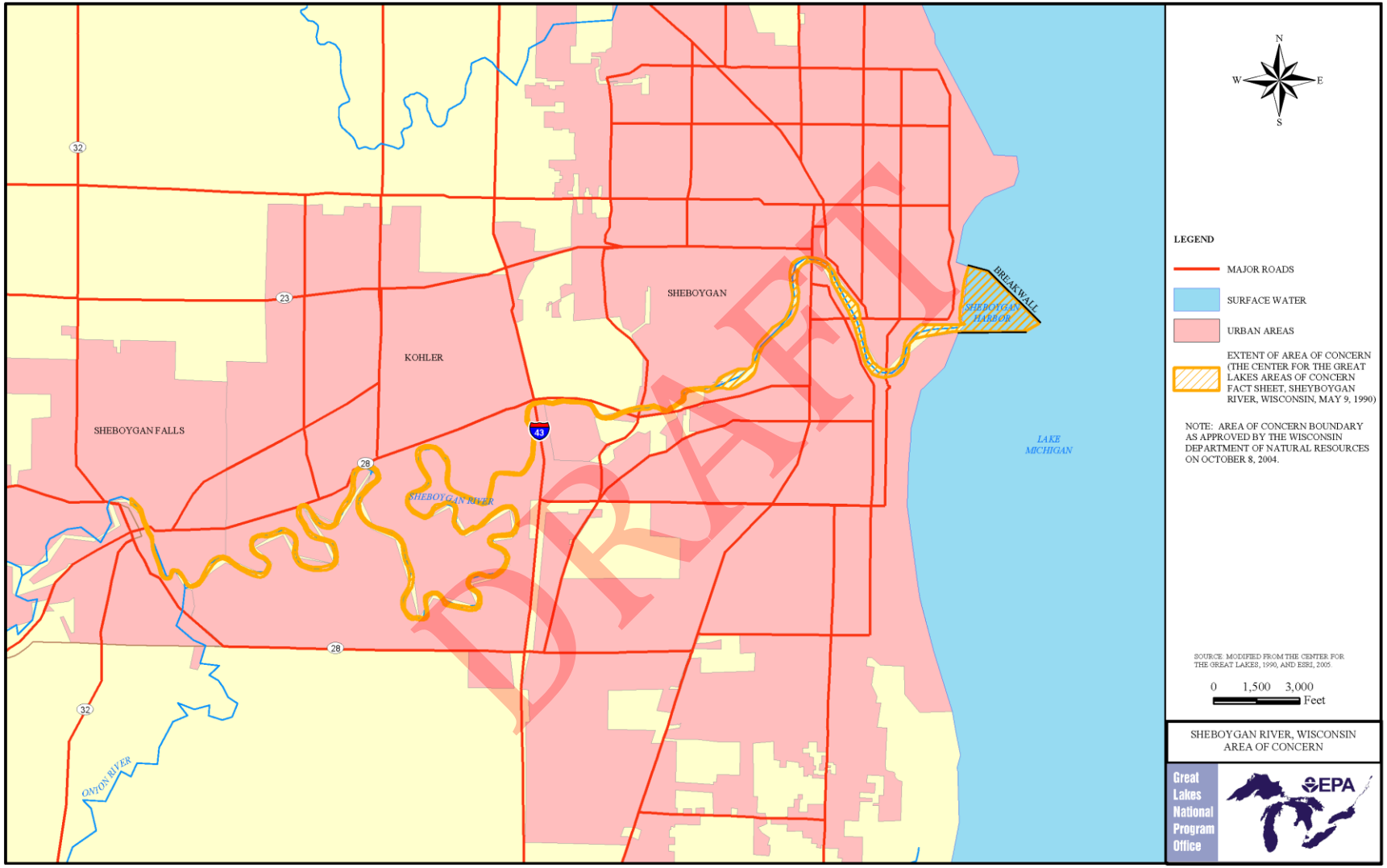
Figure 1: Sheboygan River, WI AOC Map



4. LOCATION OF PROJECT

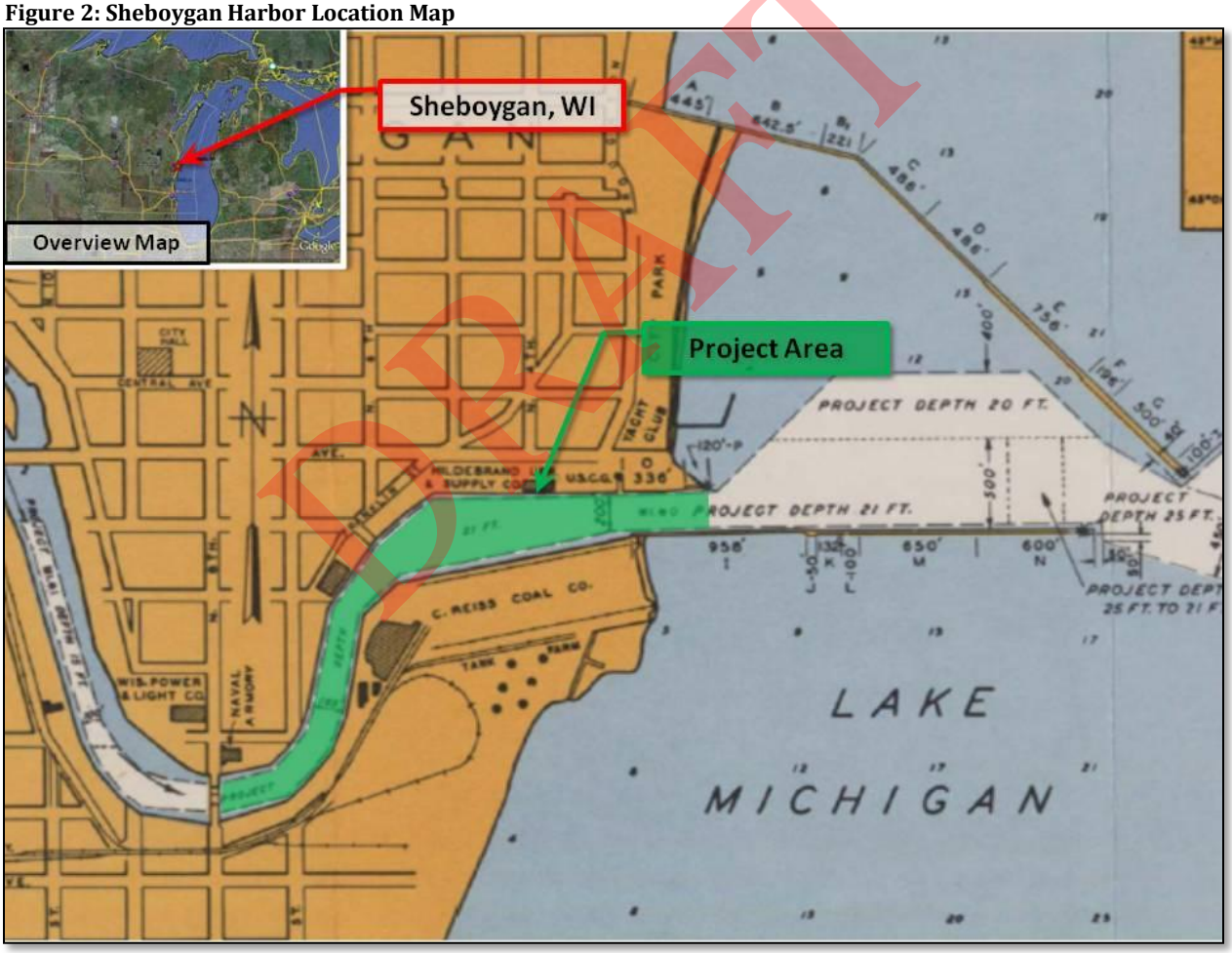
4.1 Geographic Location

Sheboygan Harbor is located on the western shore of Lake Michigan at the mouth of the Sheboygan River, Sheboygan, Wisconsin (Figure 2). The City of Sheboygan is approximately 45 miles north of Milwaukee and about 55 miles southeast of Green Bay, Wisconsin. The Sheboygan River drains an area of roughly 400 square miles. The headwaters of the river begin near the southern tip of Lake Winnebago, and meander 80 miles before reaching Lake Michigan.

4.2 Congressional District

The Project is within the jurisdiction of the 6th Congressional District of Wisconsin, represented by Congressman Thomas E. Petri (R-WI_6). Wisconsin's two senators are Sen. Ron Johnson (R-WI) and Sen. Herbert H. Kohl (D-WI).

Figure 2: Sheboygan Harbor Location Map



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5. DREDGING HISTORY AND PRIOR STUDIES & REPORTS

5.1 Dredging History

The following table summarizes the known dredging history of Sheboygan Harbor. Prior to 1969, dredged material from Sheboygan Harbor was generally placed in open water.

Table 2: Known Dredging History at Sheboygan Harbor

FY	START	COMPLETION	CUBIC YARDS	CONTRACTOR	Placement/Dredge Area
1956	5/27/1956	11/19/1956	481,780	GOVT/ KEWAUNEE	Data not available
1957	4/16/1957	4/19/1957	10,890	GOVT/ KEWAUNEE	Data not available
1958	6/3/1958	6/14/1958	31,050	GOVT/ KEWAUNEE	Data not available
1959	6/25/1959	7/18/1959	20,700	GOVT/ KEWAUNEE	Data not available
1960	7/22/1960	7/25/1960	1,550	GOVT/ KEWAUNEE	Data not available
1961	7/25/1961	8/9/1961	32,099	GOVT/ KEWAUNEE	Data not available
1962	11/19/1962	12/16/1962	35,582	GOVT/ KEWAUNEE	Data not available
1963	10/26/1963	11/4/1963	28,085	GOVT/ KEWAUNEE	Data not available
1965	5/22/1965	6/3/1965	29,350	GOVT/ KEWAUNEE	Data not available
1967	7/24/1967	8/24/1967	92,775	GOVT/ KEWAUNEE	Data not available
1968	6/28/1968	7/21/1968	61,425	GOVT/ KEWAUNEE	Data not available
1969	6/28/1969	7/19/1969	60,545	GOVT/ KEWAUNEE	Data not available
1981	7/15/1981	10/30/1981	28,556	DUROCHER	Upland at Sheboygan East Industrial Park/ 0+00 - 8+00 (Old Stationing)
1984	5/2/1984	6/15/1984	25,596	GILLEN	Upland at C. Reiss Coal Company Dock/ Entrance Channel
1985	12/6/1985	12/23/1985	12,026	HARBOR MARINE	Beach - Behind Contractor Constructed Berms on the Beach / Area Defined Between 1+00 - 32+00
1987	6/1/1987	6/25/1987	24,303	KING	Beach- South Beach Areas I and II / Outer Area Defined on Drawings
1991	9/4/1991	9/28/1991	46,577	ANDRIE	Beach S of Harbor from Centerline of Alabama Ave Extended South 700' CNTR-OHWM / Area at Harbor Entrance 24+00 - 32+00

5.2 Prior Studies and Reports

5.2.1 Sheboygan River Remedial Action Plan, February 1995

The Remedial Action Plan (RAP) was primarily developed by the Wisconsin Department of Natural Resources (WDNR) with active participation by stakeholders in conjunction with the U.S. Environmental Protection Agency (EPA) and International Joint Commission (IJC).

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The IJC, EPA, and WDNR, have identified the Sheboygan River Area of Concern (AOC) as one of the forty-three AOCs requiring remedial action. The work done in the Sheboygan River Basin is part of Wisconsin's area-wide water quality management plans that the WDNR prepares for the U.S. EPA under Section 208 of the Clean Water Act. The IJC developed the RAP program to address the remedial objectives of the Great Lakes Water Quality Agreement.[3]

The Remedial Action Plan is the overarching document outlining the cleanup effort described in Section 3.4.

5.2.2 Design Analysis Report for Confined Disposal Facility Sheboygan Harbor, Wisconsin

The Design Analysis Report was written in 1988 and evaluated 19 upland confined disposal facility locations and one in-water confined disposal facility located in the harbor itself. The report recommended two possible designs for an inwater facility that are no longer feasible due to development within the harbor. The project described in this report was never implemented.

5.2.3 Section 107 Detailed Project Report, Sheboygan Harbor Wisconsin, October 1981

The purpose of this study was to investigate the feasibility of providing a small-craft harbor at Sheboygan, WI, consistent with the demand allocations for Kenosha to Kewaunee study area. The project described in this report was never implemented.

5.2.4 Sheboygan County Solid Waste Management Plan

The Sheboygan County Solid Waste Management Plan was developed in 1977. This plan presented solid waste management alternatives for Sheboygan County to include landfilling practices. The management plan was updated in 1986. In these documents, 25 municipal or private landfills were identified within Sheboygan County. All of these facilities were expected to be closed within 5 - 15 years.[4]

5.2.5 Environmental Documents on file:

5.2.5.1 USACE Detroit District. (May 2003). *Environmental Assessment; Rehabilitation of South Pier, Sheboygan Harbor, Wisconsin*

5.2.5.2 USACE Buffalo District. (October 1996). *Dredging Alternatives and Selection; Sheboygan River Superfund Project*

5.2.5.3 USACE Detroit District. (December 1994). *Environmental Assessment; Sheboygan Harbor, Repair of the North Breakwater Connector Sections A and B. Sheboygan Harbor, Sheboygan County, Wisconsin*

5.2.5.4 USACE Detroit District. (October 1987). *Environmental Assessment and 404 (b) (1) Evaluation; Section 14 Emergency Shoreline Erosion Control at Sheboygan , Sheboygan County, Wisconsin*

5.2.5.5 USACE Detroit District. (July 1986). *Environmental Assessment; Maintenance Dredging and Nearshore Disposal, Sheboygan Harbor, Wisconsin*

[3] Sheboygan River RAP, 1995
[4] USACE Design Analysis Report, 1988

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5.2.5.6 USACE Detroit District. (March 1985). *Environmental Assessment; Maintenance Dredging of Uncontaminated Sediments and Beach Nourishment at Sheboygan Harbor Wisconsin*

5.2.5.7 USACE Detroit District. (May 1983). *Environmental Assessment; Repair of the North Revetment and South Breakwater at Sheboygan Harbor, Sheboygan, Wisconsin*

5.2.5.8 USACE Detroit District. (April 1983). *Environmental Assessment; Repair and Maintenance of the Sheboygan Harbor South Breakwater Sections J, K, L , M, and N. Sheboygan County, Wisconsin*

5.2.5.9 USACE Detroit District. (March 1981). *Environmental Assessment; Maintenance Dredging of Uncontaminated Sediments at Sheboygan Harbor, Wisconsin*

5.2.5.10 USACE Chicago District. (June 1979). *Feasibility Report and Environmental Impact Statement, Sheboygan Harbor Interim III, Harbors Between Kenosha and Kewaunee, Wisconsin*

5.2.5.11 USACE Chicago District. (March 1979). *Environmental Impact Statement; Operation and Maintenance at Sheboygan Harbor, Wisconsin*

5.2.5.12 USACE Detroit District. (July 1975). *Statement of Findings; Maintenance Dredging and Dredging Disposal for Sheboygan Harbor, Wisconsin*

5.2.5.13 USACE Detroit District. (March 1975). *Final Environmental Statement; Maintenance Dredging and Contained Disposal of Dredge Material at Sheboygan Harbor, Wisconsin*

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6. EXISTING CONDITIONS & PROJECTED FUTURE WITHOUT PROJECT CONDITIONS

6.1 Sheboygan Harbor Description

The existing Federal navigation project (Appendix E) provides for an outer harbor or stilling basin formed by a two breakwaters. The north breakwater extends from the shore about 3,829 feet on the north side of the channel at the mouth of the Sheboygan River. The south pier extends about 2,750 feet into the lake about normal to the shore on the south side of the mouth of the river. A turning basin 900 feet wide and 20 feet deep is located in the outer harbor. The entrance channel is about 3,500 feet long located on the south side of the turning basin, the depth being 25 feet from the lakeward end to a point 500 feet shoreward of the end of the north breakwater, decreasing to 21 feet in the next 300 feet and continuing at the latter depth to the inner end of the improved channel. The widths in the inner channel decrease to 200 feet at the river mouth.

The north breakwater is formed of stoned filled timber cribs, concrete caissons, and piling, all of which is capped with concrete superstructure. The south pier and north stub pier and revetment are formed of timber cribs and piling, all of which have been provided with concrete superstructure. The south breakwater is now in a state of moderate to advanced structural deterioration as evidenced by differential settlement and cracking of the concrete caps. This condition indicates that the timber substructures are beginning to fail in localized areas.

The project depth is referred to low water datum for Lake Michigan, which is 577.5 feet above mean water level at Rimouski, Quebec (International Great Lakes Datum 1985). The fluctuations of water level are seasonal changes of about one-half foot above or below the annual mean stage and extreme fluctuations of a temporary nature, due to wind and barometric pressure, of about 1 ½ feet above or below the mean lake level prevailing at the time.

The outer harbor consists of an outer basin and entrance channel formed by the North breakwater and South pier. The following sections along the South Pier are in poor structural condition; Section - I 958', Section - J 50', Section - L 100', Section - M 650', and Section – N 600'. These segments were constructed between 1873 – 1933.

The inner harbor begins at the mouth of the harbor entrance and extends 1 mile upstream within the Sheboygan River, in the City of Sheboygan, near Jefferson Avenue.

6.2 Shoaling

The inner harbor has not been dredged since 1969. It has therefore shoaled in to a level that inhibits navigation. At this time, the outer harbor provides sufficient draft for the usage. Condition surveys from September 2010 are included as Appendix D.

6.3 Economic Sector Shifts & Land Use Patterns

Historically, the Sheboygan River played a significant role in the development of the region's economy by providing a valuable waterway for the shipment of natural resources. With a natural harbor located at the mouth of the river, the city became a hub for the transport of raw timber and agricultural products. The availability of these natural resources (wood and agricultural products) created manufacturing opportunities to utilize these resources as inputs for the production of goods such as: furniture, grain products, wagons, toys, and wooden ships. As the local economy expanded, so did the manufacturing base. At one point, the city was known as the world's leading chair manufacturer with over 34 firms producing wooden chairs and other types of furniture. By the late 19th century, there was a diverse manufacturing base benefiting from the river and port. Some of the beneficiaries included: tanneries, breweries, a bathroom and kitchen fixtures manufacturer, a boiler and engine company, several ship builders and many wooden furniture companies.

Similar to other communities, the decline in North American manufacturing led to fewer firms using the Sheboygan waterfront for the production and shipment of goods. By the late 1980's the City of Sheboygan began pursuing a redevelopment plan for the city's harbor and riverfront. The objective of this plan was to redevelop the former manufacturing sites with land uses and facilities that supported recreational boating. Consequently, the former industrial waterfront now consists of a 3-star hotel, a marina, a community youth boating center, condominiums, office space, and mixed-use retail stores.

The water's edge also supports a large charter fishing industry with approximately 30 vessels offering daily trips ranging in price from $300 to $700 per fishing trip. There are several other businesses that provide services and slip space to the charter fisherman. In addition to charter fisherman, two small-scale commercial fishing vessels utilize the river in their daily navigation out to Lake Michigan. The majority of vessels using the inner harbor have a draft of less than five feet. Consequently, their operations would not be eliminated by the shoaling expected to accumulate in the harbor over the next six years. The charter fishing vessels or commercial fishing companies do not catch fish near the Sheboygan River due to the restrictions on fish consumption. All fishing

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operations take place outside the vicinity of the river and these entities only utilize the river for navigational purposes.

6.4 Sheboygan County Employment and Output by Industry Sector

Although the City of Sheboygan has seen a decline in the number of manufacturing firms, this industry sector continues to be the largest contributor to employment in Sheboygan County (Table 3). In fact, a greater proportion of the county's resident's work in a manufacturing-related job compared to other employed Wisconsin residents. Given that the City of Sheboygan is a regional tourist destination, it is not surprising that the county's second largest employment sector is food service. In addition, state and local government agencies are a large source of local employment for the county. This is a consistent trend that can be seen throughout other rural communities in the United States. The delisting of Sheboygan River from the AOC status would allow the community of Sheboygan to utilize the area for additional recreation related activities that, in turn, would increase tourism and other economic opportunities for the community.

Table 3: Sheboygan Employment Profile

Sheboygan Employment Profile		
Employment by Industry	***Sheboygan County***	***State of Wisconsin***
Metal Fabricated Products	4,797	10,991
Food Services (Restaurants, etc)	3,786	211,645
State and Local Government Agencies	2,805	138,467
State and Local Educational Agencies	2,782	227,497
Wholesale Trade Businesses	2,425	123,049
Healthcare Practitioners	2,319	82,243
Plastic Fabricated Products	2,122	16,978
Nursing & Residential Care Facilities	2,003	75,095
Retail Stores	1,714	61,942
Civic, Social, Professional and Similar Organizations	1,678	53,006
Cheese Manufacturing	1,526	12,751
Notes:		
Data was derived through the input-output model, IMPLAN.		

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Table 4 indicates that over 20% of the revenue (or dollars of output) produced by Sheboygan County businesses was in cheese manufacturing and metal fabrication industries. The cheese manufacturing industry generates the greatest amount of revenue (or dollars of output) compared to any other industry operating in Sheboygan County. Basic organic chemical manufacturing, plastic fabricated products and animal processing industries are other top producing industries located in Sheboygan County.

Table 4: Top Industry Sectors for Generating Output in Sheboygan County

Top Industry Sectors for Generating Output in Sheboygan County				
Employment by Industry	*Sheboygan County*		*State of Wisconsin*	
	Dollars Generated	*Percent of Total Economic Activity*	*Dollars Generated*	*Percent of Total Economic Activity*
Cheese Manufacturing	$1,492,811,768	12%	$12,288,460,938	3%
Metal Fabricated Products	$1,187,867,065	10%	$2,537,510,010	1%
Basic Organic Chemical Manufacturing	$639,019,592	5%	$2,866,742,432	1%
Plastic Fabricated Products	$466,755,951	4%	$3,760,368,896	1%
Animal Processing	$430,948,944	3%	$6,839,435,059	1%
Notes: Data was derived through the input-output model, IMPLAN.				

6.5 Projected Future Without Project Conditions

Sheboygan Inner Harbor was last dredged in 1969. According to Detroit District Operations Office, prior-to-dredge and after-dredge surveys reveal that the Sheboygan Harbor entrance channel shoals up to 0.33 feet annually in certain locations. The sides of the channel most often shoal heavier than the center but trouble spots of high shoaling occasionally occur in the channel center. In addition, shoaling tends to occur heavily at the corners where the channel changes direction, often interfering with a vessel's turning capability. At some point in the future, the continued cessation of maintenance dredging would render the harbor useable to only smaller vessels. For environmental and budgetary reasons over the last two decades, the harbor has not been dredged for the entire width of the channels.

Without the dredging project described in this management plan, the harbor would continue to have dredging restrictions due to the low-level contamination. The Beneficial Use Impairments would remain in place and the harbor's listing as an Area of Concern would continue. In addition, the public would continue to perceive the river as polluted and/or a contaminated ecosystem.

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7. SEDIMENT CHARACTERIZATION

7.1 Soil Properties

The material within the required dredging prism consists of material that has shoaled since the last time the area was dredged. The shoaled material contains loose to dense sand and silt with organics.

Table 5: Sheboygan Grain Size Summary

Sample ID	Date Collected	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
SH-11-01	07/05/11	0.0	**0.6**	**15.3**	**84.1**
SH-11-02	07/05/11	**0.1**	**1.7**	**11.3**	**86.9**
SH-11-03	07/06/11	0.0	**0.2**	**8.4**	**91.4**
SH-11-04	07/06/11	0.0	**1.1**	**13.6**	**85.3**
SH-11-05	07/06/11	**0.1**	**1.3**	**11.8**	**86.8**
SH-11-06	07/06/11	**0.1**	**2.8**	**11.4**	**85.7**
SH-11-07A (0-6')	07/06/11	0.0	**0.4**	**41.4**	**58.2**
SH-11-07B (6-8')	07/06/11	0.0	**0.7**	**16.9**	**82.4**
SH-11-07C (8-10')	07/06/11	0.0	**2.1**	**11.4**	**86.5**
SH-11-07D (10-12')	07/06/11	0.0	**1.1**	**11.5**	**87.4**
SH-11-08A (0-6')	07/06/11	**0.3**	**2.5**	**40.9**	**56.3**
SH-11-08B (6-8')	07/06/11	0.0	**1.2**	**36.8**	**62.0**
SH-11-08C (8-10')	07/06/11	0.0	**0.4**	**13.1**	**86.5**
SH-11-08D (10-12')	07/06/11	**0.9**	**1.8**	**13.4**	**83.9**

7.2 Contaminants Characterization

Sediment sampling data from the inner harbor in 2010 confirm polychlorinated biphenyl and heavy metal contaminants at levels that are detectable, however the sediment is considered non-hazardous for disposal purposes. Polycyclic aromatic hydrocarbons and pesticides were not detected. Previous sampling by the EPA in 2009 shows similar results, except for PAHs, which were detectable in their sampling effort.

Additional sediment samples were obtained in July 2011. The material was predominantly fine-grained silts. A summary of the grain size results are shown in Table 5. The samples were also tested for metals, PCBs and polyaromatic hydrocarbons. In six sediment samples collected from 6 stations during 2010, the following metals results were observed in the bulk sediment samples: 1) barium (Ba) was observed to have a range of 90 - 160 ppm, and a mean concentration of 106 ppm; 2) lead (Pb) was observed to have a range of 40 - 140 ppm, and a mean of 78 ppm; and 3) manganese (Mn) was observed to have a range of 380 – 680 ppm, and a mean of 458 ppm. A leachate test, Synthetic Precipitation Leaching Procedure (SPLP), was performed on the six sediment samples to determine the leachate limits for the sediment. The following metals were observed in the SPLP leachate samples: 1) iron was observed to have a range of 1.1 – 8.5 mg/L, and a mean of 3.8 mg/L; and lead was observed to have a range of 0.0083 – 0.025 mg/L, and a mean of 0.014 mg/L.

The concentration of total PCBs collected from six locations within the Inner Harbor during a 2010 sampling event ranged from 0.7 to 1 ppm. Among these samples, one (1) sample was in the concentration range of at 1. 0 ppm, and no samples exceeded 1.0 ppm (using a calculation rate of ½ method detection limit for the non-detect aroclors). The SPLP determined that 3 of the 6 samples had detectable limits of PCBs with levels ranging from 0.6 – 0.97 µg/L with a mean of 0.77 µg/L.

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The levels of PCBs and metals were compared to the consensus based sediment quality guidelines in Wisconsin, see Table 6. The levels of metals were compared to consensus based sediment quality guidelines and only two metals were above the threshold effect level, lead and zinc. The remaining metals all had an average level below the threshold effects concentration. Leachate tests (Synthetic Precipitation Leaching Procedure (SPLP)) were conducted, and the results showed an average level of 14.25 µg/l for lead and non-detectable levels for zinc. Treatment studies were conducted for the dredged material with an 8% application rate of Calciment®, and the results of the treatment study show that lead levels in the leachate after 24 hours of treatment are an average of 1.07 µg/l, below levels of concern in groundwater.

PCB levels were on average 320 µg/l normalized to 1% total organic carbon. The PCB levels were above the threshold effect concentration but below the probably effect concentration. PCB levels below 1.0 ppm are acceptable for upland placement.

Biological testing was also conducted in accordance with the 1998 Great Lakes Testing and Evaluation Manual to evaluate the proposed discharge of the dredged material from Sheboygan Harbor to the proposed open water site in Lake Michigan. The biological testing consisted of water (elutriate toxicity tests) and sediment biological testing (both toxicity tests and bioaccumulation tests). The dredged material in the harbor did meet the guidelines for the biological tests for the elutriate and the sediment toxicity tests. The dredged material in the harbor did not meet the guidelines for PCB bioaccumulation when compared to the disposal site sediment.

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Table 6: Sheboygan Harbor Analytical Results Summary - July 2011

Parameter	Sample ID		SH-11-01	SH-11-02	SH-11-03	SH-11-04	SH-11-05	SH-11-06	Average	TEC	PEC
	Date Collected		07/05/11	07/05/11	07/06/11	07/06/11	07/06/11	07/06/11			
Physical Kit	Analysis Method	Units									
Total Organic Carbon (TOC)	WALKLEY BLACK	mg/kg dry	15,000	28,000	27,000	29,000	24,000	25,000			
Total PCBs normalized at 1% TOC		µgkg	437	307	370	269	238	300	**320**	60	676
Arsenic	EPA 6020	mg/kg dry	2.8	5.1	2.8	2.9	2.6	3.4	3.27	9.8	33
Cadmium	EPA 6020	mg/kg dry	0.79	0.86	0.66	0.66	0.45	0.74	0.69	0.99	5
Chromium	EPA 6020	mg/kg dry	30	33	29	*31*	26	34	30.50	43	110
Copper	EPA 6020	mg/kg dry	30	32	31	*30*	26	36	30.83	32	150
Iron	EPA 6010B	mg/kg dry	9,900	11,000	9,600	*9,600*	10,000	9,900	10,000	20,000	40,000
Lead	EPA 6020	mg/kg dry	69	71	140	65	40	81	**77.67**	36	130
Manganese	EPA 6020	mg/kg dry	420	470	680	400	400	380	458.33	460	1100
Mercury	EPA 7471A	mg/kg dry	0.14	0.11	0.12	0.14	0.12	0.14	0.13	0.18	1.1
Nickel	EPA 6020	mg/kg dry	17	19	17	*17*	16	19	17.50	23	49
Silver	EPA 6020	mg/kg dry	0.3	0.3	0.23	0.31	0.24	0.24	0.27	1.6	2.2
Zinc	EPA 6020	mg/kg dry	140	130	210	130	110	120	**140.00**	120	460

Bold indicates average results that exceed TEC

TEC - threshold effects concentration

PEC - probably effects concentration

TOC - total organic carbon

*PCBs are normalized at 1% TOC

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8. PROBLEMS AND OPPORTUNITIES

The first step in the planning process is the identification of problems (undesirable conditions to be solved) and opportunities (chances to improve conditions) that the planning team seeks to address. Problems and opportunities should be defined in terms of their nature, cause, location, dimensions, origin, timeframe, and importance. The planning team develops objectives and constraints based on those problems and opportunities. [5]

8.1 Problems

(a) Available draft does not allow current and potential future users of harbor to move safely and efficiently through the Federal channel

(b) Due to contamination in the sediment, there are restrictions on the placement of dredged material. These restrictions are one of the Beneficial Use Impairments cited in the classification of Sheboygan River as an Area of Concern

8.2 Opportunities

The opportunity statements presented in this section evolved from evaluating the area resources and problems evident in the development of the Interim DMMP for Sheboygan Harbor:

(a) Restore navigable draft, providing current and potential future users of harbor to move safely and efficiently through the Federal channel

(b) Remove contaminated (low level) sediment to a depth that removes the dredging restriction and Beneficial Use Impairment

(c) Complete an overall, multi-agency effort to delist Sheboygan Harbor as and Area of Concern.

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9. PLANNING OBJECTIVES & CONSTRAINTS

9.1 Planning Objectives

Planning objectives are statements that describe the desired results of the planning process by solving the problems and taking advantage of the opportunities identified. The planning objectives are directly related to the problems and opportunities identified for the study and will be used for the formulation and evaluation of plans. Objectives are clearly defined and provide information on the effect desired (quantified, if possible), the subject of the objective (what will be changed by accomplishing the objective), the location where the expected result will occur, the timing of the effect (when would the effect occur) and the duration of the effect.[6]

(a) Restore navigable draft to the City of Sheboygan

[5] ER 1105-2-100, E-33-a
[6] ER 1105-2-100, 2-3-a-(3)

(b) Contribute to an overall clean-up effort within the Sheboygan Harbor with the intent to complete the remediation required to delist the harbor as an AOC by the end of 2012

(c) Improve economic opportunity in the City of Sheboygan

9.2 Planning Constraints

Constraints are restrictions that limit the planning process. Constraints, like objectives, are unique to each planning study. Some general types of constraints that need to be considered are resource constraints and legal and policy constraints. Resource constraints are those associated with limits on knowledge, expertise, experience, ability, data, information, money and time. Legal and policy constraints are those defined by law, USACE policy and guidance. Plans should be formulated to meet the study objectives and to avoid violating the constraints.[7]

(a) Control the spread of contaminated soils via proper management during removal, transport, and disposal of dredge material

(b) Perform within the time constraints of an extremely aggressive schedule

10. MANAGEMENT MEASURES IDENTIFICATION

10.1 General

A management measure is a feature or an activity that can be implemented at a specific geographic site to address one or more planning objectives. Management measures are the building blocks of alternative plans. An alternative plan is a set of one or more management measures functioning together to address one or more objectives. A range of alternative plans shall be identified at the beginning of the planning process and screened and refined in subsequent iterations throughout the planning process.[8]

The measures for this study fall into to the categories that are generally required to complete a dredging project. Those categories are Dredging Depths and Areas, Dredging Method /Equipment, Disposal of Sediments, Transport of Sediments, and a general category of Other.

10.2 Dredging Depths and Areas

10.2.1 Recreational Navigation Draft

The recreational navigation draft plan consists of dredging the Federal navigation channel from the mouth of the harbor to the 8th Street Bridge in two sections separated by depth. The first dredging section involves dredging to 15-16 feet below low water datum (LWD) from the mouth of the harbor (approx. sta. 2+19) upstream to Virginia Ave (approx. sta. 119+00). The second dredging section involves dredging to 11-12 feet below LWD from the first section (approx. sta. 119+00) upstream to the 8th Street Bridge (approx. sta. 134+00).

The recreational navigation draft plan was developed through multi-agency coordination to serve several purposes. For the EPA, dredging to this depth would remove the contaminated sediment to

[7] ER 1105-2-100, 2-3-a-(5)
[8] ER 1105-2-100, 2-3-c-(1)

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a depth that would permit future dredging operations and facilitate the removal of the dredging restriction BUI and the delisting of the harbor as an AOC. For the locals, dredging to this depth meets their identified needs as a recreational harbor and the draft needs of several potential cruise ships that have expressed interest in Sheboygan Harbor (see Section 15).

The material left in place after the corresponding dredging operations would continue to contain low-level contamination. The dredging of material below this project depth would still be restricted. However, this depth represents the recreational navigation needs of the harbor.

Figure 3: Recreational Navigation Draft Plan

10.2.2 Federal Channel to Authorized Depth

The Federal Channel to Authorized Depth Plan also meets the EPA's goals and meets the locally identified water draft needs. The Federal Channel to Authorized Depth Plan depths would remove the contaminated sediment to a depth that would permit future dredging operations to meet the local water depth needs.

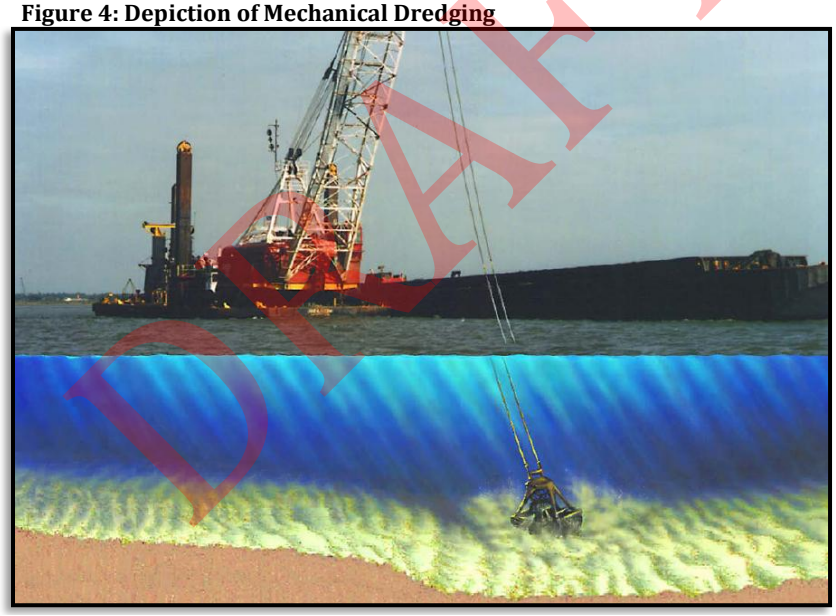
The Federal Channel to Authorized Depth Plan consists of dredging the Federal channel from the mouth of the harbor upstream to the 8th St. Bridge to the authorized depth, 21 feet below LWD.

10.3 Dredging Methods/Equipment

10.3.1 Mechanical Dredging

Most mechanical dredges scoop sediment into a bucket-shaped container and bring it to the surface where it is dumped into a placement area or transportation unit. These dredges usually consist of an excavator (i.e., clamshell bucket, dragline, power shovel, or backhoe) mounted on the deck of a non-self-propelled barge. Some versions use conventional track or rubber-wheel-mounted excavators (used on land) that are driven onto barges for temporary use, while others have the excavator's turntable (horizontal swivel point) directly mounted to the barge deck. When mobilizing to and from a project site, the dredge is usually pulled or pushed by tug. In operation, the dredge holds its position by taking tension on anchors deployed around the barge, and/or by dropping spuds (vertically-oriented large-diameter steel pipe) into the bottom sediment. The anchors are set by onboard cranes or auxiliary work vessels (tenders). Once the dredge has excavated all the sediment it can reach to the required depth at one station, it is repositioned to a new location to begin digging again. This relocation can be accomplished in a variety of ways, i.e., an anchor/winch system, tug, movable spud system, or even by using the bucket itself as an anchor point.[9]

Figure 4: Depiction of Mechanical Dredging



Numerous mechanical dredges were evaluated for their potential use in excavating sediments from the Sheboygan River for this project. Sediments excavated with a mechanical dredge are typically placed into a barge, scow or hopper for transport to a transfer or placement site.

10.3.1.1 *Backhoe Boom*

The backhoe is a boom or dipper arm with an open bucket attached to the boom (Averett 1990). The backhoe may be mounted on a crawler or a floating barge and is hydraulically operated.

[9] ERDC TR-11-2, January 2011

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10.3.1.2 *Bucket Ladder Dredge*

The bucket ladder dredge consists of an inclined submersible ladder supporting a number of buckets that rotate around the circumference of the ladder (Averett 1990). The buckets pick up sediment at the bottom of the ladder and bring the material to the top of the ladder where the sediment is removed by the dumping action produced when the bucket rotates around the top ladder pivot.

10.3.1.3 *Bucket Wheel Dredge*

The bucket wheel dredge consists of a submersible wheel supporting a number of bottomless buckets that rotate with the wheel. The dredge material is force fed toward the center of the wheel, which contains a suction pipe for collecting the sediments and bringing them to the surface. The positive-feed feature allows control over the percent solids passing into the pump by controlling the wheel rotating speed and/or the dredge swing speed (Palermo 1988).

10.3.1.4 *Open Clamshell*

The open clamshell dredge consists of a bucket or clamshell (Figure 1) operated from a crane that can be mounted on a floating barge or used on land to remove sediments from a water body. Clamshell dredges are available in different sizes, boom lengths, and bucket sizes. The clamshell dredge is used primarily in the removal of soft or cohesive sediment and is particularly useful for excavating sediment in deep water and for dredging in locations alongside structures (Averett 1990). Anchors and spuds or tug boats are used to position and move the barge during dredging.

Figure 5: Open Clamshell Bucket

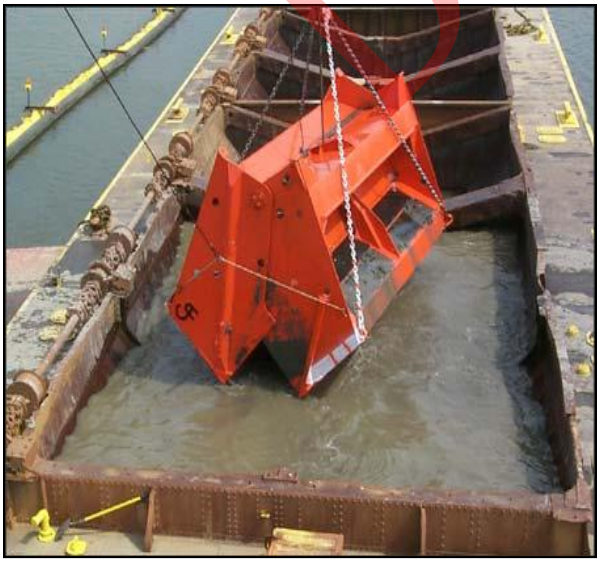

Figure 6: Depiction of Hydraulic Dredging

10.3.1.5 *Closed-Bucket Clamshell*

The closed-bucket clamshell (Figure 6), also known as an environmental bucket, is a conventional clamshell dredge fitted with a special bucket designed to enclose the excavated sediments so that sediment resuspension caused by pulling the bucket through the water column and draining above the water is minimized (Averett 1990). Operation of the closedbucket clamshell is similar to that of the open clamshell bucket.

One closed-bucket design uses tongue-in-groove edges that seal the bucket when it is closed. The top of the bucket is also covered to minimize the loss of dredged material as the full bucket is drawn up through the water column.

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10.3.1.6 *Dipper Dredge*

The dipper dredge is a barge mounted power shovel equipped with a power-driven ladder structure. An open bucket is firmly attached to the ladder structure and is forcibly thrust into the material to be removed. The dipper dredge is best suited for excavating hard compacted materials, rock, or other solid materials after blasting (Averett 1990).

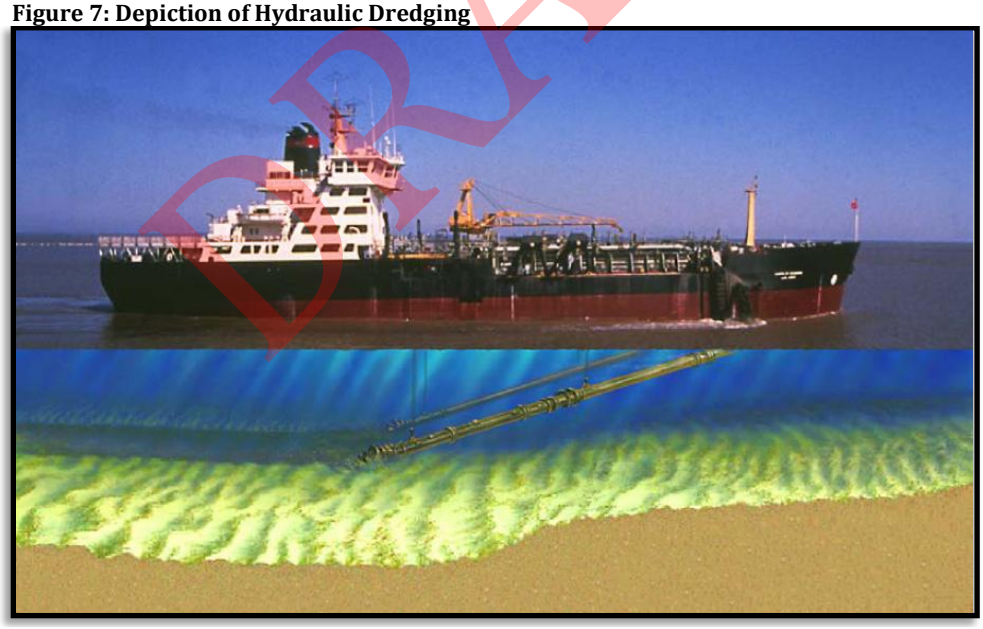
10.3.1.7 *Dragline Dredge*

The dragline dredge has been used for years in the excavation of sediments and other materials. Draglines are readily available with varying boom lengths and bucket sizes and are very reliable at removing sediment (Averett 1990). They consist of an open bucket being dragged across the sediment to be removed to collect and remove from the water.

10.3.2 Hydraulic Dredging

A hydraulic dredge generally uses a centrifugal pump to transport the dredged material in the form of slurry (water and sediment mixture). The centrifugal pump's purpose is to convert mechanical energy (usually provided by a diesel engine or electric motor) into hydraulic pressure required to transport slurry through the pipeline. Major components of a centrifugal pump include: (1) the rotating element called an impellor (or runner) that imparts energy to the slurry, (2) the volute (or case) that encloses the rotating impeller and slurry, (3) an opening in the center of the volute that the suction pipe is connected to, and (4) the discharge opening on the volute's circumference that the discharge pipe is connected to. The most common types of hydraulic dredges used, hopper and pipeline, are classified by their respective means of transporting material to the disposal site.[10]

Figure 7: Depiction of Hydraulic Dredging



10.3.2.1 *Cutterhead Suction Dredge*

The hydraulic pipeline cutterhead suction dredge is the most commonly used dredging plant and is generally the most efficient and versatile (USACE 1983). It can efficiently dredge all types of

[10] ERDC TR-11-2, January 2011

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materials including clay, silt, sand, compacted deposits, hardpan, gravel, and rock (Averett 1990). This dredge has the capability of pumping dredged material long distances to upland disposal areas.

10.3.2.2 *Dustpan Suction Dredge*

The dustpan dredge is a hydraulic suction dredge that uses a widely flared dredge head containing high-pressure water jets. The jets loosen and agitate sediment and the sediment is captured in the dustpan head as the dredge is winched forward. The dustpan dredge was designed to dredge large volumes of loose materials such as sands and gravels from the navigation channels of open reaches of major rivers (USACE 1983 and McLellan 1989).

10.3.2.3 *Hopper Dredges*

Hopper dredges are designed to operate in open waters and are best suited for dredging deep harbors and rough water shipping channels (Averett 1990). Dredged material is raised by dredge pumps through dragarms connected to drags in contact with the channel bottom and discharged into hoppers built in the vessel (USACE 1983). Once the hopper is fully loaded, the dredge moves to the disposal site to unload before resuming dredging. Because of the limitations on open-water disposal, most hopper dredges have direct pumpout capability for disposal to upland confined sites.

10.3.2.4 *Suction Dredge*

The suction dredge is a pipeline cutterhead dredge with the cutterhead removed. The operation and dredging depths for the suction dredge are comparable to those for the cutterhead pipeline dredge. Since this dredge has no cutterhead and operates on suction, only it is limited to dredging soft, free-flowing sand. Debris in the dredged material will clog the suction pipe and greatly reduce the effectiveness of the dredge (Averett 1990).

10.3.2.5 *Sidecasting Dredge*

The sidecasting dredge is similar in design to the hopper dredge except sidecasting dredges do not normally have hopper bins (USACE 1983). Instead of collecting the sediments onboard hoppers, the sidecasting dredge pumps the material directly overboard through an elevated discharge boom. The dredge picks up the sediment through two dragarms and pumps it through a discharge pipe supported by the discharge boom. [11]

10.4 Disposal of Dredged Material

10.4.1 Open Water Placement

Open water placement involves the discharge of dredged material directly to the lake. Hydraulically dredged material may be discharged by pipeline a short distance offshore. Mechanically dredged material may be placed in bottom-dump barges or scows and towed to disposal sites several miles away.

10.4.2 Beach/Littoral Nourishment

Beach/littoral nourishment involves the placement of dredged material directly onto a beach or into the shallow water. Beach nourishment is typically discharged by pipeline from a hydraulic dredge.

[11] USACE Buffalo District. (October 1996). *Dredging Alternatives and Selection; Sheboygan River Superfund Project*

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10.4.3 Upland Unrestricted

The term *upland unrestricted* refers to the practice of discharging via hydraulic pipeline or the mechanical placement of dredged sediments at an upland disposal site. The material is not placed behind a retaining structure and can flow freely into the surrounding environment.

10.4.4 Upland Restricted

The term *upland restricted* refers to the practice of the placement of a dredged material into an upland area where the sediment is physically contained and restricted from human contact and the environment. The possible applications of land based disposal varies dependent upon project specific data and requirements.

10.4.4.1 *Dredged Material Placement Facilities*

10.4.4.1.1 *General*

Most Dredged Material Placement Facilities (DMPF) are typically diked facilities with earthen berms and constructed in convenient proximity to the dredging location. Other design features vary depending on project requirements.

10.4.4.1.2 *Existing DMPF*

The use of an existing DMPF could be utilized if one can be identified that has the available capacity, meets the Federal, State, and Local requirements and has an owner willing to allow usage.

10.4.4.1.3 *Locally Provided DMPF*

This measure accounts for the Partner providing a DMPF capable of meeting the one-time dredging project needs. Some of the major hurdles for this measure are the identification of a suitable site and the local cooperation.

10.4.4.1.4 *New Federally Constructed DMPF*

This measure accounts for the Federal design and construction of DMPF capable of meeting the one-time dredging project needs with the authorized cost share requirements.

10.4.4.2 *Licensed Landfill*

This measure consists of placing the dredged material in a licensed landfill. Landfills will not accept wet material; therefore, any material placed in a landfill will require a dewatering process.

10.5 Transport of Dredged Materials

10.5.1 Barge

For mechanical dredging operations, barges would be used to transport sediment from the dredging site to the transfer site. The need for evaluation comes in selecting the transfer site from barge to truck/rail.

10.5.2 Commercial Trucking

For on-land transport of sediment, watertight trucks can be employed. This is typically used in conjunction with mechanical dredging operations. After the truck is loaded, it delivers to the upland site and dumps the sediment into the placement site.

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Figure 8: Truck Offloading Dredged Material at the Bay Port Placement Site

10.5.3 Hydraulic Pipeline

This measure consists of utilizing a hydraulic pipeline to transport the dredged material (used in conjunction with hydraulic dredging operations).

10.5.4 Railroad

For on-land transport of sediment, rail cars can be utilized. This is typically used in conjunction with mechanical dredging operations and when an existing railroad is in proximity of the placement site. This method requires an additional handling of sediment to transfer from rail to the DMPF.

10.6 Other Measures to Consider

10.6.1 Dewatering

Depending on the ultimate disposal method, a dewatering process may be required. Where existing upland storage is available and adequate, mechanical dewatering will typically not be the least-cost alternative. Where storage is limited or must be constructed, or where offsite disposal options are being considered, mechanical dewatering may offer a reasonable alternative for some projects.

10.6.1.1 Mechanical Dewatering

Mechanical dewatering uses special equipment to reduce the water content of the dredge slurry. It is not presently used as a standard operating procedure in dredged material management. However, as the available capacity in existing DMPFs has diminished, there has been greater interest in beneficial use of dredged material to reclaim or preserve disposal area capacity. Given the time required for materials to consolidate sufficiently so that they can be excavated and recovered from a DMPF, mechanical dewatering may offer a viable means of continuing to operate in a DMPF that is nearing the end of its design life. It is envisioned that with proper management, these facilities would become "rehandling" stations, and dredged material would be treated as a resource rather than a long-term storage problem. Where sediments are too contaminated for beneficial use or DMPF disposal, savings in transportation costs to a permitted placement site may

DRAFT

justify the dewatering processing cost. Whatever the motivation, mechanical dewatering is being considered more frequently in dredged material management evaluations.[14]

10.6.1.2 Chemical Dewatering/Stabilization

Dredged materials can also be dewatered through the addition of additives such as Super Absorbent Polymers or Lime Reaction Additives. These additives typically work via bulking (uptake of water and solidifying) or lime reaction (calcium hydration and exothermic evaporation).

10.6.2 Beneficial uses

Beneficial use of dredged material includes beach and littoral nourishment (as discussed above) and a variety of upland applications. Upland beneficial uses for dredged material include construction fill, landscaping, agricultural applications and wetland/habitat enhancement. Dredged material from Great Lakes harbors has been used for these and other beneficial uses. For upland uses, dredged material is typically placed into a storage area or disposal facility for dewatering, and then transported by truck for use. At the Erie Pier disposal facility in Duluth, MN, dredged material has been "washed" to separate sand for beneficial uses. The development of islands for wildlife habitat with dredged material is typically done by direct placement from a pipeline. The USACE has an authority to provide federal funding (cost-shared) for the additional cost associated with beneficial use of dredged material for the protection, preservation and enhancement of wetlands and aquatic habitat and for shore damage risk management.[15]

11. EVALUATION OF MANAGEMENT MEASURES

In the early stage of the USACE' six step planning process, some of the Management Measures can be written off because they are not engineeringly or environmentally feasible or simply cannot accomplish the goals set forth. Management measures can also be eliminated if they do not meet the USACE alternative formulation criteria of effectiveness, efficiency and acceptability. A summary of the initial evaluation of measures, eliminations, and supporting data follow.

11.1 Dredging Depths and Areas

11.1.1 Recreational Navigation Draft Plan

The Recreational Navigation Draft Plan meets the project purpose, the project's goals and objectives, the EPA's objectives and the locally identified water draft needs. The Recreational Navigation Draft Plan depths would remove the contaminated sediment to a depth that would permit future dredging operations to meet the primary local navigation needs. This measure will be considered as the basis of the alternative formulation.

Based on condition surveys performed in September of 2010, the calculated volume of sediment to be removed for the Recreational Navigation Draft Plan is 170,000 cubic yards (CY). The contract depths for this plan would be 15 and 11 foot depths respectively with 1 foot of overdepth.

[14] ERDC TN-DOER-T7
[15] Section 204, WRDA 1992, as amended – Beneficial Use of Dredged Material

DRAFT

11.1.2 Authorized Depth

Dredging the harbor to the authorized depth of 21 feet below LWD would produce approximately 322,000 CY of sediment to be disposed (based on condition surveys performed in September of 2010).

The current and projected future usage of the harbor is recreational. No need for depth greater than recreational was identified. USACE regulations state "Management plan studies shall consider the full range of measures for dredged material management including measures to reduce dredging requirements, including reduced dimensions. The Federal interest in continued O&M of an existing project for its navigation purpose is defined by that project of maximum scale and extent, within project authorization, for which continued maintenance is warranted in terms of vessel traffic and related factors."[16]

Dredging to the authorized depth is not warranted and will not be considered further.

11.2 Dredging Methods/Equipment

11.2.1 Selection Criteria for Dredging Equipment

The selection of dredging equipment to excavate sediment at a particular job is normally based on numerous factors, including:

11.2.1.1 *Quantity of Sediment to be Removed*

The proposed project involves dredging a total of approximately 170,000 cubic yards of contaminated sediment from the lower Sheboygan River. Conventional mechanical and hydraulic dredges, as well as special purpose dredges, are capable of operating at production rates equal to or greater than needed.

11.2.1.2 *Sediment Characteristics*

Some dredges are suited for excavating the type of sediment present in Sheboygan Harbor, while other dredges are not. The sediment is loose to dense shoaled material.

11.2.1.3 *Site Physical Characteristics*

Much of the Sheboygan River to be dredged has water depths of less than 5 feet. The channel dimensions, depth and width, would prevent the use of the largest dredges and will affect the dredge selection process. The size of the areas to be dredged will also affect the dredge selection process.

11.2.1.4 *Location of the Disposal Site*

The distance to the placement site as well as the type of placement site, i.e., in-lake, upland, off-site, influence the dredge selection process. If the site is not in the immediate area of the dredging project, hydraulic dredging and pipeline transportation may not be economically feasible. The cost of constructing a lengthy pipeline across roads, railroads, and private property may be prohibitive. Mechanically dredged sediment could be transported by truck or rail to upland disposal facilities.

11.2.1.5 *Compatibility with Disposal Operations*

The selected disposal method may influence the dredge selection process. A relatively small upland placement site may not have sufficient storage capacity to allow adequate settling of hydraulic

[16] ER 1105-2-100, App E-15-e-(1)

DRAFT

dredge slurries unless they are first dewatered before disposal. Similarly, sediment transported to on-site or off-site licensed landfills may require dewatering before disposal in order to satisfy regulatory requirements.

11.2.1.6 *Availability of Equipment*

Some dredge methods are readily available in the United States and the Great Lakes area while other dredging technologies are not available in the United States or have had very limited exposure in the States. Specialty dredges that are not available in the United States or dredges without available performance information should not be considered for removal of the contaminated sediments in this portion of the Sheboygan River.

11.2.1.7 *Cost of Equipment Use*

Cost of a dredging operation is also a factor to be considered in the dredge selection process. A dredge method should not be forced onto a project if there are other less expensive dredge alternatives and the alternatives do not involve significantly increased adverse impacts on the project or the environment. On the other hand, a less expensive dredge alternative should not be considered if this alternative is going to involve significant adverse impacts on the project or the environment, and these impacts cannot be mitigated satisfactorily.

11.2.1.8 *Dredge Environmental Characteristics*

This project involves the dredging of contaminated Sheboygan River sediments. Typically, contaminants are associated with the fine-grained sediments, including the PCBs of concern in the Sheboygan River; therefore, it becomes important to select a dredge that is capable of excavating the sediment of interest without generating excessive quantities of resuspended sediment. It is also desirable to utilize a dredge with adequate horizontal and vertical control in order to accomplish the dredging of the material of interest without removing excessive quantities of material that does not need to be removed. Removing unnecessary material results in unnecessary costs associated with dredging, transporting, disposal, and possibly treatment prior to disposal.[17]

11.2.1.8.1 *Resuspension*

The process whereby bedded sediments are dislodged and dispersed in the water column by the dredging operation. The resuspended sediment particles may settle in the dredging area or be transported downstream.

11.2.1.8.2 *Release*

Release is the process by which the dredging operation results in the loss of contaminants from the pore water of the sediment bed or from contaminants sorbed to resuspended sediment into the water column or air. The dissolved and colloidal contaminants that are released to the water column are typically transported farther downstream than contaminants sorbed to resuspended sediment.

11.2.1.8.3 *Residuals*

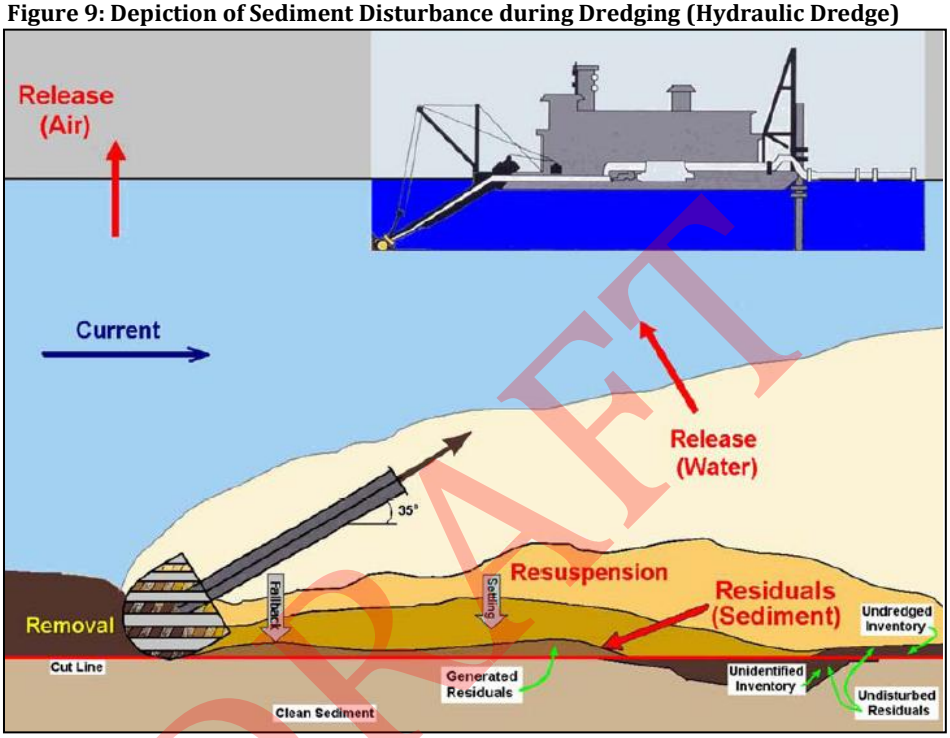
Residuals are contaminated sediments remaining in or adjacent to the dredging footprint after completion of the removal/dredging operation. There are numerous potential causes for residual sediment contamination, but residuals can be broadly grouped into two categories: 1) undisturbed residuals (also commonly termed undredged inventory), and 2) generated residuals. Undisturbed residuals are contaminated sediments found at the post-dredge sediment surface that have been

[17] USACE Buffalo District. (October 1996). *Dredging Alternatives and Selection; Sheboygan River Superfund Project*

DRAFT

uncovered by dredging but not fully removed. These residuals may have been unidentified during characterization and therefore located below the cut line or may result from dredging inaccuracies or other factors such as the presence of structures, debris, or irregular hard bottom features. Generated residuals are defined as sediment dislodged, but not removed, by dredging which falls back, spills, sloughs, or settles in or near the dredging footprint and forms a new sediment layer. The level of concern associated with the residuals depends on both the concentration and bioavailability of the contamination in the sediment and the density and thickness of the contaminated surface layer.[18]

Figure 9: Depiction of Sediment Disturbance during Dredging (Hydraulic Dredge)



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11.2.2 Mechanical Dredging Equipment

Mechanical Dredging removes sediment with little or no change in the water content, *i.e.,* at near in situ solids content. Land based dredging equipment may be used if the water body is small and the sediments to be removed can be reached from the shoreline. Placing the sediments directly into transport trucks or bins would avoid the use of floating plant, a definite benefit in a water body as shallow as the Sheboygan River. See Table 7 for a comparison of mechanical dredge operating characteristics.

11.2.2.1 *Backhoe Boom*

Dredge operating characteristics of the backhoe are shown in Table 7. Resuspension rates for the backhoe are expected to be high because the bucket is open as the dredged material is removed from the water body. Because of the high turbidity associated with the use of this dredge, the backhoe will not be considered for the dredging of the Sheboygan River.

11.2.2.2 *Bucket Ladder Dredge*

Bucket leakage and the mechanical agitation of the sediments cause high turbidity and therefore the bucket ladder dredge will not be considered for this dredging work.

[18] ERDC/EL TR-08-29

11.2.2.3 *Bucket Wheel Dredge*

Data are not available on the turbidity generation caused by the bucket wheel dredge but it will not be considered as a possible dredging alternative for this project due to the extremely shallow nature of the Sheboygan River and the lack of data available on the turbidity generated during dredging operations.

11.2.2.4 *Open Clamshell*

The clamshell dredging process resuspends solids when the bucket impacts the sediment, is drawn from the sediment, and is pulled up through the water column. In addition, the clamshell dredge usually leaves an irregular, cratered bottom (Herbich 1991). The open clamshell dredge is operationally comparable to the enclosed clamshell, but typically has higher resuspension rates. Table 9 and Table 10 provide a comparison between the open and the enclosed clamshell bucket. The information portrayed in those tables supports the open clamshell not being considered further for removal of the contaminated sediments in the Sheboygan River.

11.2.2.5 *Closed-Bucket Clamshell*

The use of a closed-bucket clamshell meets the project objectives while operating within the project constraints. The closed-bucket clamshell will be the basis of the mechanical dredging equipment alternative formulation.

11.2.2.6 *Dipper Dredge*

The dipper dredge is not recommended for use in dredging contaminated sediment or where resuspension of sediment must be controlled. The dredging action of the dipper dredge may cause considerable sediment disturbance and resuspension, particularly during the dredging of fine-grained material. A significant loss of the fine-grained material will also occur from the open bucket as it is raised through the water column, which is not as efficient as the enclosed clamshell. For this reason, the dipper dredge will not be considered as an alternative for removing the Sheboygan River sediments.

11.2.2.7 *Dragline Dredge*

Because the open bucket must be pulled through the sediment for filling and lifted through the water column, sediment resuspension will be very high. Therefore, draglines are inappropriate for contaminated sediment removal or where resuspension is an issue (Averett 1990). The dragline dredge will not be considered for the removal of the contaminated Sheboygan River sediments.

11.2.3 Hydraulic Dredging Equipment

Several hydraulic dredges were evaluated for their potential use in excavating sediments from the Sheboygan River for this project (Table 8). Hydraulic dredges remove and transport sediment in a liquid slurry form (Averett 1990). They are usually barge mounted and carry diesel or electric-powered centrifugal pumps. The pump produces a vacuum on its intake side and atmospheric pressure forces water and sediments through the suction pipe. Cutterhead, dustpan, hopper, suction, and special purpose dredges are all types of hydraulic dredges. In order to remove sediments, the four traditional hydraulic dredges add large volumes of water to each volume of in-place sediment removed, resulting in solids content typically in the 10-20 percent range. Some of the special purpose dredges are capable of removing sediments at near in situ, i.e., at solids content at a concentration close to the in place solids content.

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11.2.3.1 *Cutterhead Suction Dredge*

The cutterhead suction dredge is capable of meeting the project objectives while operating within the project constraints. The cutterhead suction dredge will be the basis of the hydraulic dredging equipment alternative formulation.

11.2.3.2 *Dustpan Suction Dredge*

Dustpan dredges generate suspended solids plumes with concentrations equal to or greater than plumes generated by cutterhead dredges (Averett 1990). Because this dredge is more suited for open reaches of major rivers and has a draft of 5-14 feet, this dredge type will not be considered for removal of the Sheboygan River sediments.

11.2.3.3 *Hopper Dredges*

The hopper dredges deep draft (12-31 feet) precludes its use in shallow water. In addition, the hopper dredge excavates with less precision than other types of dredges (Table 8). Also, the sediment load of the hopper is reduced when dredging contaminated sediments since pumping past hopper overflow is prohibited, resulting in low density material being transported to and pumped into disposal areas. For these reasons, the hopper dredge will not be considered for removal of the contaminated sediments from the Sheboygan River.

11.2.3.4 *Suction Dredge*

Since this dredge has no cutterhead it generates low levels of turbidity, lower levels than the cutterhead dredge. However, since the suction dredge is limited to removing free-flowing sand with little or no debris and has a draft of 3 feet to 14 feet, this dredge will not be considered for removing the silt, sand, and gravel sediment in the Sheboygan River.

11.2.3.5 *Sidecasting Dredge*

The USACE developed the shallow-draft sidecasting dredge for use in places too shallow for hopper dredges and too rough for pipeline dredges. The type of material that can be excavated with the sidecasting dredge is the same as for the hopper dredge, i.e., clay, silt, sand, and gravel. The method of sediment disposal, open-water disposal over the side, makes this dredge unsuitable for dredging contaminated sediments or dredging in areas where turbidity must be limited. In addition, the sidecasting dredge's 5-9 foot draft precludes its use in shallow water. Therefore, the sidecasting dredge will not be considered for dredging the contaminated sediments in the Sheboygan River. [19]

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[19] USACE Buffalo District. (October 1996). *Dredging Alternatives and Selection; Sheboygan River Superfund Project*

Table 7: Summary of Mechanical Dredge Operating Characteristics [a]

Dredge Type	Percent Solids in Slurry by Weight [b]	Turbidity Caused	Compatible With Soil Types	Vessel Draft (Ft.)	Approximate Range of Production Rates (CY/hr)	Dredging Depths (ft.)		Availability	Dredging Accuracy (ft.)	
						Minimum	Maximum		Lateral	Vertical
Backhoe	in situ	high		[c]	25-200	0[d]	30-80	Available	3	1
Bucket Ladder	Near in situ	high			low-high			Available		
Bucket Wheel	low	NA	Consolidated					Available		
Clamshell (open)	in situ	high	clay, silt, sand, gravel	[c]	30-500	0[d]	100[e]	Available	1	2
Closedbucket Clamshell	in situ	low	clay, silt, sand, gravel	[c]	30-500	0[d]	100	Available	1	2
Dipper	in situ	high	best suited for rock, hard compact material	[c]	30-500	0[d]	50	Available	1/2	
Dragline		very high		[c]			100	Available		

Notes:

NA - Not Available

a. Prepared with information from USACE and USEPA documents

b. Percent solids could theoretically be 0, but these are normal working ranges, Percent solids = $\frac{\text{wt. of dry sediment.}}{\text{wt. of wet slurry}}$

c. Depends on floating structure; if barge-mounted, approximately 5- to 6-ft draft.

d. Zero if used alongside of waterway; otherwise, draft of vessel will determine the minimum operational depth.

e. Demonstrated depth; theoretically could be used much deeper

theoretically could be used much deeper

f. Theoretically unlimited

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Table 8: Summary of Hydraulic Dredge Characteristics [a]

Dredge Type	Percent Solids in Slurry by Weight [b]	Turbidity Caused	Compatible With Soil Types	Vessel Draft (Ft.)	Approximate Range of Production Rates (CY/hr)	Dredging Depths (ft.)		Availability	Dredging Accuracy (ft.)	
						Minimum	Maximum		Lateral	Vertical
Cutterhead	10-20%	average	wide range	3-14	25-10,000	3-14	12-65	Available	2-3	1
Dustpan	10-20%	average	sand and gravel	5-14	25-5,700	5-14	50-60	Limited	2-3	1/2
Hopper	10-20%	average	clay, silt, sand, gravel	12-31	500-2,000	10-28	80	Available	10	2
Suction	10-15%	low	free flowing, sand, unconsolidated, little debris	3-14	25-5,000	3-14	12-65	Available	2-3	1
Sidecasting	10-20%	high	clay, silt, sand, gravel	5-9	325-650	6	25		10	

Notes:

NA - Not Available

a. Prepared with information from USACE and USEPA documents

b. Percent solids could theoretically be 0, but these are normal working ranges, Percent solids = $\frac{\text{wt. of dry sediment.}}{\text{wt. of wet slurry}}$

c. Depends on floating structure; if barge-mounted, approximately 5- to 6-ft draft.

d. Zero if used alongside of waterway; otherwise, draft of vessel will determine the minimum operational depth.

e. Demonstrated depth; theoretically could be used much deeper

theoretically could be used much deeper

f. Theoretically unlimited

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Table 9: Quantitative Comparison of the Conventional Clamshell vs. the Enclosed

Mechanical Dredges (2 to 8 m³ buckets)			
Operational Characteristics	**Conventional Clamshell**	**Enclosed Bucket**	**Better Measure for Sheboygan**
Operating Production Rate (m^3/hr)	50 (2 m^3 bucket)		-
	95 (4 m^3 bucket)		-
	145 (6 m^3 bucket)		-
	190 (8 m^3 bucket)		-
Percent Solids (by weight)	90% In situ	80% In situ	Conventional
Vertical Operating Accuracy (cm)	± 15	± 15	-
Horizontal Operating Accuracy (cm)	± 10	± 10	-
Maximum Dredging Depth (m)	NA	NA	-
Minimum Dredging Depth (m)	-	-	-

This table summarizes operational characteristics shown as quantitative entries, reflecting capabilities and limitations of equipment types for environmental dredging, and are solely a function of the equipment itself. The information in this table should be applied only after consideration of the details on the definitions of the various dredge types, operational characteristics, and the technical basis for the entries in this table as described in: ERDC/EL TR-08-29. This information is intended to help project managers initially assess dredge capabilities, and screen and select equipment types for evaluation at the feasibility study stage or for pilot field testing. This table is not intended as a guide for final equipment selection for remedy implementation. There are many site-specific, sediment-specific, and project-specific circumstances that will dictate which equipment is most appropriate for any given situation, and each equipment type can be applied in different ways to adapt to site and sediment conditions.

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Table 10: Qualitative Comparison of the Conventional Clamshell vs. the Enclosed

Mechanical Dredges (2 to 8 m³ buckets)			
Equipment Selection Factors	**Conventional Clamshell**	**Enclosed Bucket**	**Better Measure for Sheboygan**
Sediment Resuspension Control	Low	Medium	Enclosed
Contaminant Release Control	Low	Low to Medium	Enclosed
Residual Sediment/ Cleanup Levels	Low	Low to Medium	Enclosed
Transport by Pipeline	Medium	Medium	-
Transport by Barge	High	High	-
Positioning Control in Currents/Wind/Tides	Medium	Medium	-
Maneuverability	High	High	-
Portability/ Access	High	High	-
Availability	High	High	-
Debris/Loose Rock/Vegetation	High	High	-
Hardpan/ Rock Bottom	Low	Low	-
Sloping Bottom	Low	Low	-
Flexibility for Varying Conditions	High	High	-
Thin Lift / Residuals Removal	Low	Medium	Enclosed

Notes:
The qualitative entries of High, Medium or Low, are defined as follows:

High - indicating the given dredge type is generally suitable or favorable for a given issue or concern,

Medium - indicating the given dredge type addresses the issue or concern, but it may not be preferred, and

Low - indicating the given dredge type may not be a suitable selection for addressing the issue or concern.

This table summarizes selection factors shown as qualitative entries, reflecting the potential performance of a given dredge type, and are a function of both the capability of the equipment type and the site and/or sediment conditions. The information in this table should be applied only after consideration of the details on the definitions of the various dredge types, selection factors, and the technical basis for the entries in this table as described in: ERDC/EL TR-08-29. This general information is intended to help project managers initially assess dredge capabilities, and screen and select equipment types for evaluation at the feasibility study stage or for pilot field testing. This table is NOT intended as a guide for final equipment selection for remedy implementation. There are many site-specific, sediment-specific, and project-specific circumstances that will dictate which equipment is most appropriate for any given situation, and each equipment type can be applied in different ways to adapt to site and sediment conditions.

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11.3 Disposal Methods

11.3.1 Disposal Requirements

The sediment evaluation (Section 7) concluded that the sediment within the Sheboygan River currently does not meet Federal guidelines for open-lake placement per 40 CFR 230.11[d]. Since placement of this dredged material in the open waters of Lake Michigan would not comply with the Clean Water Act (CWA) Section 404(b)(1) Guidelines, it would be environmentally unacceptable. The data also indicate the sediment within the Sheboygan River is not suitable for beneficial uses or unconfined placement.

The sediment is suitable for upland restrict disposal in a land based disposal facility which are improvements necessary on lands, easements, or rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, or maintenance of Federal navigation projects for harbors or inland harbors.

The nature of the contamination in the sediment is low-level. Lead was detected at a range of 0.0083 - 0.025 mg/ in the SPLP, which exceeds the Wisconsin Public Welfare groundwater standard (NR140) of 0.015 mg/L for direct contact. The Federal standard for the Sheboygan Harbor, WI project is the least-cost, environmentally acceptable upland placement alternative that restricts the sediment from direct contact.

11.3.2 Open Water Placement

Biological testing was conducted in accordance with the Great Lakes Testing and Evaluation Manual to evaluate the proposed discharge of the dredged material from Sheboygan Harbor to the proposed open water site in Lake Michigan. The biological testing consisted of water (elutriate toxicity tests) and sediment biological testing (both toxicity tests and bioaccumulation tests). The dredged material in the harbor did meet the guidelines for the biological tests for the elutriate and the sediment toxicity tests. The dredged material in the harbor did not meet the guidelines for PCB bioaccumulation when compared to the disposal site sediment, therefore, the material is unacceptable for placement in the open water. This measure is eliminated from consideration in the alternative formulation.

11.3.3 Beach Nourishment

The use of maintenance-dredged material for beach restoration can serve two beneficial purposes: disposal of the material, and restoration of an eroding beach. If such material is selected, it should closely match the sediment composition of the eroding beach and be low in fine sediments, organic material, and pollutants. Sediments containing large quantities of fine materials result in high levels of turbidity and may introduce trace metals and other contaminants into the water. High turbidity and sedimentation may inhibit reestablishment of beach animals that have a specific habitat requirement or may prevent recruitment to the beach by pelagic larvae, particularly if beach restoration occurs during the peak spawning season in spring and early summer. The disposal may interfere with the selection of a nesting beach if beach sediments are significantly changed, and the appearance of such sediments is aesthetically displeasing.[20]

The Sheboygan material contains higher levels of fines and organics in addition to the low-level contaminants. Since the sediment does not fit the criteria for beach nourishment, this measure is eliminated from consideration in the alternative formulation.

[20] EM 1110-2-5026

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11.3.4 Upland Unrestricted

Based on the level of contaminants, the sediment is not suitable for Upland Unrestricted disposal. This measure is eliminated from consideration in the alternative formulation.

11.3.5 Upland Restricted

11.3.5.1 *Dredged Material Placement Facility*

11.3.5.1.1 *Existing DMPF*

An existing DMPF could not be identified that has the available capacity, meets the Federal, State, and Local requirements and has an owner willing to allow usage. The use of an existing DMPF is therefore not considered feasible and will not be considered for the Sheboygan project.

11.3.5.1.2 *Locally Provided DMPF*

Sheboygan County is providing a DMPF capable of meeting the one-time dredging project needs. As stated in Section 11.3.1, the placement facility must restrict the sediment from direct contact with humans or the environment. The locally provided DMPF restricts direct contact by having low-permeability clay soils to deposit the sediment in, an exterior fence to restrict public interaction, and after the dredging operations are complete, a cover, which will allow returning the land to agricultural use. The proposed placement facility has a capacity of approximately 200,000 cubic yards of storage.

The DMPF is located on County owned property at the Sheboygan County Memorial Airport in Sheboygan Falls, WI, approximately 9 miles from the proposed transfer site (Section 11.4.2). A proximity map of the disposal facility to the dredging project is shown in
Figure 10.

Currently the land use of the site is agricultural. The airport leases the land to local farmers and is used to grow corn and soybean. Investigation of the site indicates no HTRW (Section 18.8), no archeological findings of significance, and that the native soils in this area are generally made up of stiff to very stiff silty clay.

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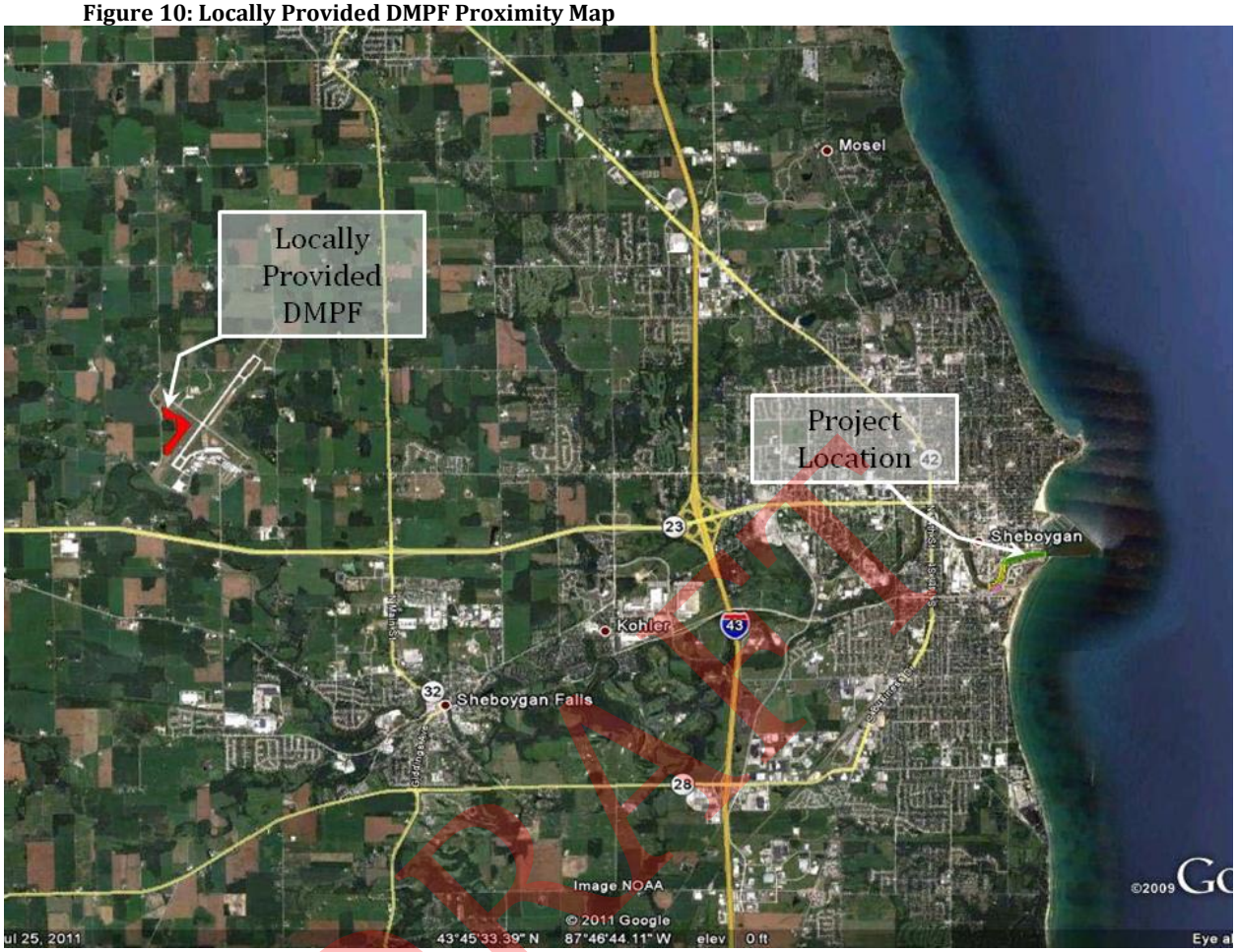
Figure 10: Locally Provided DMPF Proximity Map



11.3.5.1.3 *Licensed Landfill*

Disposal in a licensed landfill will be included in the plan formulation process.

11.4 Transport of Dredge Material

11.4.1 Transport Method

With the exception of transport via railroad, all methods of transport are viable depending on the method of dredging and dewatering. No existing railroad runs to the placement site or near any potential landfill.

11.4.2 Transfer Site

Due to limited availability of properties with access to navigable portions of river, the potential for transfer sites along the project area are very limited (Figure 11). The City of Sheboygan has provided a site located along the Sheboygan River project area at S Pier Drive just east of the 8th Street Bridge.

The proposed transfer site has 1.25 acres available for project use. The transfer site preparation will include the removal of the existing asphalt parking lot (unsuitable condition) and likely include the placement of a temporary asphalt layer to be removed after dredging operations are complete.

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Figure 11: Proposed Transfer Site Location

11.5 Other Measures to Consider

11.5.1 Dewatering

Several of this project's conditions lead to the inclusion of a dewatering process in plan formulation.

- *Acceptability*

According to the USACE *Planning Principles and Guidelines,* Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Appropriate mitigation of adverse effects is to be an integral part of each alternative plan.

Acceptability is the workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations, and public policies. Two primary dimensions to acceptability are implementability and satisfaction. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible plan should not be carried forward for further consideration. However, just because a plan is not the preferred plan of a non-Federal partner does not make it infeasible or unacceptable *ipso facto*. The second dimension to acceptability is the satisfaction that a particular plan brings to government entities and the public. Obviously, the extent to which a plan is welcome or satisfactory is a qualitative judgment. Nevertheless, discussions as to the degree of support (or lack thereof) enjoyed by particular alternatives from a community, state Department of Natural Resources, Ducks Unlimited,

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or other national or regional organizations, for example, are additional pieces of information that can help planners evaluate whether to carry forward or screen out alternative plans.[21]

Federal agencies, local government, and the public have expressed very low support for alternatives that do not include dewatering. The EPA has stated that dewatering and covering are appropriate for the sediment. The WDNR has indicated that a low hazard waste exemption would be difficult to obtain for the saturated condition sediment. Without the waste exemption, disposal in a licensed landfill becomes the only feasible alternative. The local government and public have also shown very low support for alternatives that do not include dewatering. The support of a plan is not the determining factor, but is required to be taken into account in the plan formulation process.

- *Leachate Characteristics*

Leaching of contaminants from the sediment must be taken into account when accessing a project's risk. Sheboygan Harbor sediment tests show leaching in levels below the safe threshold. Studies conducted on lime reaction treated sediment show that leaching is lessened further and thus reduces the project risk, specifically during transportation and handling of material.

The timeline for covering the DMPF is also accelerated by years. The accelerated covering timeline reduces opportunities for contaminant migration from rainfall runoff.

- *Capacity of Placement Facility*

The Locally provided placement Facility has a design capacity of 200,000* CY. Therefore, the site does not have the capacity to hold the variable amounts of free water associated with an enclosed bucket mechanical dredging operation or the free water deposited by hydraulic pipeline.

- *Workability & Stability of Materials*

The transport of dewatered sediment is a far more efficient and safer operation than that of wet sediment. This increased efficiency and safety results in lower transportation costs as well as the savings associated with not shipping thousands of gallons of water. Dewatering materials before transport also minimizes losses during transport.

The WDNR has stated that in order to receive a low hazard waste exemption, the dredge material must be covered by the locals upon completion of the dredging operations. Disposal of material into the facility without a dewatering process would require several years to dry and stabilize prior to covering.

The locals intend to re-establish agricultural use of the site in the future. To accommodate this plan, the County will increase the depth of the cover to 3 feet, which allows returning the site to agricultural use.

The placement of wet material typically requires the placement site to have built-in under-drainage of the material that will discharge carriage water and rainwater from the site. The discharge water would require long term monitoring for contaminants. Dewatering of the sediment can eliminate the need for under-drainage and long term monitoring.

[21] ER 1105-2-100, E-3-a-(4) -(a)-(1)

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11.5.2 Mechanical Dewatering

A variety of mechanical dewatering technologies exist that could be implemented for the Sheboygan Harbor project. However, developing a project specific process can be costly. As a cost saving effort, this study focuses on the technology currently employed on Sheboygan Harbor projects.

The Superfund project discussed in Section 3.4 has a fully developed and functional dewatering process. It includes hydraulically piping the dredged material to a dewatering facility located approximately two river miles upstream from the 8th Street Bridge. The dredged material is pumped into Geotubes® and the water removed and filtered. After filtration, the water is returned to the Sheboygan River. The sediment is allowed to dry and consolidate in the Geotubes® until the desirable water content is met. The Geotubes® are then cut open and the sediment transported and disposed of.

Figure 12: EPA Superfund Dewatering Facility, Lower River segment in Sheboygan

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The Superfund dewatering facility is capable of processing approximately 500 CY of dredged material per day. The USACE Sheboygan project requires a capacity 2 to 3 times that in magnitude. It is not engineeringly feasible to use the Superfund dewatering facility and still meet the project objectives. However, the process could be utilized at the transfer site for the USACE Sheboygan project.

This study evaluates the use of this process in conjunction with hydraulic dredging alternatives. The cost and quantities developed are based on the information gathered during the current Sheboygan River dewatering operations, which provides case-specific data.

11.5.3 Chemical Dewatering

Current chemical additive dewatering technology generally falls into two categories, Super Absorbent Polymers (SAP) and lime (calcium hydroxide) or pozzolanic reaction.

* Design Capacity is greater than the actual dredged material quantity to account for variable water content and bulking due to dewatering additive.

11.5.3.1 *Super Absorbent Polymers*

SAPs are typically used in biomedical waste solidification and in absorbent household products such as diapers. They have been used in dewatering operations on some contaminated material remediation projects. SAPs do not use the lime reaction, but absorb free water. As the polymers absorb water, the polymers swell typically causing a bulking in dry volume.

Technical support for SAP manufacturers have identified that the amount of SAP required would be substantially less than that of a lime reaction additive, 1% by weight opposed to 8-10%. However, SAP is roughly 72 times more expensive, $1.80/lb opposed to $0.025/lb. This equals an approximate $5 million to $8 million difference in material alone. The use of SAPs is not economically feasible.

SAP manufacturers also stated that due to demand, they could not produce the quantity needed within the project timeframe making its use engineeringly infeasible. This measure will not be considered for the USACE Sheboygan Harbor project.

11.5.3.2 *Lime Reaction Additives*

Lime reaction additives have been used worldwide for stabilization of soils and dredge material. The materials are typical of cement products such as portland cement, fly ash, and many commercial proprietary variances.

Use of lime products and lime containing coal combustion products is well documented as being able to control leaching / prevent leaching of trace elements that can be toxic to the environment. Leaching is prevented by both solidification and stabilization as a result of the pozzolanic hydration reactions that create strength and durability. ASTM E-2060, titled "Use of Coal Combustion Products for Solidification/Stabilization of Inorganic Wastes", is an important reference.[22]

Lime products alone are used to stabilize trace elements, often called heavy metals (such as lead, cadmium, barium, and zinc), which form oxyhydroxides or low solubility precipitates at high pH.[23]

Adequate unconfined compressive strengths, i.e. > 35 psi, achieved after compaction to near maximum dry density and the formation of pozzolanic and sulfo-pozzolanic mineral reaction products result in highly impermeable, clay-like soil.[24]

Lime addition is typically by percentage of wet weight of the dredge material and varies specific to the sediment classification. It is quite often in the range of 10% wet weight. Since the price range is small between the different types ($0.07 - $0.02 / lb), the ultimate choice of additive is generally based on the performance-based information available.

For the purposes of this study, cost and quantity of lime reaction additive is based on a commercial product called Calciment® Bed Ash. Mintek Resources, Inc., headquartered in Beavercreek, Ohio, manufactures this product. Chemically, Calciment® products represent a hybrid between Quicklime and Cement providing heat generated through exothermic reactions as well as cementitious properties.[25]

[22] Beeghly & Schrock (2009)
[23] Beechly & Schrock (2009)
[24] Beeghly & Schrock (2009)
[25] Calciment.com

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Calciment® Bed Ash was used in this study for the following reasons:

- Calciment® was used successfully by the USACE, Detroit District and the US EPA in the remediation of the Black Lagoon, Trenton, MI project as detailed in EPA report EPA-905-F0-9001.
- This product is readily available and manufactured locally
- This product is competitively priced in the range of other lime reaction additives (≈$0.03/lb)
- Calciment® products are currently being utilized on several of the current EPA dredging projects along the Sheboygan River. This provides specific knowledge of how the site specific sediment interact with the additive

Mintek technical support has recommended a blend rate based on lab testing of sediment samples taken from the Sheboygan River of 8% of the wet weight. Testing has shown that the sediment is of variable characteristics and will therefore require variable addition of additive. To accommodate the variability, operational measures will have to be implemented during dredging. The Calciment® will be added and mixed with the sediment in the barge. An onsite determination must be made to either ship the sediment directly to sight for disposal or if the sediment should be spread on an asphalt dewatering pad at the transfer site and allowed to stabilize prior to transport.

11.5.4 Beneficial Uses

The USACE aggressively seeks partners in Beneficial Uses of dredged material. However, because of the contaminant levels in the sediments, no beneficial use alternatives were identified that could be implemented within the proposed project timeline. In addition, the lack of clear state regulations regarding upland beneficial uses of dredged material would have significantly slowed any consideration of alternatives.

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Table 11: Summary of Measure Elimination (Depths and Equipment)

Measure	Reasoning	Result Retained or Eliminated
Category:	***Dredging Depths and Areas***	
Recreational Navigation Draft Plan dredging to 15-16 and 11-12 feet BLWD	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Federal Channel to Authorized Depth (21' BLWD)	Not Economically Feasible	Eliminated
Category:	***Dredging Methods/Equipment_Mechanical Dredging***	
Mechanical Dredge_Backhoe Boom	high turbidity associated with the use of this dredge	Eliminated
Mechanical Dredge_Bucket Ladder Dredge	bucket leakage and the mechanical agitation of the sediments cause high turbidity	Eliminated
Mechanical Dredge_Bucket Wheel Dredge	due to the extremely shallow nature of the Sheboygan River and the lack of data available on the turbidity generated during dredging operations	Eliminated
Mechanical Dredge_Open Clamshell	The open clamshell dredge is operationally comparable to the enclosed clamshell, but typically has higher resuspension rates	Eliminated
Mechanical Dredge_Closed-Bucket Clamshell	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Mechanical Dredge_Dipper Dredge	dredging action of the dipper dredge may cause considerable sediment disturbance and resuspension	Eliminated
Mechanical Dredge_Dragline Dredge	draglines are inappropriate for contaminated sediment removal or where resuspension is an issue	Eliminated
Hydraulic Dredge_Cutterhead Suction Dredge	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Hydraulic Dredge_Dustpan Suction Dredge	this dredge is more suited for open reaches of major rivers and has a draft of 5-14 feet	Eliminated
Hydraulic Dredge_Hopper Dredges	hopper dredges deep draft (12-31 feet) precludes its use in shallow water	Eliminated
Hydraulic Dredge_Suction Dredge	suction dredge is limited to removing free-flowing sand with little or no debris and has a draft of 3 feet to 14 feet	Eliminated
Hydraulic Dredge_Sidecasting Dredge	unsuitable for dredging contaminated sediments or dredging in areas where turbidity must be limited. In addition, the sidecasting dredge's 5-9 foot draft precludes its use in shallow water	Eliminated

Notes:

This table portrays a summary of Project Delivery Team expectations of how well a measure may meet the planning objectives and minimize constraints as they are specifically applied to the Sheboygan Harbor project. It is not meant to be a decision making tool.

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Table 12: Summary of Measure Elimination (Disposal, Transport, & Other)

Measure	Reasoning	Result Retained or Eliminated
Category:	***Disposal of Dredged Material***	
Open Water Placement	Sediment does not meet criteria for this measure	Eliminated
Beach/Littoral Nourishment	Sediment does not meet criteria for this measure	Eliminated
Upland Unrestricted	Sediment does not meet criteria for this measure	Eliminated
Land Based_DMPF_Existing DMPF	An existing DMPF could not be identified	Eliminated
Land Based Disposal_DMPF_Locally Provided DMPF	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Licensed Landfill	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Category:	***Transport of Dredged Material***	
Barge	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Commercial Trucking	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Hydraulic Pipeline	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Railroad	Railroads are not available for the project	Eliminated
Category:	***Other Measures to Consider***	
Dewatering _ Mechanical Dewatering _ Superfund Dewatering Facility	Cannot meet the project production requirements/Not Engineeringly feasible	Eliminated
Dewatering _ Mechanical Dewatering _ Geotube® Process	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Dewatering _ Chemical Dewatering/Stabilization _ Lime Reaction Additive	Meets Federal and Local objectives; Engineeringly, Economically and Environmentally Feasible	**Retained**
Dewatering _ Chemical Dewatering/Stabilization _ Super Absorbent Polymers	Substantially more costly than other similar measure/Not Economically Feasible	Eliminated
Beneficial Uses	no feasible beneficial use alternatives were identified	Eliminated

Notes:

This table portrays a summary of Project Delivery Team expectations of how well a measure may meet the planning objectives and minimize constraints as they are specifically applied to the Sheboygan Harbor project. It is not meant to be a decision making tool.

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12. THE NO ACTION ALTERNATIVE

Alternative 1: No Action

The No Action alternative assumes that no project is implemented at the Sheboygan Harbor. The No Action alternative is required to be evaluated as a base condition in all USACE studies. If no action is taken to address this problem, it is anticipated that the backlog of shoal material will continue to increase, continued suspension of maintenance dredging of the Federal navigation channels would occur, and only very shallow draft vessels would be capable of navigating the harbor. The harbor would continue to contain contaminants and would continue to be an Area of Concern.

13. PLACEMENT IN LOCALLY PROVIDED PLACEMENT FACILITY ALTERNATIVES

All alternatives in this section utilize the locally provided Sheboygan DMPF site (Section 11.3.5.1.2) The DMPF construction and operation and maintenance is the responsibility of the non-Federal partner.

13.1 DMPF Description

Since the disposal facility is at an airport, Federal Aviation Administration height restrictions limit the capacity of the DMPF. To accommodate the volume of the dredged material, the sediment will require a dewatering process allowing it to be placed in a dry state.

In order for the site to have future agricultural use, it is designed to have a 3-foot cover of native materials. The cover will be the responsibility of the local Partner. In addition to facilitating agricultural use, the cover would keep the sediment from interacting with rainwater, spreading via wind erosion, and restrict human and animal interaction.

The locally provided DMPF has naturally occurring clay with typical native clay berms to contain the sediment and prevent inaction with site groundwater.

The locals will provide the facility for this onetime routine dredging project and will be responsible for the operations and maintenance.

Figure 13: Depiction of DMPF Site

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13.2 Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF

For this alternative, the dredging would be performed by mechanically dredging the sediment to the Recreational Navigation Draft Plan dredging depth with an enclosed clamshell bucket, and placing the excavated material into the barge. Once the material is in the barge, a lime-reaction additive would be mixed in to dewater the material. The material will then be transported to the disposal facility or placed on a dewatering pad at the transfer site prior to transport and disposal as the situation dictates.

Over the course of the project, the in-cell sediment would require spreading . Upon completion of the disposal, the permanent cell would be covered with the stockpiled native material and the site allowed to return to a natural state.

13.3 Alternative 3: Mechanical Dewatering and Placement in the Locally Provided DMPF

For this alternative, the dredging would be performed by hydraulically dredging the sediment to the Recreational Navigation Draft Plan dredging depth with a cutterhead dredge and transported to the transfer - dewatering site via hydraulic pipeline. The sediment is then stored in Geotubes® and the free water removed, filtered, and returned to the Sheboygan River. The dewatered material is then transferred to trucks and transported to the DMPF where it is placed.

Over the course of the project, the in-cell sediment would require spreading . Upon completion of the disposal, the permanent cell would be covered with the stockpiled native material and the site allowed to return to a natural state.

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14. LICENSED LANDFILL ALTERNATIVES

All alternatives in this section utilize final placement of dredged material in a licensed landfill. The nearest landfill is located 45 miles away. Landfills will not accept material unless it is dewatered; therefore, the landfill alternatives include the dewatering options described in Section 13.

14.1 Alternative 4: Chemical Dewatering and Placement in a Licensed Landfill

For this alternative, the dredging would be performed to the Recreational Navigation Draft Plan dredging depth with an enclosed clamshell bucket and placed into the barge. Once the material is in the barge, a lime-reaction additive would be mixed with the sediment to dewater the material. The material will then be transported to a licensed landfill or placed on the dewatering pad at the transfer site prior to transport and disposal as the situation dictates.

14.2 Alternative 5: Mechanical Dewatering and Placement in a Licensed Landfill

For this alternative, the dredging would be performed by hydraulically dredging the sediment to the Recreational Navigation Draft Plan dredging depth with a cutterhead dredge and transported to the transfer - dewatering site via hydraulic pipeline. The sediment is then stored in Geotubes® and the free water removed, filtered, and returned to the Sheboygan River. The dewatered material is then transferred to trucks and transported to a licensed landfill where it permanently disposed.

Table 13: Alternatives Summary

Alternative							
#	Name	Dredging Method	Dredging Equipment	Placement	Transport	Other	Special Requirements
1	No Action	N/A	N/A	N/A	N/A	N/A	N/A
PLACEMENT IN THE LOCALLY PROVIDED PLACEMENT FACILITY ALTERNATIVES							
2	Chemical Dewatering and Placement in the Locally Provided DMPF	MD	Enclosed Bucket	Locally Provided DMPF	BG & CT	DWChem Lime Reaction Additive	DMPF Cover, Low Hazard Exemption, Temporary Storage/Mixing area at Transfer Site
3	Mechanical Dewatering and Placement in the Locally Provided DMPF	HD	Cutterhead	Locally Provided DMPF	HP & CT	DWMech Geotubes®	DMPF Cover, Low Hazard Exemption, Dewatering Facility near Project site
LICENSED LANDFILL ALTERNATIVES							
4	Chemical Dewatering and Placement in a Licensed Landfill	MD	Enclosed Bucket	Licensed Landfill	BG & CT	DWChem Lime Reaction Additive	Temporary Storage/Mixing area at Transfer Site, Tipping Fees
5	Mechanical Dewatering and Placement in a Licensed Landfill	HD	Cutterhead	Licensed Landfill	HP & CT	DWMech Geotubes®	Dewatering Facility near Project site, Tipping Fees

Key:					
BG	Barge	DWChem	Dewatering, Chemical	MD	Mechanical Dredging
BLWD	Below Low Water Datum	DWMech	Dewatering, Mechanical	N/A	Not Applicable
CT	Commercial Trucking	HD	Hydraulic Dredging		
DMPF	Dredged Material Placement Facility	HP	Hydraulic Pipeline		

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15. SHEBOYGAN INNER HARBOR DREDGING BENEFITS AND DIRECT COSTS

Sheboygan Harbor has limited commercial navigation traffic and is primarily a recreational waterway. The proposed project would yield regional economic benefits, which are important to the local economy, but would not provide sufficient National Economic Development (or NED) benefits to result in positive net benefits. Dredging to the recreational navigation draft plan depth would allow for the Yorktown, a cruise ship, to utilize the inner harbor. This vessel requires a nine-foot draft and can accommodate 138 passengers and 40 crew members. Using the cruise ship analysis from the Great Lakes Navigation System Review, Reconnaissance Report, June 2002 (revised February 2003) as a proxy, the estimated annual economic benefits associated with this vessel berthing in Sheboygan would be $470,500.

While this project has marginal transportation benefits, the environmental benefits are sufficient for the EPA to justify the use of GLRI funding for the project's implementation. Given the river's historical use for manufacturing, the sediments are contaminated to the point where consumption advisories exist. Several Federal, state and local agencies have been working together to remediate and remove this contamination from the river. The proposed inner harbor dredging of the Federal channel is the last step in this remediation process. If the proposed dredging project were to occur, the Sheboygan River could be delisted as an Area of Concern. The completion of on-the-ground actions necessary to delist AOCs is one of EPA's and the Administration's highest priorities under the Great Lakes Restoration Initiative.

The complete clean-up of the river would improve quality of water, the aquatic ecosystem, and would eventually allow for the consumption advisory to be lifted. Since fishing is an important input to the regional economy, the elimination of the consumption ban would benefit the commercial fisherman, the charter fishing businesses and the entire region. In addition, the removal of the last residual sediment contamination in Sheboygan River and Harbor would eliminate the dredging restriction Beneficial Use Impairment. This means that any future dredging for commercial or recreational navigation should be able to use unrestricted disposal methods, and reduce future dredging costs.

Below, in Table 14: Costs of Proposed Project Plans, are the costs associated with the proposed project plans. Of these plans, Alternative 2 is the least costly to implement at $10,018,801.

Table 14: Costs of Proposed Project Plans

Costs of Proposed Project Plans				
	Alternative 2	**Alternative 3**	**Alternative 4**	**Alternative 5**
Construction Costs	$ 7,464,001	$ 8,951,980	$ 10,632,840	$ 13,761,980
Contingency Costs	$ 1,492,800	$ 1,790,396	$ 2,126,568	$ 2,752,396
Total Construction Costs	***$ 8,956,801***	***$ 10,742,376***	***$ 12,759,408***	***$ 16,514,376***
Non-Construction Costs	$ 1,062,000	$ 1,187,000	$ 1,328,200	$ 1,591,000
Total Implementation Costs	**$ 10,018,801**	**$ 11,929,376**	**$ 14,087,608**	**$ 18,105,376**

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16. EVALUATION OF ALTERNATIVE PLANS

According to the USACE *Planning Principles and Guidelines,* Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability.

16.1 Alternative 1: No Action

The No Action alternative assumes that the USACE does not implement any project at Sheboygan Harbor. Evaluation of The No Action alternative is required as a base condition in all USACE studies.

With the No Action alternative, the harbor would continue to shoal in and inhibit navigation and recreation. The harbor would also continue to be classified as an AOC with dredging restrictions due to contaminants. Revitalization of Sheboygan Harbor is central to the economic development and sustainment of the area. With current draft as little as 2 feet below low water datum and a siltation rate of 4 inches per year, the harbor is accessible to only very shallow draft vessels. The No Action alternative does not provide the local draft needs to facilitate the industries and investments built to utilize the harbor for more than a decade.

16.2 Alternatives 2-5

Due to the nature of alternatives 2-5, any of the remaining alternatives would produce the same economic, environmental, and social benefits. All are considered to be complete, effective, and acceptable. Since the benefits are the same for all alternatives, the base plan becomes the least costly of the alternatives.

Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF, is the least costly and therefore the only alternative that is considered complete, effective, efficient, and acceptable.

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17. TRADE-OFF ANALYSIS

17.1 Alternative 1: No Action

The No Action alternative assumes that the USACE does not implement any project at Sheboygan Harbor. The No Action alternative is required to be evaluated as a base condition in all USACE studies.

17.1.1 Advantages

- No Federal dollars are expended

17.1.2 Disadvantages

- None of the project objectives are met
- None of the local water draft needs are met
- The harbor remains an AOC
- Dredging restrictions remain
- The backlog of shoaled material continues to increase

17.2 Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF

17.2.1 Advantages

- Requires the least space at transfer site for dewatering
- Handling and transport of lime stabilized material is safer, more efficient, and lowers project risk
- Least costly of the action alternatives

17.2.2 Disadvantages

- Requires the locals to build, operate and maintain a placement facility
- Requires the WDNR to issue a low hazard waste exemption

17.3 Alternative 3: Mechanical Dewatering and Placement in the Locally Provided DMPF

17.3.1 Advantages

This alternative does not have advantages over the other action alternatives

17.3.2 Disadvantages

- The mechanical dewatering process would require the locating, evaluation, and selection of a much larger transfer site than is currently available for project use
- More costly than alternative 2 (see Table 14)
- Requires the locals to build, operate and maintain a placement facility
- Requires the WDNR to issue a low hazard waste exemption

17.4 Alternative 4: Chemical Dewatering and Placement in a Licensed Landfill

17.4.1 Advantages

- The locals would not have to construct and operate a placement facility
- There would be no need for a low hazard waste exemption from the WDNR

17.4.2 Disadvantages

- More costly than alternative 2 (see Table 14)
- Sediment would need to be transported a greater distance, increasing project risk

17.5 Alternative 5: Mechanical Dewatering and Placement in a Licensed Landfill

17.5.1 Advantages

- The locals would not have to construct and operate a placement facility
- There would be no need for a low hazard waste exemption from the WDNR

17.5.2 Disadvantages

- The mechanical dewatering process would require the locating, evaluation, and selection of a much larger transfer site than is currently available for project use
- More costly than alternative 2 (see Table 14)
- Sediment would need to be transported a greater distance, increasing project risk

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17.6 Alternative Evaluation with the USACE Alternative Formulation Criteria

A comparison of alternatives with the USACE alternative formulation criteria of completeness, effectiveness, efficiency and acceptability is portrayed in Table 15.

Table 15: Alternative Evaluation with the USACE Alternative Formulation Criteria

Alternative		USACE Alternative Formulation Criteria			
#	Name	Completeness	Effectiveness	Efficiency	Acceptability
1	No Action	N/A	N/A	N/A	N/A
DMPF WITH PLACEMENT RESTRICTED TO 15 ACRE PERMANENT CELL ALTERNATIVES					
2	Chemical Dewatering and Placement in the Locally Provided DMPF	High	High	High	High
3	Mechanical Dewatering and Placement in the Locally Provided DMPF	High	Medium	Medium	High
LICENSED LANDFILL ALTERNATIVES					
4	Chemical Dewatering and Placement in a Licensed Landfill	High	Low	Low	High
5	Mechanical Dewatering and Placement in a Licensed Landfill	High	Low	Low	High
Key:					
N/A:	Not Applicable				
High:	Highly meets the criteria				
Medium:	Moderately meets the criteria				
Low:	Minimally meets the criteria				

18. FEDERAL STANDARD AND BASE PLAN

18.1 Federal Standard

It is the USACE policy to accomplish the disposal of dredged material associated with the construction or maintenance dredging of navigation projects in the least costly manner. Disposal is to be consistent with sound engineering practice and meet all Federal environmental standards including the environmental standards established by Section 404 of the Clean Water Act of 1972 or Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended. This constitutes the base disposal plan for the navigation purpose.[26]

Sediment within the Sheboygan River currently does not meet Federal guidelines for open-lake placement. Since placement of this dredged material in the open waters of Lake Michigan would not comply with the Clean Water Act (CWA) Section 404(b)(1) Guidelines, it would be environmentally unacceptable. The data also indicate the sediment within the Sheboygan River is not suitable for beneficial uses or unconfined placement..

The nature of the contamination in the sediment is low-level. Lead was detected at a range of 0.0083 - 0.025 mg/ in the SPLP, which exceeds the Wisconsin Public Welfare groundwater standard (NR140) of 0.015 mg/L for direct contact. The Federal standard for the Sheboygan Harbor, WI project is the least-cost, environmentally acceptable upland placement alternative that restricts the sediment from direct contact with humans and the environment.

[26] ER 1105-2-100, App E-15-a-(3)

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18.2 Base Plan

While often used synonymously with the Federal Standard, the "Base Plan" includes additional consideration of site-specific impacts.

A typical Base Plan for recreational harbors requiring one time dredging like Sheboygan Harbor consists of dredging and disposal operations at full federal cost into a locally provided placement site that meets the disposal requirements of the Federal and State acceptable environmental practices. The Base Plan presented in this DMMP is consistent with standard procedures for recreational harbors.

Based on current information in this interim DMMP; Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF, is the least costly alternative, consistent with sound engineering practice and meets all Federal environmental requirements. Alternative 2 is complete, efficient, effective, and acceptable.

The Base Plan meets the disposal criteria (restrict from direct contact) by placing the sediment into a natural clay excavated site. The public is further restricted from direct contact by the material being placed at a fenced airport site and placement of a 3 foot cover of native soils.

18.3 Project Advantages

Selection of Alternative 2 provides the Federal government and local stakeholders a plan to serve navigation interest within the Great Lakes. The project provides advantages consistent with the planning objectives:

(a) Restores navigational draft to the Sheboygan Harbor Federal Navigation Channel to a depth identified by the City of Sheboygan

(b) Improves economic opportunity in the City of Sheboygan

(c) Reduces the negative impact of past industrial activities by removing contaminated sediment from Sheboygan Harbor

(d) Contributes to an overall clean-up effort within the Sheboygan Harbor with the intent to complete the remediation required to delist the harbor as an AOC by the end of 2012

18.4 Project Impact on Dredging Restriction BUI

The project would effectively remove the dredging restriction BUI to the dredged depth. The EPA cleanup upriver of the Base Plan will result in clean material shoaling above this project's dredge limit. However, if dredging to authorized depth becomes necessary; dredging restrictions would remain in place on material below this projects dredge limit and throughout the river. It is highly unlikely however, that this harbor would return to commercial usage.

18.5 Real Estate

The Real Estate Plan (Appendix B) includes a discussion of Real Estate fee information, Lands, Easements, Rights-of-Way, Relocations and Disposal (LERRDs), costs and the non-Federal acquisition capability.

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18.6 Project Construction

Upon issuance of the Notice to Proceed, the contractor would begin their mobilization process and begin with project submittals. Once onsite, the contractor would prepare the transfer site for the dredging project. The transfer site will be stripped of existing finish grade as it is of variable consistency and quality. An asphalt pad will be laid for use in the dewatering operation. Once dredging commences, the contractor will use an enclosed clamshell bucket mechanical dredge with a controlled pace to minimize sediment resuspension. Once the sediment is in the barge, the lime reaction additive will be added and the material stockpiled on the transfer site asphalt pad. Some additional additive may be needed while on the dewatering pad due to varying water content and soil characteristics.

When the sediment has reached the desired consistency, it will be placed into trucks and transported to the placement facility. The in-cell sediment would then be spread as it is placed.

18.7 Project Cost

Table 16: Cost Estimate for Base Plan

ALTERNATIVE 2 - CHEMICAL DEWATERING AND PLACEMENT IN THE LOCALLY PROVIDED DMPF MECHANICAL DREDGING AND PLACEMENT AT SHEBOYGAN COUNTY MEMORIAL AIRPORT SITE					
S. No.	Item Feature/Description	Quantities	Unit	Unit Cost	Alternative 2
	CONSTRUCTION COST				
12	NAVIGATION PORTS & HARBORS				
1.0	Mobilization	1	LS	$176,684.00	$ 176,684.00
2.0	Transfer Site	1.00	LS	$711,481.00	$711,481.00
3.0	Water Treatment At Transfer Site	1.00	LS	$566,057.00	$566,057.00
4.0	Water Treatment At Airport Site	1.00	LS	$276,966.00	$276,966.00
5.0	Dredging (Mechanical)	170000.00	CY	$11.38	$1,934,600.00
6.0	Drying Agent (Calciment)	20196.00	TN	$76.98	$1,554,700.00
7.0	Trucking to Disposal Site (includes loading)	170000.00	CY	$11.07	$1,881,900.00
8.0	Placement Site	1.00	LS	$359,017.00	$359,017.00
9.0	Site Restoration	1.00	LS	$2,596.00	$2,596.00
	SUB TOTAL				$7,464,001.00
	CONTINGENCY 20%				$1,492,800.00
	CONSTRUCTION COST				**$8,956,801.00**

DRAFT

	NON CONSTRUCTION COST	
30	PLANNING, ENGINEERING & DESIGN	
	Project Management	$50,000.00
	Planning & Environmental Compliance	$25,000.00
	Engineering & Design	$250,000.00
	Engineering Tech Review ATR	$10,000.00
	Contracting	$20,000.00
	Planning During Construction	$10,000.00
	LEERDS	$ -
31	CONSTRUCTION MANAGEMENT	
6.5%	Construction Management	$582,200.00
0.5%	Engineering During Construction	$44,800.00
	Monitoring (QA)	$20,000.00
	Project Management	$50,000.00
	TOTAL NON CONSTRUCTION COST	**$1,062,000.00**
	TOTAL CONSTRUCTION COST	**$10,018,801.00**

* Does not represent the Contingency resulting from the Risk Assessment. See the Cost Appendix MCACES estimate for further detail

18.8 HTRW Evaluation

18.8.1 Existing Environment

The purpose of a HTRW investigation is ascertain the environmental history and current conditions of a site as it relates to HTRW, within practical measures and using reasonably available resources. By conducting such an investigation, the uncertainty regarding the potential for HTRW in connection with the project is reduced, though not eliminated. There is always some risk of encountering unknown HTRW elements during a project, thus contract clauses incorporate wording on how to address such conditions should they be discovered. A review of the EPA's Envirofacts (which includes Superfund sites, toxic releases, water dischargers, air emissions, and hazardous wastes), Wisconsin's Bureau for Remediation and Redevelopment Tracking System (BRRTS), and interviews with property owners were conducted for both the transfer site and upland placement site. The details from the database review are included in the two paragraphs below.

18.8.1.1 *Transfer site*

The transfer site is a mixture of pavement and grass with no surface water. The transfer site was a small part of a larger parcel of land that was previously occupied by the Reiss Coal Company, specific industrial practices are unknown. The use resulted in subsurface contamination, which is known to include leaded/unleaded gasoline contamination from leaking underground storage tanks (LUSTs). Various investigations and remedial activities have been completed on the Reiss

DRAFT

parcel; however, the remediation activities do not appear to have occurred in the area of the transfer site. The closure documentation from DNR indicates a use restriction and a protective cover or barrier remain intact for the Reiss Property and has limitations on the activities that can be performed that would result in disturbance to the cap.

18.8.1.2 *Upland Placement Site*

The known historical use for the property was reported to be agricultural use, with no indication of industrial use. The database review conducted as part of this HTRW investigation did not reveal any indication of HTRW issues. For the placement site, an Environmental Data Resources Inc (EDR) Report dated November 9, 2011 was reviewed. The target property was not identified in any of the databases searched. A nearby property, Prange Estate Property, W3348 County Highway O, Sheboygan Falls, WI was identified as having LUSTs and having administrative controls on the site. This property is not of significant concern due to the closure that was provided by DNR, and distance from the upland site. Environmental and geotechnical soil sampling was conducted at the upland placement site for general screening purposes. Unstained clay soils were encountered throughout, with one pocket of surface sand. Based on the visual and olfactory observations from the soil sampling did not indicate contamination. The soil samples were not able to be analyzed within their hold time, therefore the results will be used for screening purposes only. At this time the laboratory analysis are pending. Data and resource reviews indicate that no HTRW sites are located at or in the immediate vicinity of the site that would impact the placement site.

18.8.2 Environmental Consequences

18.8.2.1 *No Action Alternative*

By taking no federal action, there would be minimal changes to current conditions, and therefore no impacts to HTRW resources in the area would occur. The No Action Alternative would not contribute to cumulative impacts to HTRW resources.

18.8.2.2 *Preferred Alternative*

Potential activities at the transfer site may include construction of an asphalt pad to temporarily contain dredged material prior to transfer to the upland site, and / or placement of stone to help reduce sediment on truck tires. The site may be re-paved upon completion of the project, but this would not exacerbate HTRW concerns. The intended use of the transfer site does not include subsurface activities that would compromise the integrity of the cap. If the project plans do require an asphalt or concrete pad to be placed at the site, it will be done in a manner that does not negate the current design that has been approved by DNR. Coordination would be done with the DNR in the event activities will be performed that are restricted in the closure documentation. Implementation of the Recommended Alternative would not cause or exacerbate HTRW concerns at the upland placement site. As a precaution, the construction contract would contain standard language on procedures to follow to help ensure that there are no releases and that the materials are properly remediated where applicable, in the event that contaminated materials are encountered.

18.9 State Restrictions on Placed Material

In order for the sediment to be placed at the airport site, the County will apply, with technical support form USACE, for a Low Hazard Waste Exemption (LHWE) from the WDNR. As stated in Section 20, the WDNR has been active in project coordination and no issues are foreseen in acquiring the LHWE.

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After the WDNR has approved the LHWE, any future disturbances of the sediment are required to be submitted in writing to the WDNR as a Plan Modification. Any Plan Modifications are assessed by the WDNR on a case-by-case basis and cannot proceed without WDNR approval. The restriction remains in place regardless of the property owner.

19. COST SHARING AND FINANCING

19.1 Management Plan Studies

The cost associated with Management Plan studies for continued maintenance dredging of existing Federal navigation projects are O&M costs and are 100% Federally funded. Project partners, port authorities, and other project users, are partners in dredged material management and must pay the costs of their own participation in the dredged material management studies including participation in meetings, providing information and other coordination activities.

Budgeting priorities for the navigation purpose is limited to the Base Plan. Therefore, the cost for any component of a management plan study attributable to meeting more stringent local or state requirements than Federal laws and regulations shall be a non-Federal cost. The USACE does not anticipate any additional costs will be incurred beyond those associated with the execution of the base plan related to compliance with any required local or state laws and regulations. Study activities related to dredged material management for the Federal project but not required for continued maintenance dredging and dredged material disposal, will not be funded by the Federal Government and will not be included in the dredged material management studies unless funded by others.

19.2 Implementation

A typical Base Plan for recreational harbors requiring one time dredging like Sheboygan Harbor consists of dredging and disposal operations at full federal cost into a locally provided placement site that meets the disposal requirements of the Federal and State acceptable environmental practices. The Base Plan presented in this DMMP is consistent with standard procedures for recreational harbors.

For this project, the non-Federal partners are providing a dredged material placement facility for the sediment dredged during this one time dredging project. This represents a non-Federal investment of approximately $1.3M - $1.8M. The cost of the facility is estimated and includes some elements not required by the Base Plan.

20. RESULTS OF COORDINATION WITH LOCAL, STATE AND FEDERAL AGENCIES

Throughout development and design of this DMMP and proposed project, biweekly teleconference meetings were held with the USACE (District and Division), EPA, WDNR, County of Sheboygan, and the City of Sheboygan. A open and continual dialogue between all stakeholders was essential to the planning process.

The proposed action for upland placement of dredged material in Sheboygan, Wisconsin was also coordinated via written correspondence with numerous Federal, State, and Tribal groups between June and November, 2011. No significant concerns were noted in responses. These entities will

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receive a copy of the Environmental Assessment for review and comment during the 30- day public review period. Coordination response letters can be found in the Environmental Assessment.

20.1 Federal Aviation Administration (FAA)

USACE coordinated the proposed action with the FAA and Wisconsin Bureau of Aeronautics in September 2011, in addition to the County conducting ongoing coordination with the FAA and the Wisconsin Bureau of Aeronautics regarding the proposed DMPF at the Sheboygan County Memorial Airport. The FAA responded to the County's proposed construction plan, indicating that they did not see any affect to the aviation localizer / navigation aids or routine maintenance of such equipment by a Designated Maintenance Examiner by the proposed DMPF design. The FAA and the Wisconsin Bureau of Aeronautics shall receive copies of the EA for review and comment.

20.2 Native American Tribes

Coordination of the proposed action was initiated with nearby Tribes in June and September 2011. A response letter dated September 13, 2011 was received from the Stockbridge-Munsee Tribal Historic Preservation Office. The letter states that the project is not within a county that the Michigan Tribe has interest in. Should the proposed action inadvertently uncover a Native American site, associated earthwork would be halted and appropriate Tribes contacted immediately. No other comments were received.

20.3 Natural Resources Conservation Service (NRCS)

Coordination of the proposed action was initiated in June 2011. NRCS provided various maps and data to aid in evaluating soil conditions and potential impacts at the upland placement facility. There would not be a significant effect or permanent conversion of farmland to another land use because after the dredged material is placed, the site will be covered (1' of topsoil plus 2' of temporarily stockpiled soil currently present) and returned to agricultural use. The field would be out of production during implementation of the Recommended Alternative (Alternative 2), but would return to agricultural use after the cover is placed by the County. NRCS did not note any concerns regarding the proposed action.

20.4 U.S. Environmental Protection Agency

Several dredging projects are under way or being planned as part of a multi-phase cleanup project located in the Sheboygan River Area of Concern are being coordinated by the Great Lakes National Program Office of the EPA and have shown support for this project to assist in this cleanup effort. The EPA has been involved throughout development and design of this proposed project including biweekly teleconference meetings with the USACE, EPA, WDNR, County of Sheboygan, and the City of Sheboygan. A letter dated July 6, 2011 outlined comments related to contamination, the dewatering process, erosion, transport to the upland facility, and aquatic resources and habitats. All comments have been addressed in the EA as appropriate. A letter dated November 10, 2011 was received where the EPA expressed their support for the dredging project and implementation of the preferred alternative. If this project is approved for implementation, the harbor would be dredged using Great Lakes Restoration Initiative funding from the EPA and they will continue to be a fully engaged partner in this project.

20.5 U.S. Fish and Wildlife Service (FWS)

Coordination with the FWS was initiated in June 2011. A response letter dated Oct 25, 2011 was received in which the FWS concurred with the USACE determination that "no federally-listed, proposed, or candidate species would be expected in the project area," and that "no critical habitat is present." No other comments were received.

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20.6 Wisconsin Department of Natural Resources

The WDNR has been involved throughout development and design of this proposed project as it coincides with their Remedial Action Plan for the Sheboygan Harbor. Their involvement includes biweekly teleconference meetings with the USACE, EPA, WDNR, County of Sheboygan, and the City of Sheboygan. Coordination letters were sent to WI Southeast Region Headquarters in June and September. Various coordination has occurred with the Bureau of Waste and Materials Management, Sheboygan Basin Team, and several biologists. The WDNR has provided various input and assistance related to development of the proposed upland placement facility design and various potential impacts from the proposed action. The WDNR will continue to be a team member as this project becomes implemented. No other comments were received.

21. RECOMMENDATIONS

The recommendations contained herein reflect the information available at this time and current Department policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program.

I, Lieutenant Colonel Michael C. Derosier, Detroit District Engineer, have given consideration to all significant aspects in the overall public interest for this project. Those aspects considered include environmental, social, and economic effects; engineering feasibility, and any other elements bearing on this recommendation.

Given that Sheboygan Harbor is primarily used for recreation, the project described in this report is not a priority for operation and maintenance funding. However, the completion of this project would meet the local community's navigation needs, improve the aquatic environment, and remove the dredging restrictions from the harbor to the dredged depth. By removing the dredging restrictions, the Beneficial Use Impairment would be removed to the dredged depth. This would help the EPA move towards delisting the Sheboygan River as an Area of Concern. Therefore, I recommend that the Detroit District proceed with detailed design, plans and specifications, and implementation of the Base Plan, Alternative 2: Chemical Dewatering and Placement in the Locally Provided DMPF, presented in this Interim DMMP document to provide management of dredged material for Sheboygan Harbor provided that GLRI funds are available.

MICHAEL C. DEROSIER
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