DETAILED PROJECT REPORT and ENVIRONMENTAL ASSESSMENT NORTHWESTERN MICHIGAN COLLEGE SECTION 107 GRAND TRAVERSE COUNTY, MICHIGAN

Detroit District
Great Lakes and Ohio River Division
August 2011

US Army Corps of Engineers®

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 2011		**00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Detailed Project Report and Environmental Assessment Northwestern Michigan College Section 107 Grand Traverse County, Michigan	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U. S. Army Corps of Engineers,Detroit District ,477 Michigan Avenue,Detroit,MI,48226-2523**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**225**	

Northwestern Michigan College
Harbor Improvements
Section 107
Detail Project Report

Table of Contents

Section	Description	Page
1.0	**Background and Study Authority**	**1**
	1.1 Study Background and Purpose	2
	1.1.1 Study Background	2
	1.1.2 Study Purpose	2
	1.2 Prior Studies, Reports and Existing Water Projects	2
	1.2.1 Prior Studies	2
	1.2.2 Existing Water Projects	2
2.0	**Existing Conditions: Assessment of Water and Related Land Resources**	**3**
	2.1 National Objectives	3
	2.2 Public Concerns	3
	2.3 Existing Conditions	3
	2.4 Physical Environment	5
	2.4.1 Sedimentation and Erosion	5
	2.4.2 Aesthetics	6
	2.4.3 Natural Resources	6
	2.5 Socioeconomic Resources, Safety and Recreation	7
	2.5.1 Population & Industry	7
	2.5.2 Northwestern Michigan College Financial Information	8
	2.5.3 Public Health and Safety	8
	2.5.4 Recreational Fishing, Public Access & Harbor of Refuge	9
	2.5.5 Traffic and Transportation	9
	2.6 Future without Project Condition	9
3.0	**Problems and Opportunities and Planning Objectives and Constraints**	**10**
	3.0.1 Problems	10
	3.0.2 Opportunities	10
	3.1 Planning Objectives & Constraints	10
	3.1.1 Planning Objectives	10
	3.2.1 Planning Constraints	11
4.0	**Management Measures**	**11**
	4.0.1 Dredging Component	11
	4.0.2 Non-Structural	12
	4.0.3 Structural	12

4.0.3.1 Double Steel Sheet Pile (SSP) Wall 13
4.0.3.2 Circular Cell Steel Sheet Pile Wall 13
4.0.3.3 Rubblemound 13
4.0.3.4 Single Steel Sheet Pile Wall 13
4.0.4 Additional Measures 14
4.1 Reasons for Selecting/Combining Measures to Formulate Alternatives 14
4.2 Screening of Alternative Plans 14
4.3 Evaluated Alternatives 15
4.3.1 Alternative 1: Dredging and a Double SSP Breakwater 15
4.3.2 Alternative 2: Circular cell SSP Breakwater 17
4.3.3 Alternative 3: Rubblemound 18
4.3.4 Alternative 4: Single SSP Breakwater 18
4.3.5 Alternative 5: No Action 18
4.4 Formulation Criteria 18
4.4.1 Completeness 19
4.4.2 Effectiveness 19
4.4.3 Efficiency 20
4.4.4 Acceptability 20
4.5 Comparison of Alternatives 20

5.0 Alternative Selection 22
5.0.1 Rationale for Designation of the NED Alternative 22
5.0.2 Rationale for Designation of the Optimum Trade-off Plan (OTO) 22
5.0.3 Rationale for Designation of the Local Preferred Plan 22
5.0.4 Rationale for Designation of the Selected Plan 22
5.1 Risk and Uncertainty 23
5.2 Description of the Selected Alternative 23
5.2.1 Alternative Components 23
5.2.2 Design and Construction Considerations 24
5.2.3 Real Estate Requirements 25
5.2.4 Local Betterments 25
5.2.5 Operational, Maintenance and Replacement Considerations 25
5.3 Environmental Requirements 25
5.4 Implementation Requirements 26
5.4.1 Institutional Requirements 26
5.4.2 Credit Provisions 27
5.4.3 Cost Apportionment 28
5.4.4 Views of Non-Federal Sponsors and Others 28

6.0 Summary of Coordination, Public Involvement and Comments **29**
6.0.1 Public Involvement Program 29
6.0.2 Institutional Involvement/Study Team 29
6.0.3 Additional Required Coordination 29
6.0.4 Report Recipients 29

7.0 Recommendation **30**

List of Tables

Table		**Page**
1	Four years of College Revenues/Expenditures	8
2	Ability of Alternatives to meet Project Objectives	15
3	Effectiveness Ranking Table	19
4	Alternative Acceptability Table	20
5	Economic Comparison of Alternatives in 2010 Dollars	21
6	Areas of Risk and Uncertainty	23
7	Implementation Schedule	26
8	Cost Apportionment Table	28

List of Figures

Figure		**Page**
1	Location Map	4
2	Site Map	5
3	Aerial view of NMC harbor illustrating the existing shoaling problem	6
4	Proximity of the proposed dredge material placement (Area A) to the project site	12
5	Plan view of the double sheet pile breakwater alternative…	16
6	Potential mooring configuration	17
7	Cross-section of Alternative 1 double steel sheet pile breakwater	24

List of Appendices

Appendix	Title
A	Engineering Appendix
B	Wave & Shoaling Analysis
C	Cost Appendix
D	Economic Appendix
E	Real Estate Plan
F	Implementation Guidance
G	Correspondence

Environmental Assessment

Northwestern Michigan College
Harbor Improvements
Section 107
Feasibility Study

1.0 BACKGROUND AND STUDY AUTHORITY

This study was conducted under the authority of Section 107, 1960 RHA (P.L. 86-645) as amended by Section 915(d), Water Resources Development Act (WRDA) 1986 (P.L. 99-662). Section 1004 of WRDA 2007, (P.L. 110-114) provides specific language. The project is subject to the requirements of the National Environmental Policy Act of 1969 (NEPA), Section 404(b)(1) of the Clean water Act, Section 401 of the Clean Water Act, as well as U.S. Army Engineers Regulation 1102-5-100.

Section 107 projects are defined in the RHA 1960 (P.L. 86-645) as amended:

> "*That the Secretary of the Army is hereby authorized to allot from any appropriations heretofore or hereafter made for rivers and harbors, not to exceed $35,000,000 for any one fiscal year, for the construction of small river and harbor improvement projects not specifically authorized by Congress, which will result in substantial benefits to navigation and which can be operated consistently with appropriate and economic use of the waters of the Nation for other purposes, when, in the opinion of the Chief of Engineers, such work is advisable, if benefits are in excess of cost."*
>
> *"Also provided that not more that $4,000,000 shall be allotted for the construction of a project at any single locality and the amount allotted shall be sufficient to complete the Federal participation in the project under this section."*

The authorizations specific to Northwestern Michigan College was provided in WRDA 2007, as follows:

> *"The Secretary shall review the locally prepared plan for the project for navigation, Traverse City Harbor, Michigan referred to in subsection (a), and, if the Secretary determines that the plan meets the evaluation and design standards of the Corps of Engineers and that the plan is feasible, the Secretary may use the plan to carry out the project and shall provide credit toward the non-Federal share of the cost of the project for the cost of work carried out by the non-Federal interest before the date of the partnership agreement for the project if the Secretary determines that the work is integral to the project."*

1.1 Study Background and Purpose

1.1.1 Study Background

The reconnaissance phase of the study was initiated in August 2006 and resulted in the finding that there was Federal interest in continuing the study into the feasibility phase.

Northwestern Michigan College (NMC), the non-Federal sponsor, and the U.S. Army Corps of Engineers (Corps) initiated the feasibility phase of the study on October 1, 2008. The feasibility phase study cost was shared equally between the Corps and the sponsor.

1.1.2 Study Purpose

The purpose of this report is to present the findings of the investigation conducted to determine the feasibility of providing navigation improvements at the Northwestern Michigan College Maritime Academy Harbor in Grand Traverse Bay, Traverse City, Michigan. This report analyzes the problems and opportunities, planning objectives and desired outcomes. Alternatives were developed to address the determined objectives. These alternatives include a plan of no action and various combinations of structural and non-structural measures. The economic and environmental impacts of the alternatives are then evaluated and a feasible plan is selected. The report also presents details on Corps and sponsor participation needed to implement the plan and then concludes with a recommendation for authorization.

1.2 Prior Studies, Reports and Existing Water Projects

1.2.1 Prior Studies

The following reports were reviewed in the course of collecting data for this study:

- Assistant Secretary of the Army for Civil Works (ASACW) Fact Sheet, completed and approved in August 2006.

1.2.2 Existing USACE Water Resources Projects

This study will not modify any existing USACE projects.

2.0 EXISTING CONDITIONS: ASSESSMENT OF WATER AND RELATED LAND RESOURCES

2.1 National Objectives

The national or Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to National Economic Development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

2.2 Public Concerns

A number of public concerns have been identified by the non-Federal sponsor during the course of the study. Additional input was received through coordination with the sponsor, coordination with other agencies, and review of the reconnaissance phase products. Public review and a public meeting will occur prior to project approval. A discussion of pubic involvement is included in Section 6, Summary of Coordination, Public Involvement and Comments. The public concerns that are related to the establishment of planning objectives and planning constraints are:

- The College is an important educational resource in the Traverse City community. Anecdotal evidence suggests that the public is supportive of the navigation improvements.

2.3 Existing Conditions

The project site is located within Grand Traverse Bay, Traverse City, Grand Traverse County, Michigan. Grand Traverse Bay is about 260 miles northwest of the City of Detroit. The harbor is home to the Great Lakes Maritime Academy (GLMA), the nation's only freshwater State Maritime Academy. The project site is on Northwestern Michigan College's campus located in Traverse City, MI on the southern shore of the west arm of Grand Traverse Bay.

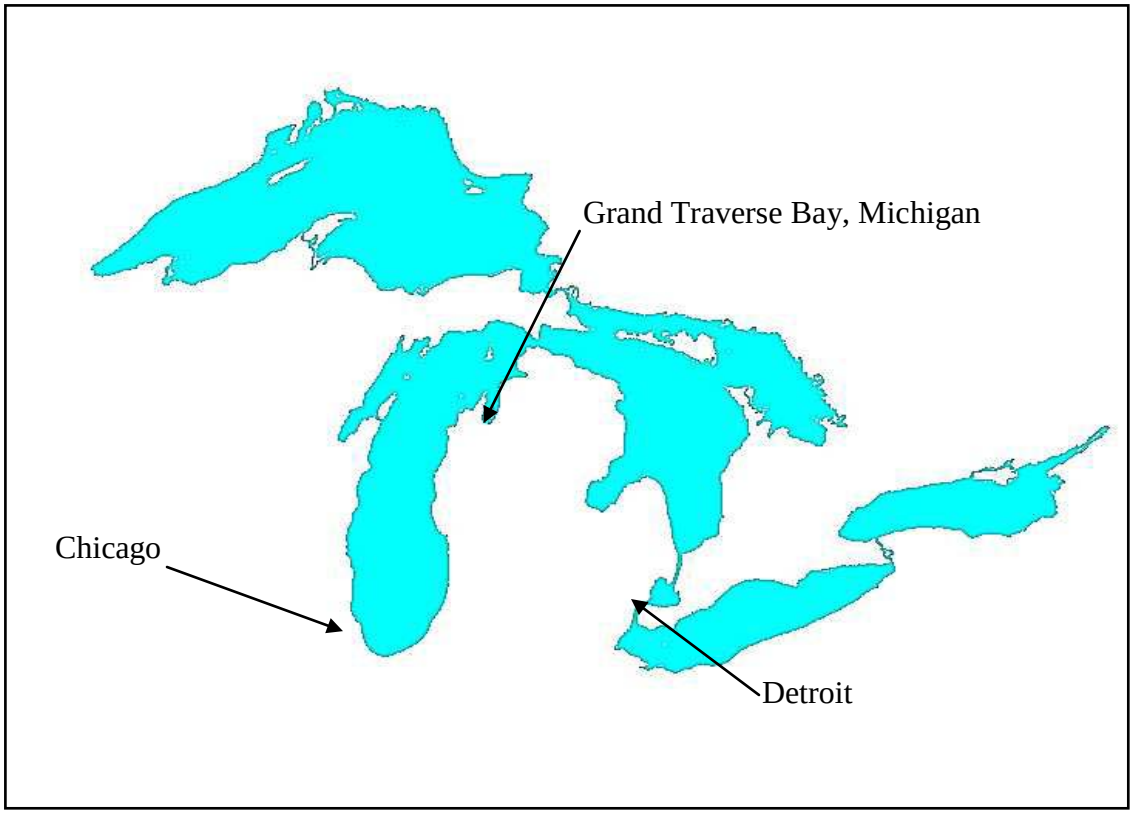


Figure 1: Location map

Northwestern Michigan College has been nurtured and generously supported by the Grand Traverse region since being established in 1951. The College has about 5,000 students that it teaches through its partnerships with other Universities in the region. The College's Great Lakes Water Studies Institute offers learning opportunities and fosters stewardship of freshwater resources. The Institute's GLMA provides a professional training environment for a career in Marine Transportation. Graduates qualify for a United States Coast Guard (USCG) license as a Merchant Marine Officer as Third Mate Oceans or Great Lakes (First Class Great Lakes Pilot) or Third Assistant Engineer. Students are trained on the T/S State of Michigan, a 225 foot floating classroom. The Academy is a valuable resource for Great Lakes Coast Pilots.

The current configuration of the harbor allows sand from nearby beaches to accumulate in the harbor, decreasing the harbor depth making it difficult to moor the T/S State of Michigan. The institute dredges 2,000 to 3,000 cubic yards (cy) of sediment bi-annually to allow entry of the GLMA training vessel. Waves often enter the harbor from the east, which can cause disruption of moored vessels and damage to the navigation structures. Minor repairs are made to the piers annually. Research and Government vessels that visit Grand Traverse Bay and Lake Michigan in the Traverse City area are unable to utilize the harbor due to its inadequate size and lack of protection. These vessels currently dock at Frankfort (60 miles away), St. Ignace (100 miles away), and Leeland (45 miles away). From these docks, the vessels travel to Grand Traverse Bay to perform research or governmental duties, typically traveling back at night.

Figure 2: Site Map

2.4 Physical Environment

Grand Traverse Bay has 132 miles of shoreline. The shoreline is comprised of sandy beaches, macrophyte zones and hardened reaches. Land use in the Grand Traverse Bay Watershed is predominately forest (49 percent) and agriculture (20 percent). The remaining land use types are open shrub/grasslands (15 percent), water (9 percent), urban (6 percent) and wetlands (1 percent). The Boardman River and Elk River both flow into Grand Traverse Bay.

2.4.1 Sedimentation and Erosion

The Boardman River, which discharges into the bay to the west of the harbor, has more than 600 identified erosion sites areas along its banks and has been found to contribute significant quantities of sediment to the bay. The bottom of Grand Traverse Bay is mostly sandy with some areas of silt and stone. The littoral currents within the southern portion of the bay move material primarily from east to west. The existing configuration of the NMC Harbor allows material to flow into the harbor. The College must dredge the harbor on a biannual basis in order to maintain an operable depth for its training vessel, this increases the operation cost of the Maritime Academy program.

Figure 3. Aerial view of the NMC harbor illustrating the existing shoaling problem

2.4.2 Aesthetics

The Grand Traverse Bay watershed is one of the premier tourist and outdoor recreation regions in the State of Michigan. Its natural resource base and beauty contributes significantly to the quality of life enjoyed by year round residents accounting for the area's continued growth and prosperity. The Maritime Academy harbor is one of two harbors in the area with hotels and tourist related businesses located on sandy beaches between the Academy and the Bryant Park Marina. The entire section of the West Bay shoreline located in Traverse City is generous in its public access to this extraordinarily beautiful sandy beach shoreline.

2.4.3 Natural Resources

Land use and land cover in the watershed is predominantly forest (49%) and agriculture (20%). Other land uses include: open shrub/grassland, water, wetlands, and urban. Patches of forests occur regularly throughout the watershed with the bulk occurring in the Pere Marquette State Forest (found in the upper Boardman River watershed) and the headwater areas in the Elk River Chain of Lakes watershed.

The Grand Traverse shoreline is diverse with a mix of sandy beaches, macrophyte zones and hardened reaches. The near shore and beach areas in the harbor vicinity are generally sand and vary in width between 25 and 100 feet with a gradual slope. Due to the dynamic nature of the beach shore, vegetation there is sparse and limited to tolerant

grasses and shrubs. No significant wetlands are located near the NMC harbor or dredged material critical erosion zone placement site.

Lake Michigan contains a diverse community of native fishes. Grand Traverse Bay is listed as one of the top ten places in the country for smallmouth bass fishing. The NMC harbor area currently provides fishing opportunities for smallmouth bass, bluegills, yellow perch, common carp, and brown trout. There would be some localized disturbance of the aquatic habitat during construction of the breakwater including effects on fish and bottom dwelling organisms. Fish would temporarily avoid the area of the breakwater construction but would return upon completion of construction. The footprint of the breakwater would impact an insignificant area of bottom land within the larger Grand Traverse Bay. Riprap scour stone placed along the breakwater would provide habitat similar to that lost at the existing dilapidated crib and stone structure. Based on critical spawning and juvenile fish development periods, the Michigan Department of Natural Resources may impose a no work period to avoid fishery impacts. The designated erosion zone site for placement of dredged material is the high energy 2' to 8' depth contour with limited habitat value. Wave energy would tend to move the placed dredged material inland and help protect valuable nearshore beach habitat.

Wildlife in the vicinity of project activities is limited due to the location with the Traverse City urban area. Construction and dredged material placement activities would occur primarily off shore in shallow water. Some wildlife including birds would avoid the area during construction and dredging/ placement but would return following project completion. The proposed project would not result in significant impacts on wildlife.

2.5 Socioeconomic Resources, Safety and Recreation

2.5.1 Population & Industry

Populations in Grand Traverse Bay area watershed counties increased by more than 50% between 1970 and 1990 reaching as high as 156% for Kalkaska County. Between 1990 and 2000, populations in all the surrounding counties increased between 20-27%. Going back further, populations in counties containing major portions of the watershed (Antrim, Grand Traverse, Kalkaska, and Leelanau) have increased an average of 153% since 1900. It is evident that the greatest population growth, and corresponding development, is currently occurring along major lakefront areas (i.e., Grand Traverse Bay, Elk Lake, and Torch Lake) as well as in townships located just outside major city and village boundaries, indicating increasing sprawl in those areas.

Traditional uses of watershed resources have included agriculture, tourism and recreation. Cherries and other fruit crops dominate agricultural production in the region, and are harvested for the global market.

Northwestern Michigan, also known as the ***Cherry Capital of the World***, produces half the state's tart cherry crop and more than 80% of its sweet cherries. The National Cherry Festival in Traverse City attracts more than 500,000 tourists each year, celebrating the harvest with festivities over an eight-day period each summer.

Other tourism and recreational activities include: boating, biking, swimming, skiing, golfing, fishing, and camping. Attracted to the natural beauty of the Bay and its surroundings, tourists from around the world come to enjoy the pleasures of the region, away from the busy rush of more urban areas.

Businesses supporting the above activities include marinas, canoe liveries, bike rentals, ski resorts, hotels, restaurants, and bed & breakfasts off the beaten path for those who enjoy more solitary pleasures.

The area also supports a thriving regional business community representing many economic sectors including, banking, healthcare, retail, light industry and others.

2.5.2 Northwestern Michigan College Financial Information

Northwestern Michigan College is a public institution governed by a board of six publicly elected Trustees, each serving six year terms. The College has an annual enrollment of approximately 5,000 students. The NMC Foundation, thanks primarily to local donors, offers more scholarship dollars to more students than any community college in Michigan. The College Fiscal year runs from July 1 to June 30. **Table 1** provides the last four years of College revenues and expenditures and is a positive indicator of the institution's solvency. Furthermore, is it reasonable to assume that NMC will have the financial capability to operate and maintain the harbor renovation throughout the project life.

Table 1 – Four years of College Revenues/Expenditures

Fiscal Year	Revenues	Expenditures	Internal Transfers	Net Increase in Net Assets
2006-2007	$44,010,498	$43,159,550	$850,948	$0
2007-2008	$45,486,592	$45,244,336	$242,256	$0
2008-2009	$47,378,050	$47,315,745	$62,305	$0
2009-2010	$50,623,165	$47,664,128	$2,959,037	$0

2.5.3 Public Health and Safety

After the attacks of September 11, 2001 the U.S. government began requiring some maritime vessels to adhere to security requirements to ensure U.S. vessels don't fall into the hands of terrorists. Thus, under MERSC [Maritime Administration Security] requirements, access to vessels must be restricted. NMC College complies with these policies.

All facilities require a Transportation Worker Identification Card (TWIC) for entry to a US public vessel (TS State of Michigan) or they must be accompanied by a person with a TWIC. A fence surrounding the TS State of Michigan berth has a locked gate with staff and/or cadets aboard. Cadets stand security watches 6:00 pm until 6:00 am each day which is supervised by senior cadets and managed by GLMA staff.

No visitors can board the vessel unless accompanied by a senior cadet or staff member. The TS State of Michigan's Security Plan was prepared by the Maritime Administration (MARAD).

2.5.4 Recreational Fishing, Public Access & Harbor of Refuge

The NMC harbor is reserved for official use only. However the general public is allowed to fish off the existing structure. It is expected that the general public will be given the same level of access under the "with" or "without" project condition. The College allows the harbor to be used as a "Harbor of Refuge" during storm activity.

2.5.5 Traffic and Transportation

Research and government vessels that currently visit or have expressed a desire to visit Grand Traverse Bay and Lake Michigan in the Traverse City area are unable to utilize the harbor due to its shape and lack of wave protection. These vessels currently dock at Frankfort (60 miles away), Escanaba and Mackinac City (both 120 miles away). From these docks, the vessels travel to Grand Traverse Bay to perform research or governmental duties, and then travel back to these docks at night.

2.6 Future without Project Condition

The without project condition, also known as the No Action alternative, describes the future condition of the area if no project were implemented to address the existing problem.

The Northwestern Michigan College's Great Lakes Maritime Academy has been training mariners for over 50 years. The Academy will continue to operate and maintain the harbor and the T/S State of Michigan because they are essential to the Academy's education mission. Without the Section 107 project the east side of the harbor will remain open and the harbor will continue to be subject to shoaling and the vessels berthed in the harbor will continue to be subject to wave energy which could cause damage to the vessels. The harbor will continue to have limited berthing space.

NMC's academic partners would continue to seek alternative mooring arrangements during joint marine activities. Research and government vessels that currently visit or have expressed their desire to visit Grand Traverse Bay and Lake Michigan in the Traverse City area would be unable to utilize the harbor due to its shape and lack of protection. These vessels currently dock at Frankfort (60 miles away), Escanaba and Mackinac City (both 120 miles away). From these docks, the vessels travel to Grand Traverse Bay to perform research or governmental duties, and then travel back to these docks at night.

In addition to enrollment/graduate concerns, the personnel at the GLMA indicated that a new seawall is necessary to aid in the security of the harbor. The T/S State of Michigan

is a federally owned vessel. As such, the vessel and harbor must adhere to MERSC [Maritime Administration Security] requirements.

Without the Section 107 project, the College would continue to perform minimum maintenance dredging as its finances allow. The Academy's curriculum expansion plans would be placed on hold or canceled since the classes require a "quiet basin" environment for implementation. These classes include small craft operation, or require students to be in the water for portion of the lesson. A "quiet basin" provides a safer environment for students and College personnel.

3.0 Problems, Opportunities and Planning Objectives and Constraints

This section presents the results of the initial planning process, the specification of water and related land resources, problems and opportunities in the study area.

3.0.1 Problems

- The harbor has problems with shoaling and reduced depth
- Wave action within the harbor causes damage to moored vessels
- The existing harbor configuration lacks the mooring space to efficiently and effectively house the Maritime Academy research vessels and to adequately accommodate additional vessels

3.0.2 Opportunities

- Reduce shoaling and the need to dredge the harbor, thus reducing the Academy's operating cost
- Reduce the amount of wav**e** energy that enters the harbor, resulting in lower vessel damages
- Provide increased harbor capacity and effective use of existing Maritime Academy Fleet
- Dredge material from the harbor can be used to nourish high erosion areas in Traverse City near the harbor
- Provide a better training facility

3.1 Planning Objectives & Constraints

This section presents the establishment of planning objectives and constraints, which is the basis for the formulation of alternatives.

3.1.1 Planning Objectives

The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of

alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes in the without project condition. The planning objectives are specified as follows:

- Effectively reduce the shoaling in the harbor.
- Effectively reduce the wave energy in the harbor.
- Increase the depth of the harbor to allow other colleges, universities or government agency vessels to use the facility.
- Reduce the operating cost of the public institution.

3.1.2 Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The planning constraints identified in this study are as follows:

- Dredge material disposal must comply with Federal and State regulations
- The Academy harbor has small footprint, which limits the type of breakwater that can be built.
- The new structure will require facilities for mooring vessels.
- The orientation of the breakwater should not impede vessel movement, but it should reduce shoaling and wave action within the harbor.

4.0 Management Measures

A management measure is a feature or activity at a site which addresses one or more of the planning objectives. A wide variety of measures were considered, some of which were found to be infeasible due to technical, economic, or environmental constraints. Each measure was assessed and a determination was made regarding whether it should be retained in the formulation of alternative plans. The descriptions and results of the evaluations of the measures considered in this study are presented below.

4.0.1 Dredging component

The harbor is subject to shoaling from nearby beaches and sediment from the Boardman River. On average, the College has dredged approximately 2,000 to 3,000 cubic yards of material from the harbor every other year. However, the harbor has not been dredged in about 3 years. Approximately 16,000cy of material will be dredged as part of the Section 107 project. Based on soil borings taken in the area of the harbor and conversations with the local sponsor it appears that the dredge material consists of medium sand making it suitable for beach nourishment. Per the local sponsor, material dredged from the harbor during construction of the West and North breakwaters was used by the contractor for other projects.

Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) data from 2007 was used to locate nearshore sand bars. These sand bars are indicators of long shore

transport pathways within the littoral zone. Placement of sediment landward of these features would most likely result in dredged sediment remaining within the littoral zone. The plan is to place the dredged material near the littoral zone near the West End beach area. The West End beach area (Area A in Figure 4) has been identified as a high erosion area by the Michigan Department of Environmental Quality (MDEQ). The material would be placed between the two and eight foot contours. A booster pump will be required to transfer the material from the NMC harbor to the placement area about 8000 feet away. Details of the wave analysis and shoal modeling are in **Appendix B**.

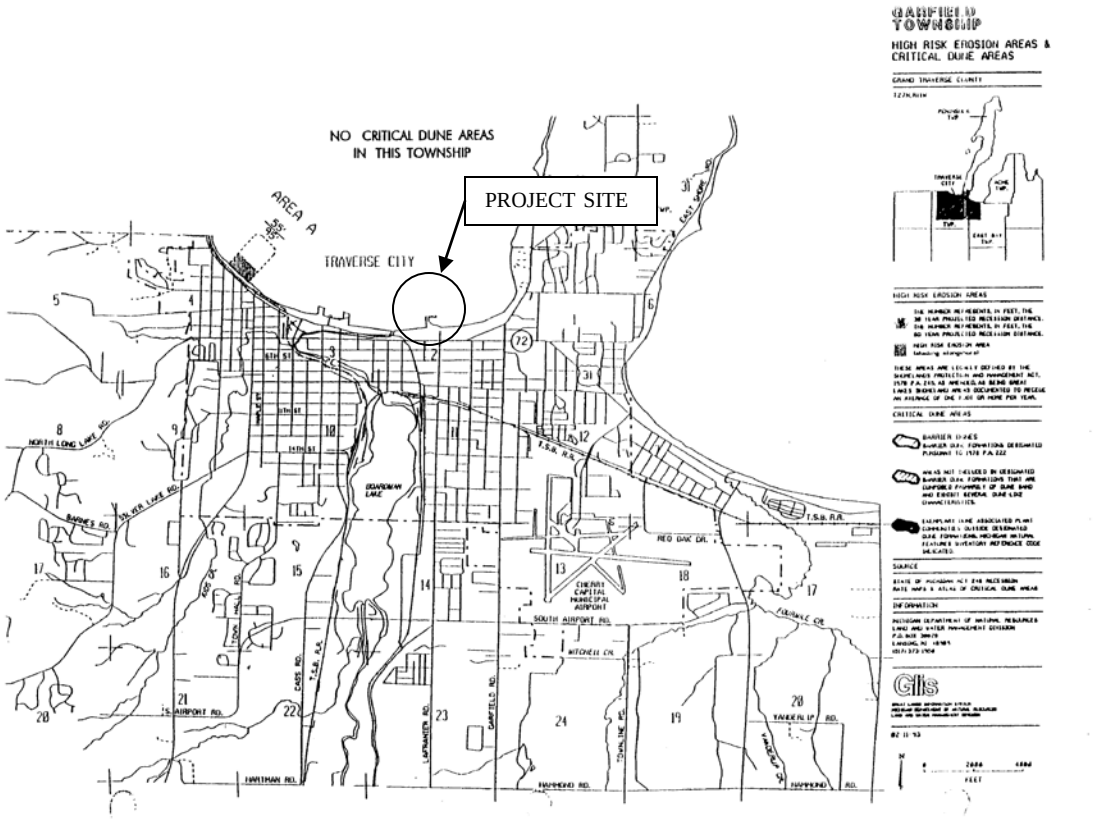


Figure 4. Proximity of the proposed dredge material placement (Area A) to the project site.

4.0.2 Non-Structural Measures

Due to the mooring requirements of the non-federal sponsor, non-structural solutions were not feasible for this study.

4.0.3 Structural

Structural solutions that were considered include a double steel sheet pile wall, rubble mound, circular cell steel sheet pile wall and a single steel sheet pile wall.

4.0.3.1 Double Steel Sheet Pile (SSP) Wall

The double SSP wall would consist of two parallel steel sheet pile walls 280 feet long spaced approximately 15 feet apart and tied together and a concrete cap. The top elevation of the steel sheet pile was established at 7 feet above Low Water Datum (LWD). This elevation is similar to the existing breakwater structures that were constructed by the college. The steel sheet pile section and tie rod diameter were designed in accordance with USACE criterion for construction of such structures in a marine environment. Concrete anchor blocks, 7.5 feet long by 5.5 feet wide by 2 feet thick, are required in locations where mooring anchors are placed. The design of the anchor blocks was developed based on the loading expectations. **See Appendix A, Plate 3**.

4.0.3.2 Circular Cell Steel Sheet Pile Wall

The circular cell SSP wall would consist of circular cells constructed of steel sheet pile 35 feet in diameter and connected by steel sheet pile diaphragms. The required tip elevation would be approximately –28.0' below LWD. The SSP section and diameter were assumed based on other projects with similar soil conditions. To accommodate docking needs of the Maritime Academy, a floating dock with the required pile guides would be placed adjacent to the circular cell structure. The sizes of the floating dock and pile guides were assumed based on past projects, as was the pile tip elevation of –30.0' below LWD. It should be noted that because this structure is wider than the double steel sheet pile wall, it will require a greater footprint area of the lake bottom.

4.0.3.3 Rubblemound

The rubblemound breakwater would consist of constructing a 280foot rubble mound breakwater. The structure would be constructed out of large toe stone and core stone. Stone from the existing breakwater would be used in the construction of the structure which would protect the harbor from wave action and reduce shoaling. It would not have any mooring capability and is likely to reduce the capacity of the harbor because it requires a large footprint.

4.0.3.4 Single Steel Sheet Pile Wall

The single steel sheet pile wall would have the same basic dimensions as the double steel sheet pile breakwater measure. This measure would consist of a concrete cap supported by an SSP wall on the harbor side and steel h-piles on the lake side. Scour stone would provide scour protection at the toe of the SSP on the harbor side. Riprap would be placed under the concrete cap to prevent ice buildup and as an added benefit would reduce wave action at the beach just east of the harbor. Concrete anchors blocks would be needed for anchoring of mooring bollards.

4.0.4 Additional Measures

Handrails and lighting are necessary safety measures because the facility will be used to embark and disembark from College vessels. In addition, it is anticipated that the structure will receive significant usage by the general public for fishing and other activities.

With the management measures described above, there are design requirements that must be included for the formulation of complete alternative plans. These measures include the following:

- The breakwater should be oriented and of sufficient length to reduce shoaling and wave activity within the harbor.
- The opening between proposed and existing breakwaters must be wide enough to provide the Academy's training vessel space to maneuver within the harbor.
- The Academy would like to moor vessels to the proposed structure.
- The breakwater should be accessible to the public and provide some areas for fishing.

4.1 Reasons for Selecting/Combining Measures to Formulate Alternatives

A variety of management measures were developed that would address one or more of the planning objectives. These measures were then evaluated and screened. Alternative plans were then developed comprised of one or more of the management measures. Table 2 provides a pass/fail comparison of each alternative in relation to the project objectives.

The selected measures were chosen to further develop because they meet one or more of the study objectives of reducing shoaling in the harbor, decreasing wave energy in the harbor, and providing additional vessel mooring capacity.

4.2 Screening of Alternative Plans

Due to the narrow focus of the study and the 2007 WRDA language requiring the Corps to evaluate the local preferred plan, preliminary plans were not immediately eliminated from further consideration in the study. This will allow the District to complete an economic evaluation in accordance with USACE guidance. **Table 2** depicts the ability of each alternative to meet project objectives.

Table 2 – Ability of Alternatives to meet Project Objectives

	Project Objectives		
Plans/Alternatives	Reduce Shoaling	Reduce Wave action	Provide harbor space for vessel mooring
Alt 1: Double steel sheet pile wall & dredging	X	X	X
Alt 2: Circular steel sheet pile wall & dredging	X	X	X
Alt 3: Rubblemound & dredging	X	X	-
Alt 4: Single steel sheet pile wall & dredging	X	X	X
Alt 5: No Action	-	-	-

4.3 Evaluated Alternatives

The evaluated alternatives were formulated from the management measures remaining after the screening process described above.

Due to the limited scope of the project, all of the alternatives considered during the preliminary analysis were carried over to the final array of alternatives. Each of the alternatives addresses the objectives of the project. Implementation guidance for Section 1004(a)(18) and 1004(b)(1) of the Water Resources Development Act of 2007 (WRDA 2007) states that the Detroit District will consider a breadth of alternatives to determine if there is Federal interest in the locally preferred alternative.

4.3.1 Alternative 1: Dredging and a Double SSP Breakwater

Alternative 1 consists of the construction of a 280 foot double steel sheet pile (SSP) wall and dredging 16,000 cubic yards of sandy material from the harbor. The double SSP breakwater will consist of two parallel steel sheet pile walls spaced approximately 15 feet apart and tied together. The tip elevation was designed to be -30.5 LWD feet based on soil conditions, expected loading, and the expected wave climate within the harbor. The steel sheet pile section and tie rod diameter were designed in accordance with USACE engineering manual EM 1110-2-2504, “Design of Sheet Pile Walls” and using USACE software program CWALSHT. Stone from the existing crib would be used in the sub-base of the new breakwater. Concrete anchor blocks, 7.5 feet long x 5.5 feet wide x 2 feet thick, would be required in locations where mooring anchors are placed. The design of the anchor blocks was developed based on the loading expectations. Scour stone will be placed to protect the toe of the structure. **Figure 5** provides a plan view of alternative 1.

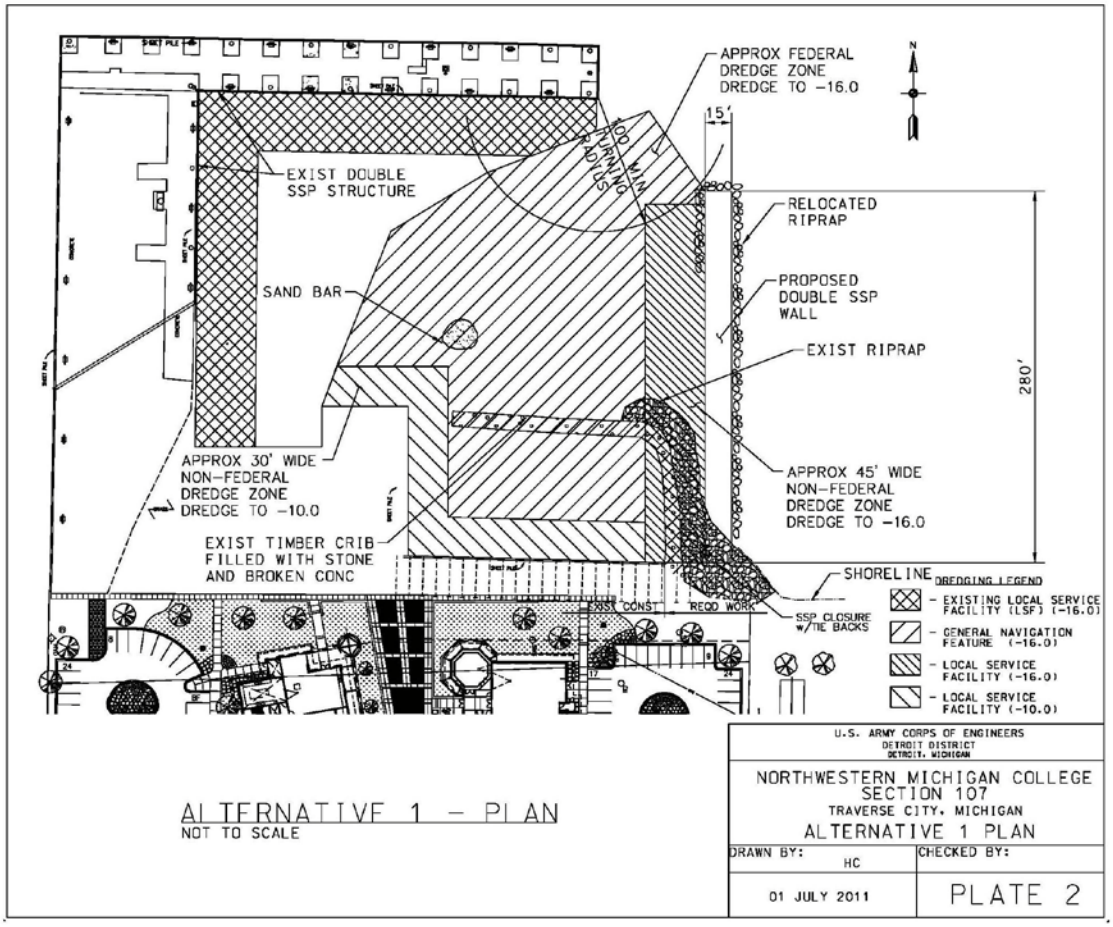


Figure 5. Plan view of the double sheet pile breakwater alternative, this also represents the locally preferred plan.

Alternative 1 or the double steel sheet pile breakwater represents the locally preferred plan. This alternative would significantly reduce the amount of shoaling within the harbor, reduce the operation and maintenance cost of the harbor for the Non-Federal sponsor and provide space for additional research vessels. The double steel sheet pile wall will include a structural concrete cap that can be used for embarking and disembarking from the College's training vessels. Mooring cleats will be installed so that additional ships can be secured in the harbor. **Figure 6** illustrates one of the potential vessel mooring configurations that would result from the implementation of the project. NED benefits accrue to the project by damages prevented to vessels and docks, the reduction in maintenance costs to the harbor and increased capacity for other research vessels.

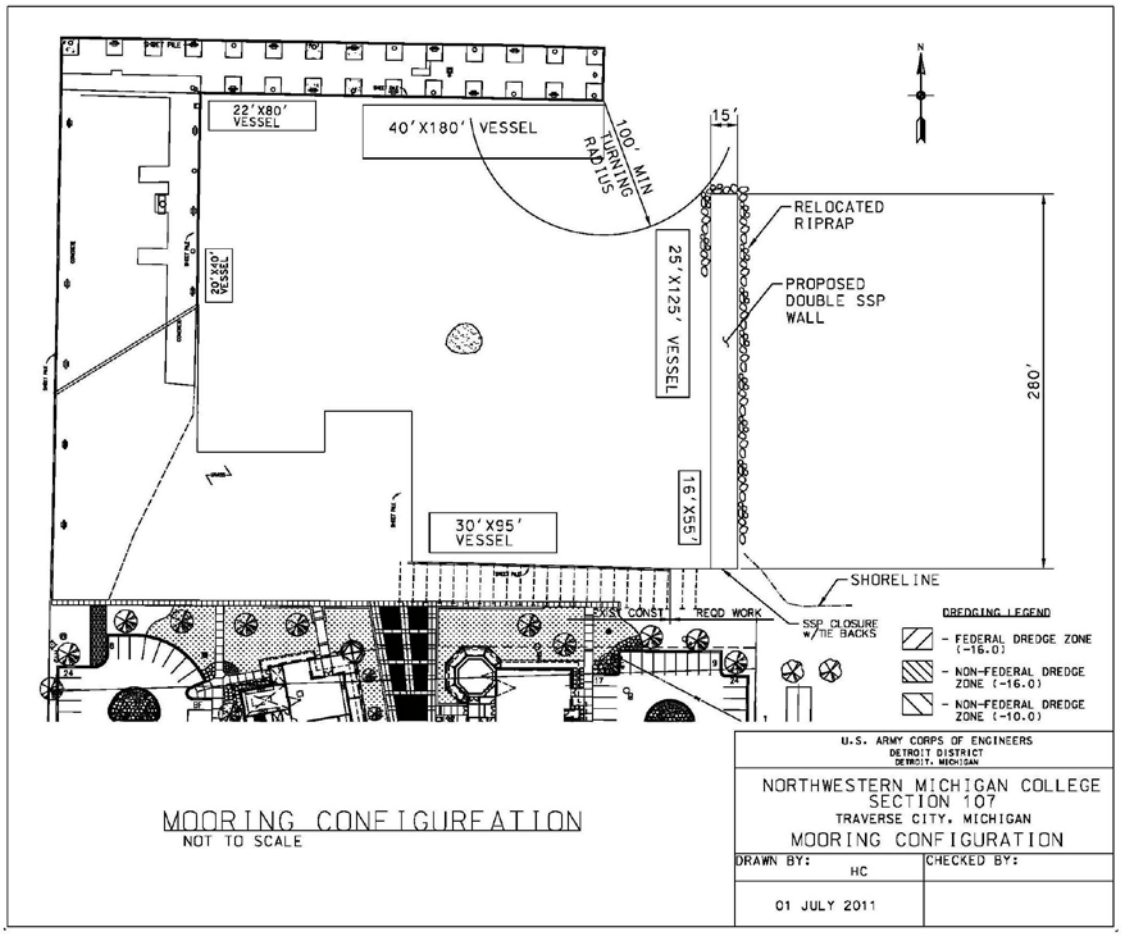


Figure 6. Potential mooring configuration

4.3.2 Alternative 2: Circular cell SSP Breakwater

Alternative 2 includes the construction of a 280 foot long breakwater comprised of circular steel sheet pile cells and dredging 16,000 cy of material from the harbor. The circular cell SSP wall would consist of circular cells constructed of steel sheet pile, 35 feet in diameter and connected by steel sheet pile diaphragms. The required tip elevation would be approximately –28.0 feet LWD. The SSP section and diameter were assumed based on other projects with similar soil conditions. The stone from the existing breakwater would be used in the base of the cells. To accommodate docking needs of the Maritime Academy, a floating dock with the required pile guides would be placed adjacent to the circular cell structure. The sizes of the floating dock and pile guides were assumed based on past projects as was the pile tip elevation of –30.0 feet LWD. The footprint of the cells would reduce the mooring capacity of the harbor. Additionally, this alternative would require a substantial amount of stone and was therefore, deemed cost prohibitive by the design and cost engineers.

4.3.3 Alternative 3: Rubblemound

Alternative 3 consists of constructing a 280 foot long rubble mound breakwater and dredging 16,000 cy of material from the harbor. The rubblemound would be constructed out of large toe stone and core stone. Stone from the existing breakwater would be used in the construction of the rubblemound. The rubblemound would protect the harbor from wave action and reduce shoaling. It would not have any mooring capability and is likely to reduce the capacity of the harbor because it requires a large footprint.

4.3.4 Alternative 4: Single SSP Breakwater

Alternative 4 includes constructing a 280 foot single steel sheet pile (SSP) wall and riprap and dredging approximately 16,000 cy of material from the harbor. The single SSP wall and riprap wall would consist of a steel sheet pile wall on the inside of the harbor and stone placed along the outside of the harbor. Stone from the existing breakwater would be used to construct the new breakwater. The tip elevation was assumed to be –34.5 feet based on the tip elevation of the existing walls at the harbor. Concrete anchor blocks, 7.5 feet long x 5.5 feet wide x 2 feet thick, would be required in locations where mooring anchors are placed. The size of the anchor blocks was assumed based on the anchor blocks in the existing north and west walls. Alternative 4 would prevent the harbor from shoaling, and reduce the operation and maintenance cost of the harbor for the Non-Federal sponsor. The single steel sheet pile wall will include a concrete walkway for embarking and disembarking. Mooring cleats would be installed so that additional ships could be secured in the harbor.

4.3.5 Alternative 5: No Action

The no action alternative assumes that that no project would be implemented by either the Corps or by local interests to achieve the planning objectives. The no action alternative is synonymous with the without project condition. Critical assumptions in defining the no action alternative include:

- The College would continue to operate the TS State of Michigan
- The College might have to alter its course offerings from year to year dependent upon the shoaling condition of the harbor.
- Visiting colleges and universities and other government agencies will be required to moor their vessels at other harbors due to the limited mooring space at the Academy's harbor.
- The College would continue to do minimum maintenance dredging of the harbor.

4.4 Formulation Criteria

The final array of alternative plans is compared using four formulation criteria as indicated in ER 1105-2-100, 22 APR 2000. These criteria are completeness, effectiveness, efficiency and acceptability.

4.4.1 Completeness

Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives of the plan. It is an indication of the degree that the outputs of the plan are dependent upon the actions of others.

It is expected that the Great Lakes shipping industry will continue well beyond the life of the proposed project. The industry will continue to be dependent upon well trained ship pilots and crews to man vessels. The Maritime Academy is one of two institutions in the country that provide this valuable human commodity. Each of the alternatives is complete with respect to its ability to allow the Academy to continue to provide trained pilots and crews.

4.4.2 Effectiveness

All of the plans in the final array provide some contribution to the planning objectives. Effectiveness is defined as a measure of the extent to which a plan achieves its objectives.

Table 3 presents a rating of the individual alternatives within each of the project objectives. It indicates that the formulated alternatives are similar in effectiveness relative to the project objectives. However, Alternative 1 is the locally preferred plan and has a higher aesthetic value in the opinion of the non-Federal sponsor so alternative 1 is assigned a 5 for each of the project objectives. Additionally, **Appendix B** contains detailed information that supports the effectiveness of the proposed alternative on the wave climate and shoaling within the harbor.

Table 3 - Effectiveness Ranking Table

	Project Objectives			
Alternatives	Reduce Shoaling	Reduce Wave action	Vessel mooring space	**Total**
No Action	0	0	0	**0**
Alt 1: Double steel sheet pile wall & dredging	5	5	5	**15**
Alt 2: Circular steel sheet pile wall & dredging	5	5	4	**14**
Alt 3: Rubblemound & dredging	5	5	0	**10**
Alt 4: Single steel sheet pile wall & dredging	5	5	4	**14**

Scale: 0 - 5 with 0 being least effective plan and 5 the most effective plan relative to accomplishing the project objectives

4.4.3 Efficiency

All of the plans or alternatives in the final array provide net benefits such as reduce operations and maintenance cost and increased mooring capacity. Efficiency is a measure of the cost effectiveness of the plan expressed in net benefits.

Due to the narrow scope of the project it could be stated that each of the alternatives are very close to each other in terms of their efficiency. Alternative 1 is more efficient then the other alternative because it accomplishes all of the project objectives for the least amount of costs.

4.4.4 Acceptability

All of the plans in the final array must be in accordance with Federal law and policy. The comparison of acceptability is defined as acceptance of the plan to the local sponsor and the concerned public.

Alternative 1 is the most acceptable alternative to the College. Alternative 1 not only meets the project objective to provide a still basin and reduced shoaling in the harbor, it also provides additional security for the College's training vessel. Table 4 summarizes the acceptability of the 2 evaluated alternatives.

Table 4. Alternative Acceptability Table

Alternative	Total Cost **(2011 dollars)**	O&M Cost **(2011 dollars)**	Benefit/Cost Ratio	Other social effects
1	$2,566,253	$8,006	1.03	Locally preferred plan (LPP); meets project objectives
4	$2,622,935	$8,217	1.01	Meets project objectives

4.5 Comparison of Alternatives

Comparison of the alternatives is based on the evaluation of the impacts of the alternatives. The Planning Process requires that the analyzed alternatives also meet all of the following criteria: economically-justifiable, engineeringly feasible, and environmentally and socially acceptable. If an alternative does not meet one or more of these criteria, it is eliminated from further consideration. There are certain policies and circumstances that allow justification of alternatives outside of these guidelines if there is supporting rationale. The estimates also include contingencies determined through an M-II risk assessment.

Typically benefits for a harbor improvement or construction project would be derived from the amount and type of tonnage that passes through a commercial harbor. In the case of recreational harbor projects it may be the construction of a marina or the addition

of boat slips or a boat ramp that provide benefits. The navigational improvement project at Northwestern Michigan College is unique in that its use is governmental and educational in nature. The harbor is used to train students for careers in Great Lakes navigation and to conduct classes in aquatic ecosystem stewardship.

Alternatives 1 and 4 only differ slightly with respect to their design elements and provide the same amount of reduction in shoaling, protection against wave action, and increase the productivity of the harbor. Therefore, the NED benefits derived from each alternative are essentially the same in quantity and quality. Those NED benefits include: 1) government or institutional vessels visiting and or mooring at the harbor to reduce their vessel operational costs; 2) the college will realize benefits through reduced maintenance dredging cost; 3) the college will no longer have to pay to have piers and docks repaired since the new eastern pier will provide protection against waves surging into the harbor.

Table 4 contains an economic summary of the two alternatives that meet all of the project objectives and thus, were assigned costs. A complete analysis of the benefits and costs of the alternatives is contained in **Appendix D - Economic Analysis.** The M-II cost estimates and their associated cost risk analysis can be found in **Cost Appendix - Appendix C.**

Table 5- Economic Comparison of Alternatives

Alternative	Average Annual Benefits		Average[2] Annual Costs	Net Benefits	Benefits-Cost Ratio
1	Visiting Agency Vessel Savings	$57,968	$113,125[1]	$3,439	1.03
	Reduction in Maintenance Dredging	$53,539			
	Maintenance Savings for Repairs to Piers & Docks	$5,057			
	Total Average Annual Benefits	**$116,564**			
4	Visiting Agency Vessel Savings	$57,968	$115,858[1]	$707	1.01
	Reduction in Maintenance Dredging	$53.539			
	Maintenance Savings for Repairs to Piers & Docks	$5,057			
	Total Average Annual Benefits	**$116,564**			

[1]Average annual costs include feasibility study cost and were computed using a Federal Discount Rate of 4.125%.

[2]All costs calculated at 2011 price levels

Construction and non-construction costs were developed for alternatives 1 and 4 using MCASES cost estimating software and a Cost Risk Analysis was conducted to determine the contingency that should be applied to the costs in accordance with ER 1105-2-263 and EC 1105-2-268. Construction cost included items such as cost of materials, mobilization and demobilization, and demolition of the existing breakwater. Non-construction costs are comprised of the cost of the feasibility study, LERRDs and supervision and administration during construction. The cost risk analysis incorporates

input from the entire Product Delivery Team (PDT). The risk register is comprised of various project specific uncertainties that could affect the implementation cost of the project. The project risk register listed the following uncertainties: fluctuating fuel prices, availability of material (stone), adequate funding during construction, etc. The PDT determined that the contingency for the NMC project is 11 percent.

Average annual costs for alternative 1 and 4 were derived by amortizing the cost of the project over a 50-year period at a Federal discount rate of 4.125%. **Please see Table 7 on pg D-19 of Economic Appendix - Appendix D** for further details on project costs.

5.0 Alternative Selection

5.0.1 Rationale for Designation of the NED Alternative

Alternative 1 is the plan that maximizes net national economic benefits. Therefore, this plan is designated as the NED Plan. See economic details in **Appendix D.**

5.0.2 Rationale for Designation of the Optimum Trade-off Plan (OTO)

Alternative 1 is the plan that provides the best mix of contributions to net national economic development and ecosystem restoration. It attempts to maximize the net economic and ecosystem benefits. Therefore, this plan is designated as the Optimum Trade-off Plan.

5.0.3 Rationale for Designation of the Locally Preferred Plan (LPP)

Alternative 1, the Double Steel Sheet Pile Wall, is the plan that, in the opinion of the sponsor, best meets the needs of the local community. This designation is based on the following considerations. Alternative 1:

- has lower operations and maintenance costs.
- fits aesthetically with the current facilities already constructed by the college.

5.0.4 Rationale for Designation of the Selected Plan

Alternative 1 is designated as the selected plan for the following reasons. Alternative 1 meets:

- the guidance requirements issued in August 2008 that the recommended or locally preferred plan falls within the range of alternatives likely to be evaluated in a feasibility study.
- the project goal and objectives as they are described in section 5.3 of this report.

5.1 Risk and Uncertainty

Areas of risk and uncertainty are analyzed and described so that informed decisions regarding the degree of reliability of the estimated benefits, costs and effectiveness of the alternative plans can be made. Areas of risk and uncertainty are described in the **Table 6**.

Table 6 - AREAS OF RISK AND UNCERTAINTY

Area of Concern	Likelihood	Potential Impacts	Mitigation Measures
• Actual cost far exceeding estimated cost.	Because of the limited scope of the project it is unlikely	Project might require more time to construct because of environmental constraints	NA
• Northwestern Michigan College not having their cost share.	NMC is a solvent institution so it is unlikely they would not have funds at the time of construction	Construction would be delayed until NMC could acquire funds	NA

5.2 Description of the Selected Alternative

5.2.1 Alternative Components

Alternative 1 the Double Steel Sheet Pile Breakwater consists of the construction of a 280 foot double steel sheet pile (SSP) wall and dredging approximately 16,000 cubic yards of sandy material from the harbor. The double SSP wall would consist of two parallel steel sheet pile walls spaced approximately 15 feet apart and tied together. Stone from the exiting crib would be used in the sub-base of the new breakwater. Concrete anchor blocks, 7.5 feet long x 5.5 feet wide x 2 feet thick, would be required in locations where mooring anchors are placed. **Figure 7** depicts the cross-section of Alternative 1.

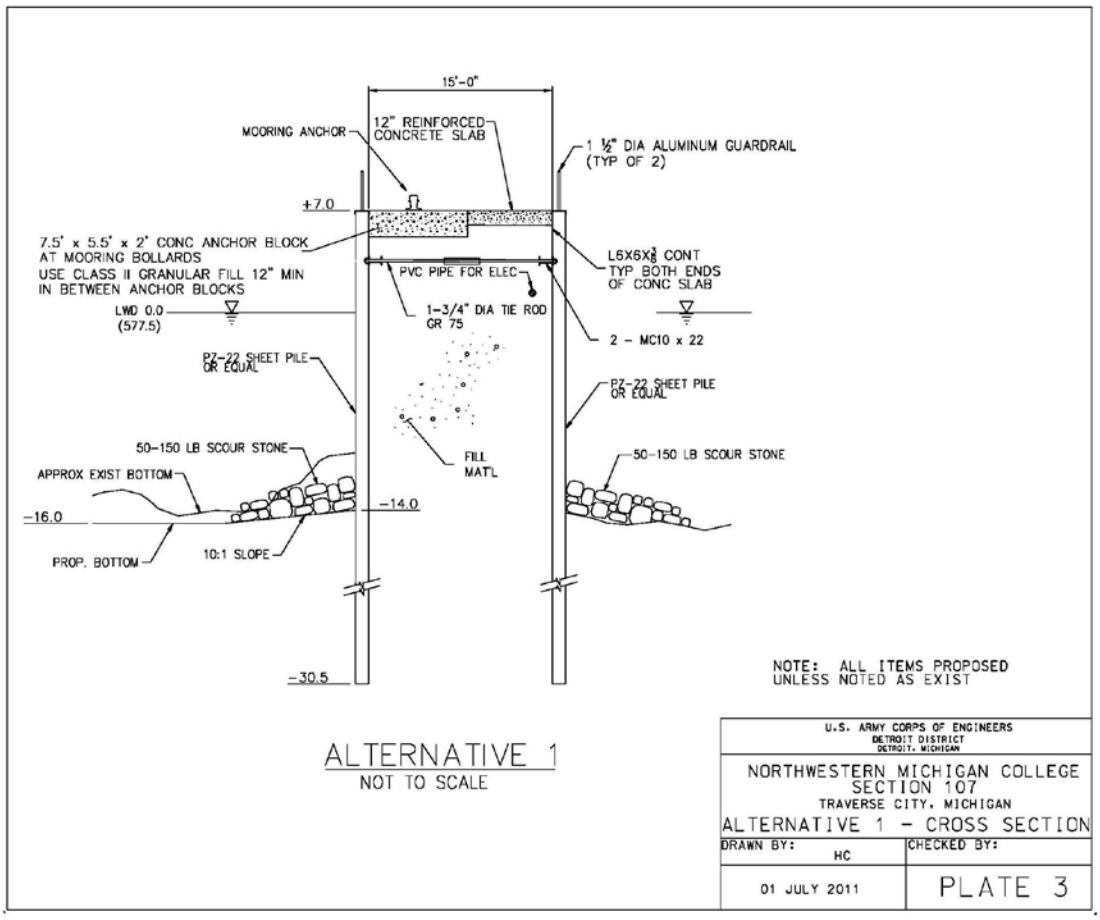


Figure 7. Cross-section of Alternative 1 double steel sheet pile breakwater

The 16,000 cy of dredge material will be placed in the 2 to 8 foot contour in the high erosion area specified by the State of Michigan, about 1.5 miles from the College harbor.

5.2.2 Design and Construction Considerations

The breakwater component of the breakwater and dredging alternative for the NMC harbor followed standard Corps of Engineers breakwater design. The site for the breakwater does not merit any special considerations or restrictions in terms of what materials could be used to construct a breakwater that will close the east side of the harbor. Water Resources Development Act of 2007 as amended and the guidance provided to the Detroit District stated that the District was to design and if feasible construct the locally preferred alternative. The locally preferred alternative consists of a double steel sheet pile wall and a concrete cap. This configuration achieves the project objectives and matches aesthetically with the existing harbor. A wave analysis indicated that the structure should be constructed to withstand four to six foot waves. The breakwater will inhibit shoaling from taking place within the harbor, thus reducing the operation and maintenance cost to the College. The complete Design Appendix (**Appendix A - Engineering Appendix**) is attached to this report.

5.2.3 Real Estate Requirements

The real estate required to implement the breakwater portion of the project is owned by the College. The dredge material will be placed between the two and eight foot contours near the State designated high erosion zone. Because the material will not be place on land, a Right of Entry (ROE) or easement will not be required to accomplish this task. Detailed real estate descriptions and information on Lands Easements Rights of way, Relocation and Disposal (LERRD) is provided in **Appendix E- Real Estate Plan** of this report.

5.2.4 Local Betterments

Northwestern Michigan College has not requested any betterment to the project.

5.2.5 Operations, Maintenance and Replacement Considerations

Operations, Maintenance and Replacement costs are expected to be minimal since the recommended structure is composed of steel sheet pile and a concrete cap. The concrete cap may require some minor repair due to exposure to the freeze thaw cycle. The College is not expected to need to dredge during the 50 year life of the project.

5.3 Environmental Requirements

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies, including the Corps, to assess the potential environmental impacts of proposed Federal actions. Typically an Environmental Assessment (EA) document is prepared to determine whether the Federal action may have significant adverse impacts on the quality of the human environment. Environmental consequences are evaluated for fish and wildlife, endangered species, wetlands, water quality, floodplains, cultural resources, recreation, noise, aesthetics, air quality, cumulative impacts, etc.

Environmental review of the proposed action has indicated that no significant cumulative or long-term adverse environmental impacts would be expected as a result of the proposed project activities. The proposed project would improve navigation at the NMC harbor, increasing the basin size and reducing wave damage and shoaling.

The proposed action has been reviewed pursuant to the following Acts and Executive Orders: National Environmental Policy Act of 1969; Fish and Wildlife Act of 1956; Fish and Wildlife Coordination Act of 1958; National Historic Preservation Act of 1966; Clean Air Act of 1970; Executive Order 11593, Protection and Enhancement of the Cultural Environment, May 1971; Coastal Zone Management Act of 1972; Endangered Species Act of 1973; Water Resources Development Act of 1976; Clean Water Act of 1977; May 1977; Executive Order 11990, Wetland Protection, May 1977; Rivers & Harbors Act of 1899 and the Farmland Protection Policy Act (Subtitle I of Title XV of

the Agriculture and Food Act of 1981). The proposed project has been found to be in compliance with the above Acts and Executive Orders.

The general objective of EO 11988, Floodplain Management, is to avoid, to the maximum extent possible, long and short-term adverse impacts associated with the occupation and modification of the base floodplain whenever there is a practical alternative to such an action. The harbor improvement and dredged material placement areas are located outside of the 100-year floodplain. Thus, this project would be consistent with the EO.

Pursuant to the Clean Water Act, a Section 404(b)(1) Evaluation of the environmental effects of the discharge of fill material into waters of the United States has been prepared (Appendix B) for the breakwater construction and dredging/placement activities and concludes that the proposed action is in compliance with the Clean Water Act. The COE has concluded that the proposed work is consistent with Michigan's Federally approved Coastal Management Program and state water quality standards.

The Environmental Assessment will be made available to the public for a 30-day review period. Following this period and a review of the comments received, a final determination will be made by the District Engineer regarding the necessity of preparing an Environmental Impact Statement (EIS) for a Small Navigation Project at NMC, Grand Traverse Bay, Michigan.

Based on the conclusions of the Environmental Assessment, it appears that preparation of an EIS will not be required. Therefore, a Preliminary Finding of No Significant Impact (FONSI) is included with this Environmental Assessment (Appendix C). If the District Engineer determines that an EIS is not necessary, the Preliminary FONSI would be finalized and the project implemented. **The EA for the Northwestern Michigan College Section 107 navigation improvement project is attached to this DPR.**

5.4 Implementation Requirements

5.4.1 Institutional Requirements

The implementation schedule assumes that the Corps is authorized to carry out the project as indicated in the Water Resources Development Act of 2007. The estimated schedule for project implementation is shown in the following table:

Table 7 - Implementation Schedule

Task	Date
Execute PPA	September 2011
Complete Plans and Specifications	November 2011
Acquire Real Estate	November 2011
Contract RTA	January 2011
Contract Award	February 2012

5.4.2 Credit Provisions

Section 1004(b)(1) of WRDA 2007 directs the Secretary to afford credit toward the non-Federal share of the cost of the project for work (construction and design required for such construction) carried out by the non-Federal interest of the project before the date of the project partnership agreement (PPA). The guidance and procedures contained in Engineering Circular No. 1165-2-208, In-Kind Contribution Provisions of Section 221, dated 6 June 2008, will be used to determine eligibility of the credit for such work (construction and design required for such construction). At this time it does not appear that credit will apply to the proposed project.

5.4.3 Cost Apportionment

The cost apportionment for projects implemented under Section 107 is determined according to usage of the harbor. For recreational projects, the non-Federal cost share is 50 percent of the construction cost. For commercial projects, the non-Federal cost share of the General Navigation Features varies depending upon the harbor depth, and can be as low as 20 percent (total) if the harbor is classified as a shallow draft (i.e. less than 20' depth) commercial harbor. The NMC harbor is considered a commercial harbor because of its governmental vessel traffic and training/research mission. Further, the harbor offers no facilities for recreational vessels other than emergency refuge. Because the NMC harbor has a project depth of 16 feet, the total cost-share of the General Navigation Features is 80% Federal and 20% non-Federal. It is noted that the non-Federal sponsor is required to contribute 10% of total costs of the General Navigation Features prior to final design and construction, with the remaining 10% to be provided upon completion of final accounting for the period of design and construction. For simplicity, this total 20% cost-share is referenced throughout and reflected in Table 8 below.

Per USACE policy, some harbor features or portions of construction are considered Local Service Facilities, the costs of which are solely the responsibility of the non-Federal sponsor. Since mooring facilities are typically not eligible for cost sharing as part of Federal Section 107 projects, they are considered to be Local Service Facilities. For this project, mooring facilities are considered to include the bollards to which vessels would be tied and the anchor blocks that support these bollards. In addition, the dredging required where vessels would be moored (i.e. the "berthing area" within 45 feet of the breakwaters) is considered a non-Federal cost. The cost of providing these Local Service Facilities within the context of this project has been calculated and is identified in Table 8 below. For the NMC Harbor project, additional features such as electrical service (i.e. shore power), light fixtures on the new breakwater, etc. have not been included in the project design, but may be added by the college at a later date. Exclusion of such project features was coordinated with the non-Federal sponsor in an effort to simplify the cost-sharing aspects of the project and in the associated Project Partnership Agreement.

All remaining aspects of the project are considered to be General Navigation Features. These include dredging not associated with berthing areas, the steel sheet piling (SSP), concrete cap and fill material inherent with the structural design of the breakwater, and the safety features that reflect normal breakwater design for Lake Michigan projects. All General Navigation Features are subject to the 80/20 (Federal/non-Federal) cost share for commercial harbors. Table 8 contains the expected cost apportionment and total cost for the recommended alternative. Final costs will depend upon bids received for construction. Apportionment of these costs may vary from what is described here as the result of higher level review of the proposed plan. Additional cost information can be found in the back of **Appendix C – Cost Appendix**.

Table 8 - Cost Apportionment Table FY11 dollars

	Federal Cost	**Non-Federal Cost**	**Total Cost**
Feasibility Phase[1]	$225,000	$125,000	$350,000
Design & Implementation Phase[2]			
General Navigation Features[3]	$1,705,222	$426,306	$2,131,528
Local Service Facilities[4]	-	$67,136	$67,136
LERRDs Costs[5]	-	$9,582	$9,582
Subtotal	$1,930,222	$628,024	
TOTAL PROJECT COST			**$2,558,246**[6]

[1] First $100,000 of Feasibility Phase is fully Federal, remainder is cost shared 50% Federal, 50% non-Federal .

[2] Design and Implementation Phase costs include both the General Navigation Features (subject to cost-sharing)
and Local Service Facilities (provided at 100% non-Federal expense).

[3] General Navigation Features for this project are cost shared 80% Federal, 20% non-Federal.

[4] Local Service Facilities for this project include bollards, anchor blocks, and dredging the proposed berthing areas.

[5] LERRDS for this project are estimated at $9,582. This is credited to the local sponsor for cost sharing purposes.

[6] Does not include O&M costs, which are estimated at $8,006 annually.

.

5.4.4 Views of Non-Federal Sponsor and Others

Northwestern Michigan College has expressed the desire for implementing the project and sponsoring project construction in accordance with the items of local cooperation that are set forth in the recommendations section of this report. The financial analysis indicates that the non-Federal sponsor is financially capable of participating in the selected plan.

6.0 Summary of Coordination, Public Views and Comments

6.0.1 Public Involvement Program

The College and the general public have a very good relationship. It provides jobs to the community and the student population, and is a source of economic benefit in addition to its thriving tourist industry. The College has allowed the public to access the existing breakwater structure. People can be seen fishing from the pier. It is expected that the same level of access will be granted upon completion of the Federal structure. The College and its graduates are seen as a valuable resource to the Lake Carriers Association (LCA) and throughout the Great Lakes shipping industry.

6.0.2 Institutional Involvement/Study Team

During the feasibility study, staff from Northwestern Michigan College participated as members of the study team. They participated directly in the study effort and on the Executive Committee. This involvement has led to support for the implementation of Alternative 1, the double steel sheet pile wall plan.

6.0.3 Additional Required Coordination

The draft Detail Project Report and the Environmental Assessment was released to the general public for review. The duration of the review will be 30 days in accordance with NEPA policy.

6.0.4 Report Recipients

The following Federal, State, County, local and regional agencies, environmental organizations, and interested groups and individuals will receive notice of the availability of this document:

- Michigan Department of Natural Resources
- Michigan Department of Environmental Quality
- State Historic Preservation Office
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Traverse City, Michigan
- Grand Traverse County

7.0 Recommendation

Implementation guidance dated August 14, 2008 for Sections 1007(a)(18) and 1004(b)(1) of the Water Resources Development Act of 2007 states that the Secretary is to conduct a study of a project for navigation at Traverse City, Michigan. Furthermore the Secretary is directed to focus on the Locally Preferred Plan (LPP). The LPP must be engineeringly feasible, environmentally sound, economically justified and reasonably maximize National Economic Development benefits. The LPP must demonstrate that the benefits of the project exceed the cost in accordance with Section 107 of the Rivers and Harbors Act of 1960, as amended.

Based on the findings of this Detailed Project Report, it is recommended that Alternative 1 also known as the LPP be approved for implementation under Section 107 of the Rivers and Harbors Act of 1960 and Sections 1007(a)(18) and 1004(b)(1) of the Water Resources Development Act of 2007. This detailed project report indicates that the LPP is engineeringly feasible, environmentally sound and its benefits exceed its cost in accordance with the aforementioned guidance.

The estimated first cost of the recommended plan is $2,558,246 and the estimated annual OMRR&R cost is $8,006. The Federal portion of the estimated first cost is $1,930,222. The final BCR and net benefits for the recommended alternative, adjusted for the risk-based contingency rate, are: 1.06 and $7,039.

The recommendation contained herein reflects the information available at the time of this report and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Michael C. Derosier
Lieutenant Colonel, U.S. Army
District Engineer

APPENDIX A

ENGINEERING APPENDIX FOR FEASIBILITY PHASE

for

NORTHWESTERN MICHIGAN COLLEGE SECTION 107

TRAVERSE CITY, MICHIGAN

prepared by the

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT

1. GENERAL INFORMATION:

1.1 Introduction: The purpose of this report is to present alternatives for breakwater construction at the Great Lakes Maritime Academy Harbor. This report will be a part of the engineering appendix to the feasibility study being prepared by Planning Division.

1.2 Background: The project site is on Northwestern Michigan College's campus located in Traverse City, MI on the southern shore of the west arm of Grand Traverse Bay (Plate 1). Northwestern Michigan College has already completed renovations to the northern, western, and southern walls of the harbor (Phase 1). Renovations are being made to increase the usable harbor area and to reduce the amount of shoaling in the harbor and subsequent dredging. Northwestern Michigan College has applied for assistance from the Corps of Engineers under Section 107 of the Rivers and Harbors Act to construct a new eastern wall.

2. ALTERNATIVES: All alternatives would include removal of an existing rubblemound and timber crib, dredging of the harbor, and construction of a new eastern wall approximately 280 feet long. Four alternatives were considered for the east wall construction, although two were dismissed as being cost prohibitive. Design calculations for the two alternatives considered can be found in Section C. The new east wall will be used for mooring vessels and possible pedestrian traffic as it is open to the public.

2.1 Alternative 1 – Dredging and Double Steel Sheet Pile (SSP) Wall: This alternative would consist of two parallel SSP walls with a concrete cap and scour stone at the toe. Concrete anchor blocks would be placed to resist mooring loads. See Plates 2 and 3 for Alternative 1 plan and cross section, respectively.

2.2 Alternative 2 – Dredging and Circular Cell SSP Wall: This alternative would include the removal of the existing wooden crib breakwater and the construction of a 285 foot circular steel sheet pile wall and dredging. A floating dock would be included for mooring capabilities.

2.3 Alternative 3 – Dredging and Rubblemound: This alternative would consist of constructing a 280-foot long rubblemound breakwater and dredge material for the harbor. There would be no mooring capabilities.

2.4 Alternative 4 – Dredging and Single SSP Wall with Concrete Walkway Supported by H-piles: This alternative would consist of a concrete cap supported by an SSP wall on the harbor side and steel h-piles on the lake side. Scour stone would provide scour protection at the toe of the SSP on the harbor side. Riprap would be placed under the concrete cap to prevent ice buildup and as an added benefit would reduce wave action at the beach just east of the harbor. Concrete anchor blocks would be needed for anchoring of mooring bollards. See Plates 4 and 5 for Alternative 4 plan and cross section, respectively.

3. DESIGN

3.1 General: The top of the structure for all alternatives was taken as +7.0 low water datum (LWD) to match the height of the existing structures. The harbor dredge depth will be -16 LWD but the design dredge elevation will be -17 to account for a 1-foot dredge overdepth. Additionally both structures will have to accommodate mooring of vessels. All elevations in this report reference LWD 577.5 (IGLD 85) unless otherwise noted.

3.2 Survey Data: Survey data used in the design of both alternatives was obtained by Gourdie Fraser in 2008. A copy of the survey can be found in Section A.

3.3 Geotechnical Data: Three soil borings were taken along the line of the proposed structure in June 2009. Soil borings and a soil profile can be found in Section B.

3.4 Alternative 1 – Dredging and Double SSP Wall

3.4.1 SSP: The SSP was designed in accordance with USACE engineering manual EM 1110-2-2504, "Design of Sheet Pile Walls" and using USACE software program CWALSHT. Soil parameters used in the design were taken from the soil profile in Section B of this report. Water levels on both sides of the structure were assumed to be at 0.0 LWD. Mooring loads were assumed to be resisted by the anchor block therefore no horizontal load is transferred to the SSP. However the weight of the concrete will apply a surcharge to the SSP. Therefore, a strip load of 300 psf was applied to the structure to accommodate the 2-foot thick anchor blocks. To account for snow load or possible pedestrian traffic a loading of 60 psf was applied. This is the loading for walkways as listed in Table 1607.1 of the International Building Code. Using factors of safety of 1.0 for both the active and passive soil pressures it was determined that a PZ-22 section would be adequate. To determine the minimum embedment and anchor force the factor of safety for passive soil pressure was changed to 1.5. CWALSHT returned a minimum embedment elevation of 547.0 or -30.5 LWD and an anchor force of 5.7 kip/ft. Based on a 5.7 kip/ft anchor force the tie rods should be 1¾" - Grade 75 and the required wale is a double MC12x22.

3.4.2 Scour Stone: Scour stone was designed in accordance with USACE engineering manual, EM 1110-2-1100, "Coastal Engineering Manual". The scour stone was sized as toe stone based on data from a wave analysis prepared by Hydraulic Engineering Branch (HEB), Detroit District. The required stone size is 50 to 150 pounds. The scour apron should be 6 feet wide and 2 layers thick.

3.4.3 Concrete Cap: The concrete cap was designed in accordance with EM 1110-2-2104, "Strength Design for Reinforced-Concrete Hydraulic Structures". A concrete compressive strength of 4,000 psi and a steel yield stress of 60 ksi were assumed. The walkway slab will be designed as a structurally supported slab. A 12" thick reinforced concrete slab is required.

Concrete anchor blocks will be needed on the eastern breakwater for mooring vessels. The blocks should be 7.5' long x 5.5' wide and 2' thick. This size was based on a maximum allowable mooring load at 45° of 33.5 tons; the same maximum allowable mooring load as the

bollards used in Phase 1 of the harbor rehabilitation (cast steel bollards manufactured by J.C. Macelroy, item CSB-9 or equal).

3.5 Alternative 2 - Dredging and Circular Cell SSP Wall: The circular cell SSP wall would consist of circular cells constructed of steel sheet pile, assumed to be 35 feet in diameter, and connected by steel sheet pile diaphragms. It was assumed that the required tip elevation would be approximately –28.0. The SSP section and diameter were assumed based on other projects with similar soil conditions. The stone from the existing breakwater would be used in the base of the cells. To accommodate docking needs of the Maritime Academy, a floating dock with the required pile guides would be placed adjacent to the circular cell structure. The sizes of the floating dock and pile guides were assumed based on past projects, as was the pile guide tip elevation of –30.0. This alternative would require more SSP and a larger lake bottom footprint than Alternatives 1 and 4. It was therefore, deemed cost prohibitive and was not developed any further.

3.6 Alternative 3 - Dredging and Rubblemound: The rubblemound would be constructed out of large toe stone and core stone. Stone from the existing breakwater would be used in the construction of the rubblemound. The rubblemound would protect the harbor from wave action and reduce shoaling. It would not have any mooring capability and is likely to reduce the capacity of the harbor because it requires a large footprint so it was not developed further.

3.7 Alternative 4 – Dredging and Single Sheet Pile Wall with Concrete Cap Supported by H-piles

3.5.1 SSP Wall: The SSP was designed as a cantilevered wall in accordance with EM 1110-2-2504 and using CWALSHT. Soil parameters used can be found in the soil profile in Section B of this report. Water levels were again assumed to be at 0.0 LWD on both sides of the structure. Using a factor of safety of 1.0 for both the active and passive soil pressures it was determined that a PZ-27 section with a tip elevation of 543.0 or -34.5 LWD would be needed.

3.5.2 Scour Stone: Scour stone sizing and apron width and thickness are the same as for Alternative 1. It is needed on the harbor side only as the lake side will be protected by riprap.

3.5.3 Concrete Cap: The concrete cap was designed in accordance with EM 2104, “Strength Design for Reinforced - Concrete Hydraulic Structures”. A concrete compressive strength of 4,000 psi and a steel yield stress of 60 ksi were assumed. A 60 psf loading was applied to the concrete slab to account for snow load and possible pedestrian load. A 12” thick reinforced concrete slab is required.

Concrete anchor blocks for this alternative are also the same as those needed for Alternative 1.

3.5.4 H-Piles: H-piles were designed in accordance with USACE engineering manual, EM 1110-2-2903, “Design of Pile Foundations”. Per EM 2903, the factor of safety for pile capacity can vary from 2.0 to 3.0 depending on whether or not load capacity is verified by load tests. For projects with a large number of piles it is typically more cost effective to use a

lower factor of safety, and subsequently less required embedment, in conjunction with a pile load test. This project requires approximately 25 piles. Therefore, a factor of safety of 2.0 was used and a pile load test will be required. The required tip elevation is -29.5 LWD or 548.0 and the H-Pile section should be an HP 14x73.

3.5.5 Slab Support Beams and Tie Beams: Beams tying the SSP wall to the H-piles and beams tying the H-piles together were designed in accordance with USACE engineering manual, EM 1110-2-2105, "Design of Hydraulic Steel Structures". The beams were designed for a 15-foot span. For simplicity it was assumed that the concrete was 2-feet thick across the entire span of the beam. This results in a 300 psf loading on the steel beams. Assuming Grade 50 steel a W12x45 is required. The beams spanning between the H-piles could be slightly lighter because of the shorter span but to avoid confusion in the field a W12x45 will be required.

3.5.6 Riprap: Riprap stone was sized in accordance with USACE engineering manual, EM 1110-2-1100, "Coastal Engineering Manual" based on the wave analysis prepared by HEB. The armor stone should be 1,500 to 2,500 pounds with a minimum layer thickness of 5 feet. Underlayer/toe stone should be 100 to 300 pounds and minimum 2 feet thick. The bedding layer stone should be .5 to 10 pounds and minimum 4 inches thick.

4. CONSTRUCTION:

4.1 Site Access: The project site can be accessed via water or via permanent public road and NMC's parking lot**.** The work and storage area is to be located at the north end of NMC's parking lot as shown on the attached real estate plan on Plate 6. The work and storage area was sized to include storage of the SSP and miscellaneous steel. It was assumed all stone and fill materials would be stored on a barge.

4.2 Construction Method: It is anticipated that construction of the SSP wall will be marine based. Dredge material will be moved through a temporary, underwater pipeline to a State Designated High Erosion Area.

5. CONSTRUCTION COST ESTIMATE:

5.1 General: No real estate costs will be incurred due to dredging. Easements needed during construction include temporary access and temporary work and storage easements. Complete cost details can be found in the Cost Appendix – Appendix C.

5.2 Alternative 1 - Dredging and Double SSP Wall: The estimated construction cost for this alternative is $1.9 million.

5.3 Alternative 4 - Dredging and Single Sheet Pile Wall with Concrete Cap Supported by H-piles: The estimated construction cost for this alternative is $2.0 million.

5.4 Operations and Maintenance (O&M) Cost: Anticipated O&M costs include survey of scour stone every 2 to 3 years and replenishment of scour stone every 5 years. The estimated O&M cost for Alternative 1 is $7,650 and for Alternative 4 it's $8,000.

6. RECOMMENDED ALTERNATIVE: Alternative 1, dredging with a double steel sheet pile wall is the recommended alternative based on construction and O&M costs. Additionally, this alternative will be more aesthetically pleasing as it matches the existing wall construction and will allow for a larger harbor area.

APPENDIX - B
Analysis of CMS-Wave & CMS-Flow Model Results
Northwestern Michigan College (NMC) –
Maritime Academy Campus
Traverse City, MI
Steel Sheet Pile (SSP) Breakwater Project

Source: Google Earth

Prepared By:

US Army Corps of Engineers
Great Lakes Hydraulics & Hydrology Office
Detroit District

Table of Contents

1.0 Introduction 3

2.0 Data Description 5

2.1 Water Levels 5

2.2 Bathymetry 5

2.3 Waves 6

2.4 Aerial Photography 8

3.0 Computer Modeling 9

3.1 Software 9

3.2 Modeling Alternatives 10

4.0 CMS Modeling Results 11

4.1 CMS-Wave Modeling Scenarios 11

4.2 CMS-Flow Analysis 20

5.0 Conclusion and Recommendations 29

5.1 CMS-WAVE 29

5.2 CMS-FLOW 30

1.0 Introduction

As part of the study to redesign the entrance breakwater of the Northwest Michigan College harbor, in an effort to reduce shoaling in the harbor, the Great Lakes Hydraulics & Hydrology Office (H&H) conducted a wave analysis to help determine design parameters for the new structure. The NMC Maritime Academy Campus in Traverse City, MI has an excessive amount of sediment that is being deposited behind the existing SSP breakwater which requires short time intervals between dredging activities. In order to extend the time interval between dredging activities the USACE has proposed to install a new breakwater on the east end of the property with a 100' minimum turning radius between the new and existing breakwaters at the north end. Figure 1 shows the project location and approximate area of investigation with a Google Earth background image. Figure 2 shows a satellite image from Google Earth where the long-shore sediment movement can be seen moving, from east to west, around the existing structure and into the area behind the existing SSP breakwater; image date was June 1, 2005.

Figure 1 – Site Location Map

Grand Traverse Bay, Traverse City, MI

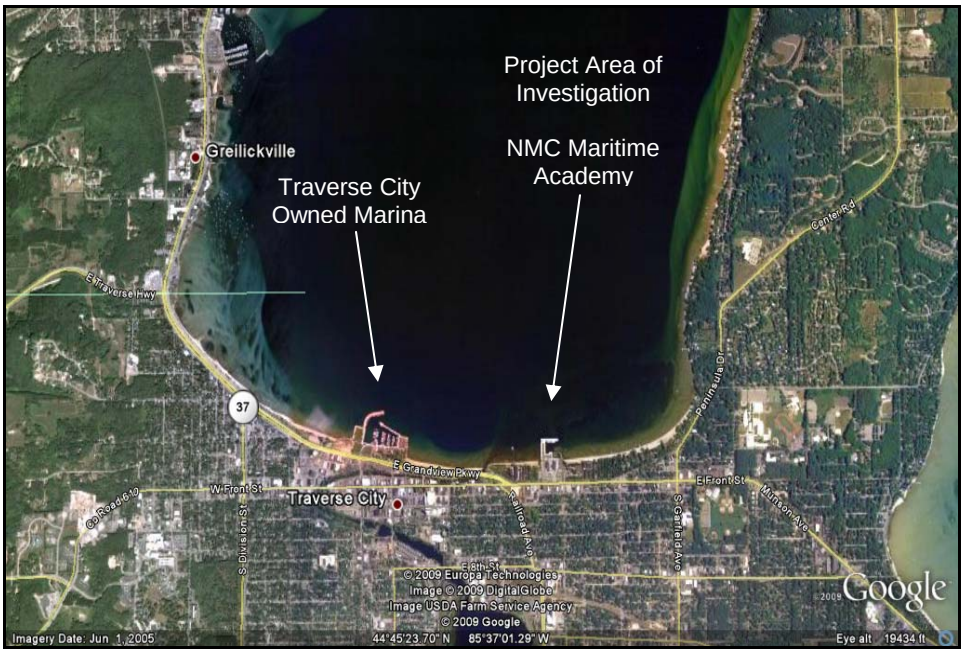


Figure 2 – Longshore Sediment Movement

2.0 Data Description

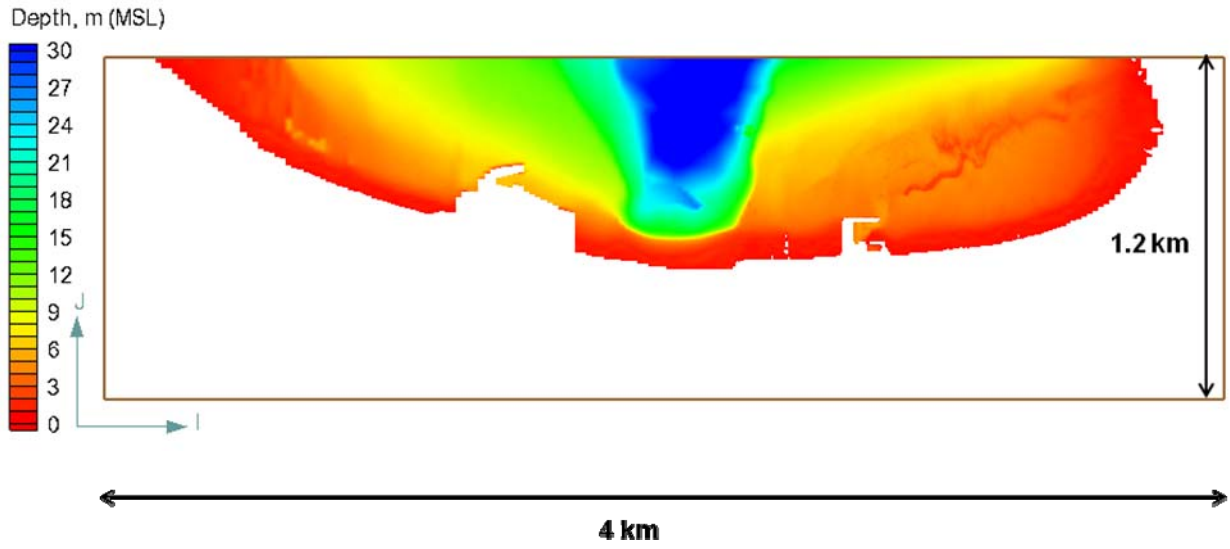
2.1 Water Levels

Because higher water levels can allow larger waves to enter the harbor, a 20-year return period water level (177.52 m, IGLD85) was used from the Design Water Level Determination on The Great Lakes report, 1993. This was thought to be a reasonable value considering water levels on Lake Michigan have historically ranged from 175.5 m to 177.5 m, IGLD85.

2.2 Bathymetry

On June 6, 2009, a hydrographic survey was conducted at the NMC harbor project site. The survey covered the entire inner harbor. Offshore bathymetry was added by digitizing a 1997 NOAA navigation chart. Points were added in critical areas, such as along model boundaries, using linear interpolation to insure that the waves were modeled correctly. All depths are referenced to the aforementioned 20 year return period water elevation. The model domain and nearshore bathymetry in meters is shown in Figure 3.

Figure 3 – Model Domain and Nearshore Bathymetry



2.3 Waves

Station 33 from the Wave Information Studies (WIS) Hindcast data was used for the wave analysis (Figure 4). The data represented a 42-year period from 1956 to 1997. The WIS station was located well offshore, representing deep water waves. STWAVE was used to bring waves from the WIS to the CMS domain boundary at a depth of 13 meters. After careful analysis it was determined that only one small wave band carried a measurable significant wave height into the project site area within Grand Traverse Bay. This was most likely caused by the narrowness and overall length of Grand Traverse Bay. A total of 6 different wave periods were analyzed in total, within an angle band of 266.75E and 269.5E, significant wave heights that varied from 0.717 m through 0.823 m, and a period range between 3 – 8 seconds. The wave climates that were analyzed can be seen in Table 1 below.

Figure 4 – WIS Station Location

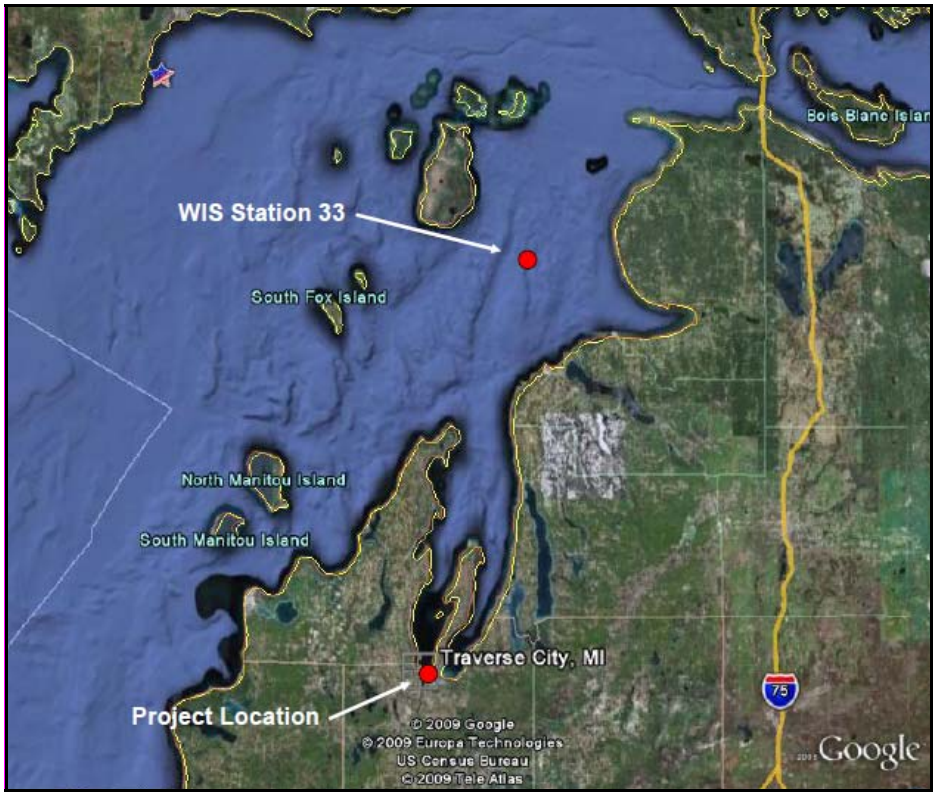


Table 1 – NMC Wave Climate Analysis

Index	Angle	Hs (m)	Tp (sec)	Gamma	nn	Depth (m)	Hours/Year
1	269.5	0.721	3	3	10	13	29.4
2	268.5	0.725	4	3	10	13	42.4
3	268.5	0.726	5	3	10	13	27.7
4	268.5	0.726	6	3	10	13	5.3
5	268.5	0.743	5	3	10	13	3
6	268	0.755	6	3	10	13	4.6
7	268	0.752	7	3	10	13	1.6
8	267.75	0.771	6	3	10	13	0
9	267.25	0.79	7	3	10	13	0.1
10	267.25	0.785	8	3	10	13	0
11	267.25	0.811	8	3	10	13	0
12	268.5	0.722	3	3	10	13	17.8
13	268.5	0.728	4	3	10	13	25.6
14	268.5	0.726	5	3	10	13	16.7
15	268.5	0.724	6	3	10	13	3.2
16	268.5	0.744	5	3	10	13	1.5
17	268.5	0.747	6	3	10	13	2.3
18	268.5	0.737	7	3	10	13	0.8
19	268	0.767	6	3	10	13	0
20	268	0.768	7	3	10	13	0.1
21	267.75	0.762	8	3	10	13	0
22	268.5	0.722	8	3	10	13	0
23	268.5	0.728	3	3	10	13	9.6
24	268.5	0.728	4	3	10	13	13.9
25	268.5	0.727	5	3	10	13	9.1
26	268.5	0.747	6	3	10	13	1.8
27	268	0.76	5	3	10	13	0.7
28	268	0.754	6	3	10	13	1
29	267.5	0.78	7	3	10	13	0.4
30	267.25	0.795	6	3	10	13	0
31	267.25	0.79	7	3	10	13	0
32	266.75	0.823	8	3	10	13	0
33	268.5	0.721	3	3	10	13	6.5
34	268.5	0.721	4	3	10	13	9.4
35	268.5	0.722	5	3	10	13	6.1

Table 1 (Continued) – NMC Wave Climate Analysis

Index	Angle	Hs (m)	Tp (sec)	Gamma	nn	Depth (m)	Hours/Year
36	268.5	0.723	6	3	10	13	1.2
37	268.5	0.734	5	3	10	13	1.4
38	268.5	0.741	6	3	10	13	2.1
39	268.5	0.736	7	3	10	13	0.7
40	268	0.752	6	3	10	13	0
41	267.75	0.76	7	3	10	13	0.1
42	268	0.757	8	3	10	13	0
43	267.75	0.774	3	3	10	13	18.7
44	268.5	0.721	4	3	10	13	26.9
45	268.5	0.717	5	3	10	13	17.6
46	268.5	0.719	6	3	10	13	3.4
47	268.5	0.72	5	3	10	13	3.2
48	268.5	0.725	6	3	10	13	4.9
49	268.5	0.729	7	3	10	13	1.7
50	268.5	0.722	6	3	10	13	0
51	268.5	0.735	7	3	10	13	0.2
52	268.5	0.732	8	3	10	13	0
53	268.5	0.731	8	3	10	13	0

2.4 Aerial Photography

The most recent aerial photography was used to construct the computer model. This consisted of a 2005 aerial photograph. The photo was geo-referenced to a UTM Zone 16, NAD 1983 coordinate system using ArcGIS software.

3.0 Computer Modeling

3.1 CMS Software

CMS-Wave is part of the Coastal Modeling System (CMS). CMS-Wave is a 2-D wave spectral transformation, phase-averaged wave, modeling software program developed by the USACE Engineering Research and Development Center in Vicksburg, Mississippi. The CMS-Wave model uses "phase-averaged", which means that it neglects changes in the wave phase in calculating wave and other near-shore processes. The program represents reflection, diffraction, wave breaking, dissipation, wave-current interaction and refraction processes within the near-shore zone and was originally designed to reliably represent the wave processes that affect operation and maintenance of various coastal inlet structures used in navigation. CMS-Wave also includes a wave run-up calculation which uses both wave setup and maximum vertical swash.

CMS-Flow is also part of the CMS. CMS-Flow was originally developed as M2D, until in 2007 it was added into the CMS suite and updated. CMS-Flow is a finite-volume numerical model that includes the capabilities to compute hydrodynamics, sediment transport (bedload, suspended load, and total load) and morphology change.

CMS uses the Surface-water Modeling Software (SMS) graphical user interface which includes a variety of tools for creating input files, meshes, grids, running models as well as post-processing capabilities that allow for user friendly viewing and analysis of results. SMS is used with a variety of coastal engineering design and analysis programs for a graphical interface.

The sediment transport and morphology changes for the NMC site were determined from the CMS-Flow model that was set up for the site. The significant wave height was obtained using the CMS-Flow model that was assembled by H&H LRE and ERDC for the

sediment balance model that was needed for the initial investigation at the NMC docking facility. CMS-Wave is able to use the CMS-Flow inputs that were already in the model to run the results to determine the wave heights within the study area. CMS-Wave was formerly known as WABED (Wave-Action Balance Equation Diffraction). Wave run-up was not included in this model analysis; it was initially investigated and found to be minimal with small resultant wave heights in the Grand Traverse Bay. The program can also be run in "stand-alone" DOS mode with results that have to be interpreted compared to using in conjunction with the SMS interface. The DOS based results will not yield any graphs or charts for visual data result representation, unless they are opened up and analyzed in SMS. The CMS-Wave DOS based program was run one time in DOS mode to confirm that the program results were the same in SMS and DOS modes.

3.2 Modeling Alternatives

The CMS-Wave and CMS-Flow models were run with the same six different input waves. Within each of the six input wave conditions there are 9 separate wave time steps, every three hours, within the CMS-Wave model. The time steps are every three hours for a total time period of twenty-four hours is the expected amount of time to allow convergence of the resultant wave heights.

4.0 CMS Modeling Results

4.1 CMS-Wave Modeling Scenarios

Table 2 below features the average wave height along both an east-west monitoring station transect and a north-south monitoring station transect. Figure 5 shows the east-west monitoring station cells that were used for an average wave height highlighted. Figure 6 shows the north-south monitoring station cells that were used for an average wave height highlighted. Table 2 also features two columns for the existing 6 wave models and the proposed 6 wave models that were run for maximum wave height at the location of the new SSP breakwater. The maximum wave height from CMS-Wave was 1.556 meters for Wave #1 – Time Step 24:00 – Period of 7.69 seconds – Direction of 270°.

Table 2 – CMS-Wave Resultant Wave Heights

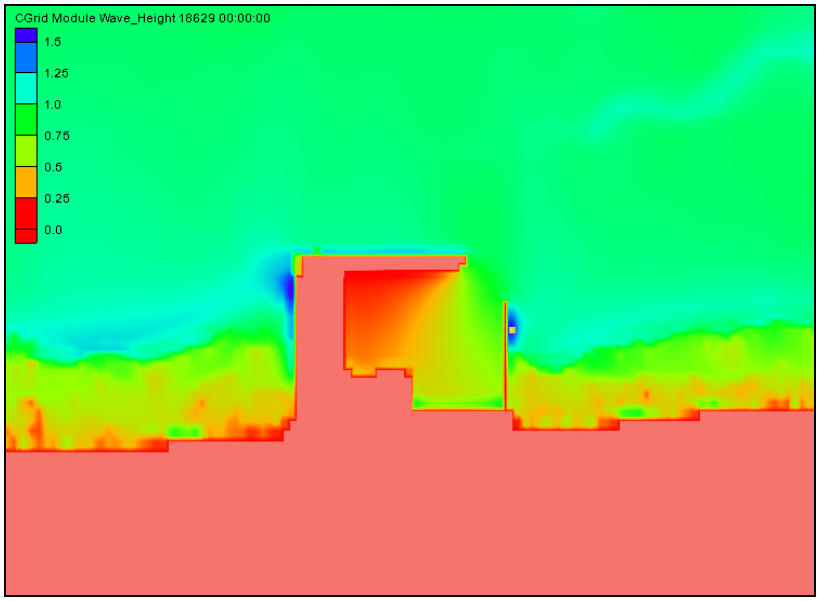
Wave	Average wave height along monitoring station transect from East-West (meters)	Average wave height along monitoring station transect from North-South (meters)	Maximum wave height at new breakwater (meters)	Cell # on new breakwater from the top
Wave 1	0.9452	0.8831	1.556	5th
Wave 2	0.8609	0.8331	1.533	5th
Wave 3	0.8061	0.8048	1.441	5th
Wave 4	0.7072	0.7281	1.309	5th
Wave 5	0.6702	0.6847	1.280	6th
Wave 6	0.6841	0.6736	1.241	6th

Figure 5 - East-West Monitoring Station Cells

Figure 6 - North-South Monitoring Station Cells

Figure 7 shows the maximum cell (yellow highlighted cell on east side of proposed breakwater) for Wave #1 for the proposed model runs where the maximum wave height is located. The maximum wave height from CMS-Wave at the location of the new SSP breakwater was located at either the fifth or the sixth cell down from the north end of the new structure; this can be seen in the last column of Table 2.

Figure 7 – Maximum Wave Height Location for Wave #1 for Proposed Breakwater (meters)



The harbor interior wave heights have also been compared between the existing harbor configuration and the proposed harbor configuration. Figure 8 below shows the current harbor configuration and Figure 9 shows the proposed configuration that was compared and that will be discussed in further detail. The average wave height over the entire area shown highlighted in Figure 8 is 0.25 meters and the average wave height for the entire area shown highlighted in Figure 9 is 0.29 meters. There will be an average wave height increase between the existing harbor configuration and the proposed harbor configuration for Wave #1, but it is minimal. The reason for the increase inside of the harbor is that the interior stone revetment will be removed and the waves can propagate to the shoreline revetment. Figures 10-19 show the comparison of Wave #2 to Wave #6.

Figure 8 – Wave 1 - Existing Harbor Configuration Interior Area Wave Heights

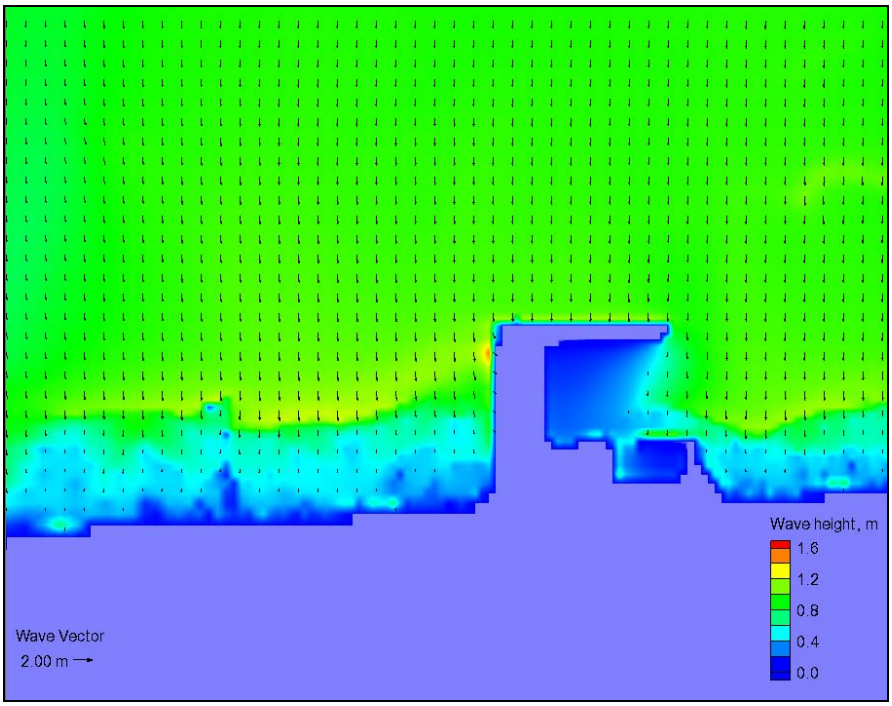


Figure 9 – Wave 1 - Proposed Harbor Configuration Interior Area Wave Heights

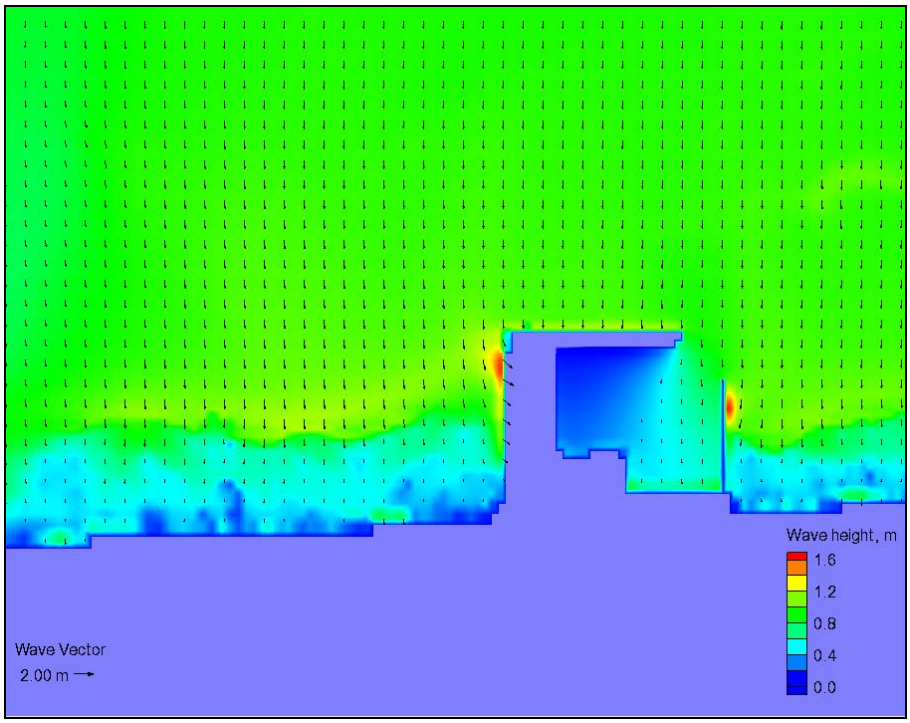


Figure 10 – Wave 2 - Existing Harbor Configuration Interior Area Wave Heights

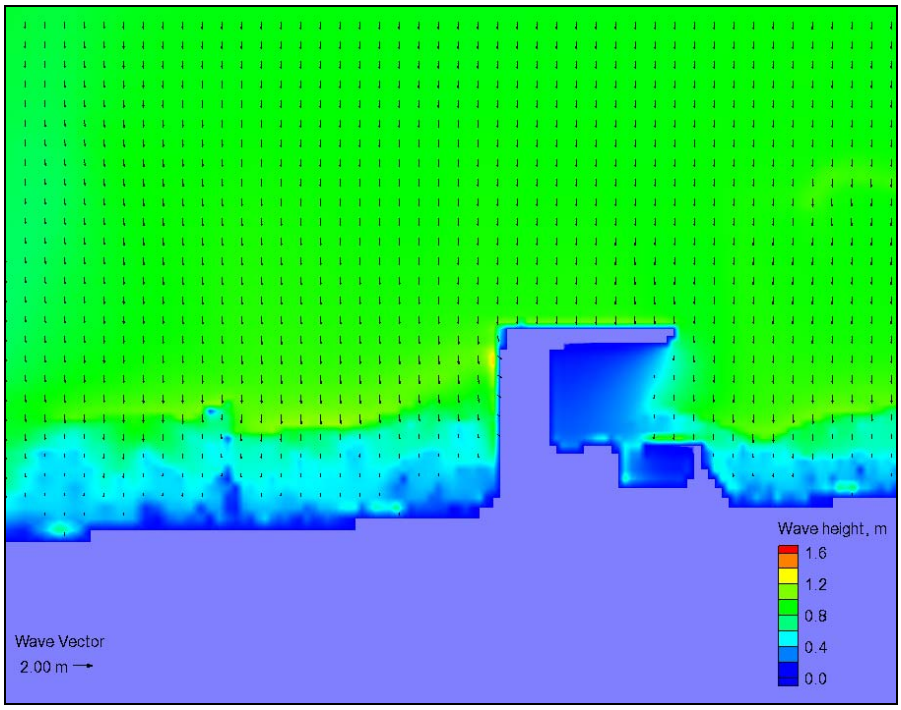


Figure 11 – Wave 2 - Proposed Harbor Configuration Interior Area Wave Heights

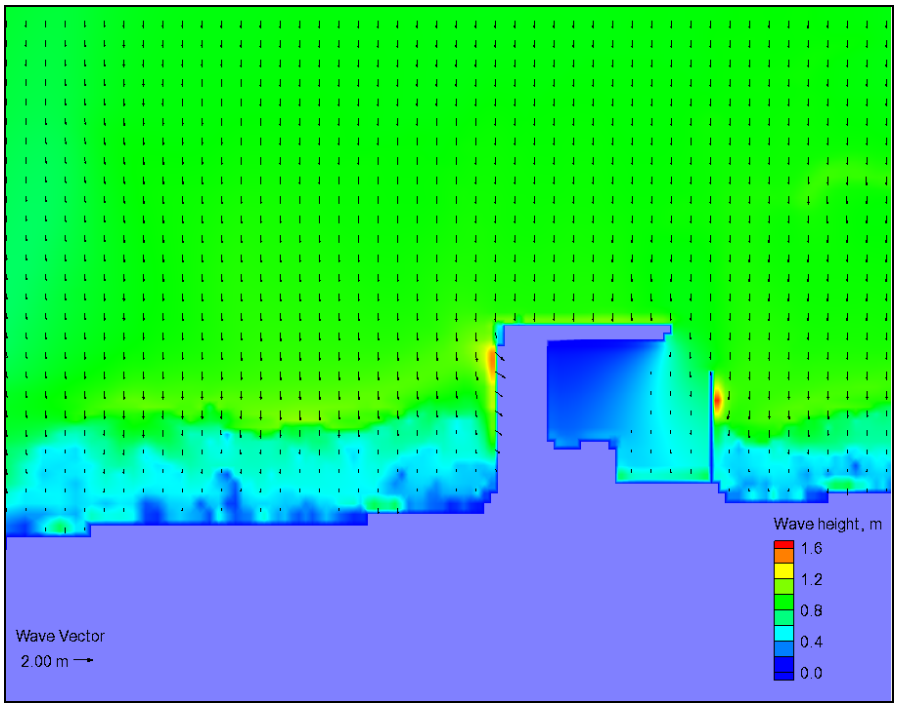


Figure 12 – Wave 3 - Existing Harbor Configuration Interior Area Wave Heights

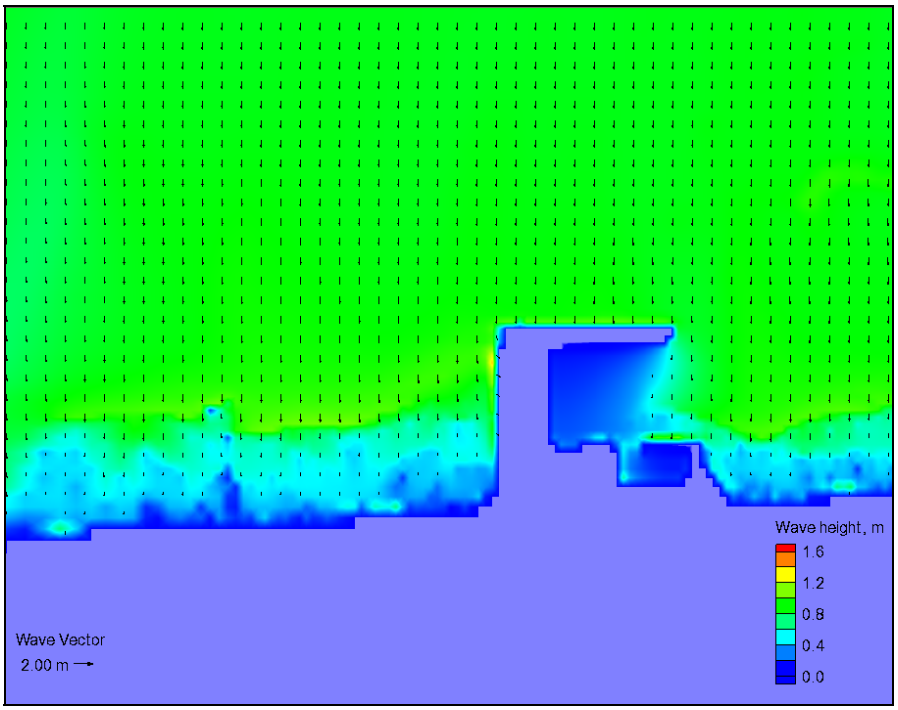


Figure 13 – Wave 3 - Proposed Harbor Configuration Interior Area Wave Heights

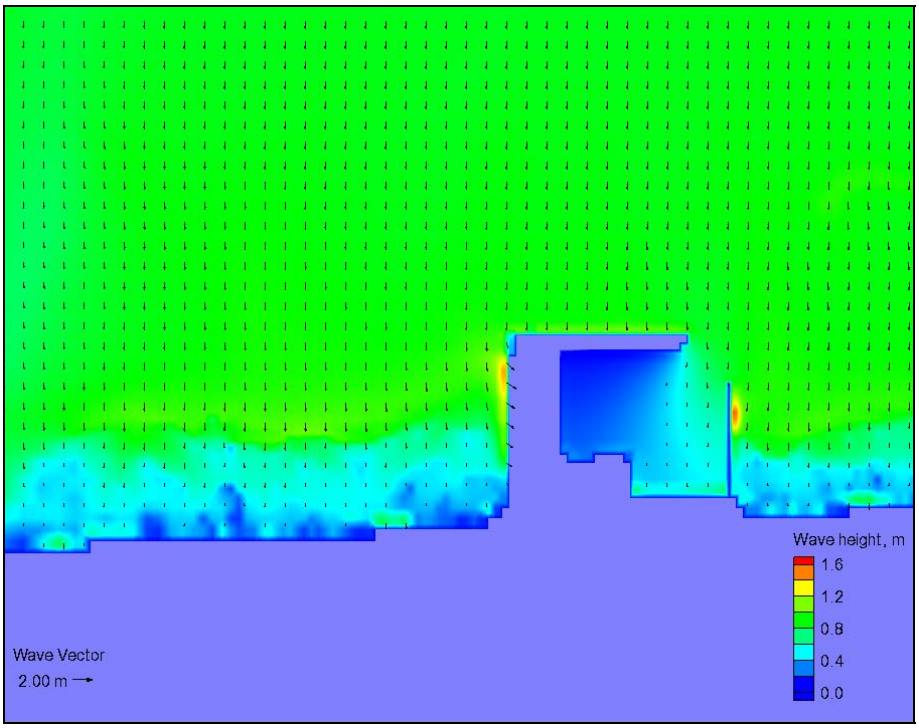


Figure 14 – Wave 4 - Existing Harbor Configuration Interior Area Wave Heights

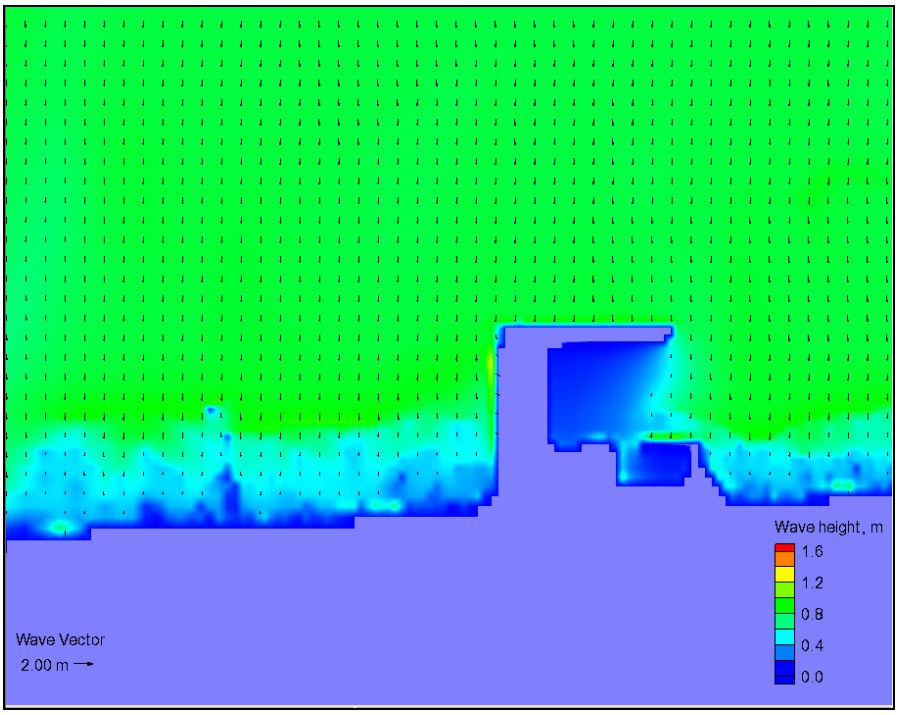


Figure 15 – Wave 4 – Proposed Harbor Configuration Interior Area Wave Heights

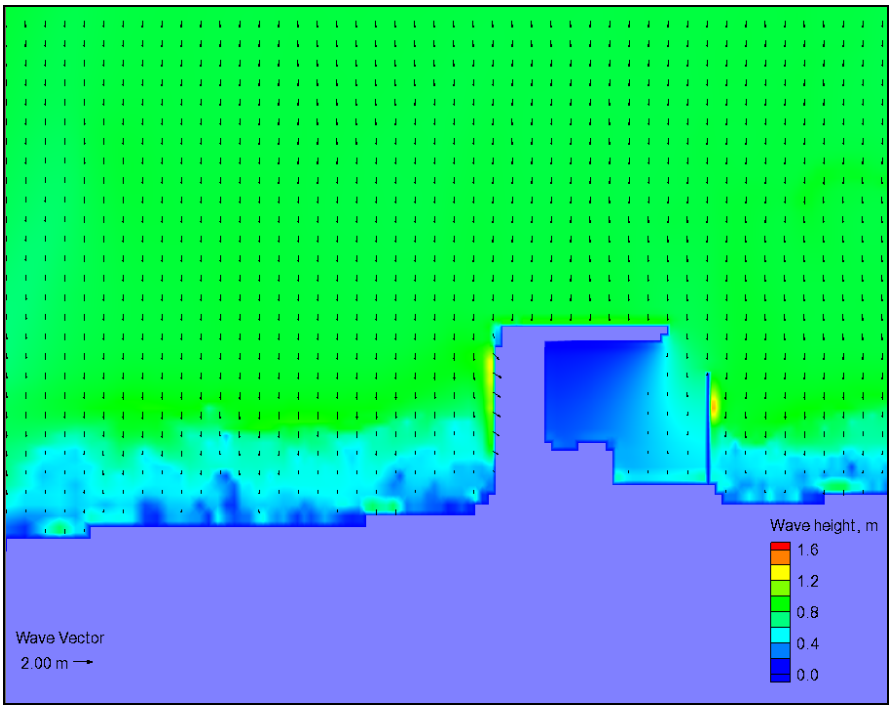


Figure 16 – Wave 5 - Existing Harbor Configuration Interior Area Wave Heights

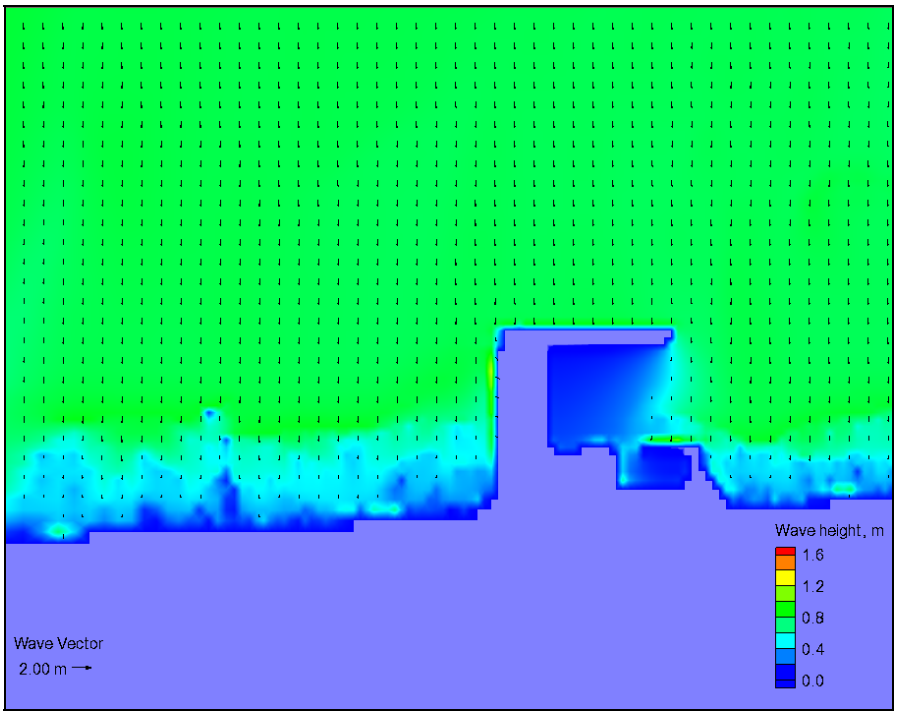


Figure 17 – Wave 5 - Proposed Harbor Configuration Interior Area Wave Heights

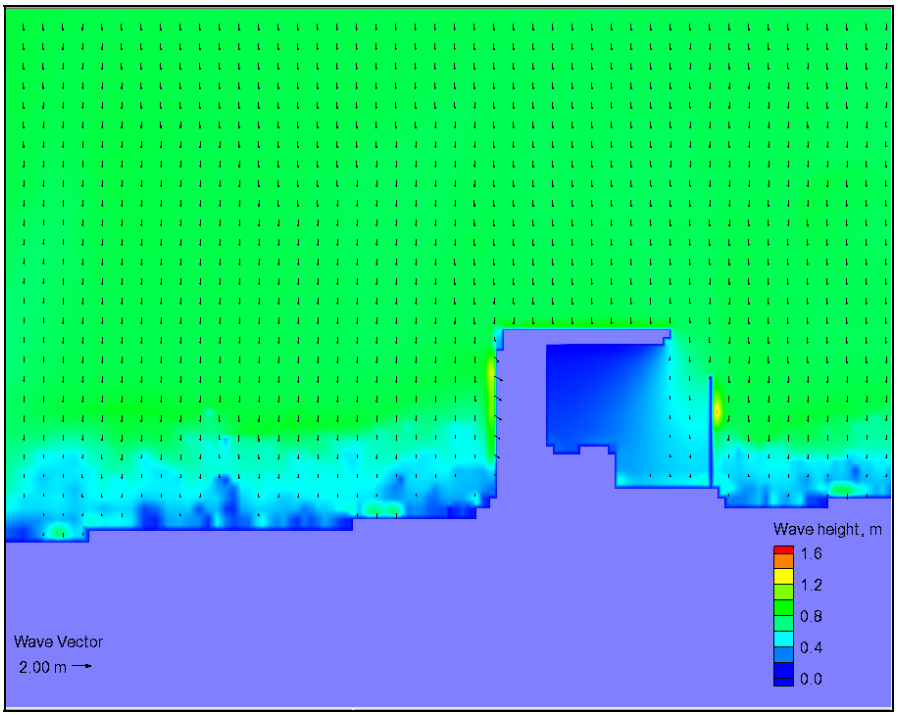


Figure 18 – Wave 6 - Existing Harbor Configuration Interior Area Wave Heights

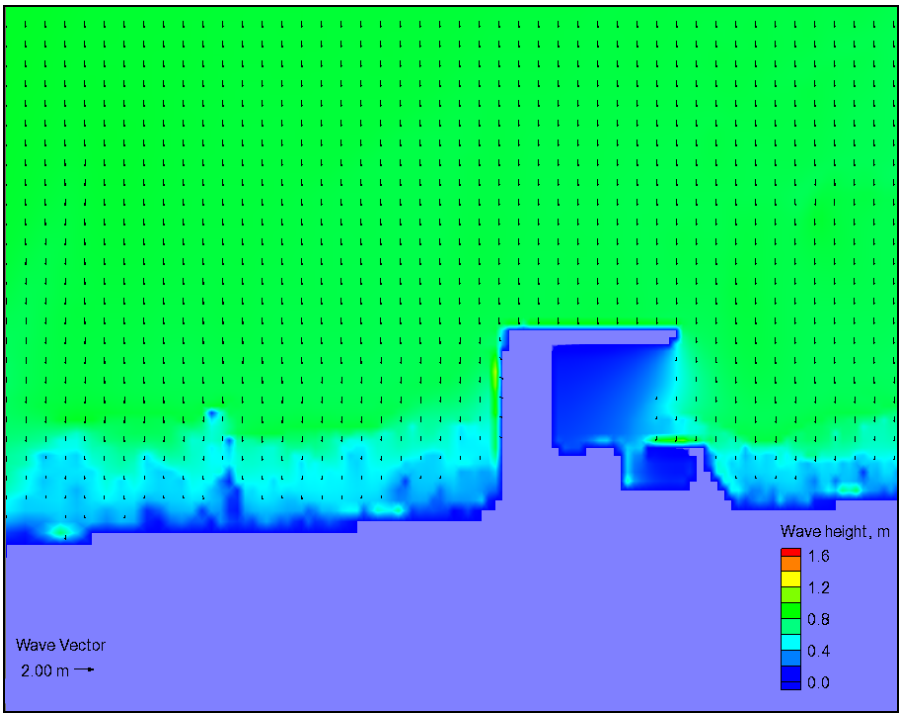
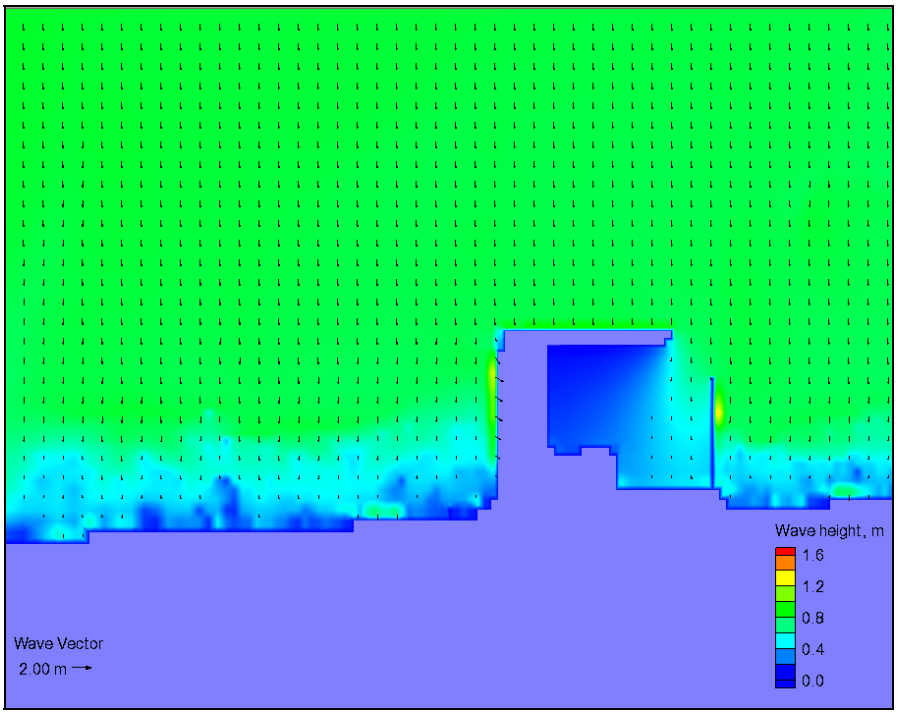


Figure 19 –Wave 6 - Proposed Harbor Configuration Interior Area Wave Heights



4.2 CMS-Flow Analysis

A CMS-Flow analysis was performed on the NMC project site in order to determine the possible outcomes of shoaling within and around the marina. A CMS-Flow model was setup and run both as the existing harbor configuration and with the proposed breakwater structure configuration. Figure 20 to Figure 31 go through the six different wave scenarios that were run for the project in order to compare the existing and proposed scenarios. Figures 20-31 show the CMS-Flow results with the blue color shading being erosion, and the yellow/red shading being accretion. The CMS-Flow models were run as a 48 hour simulation, with the first 24 hours used to ramp the model up and then the second 24 hours being run at full strength. Figure 20 is the existing harbor configuration CMS-Flow model and Figure 21 is the proposed harbor configuration CMS-Model with both being steered by Wave #1, which is a 0.823 meter wave with an 8 second period.

Figure 20 – CMS-Flow Morphology Change Wave #1 Existing Conditions Results (meters)

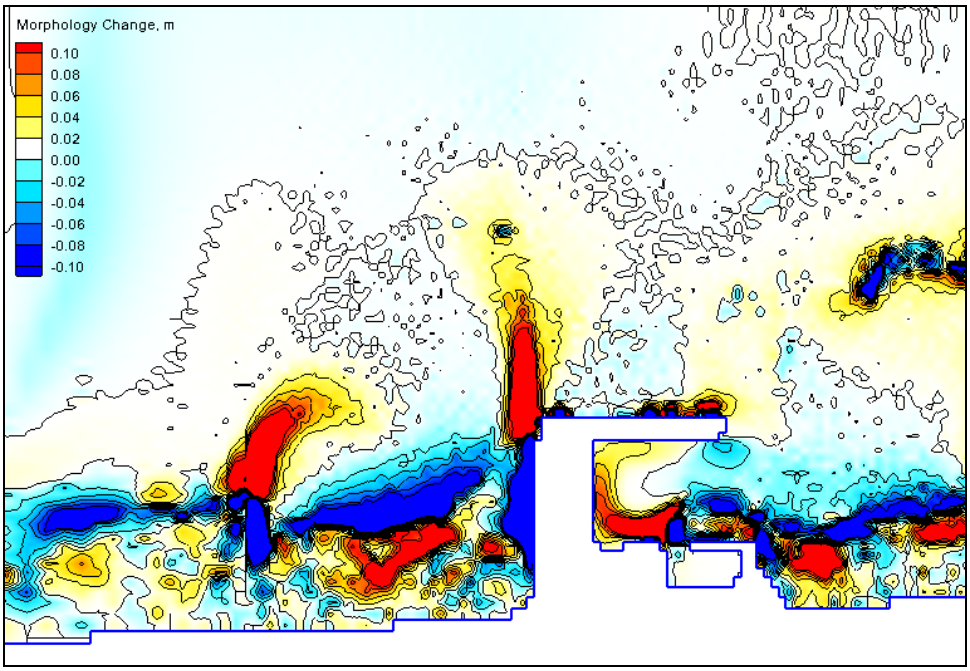


Figure 21 – CMS-Flow Morphology Change Wave #1 Proposed Conditions Results (meters)

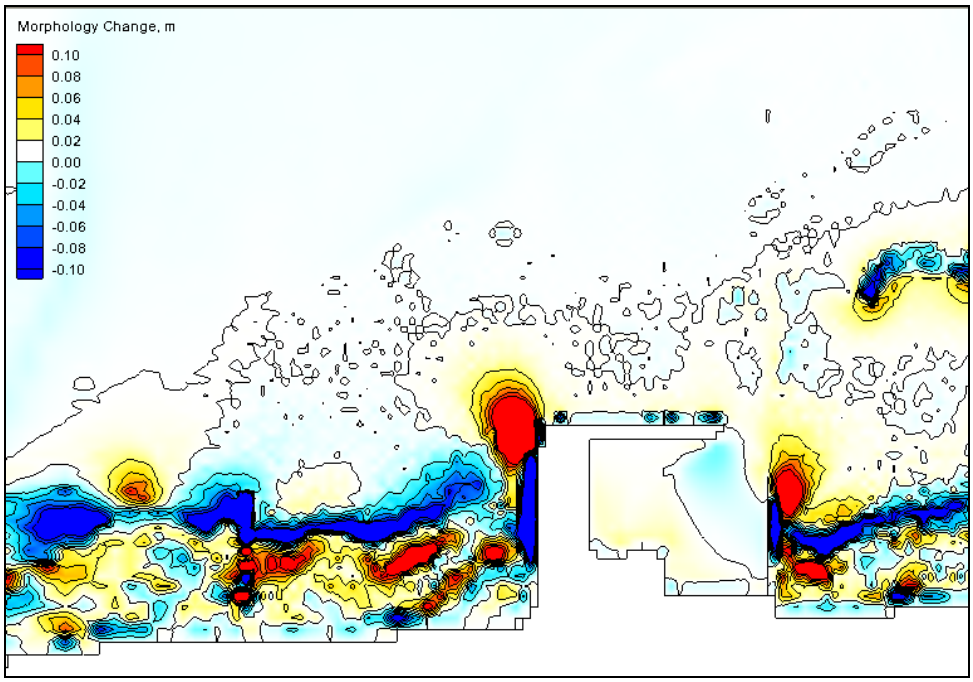


Figure 22 – CMS-Flow Morphology Change Wave #2 Existing Conditions Results (meters)

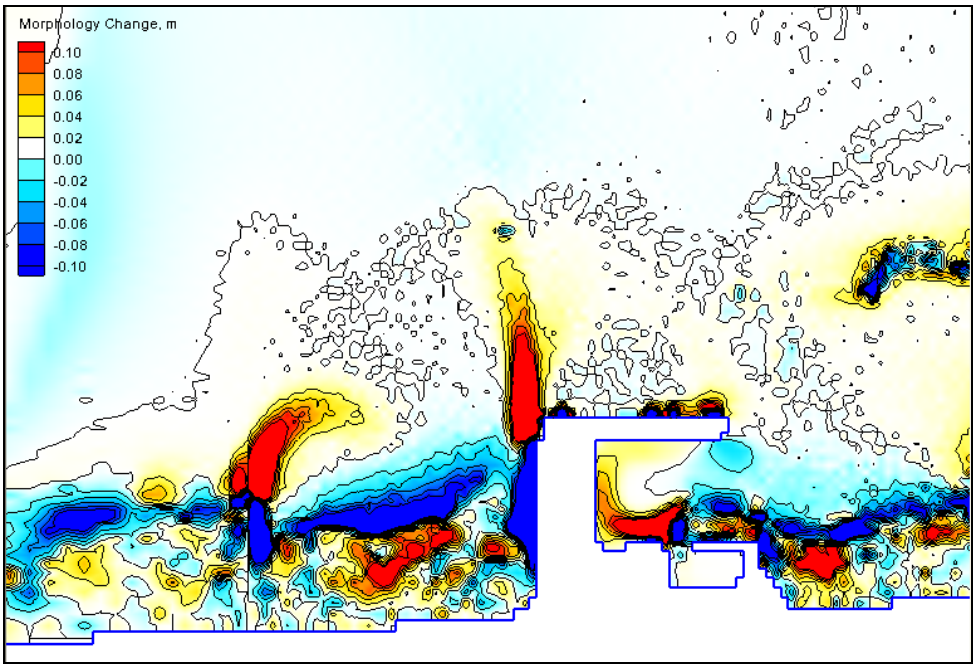


Figure 23 – CMS-Flow Morphology Change Wave #2 Proposed Conditions Results (meters)

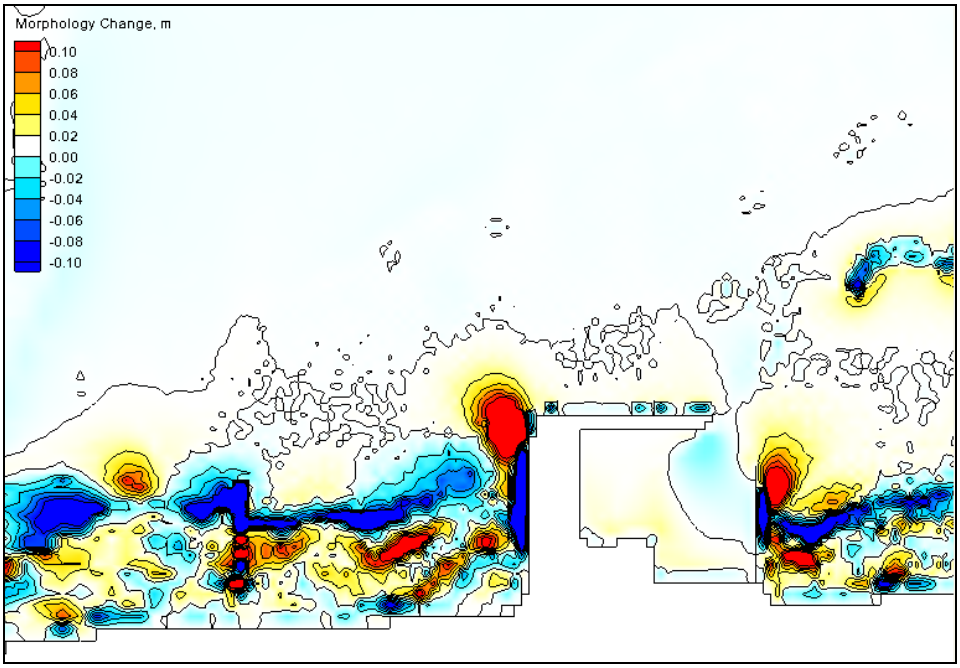


Figure 24 – CMS-Flow Morphology Change Wave #3 Existing Conditions Results (meters)

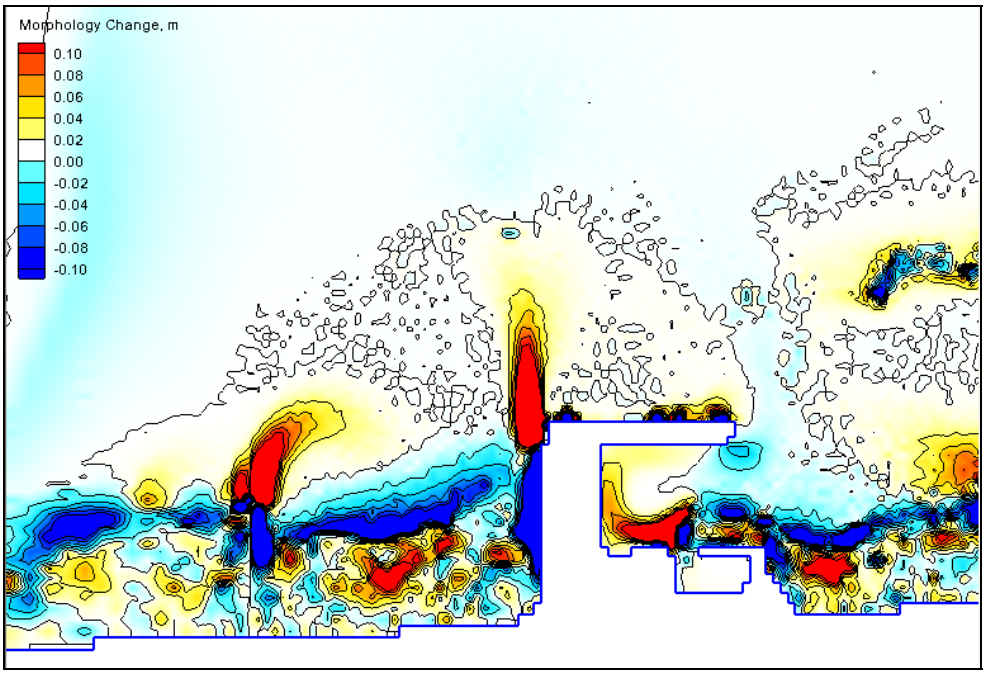


Figure 25 – CMS-Flow Morphology Change Wave #3 Proposed Conditions Results (meters)

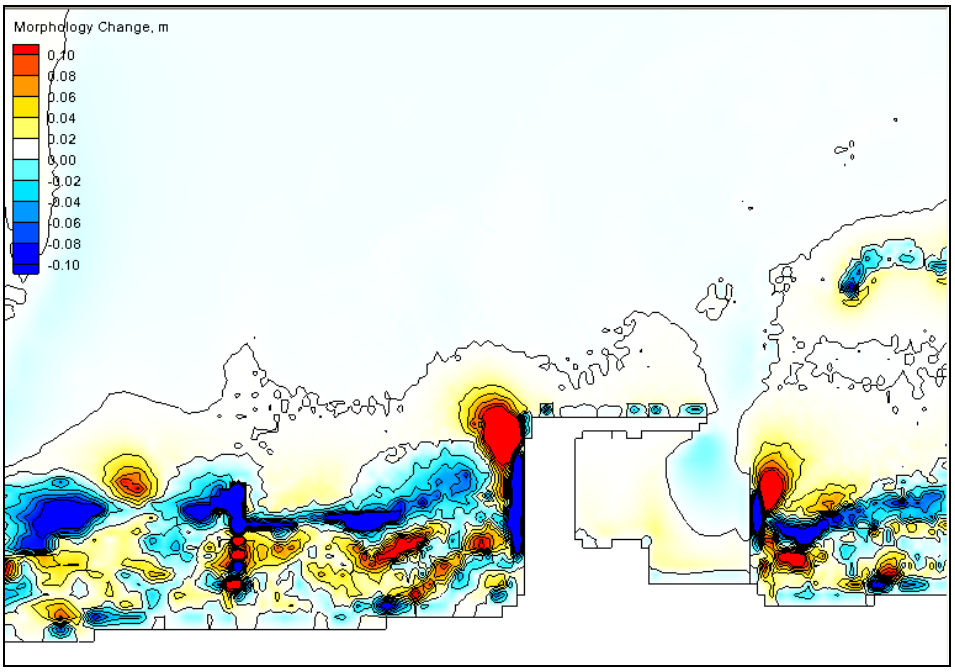


Figure 26 – CMS-Flow Morphology Change Wave #4 Existing Conditions Results (meters)

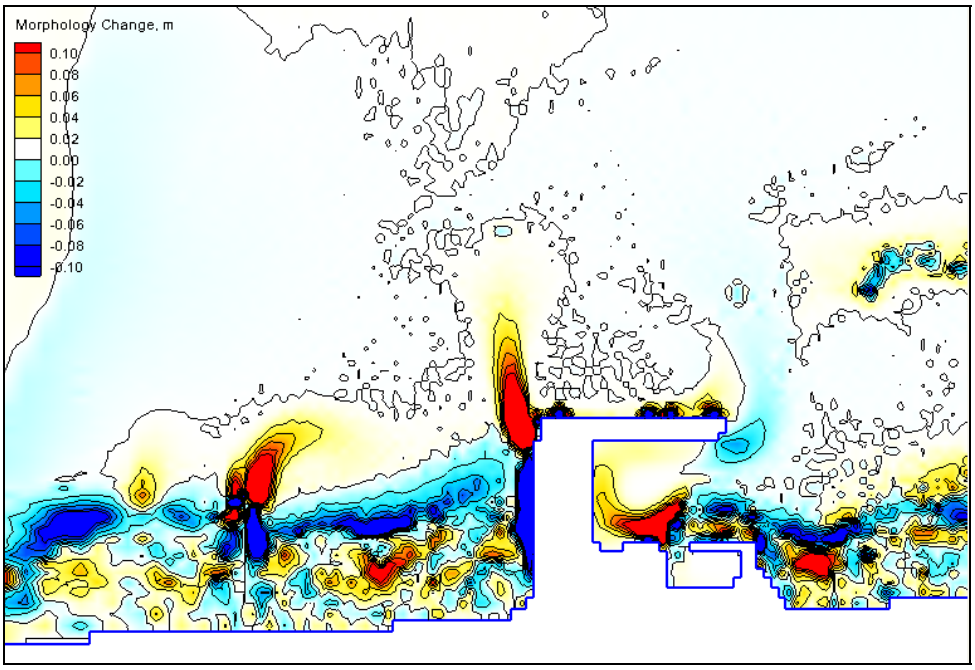


Figure 27 – CMS-Flow Morphology Change Wave #4 Proposed Conditions Results (meters)

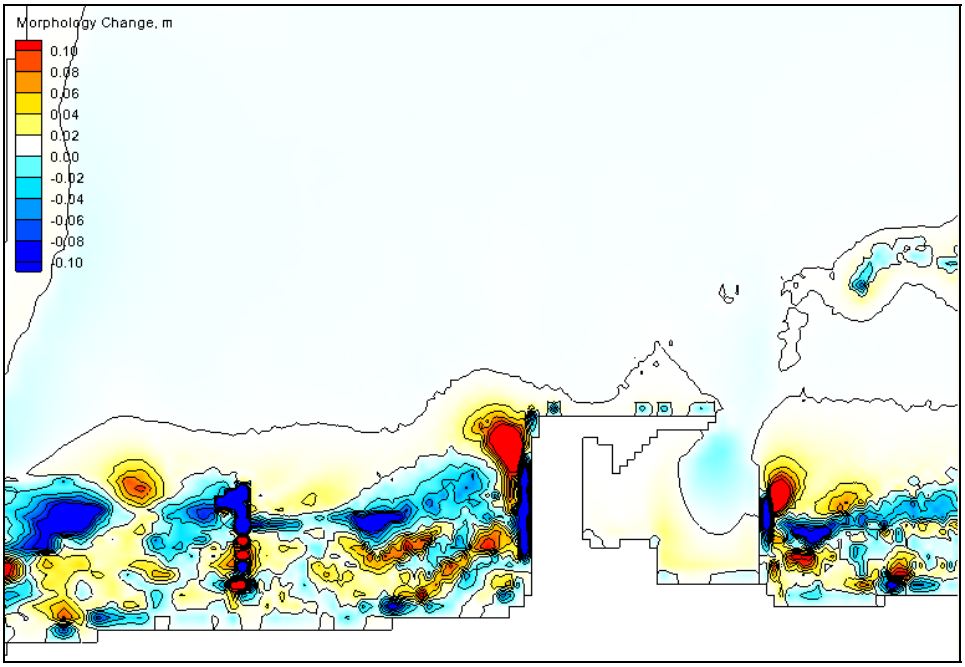


Figure 28 – CMS-Flow Morphology Change Wave #5 Existing Conditions Results (meters)

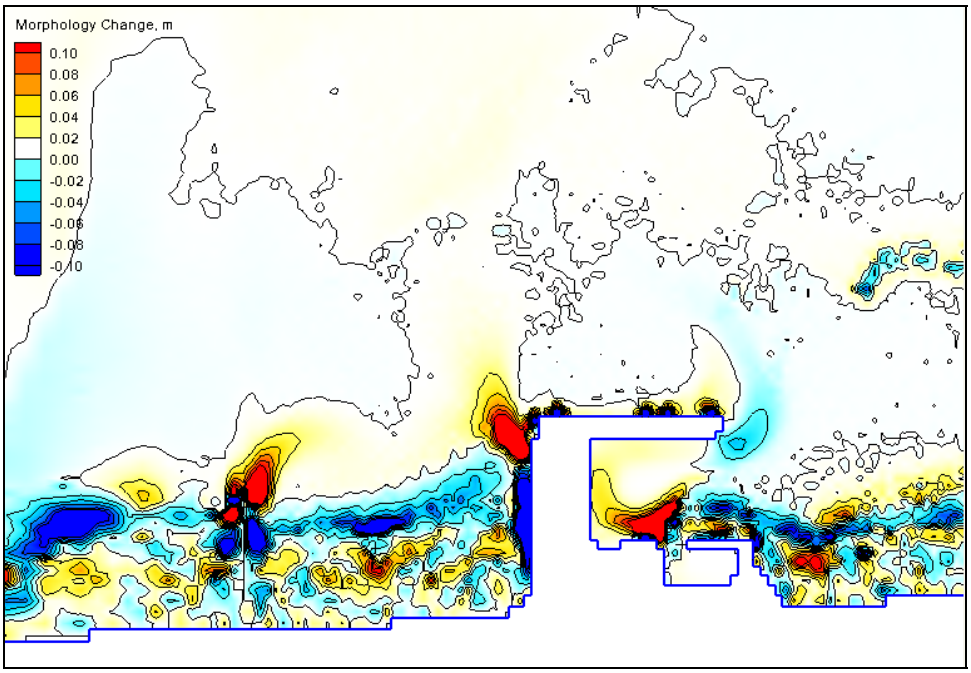


Figure 29 – CMS-Flow Morphology Change Wave #5 Proposed Conditions Results (meters)

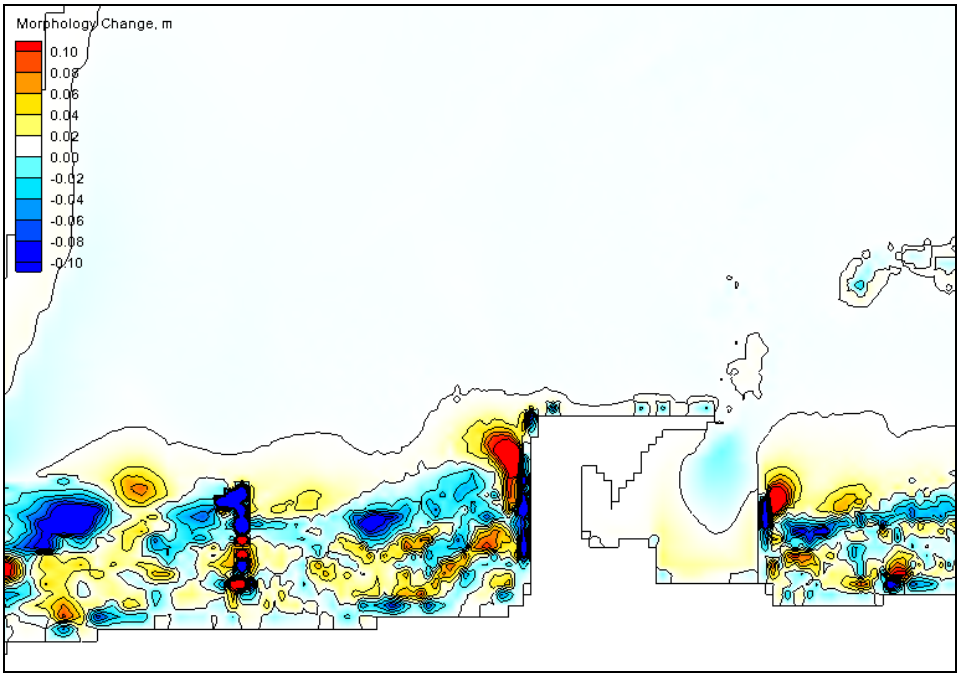


Figure 30 – CMS-Flow Morphology Change Wave #6 Existing Conditions Results (meters)

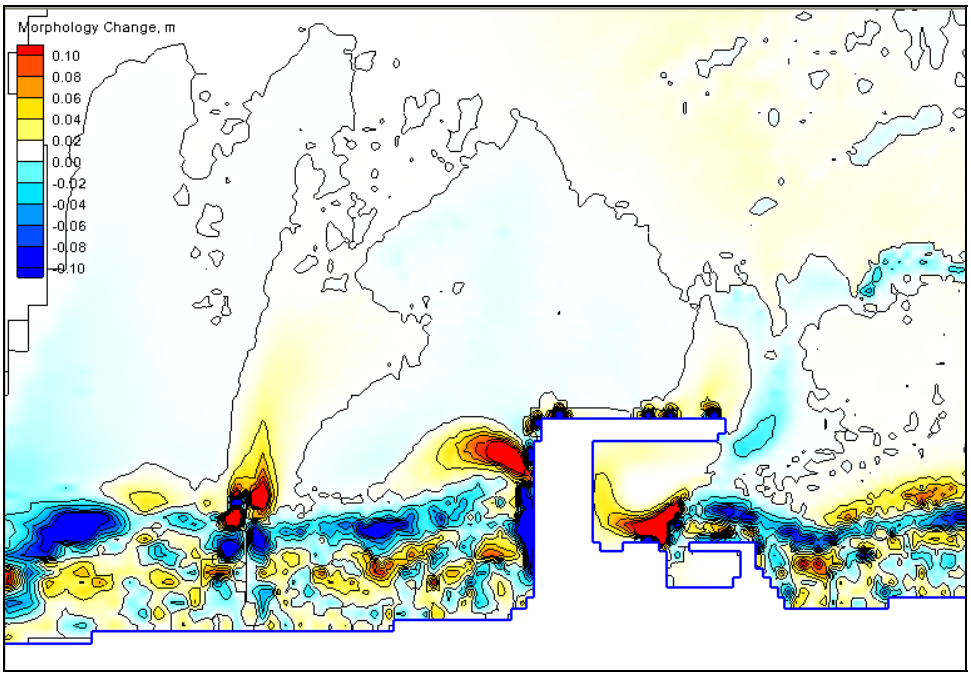
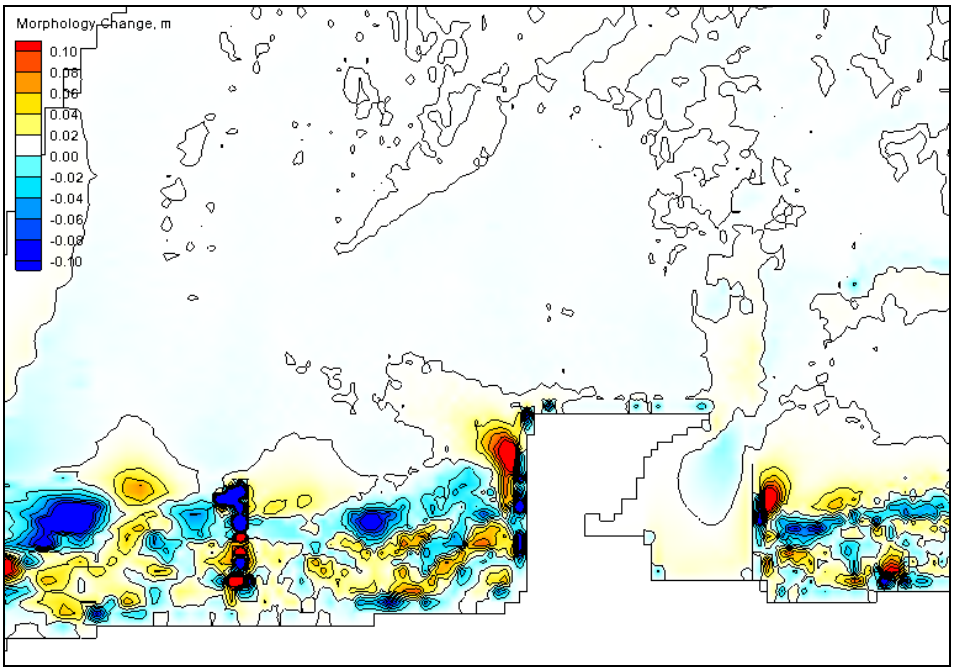


Figure 31 – CMS-Flow Morphology Change Wave #6 Proposed Conditions Results (meters)



The proposed breakwater will help to reduce shoaling within the marina. Based on current aerial photos of the area there is no current evidence of a bypass bar forming north of the existing marina. Furthermore, there is no significant accretion fillet present to the east of the marina at this time. The entire model domain was used to determine a shoaling rate per wave event, Wave #1 – Wave #6, over the east side of the marina, which was approximately 6" of shoaling per storm event. In the existing marina configuration, littoral drift flows almost exclusively into the marina from the east to the west as shown in the 2005 Google Earth satellite image in Figure 32. With the breakwater installed, the littoral drift pattern probably begin forming an accretion fillet to the east and eventually a bypass bar formed to the north. After analysis of the CMS-Flow model results for the NMC marina including the breakwater, sediment settling in the marina will be minimal for a number of years after the construction of the east breakwater.

Figure 32 – Existing Marina Littoral Movement

The accretion fillet that may develop over time along the east side of the proposed breakwater could begin to create both a bypass bar and shoal within the marina. The designated area for the new breakwater shoals approximately 3,300 yd^3 per year on average from CMS-Flow results, but there are a few issues with this quantity being used. The model results were never calibrated or validated to observed transport rates at the site. The numerical model is only providing a potential transport rate. An analysis of aerial photos, in addition to knowledge of the low bluff heights, small littoral cell size (only 18 mi of shoreline) and the presence of bedrock near the surface strongly indicate that this is a supply-limited reach. To gain an accurate understanding of actual transport rates, a detailed analysis of the reach would need to be done to calibrate the model results. For this study, model results were compared to the quantity of material presently dredged from the Maritime Academy boat basin assuming this was a good approximation for the longshore transport rate. Based on the dredge quantity analysis and comparing to model results, the best approximation of the longshore transport rate into the boat basin is believed to be 1500 cy/yr (average between the CMS-FLOW model results and the historic dredging rate).

Figure 33 shows the estimated accretion fillet area. It may extend approximately 2200′ east along the beach front and possibly half the distance of the breakwater or more lakeward. A volume was calculated using the above mentioned area along with the lower bay bathymetry and the low water datum on Lake Michigan of 577.5 ft, IGLD as the vertical constraints. A total calculated volume of 73,000 yd^3 would take approximately 49 years to reach capacity. As the accretion fillet grows the marina may consider limiting shoaling within the marina by dredging the accretion fillet and mechanically or hydraulically moving sediment to the west of the marina. This would promote the health of adjacent beaches and represent best regional sediment management practices.

Figure 33 – Estimated Accretion Fillet Area

5.0 Conclusion and Recommendations

5.1 CMS-WAVE

The CMS-Wave resultant wave height of 1.556 meters (5.105 feet) is the significant wave height, H_s, which is recommended for design of the structure. $H_{1/10}$ is the wave height which only 10% of all waves in the area are higher than. To determine the $H_{1/10}$ the Rayleigh Distribution was used. Table 3 shows the step by step process used to determine the $H_{1/10}$ for the new SSP breakwater. The resultant Rayleigh Distribution wave height for $H_{1/10}$ was 1.978 meters (6.49 feet).

Table 3

Rayleigh Distribution

$$H_s = H_{1/3} = 1.416\ H_{rms}$$

$$H_s = 1.556 \text{ m} = 5.105 \text{ ft} = H_{1/3}$$

$$H_{rms} = (H_s)/1.416 = (H_{1/3})/1.416$$

$$H_{rms} = (1.556)/(1.416) = 1.099 \text{ m}$$

$$H_{1/10} = 1.80\ H_{rms}$$

$$H_{1/10} = 1.80 * 1.099 \text{ m} = 1.978 \text{ m}$$

$$H_{1/10} = 1.978 \text{ m} = 6.49 \text{ ft}$$

5.2 CMS-FLOW

The CMS-Flow resultant sediment transport calculations show approximately a 3,300 yd^3 shoaling rate per year and dredging records for the project site show approximately 1,000 yd^3 per year. For reasons explained in Section 4.2, the 1,500 yd^3 per year quantity will be used. The approximate sediment fillet capacity at the site has been estimated at 73,000 yd^3. For the NMC site if the breakwater is installed it would take approximately 49 years to reach the full estimated capacity of the accretion fillet. After the accretion fillet reaches capacity some of the littoral drift will bypass the marina and continue on west through the bay. When shoaling occurs in the marina or at the marina entrance dredging can include the accretion fillet, marina and entrance. Larger storm events that were modeled showed that single events can cause possible accretion in the marina and entrance.

APPENDIX C

COST APPENDIX FOR DESIGN PROJECT REPORT

for

NORTHWESTERN MICHIGAN COLLEGE SECTION 107

TRAVERSE CITY, MICHIGAN

prepared by the

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
MARCH 2011

1. GENERAL INFORMATION:

1.1 Introduction: The purpose of this report is to present alternatives for breakwater construction at the Great Lakes Maritime Academy Harbor. This report will be a part of the engineering appendix to the feasibility study being prepared by Planning Division.

1.2 Background: The project site is on Northwestern Michigan College's campus located in Traverse City, MI on the southern shore of the west arm of Grand Traverse Bay (Plate 1). Northwestern Michigan College has already completed renovations to the northern, western, and southern walls of the harbor (Phase 1). Renovations are being made to increase the usable harbor area and to reduce the amount of shoaling in the harbor and subsequent dredging. Northwestern Michigan College has applied for assistance from the Corps of Engineers under Section 107 of the Rivers and Harbors Act to construct a new eastern wall.

1.3 Site Access: The project site can be accessed via water or via permanent public road and NMC's parking lot. The work and storage area is to be located at the north end of NMC's parking lot as shown on the attached real estate plan on Plate 6. The work and storage area was sized to include storage of the SSP and miscellaneous steel. It was assumed all stone and fill materials would be stored on a barge.

1.4 Construction Method: It is anticipated that construction of the SSP wall will be marine based. Dredge material will be moved through a temporary, underwater pipeline to a State Designated High Erosion Area.

2. ALTERNATIVES:

All alternatives would include removal of an existing rubble mound and timber crib, dredging of the harbor, and construction of a new eastern wall approximately 280 feet long. Four alternatives were considered for the east wall construction, although two were dismissed as being cost prohibitive. Design calculations for the two alternatives considered can be found in Section C.

2.1 Alternative 1 – Dredging and Double Steel Sheet Pile (SSP) Wall: This alternative would consist of two parallel SSP walls with a concrete cap and scour stone at the toe. Concrete anchor blocks would be placed to resist mooring loads. See Plates 2 and 3 for Alternative 1 plan and cross section, respectively.

2.2 Alternative 2 – Dredging and Circular Cell SSP Wall: This alternative would include the removal of the existing wooden crib breakwater and the construction of a 285 foot circular steel sheet pile wall and dredging. A floating dock would be included for mooring capabilities.

2.3 Alternative 3 – Dredging and Rubble mound: This alternative would consist of constructing a 285-foot long rubble mound breakwater and dredge material for the harbor. There would be no mooring capabilities.

2.4 Alternative 4 – Dredging and Single SSP Wall with Concrete Walkway Supported by H-

piles: This alternative would consist of a concrete cap supported by an SSP wall on the harbor side and steel h-piles on the lake side. Scour stone would provide scour protection at the toe of the SSP on the harbor side. Riprap would be placed under the concrete cap to prevent ice buildup and as an added benefit would reduce wave action at the beach just east of the harbor. Concrete anchors blocks would be needed for anchoring of mooring bollards. See Plates 4 and 5 for Alternative 4 plan and cross section, respectively.

2.5 Recommended Alternative: Alternative 1, dredging with a double steel sheet pile wall is the recommended alternative based on construction and O&M costs. Additionally, this alternative will be more aesthetically pleasing as it matches the existing wall construction.

4. PURPOSE AND SCOPE OF COST ENGINEERING APPENDIX

4.1 Purpose of Cost Engineering Appendix

The purpose of this appendix is to present the cost estimates associated with the four alternative plans identified in the preceding paragraphs. Excel summary spreadsheets are used to present the alternative cost estimates found in this appendix. O&M costs are considered in the summary sheet but not included in the TPCS.

4.2 Scope of Cost Engineering Appendix

The scope of this appendix is to present the construction cost of Alternative 1 – Dredging and Double Steel Sheet Pile (SSP) Wall. This appendix is prepared in accordance with the guidance contained in ER 1110-2-1302, Civil Works Cost Engineering, and ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works. The submitted cost estimate was prepared using Micro-Computer Aided Cost Estimating System (MCACES), Second Generation (MII) software for cost estimating, and cost estimates will be presented in the Civil Works Breakdown Structure (CWBS) format to the sub-feature level. The Cost and Schedule Risk Analysis is provided in this appendix. The project Construction Schedule shows activity to project completion. The Total Project Cost Summary (TPCS) and the MII cost estimate and quantities are also included in this appendix.

5. ALTERNATIVE COST ESTIMATES

Construction quantities shown in the engineering technical appendix are used in the cost estimates presented in this appendix. Additional quantities and features that should be considered for the chosen alternative have been computed by the cost engineering personnel and included in the cost estimate. The quantities are therefore substantially complete from the standpoint of biddability, constructibility, and operability of the chosen alternative.

6. SCHEDULE

6.1 Schedule

The duration of alternative 1 is expected to last 1 construction season. A MS Project schedule is included in this appendix.

7. COST AND SCHEDULE RISK ANALYSIS

The informal cost and schedule risk analysis was prepared by Detroit District. The analysis was held to determine the contingency placed on the cost estimate of alternative 1. The cost estimate reflects the findings of the risk analysis; contingency was determined to be 10.8%. The informal risk register used for this process is attached to this appendix.

7.1 Methodology/Process

A risk identification meeting was held providing qualitative analysis from the project team to produce a risk register that served as the framework for the risk analysis. The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence.

In simple terms, contingency is an amount added to an estimate to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required.

7.2 Identify and Assess the Risk Factors

Identifying the risk factors via the PDT is considered a qualitative process that results in establishing a risk register that serves as the document for the quantitative study. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors were used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered. PDT meetings are held for the purposes of identifying and assessing risk factors. The meetings should include capable and qualified representatives from multiple project team disciplines and functions:

Project/Program managers – Carl Platz, John Love, Ashley Binion
Contracting/acquisition – Later coordinated with Tom McKay
Real Estate – Mark Brewer
Environmental – Paul Allerding
Civil and Coastal Design – Cynthia Jarema

Cost and schedule engineer – Julie Udell
Structural & Geotechnical – Later coordinated with Heather Calappi
Construction – Tom O'Bryan, Jim Schulz

The initial meeting focused primarily on risk factor identification using brainstorming techniques but also include some facilitated discussions based on risk factors common to projects of similar scope and geographic location. Additionally, conference calls and informal meetings will be conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

7.3 Quantify Risk Factor Impacts

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines. The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

Maximum possible value for the risk factor.
Minimum possible value for the risk factor.
Most likely value (the statistical mode), if applicable.
Nature of the probability density function used to approximate risk factor uncertainty.
Mathematical correlations between risk factors.
Affected cost estimate and schedule elements.

The resulting product from the PDT discussions is captured within a risk register as presented in this appendix for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

8. LIFE CYCLE COST ANALYSIS AND COMPARISON OF ALTERNATIVES

8.1 Life Cycle Cost Analysis

The life cycle cost analysis for each alternative includes the following cost elements:

- Initial capital costs
- Annual Operations and Maintenance (O&M) costs

The development of each of these cost are described below, followed by a summary of the life cycle cost.

8.2. Initial Capital Cost

The initial capital costs of each alternative were developed and are shown in the cost estimate

summaries attached to this appendix. These costs are in current dollars.

8.3. Annual Life Cycle Cost Analysis and Comparison of Alternatives

The life cycle cost analysis for each alternative includes initial capital cost with contingency and annual operations and maintenance (O&M) cost. For all alternatives, it is anticipated that project life is 50 years; no additional capital costs are anticipated. The annual operations and maintenance costs are estimated to be .4% of the total construction cost and are summarized below and in the cost estimate summaries attached to this appendix.

Alternative Number	**Total Construction Cost**	**Lifecycle Cost**
Alternative 1	$2,001,555	$8,006
Alternative 4	$2,054,332	$8,217

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107 DDR
USACE – DETROIT DISTRICT

COST ENGINEERING DX - TPCS ATR CERTIFICATION

The Northwestern Michigan College - Section 107 DDR for Detroit District has undergone a successful Cost Agency Technical Review (ATR), performed by the Walla Walla Cost Dx representatives. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies in accordance with ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of 14 June 2011, the Walla Walla District, Cost Engineering Directory of Expertise (DX) for Civil Works, certifies the estimated total project cost of the Northwestern Michigan College – Section 107 estimated values of:

FY 2011 Price Level:	$2,485,000
Fully Funded Amount:	$2,629,000 including spent costs

It remains the responsibility of the District to correctly reflect these cost values within the Final Report.

14 JUN 2011
Date

for **Kim C. Callan, PE, CCE, PM1**
Chief, Cost Engineering
Walla Walla District

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: North West Michigan College Section 107
LOCATION: Traverse City, Michigan

DISTRICT: LRE
POC: CHIEF, COST & GENERAL ENGINEERING, William D. Merte,

PREPARED: 4/16/2011

This Estimate reflects the scope and schedule in report; Feasibility Study, North West Michigan College Secion 107, Alternative 1

Program Year (Budget EC): 2011
Effective Price Level Date: 1 OCT 10

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE Spent Thru: Q1 2011 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
10	BREAKWATER & SEAWALLS	$1,781	$196	11%	$1,977		$1,781	$196	$1,977			$1,812	$199	$2,011
	CONSTRUCTION ESTIMATE TOTALS:	$1,781	$196		$1,977		$1,781	$196	$1,977			$1,812	$199	$2,011
01	LANDS AND DAMAGES	$10	$0	3%	$10		$10	$0	$10			$10	$0	$10
30	PLANNING, ENGINEERING & DESIGN	$288	$35	11%	$323		$288	$35	$323	$105		$291	$36	$431
31	CONSTRUCTION MANAGEMENT	$158	$16	10%	$174		$158	$16	$174			$160	$17	$177
	PROJECT COST TOTALS:	$2,237	$248	11%	$2,485		$2,237	$248	**$2,485**	$105		$2,272	$252	$2,629

ESTIMATED FEDERAL COST (80%): **$2,103**
ESTIMATED NON-FEDERAL COST (20%): **$526**

ESTIMATED TOTAL PROJECT COST: $2,629

_____ CHIEF, COST & GENERAL ENGINEERING, William D. Merte, P.E.

_____ PROJECT MANAGER, Carl Platz

_____ CHIEF, REAL ESTATE, Victor Kotwicki

_____ CHIEF, PLANNING, Jim Galloway

_____ CHIEF, ENGINEERING & CONSTRUCTION, Mark S. Allen, P.E.

_____ CHIEF, OPERATIONS, Wayne Schloop

_____

_____ CHIEF, CONTRACTING, Marilyn Hill

_____ CHIEF, PM-PB, PLANNING, PROGRAM PROJECT MANAGEMENT , Gary O'Keefe

_____

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: North West Michigan College Section 107
LOCATION: Traverse City, Michigan
This Estimate reflects the scope and schedule in report; Feasibility Study, North West Michigan College Secion 107, Alternative 1

DISTRICT: LRE PREPARED: 4/16/2011
POC: CHIEF, COST & GENERAL ENGINEERING, William D. Merte, P.E.

Estimate Prepared: 16-Apr-11
Effective Price Level: 1-Oct-10

Program Year (Budget EC): 2011
Effective Price Level Date: 1 OCT 10

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1													
10	BREAKWATER & SEAWALLS	$1,781	$196	11%	$1,977		$1,781	$196	$1,977	2012Q2	1.7%	$1,812	$199	$2,011
	CONSTRUCTION ESTIMATE TOTALS:	$1,781	$196	11%	**$1,977**		$1,781	$196	$1,977			$1,812	$199	$2,011
01	LANDS AND DAMAGES	$10	$0	3%	$10		$10	$0	$10	2011Q4	1.0%	$10	$0	$10
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$35	$2	5%	$37		$35	$2	$37	2011Q4	0.9%	$35	$2	$37
	Planning & Environmental Compliance	$58	$6	11%	$64		$58	$6	$64	2011Q4	0.9%	$59	$6	$65
	Engineering & Design	$153	$21	14%	$174		$153	$21	$174	2011Q4	0.9%	$154	$22	$176
	Engineering Tech Review ATR & VE	$25	$4	15%	$29		$25	$4	$29	2011Q4	0.9%	$25	$4	$29
	Contracting & Reprographics	$7	$0	3%	$7		$7	$0	$7	2011Q4	0.9%	$7	$0	$7
	Engineering During Construction	$10	$2	17%	$12		$10	$2	$12	2012Q2	1.4%	$10	$2	$12
	Planning During Construction													
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$133	$13	10%	$146		$133	$13	$146	2012Q2	1.4%	$135	$13	$148
	Project Operation:													
	Project Management	$25	$3	12%	$28		$25	$3	$28	2012Q2	1.4%	$25	$3	$28
	CONTRACT COST TOTALS:	$2,237	$248		**$2,485**		$2,237	$248	$2,485			$2,272	$252	**$2,524**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: North West Michigan College Section 107
LOCATION: Traverse City, Michigan

DISTRICT: LRE
POC: CHIEF, COST & GENERAL ENGINEERING, William D. Merte,

PREPARED: 4/16/2011

This Estimate reflects the scope and schedule in report; Feasibility Study, North West Michigan College Secion 107, Alternative 1

Program Year (Budget EC): 2011
Effective Price Level Date: 1 OCT 10

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE Spent Thru: Q1 2011 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
10	BREAKWATER & SEAWALLS	$ 1,740	$ 191	11%	$1,931		$1,740	$191	$1,931			$1,770	$195	$1,965
	CONSTRUCTION ESTIMATE TOTALS:	$ 1,740	$ 191		$1,931		$1,740	$191	$1,931			$1,770	$195	$1,965
01	LANDS AND DAMAGES	$ 10	$ 0	3%	$10		$10	$0	$10			$10	$0	$10
30	PLANNING, ENGINEERING & DESIGN	$ 288	$ 35	11%	$323		$288	$35	$323	$105		$291	$36	$431
31	CONSTRUCTION MANAGEMENT	$ 158	$ 16	10%	$174		$158	$16	$174			$160	$17	$177
	PROJECT COST TOTALS:	$ 2,196	$ 243	11%	$2,439		$2,196	$243	**$2,439**	$105		$2,231	$247	$2,583

CHIEF, COST & GENERAL ENGINEERING, William D. Merte, P.E.

PROJECT MANAGER, Carl Platz

CHIEF, REAL ESTATE, Victor Kotwicki

CHIEF, PLANNING, Jim Galloway

CHIEF, ENGINEERING & CONSTRUCTION, Mark S. Allen, P.E.

CHIEF, OPERATIONS, Wayne Schloop

CHIEF, CONTRACTING, Marilyn Hill

CHIEF, PM-PB, PLANNING, PROGRAM PROJECT MANAGEMENT , Gary O'Keefe

ESTIMATED FEDERAL COST (80%): **$2,066**
ESTIMATED NON-FEDERAL COST (20%): **$517**

ESTIMATED TOTAL PROJECT COST: $2,583

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: North West Michigan College Section 107
LOCATION: Traverse City, Michigan
This Estimate reflects the scope and schedule in report; Feasibility Study, North West Michigan College Secion 107, Alternative 1

DISTRICT: LRE REVISED & PREPARED: 6/28/2011
POC: CHIEF, COST & GENERAL ENGINEERING, William D. Merte, P.E.

Estimate Prepared: 16-Apr-11
Effective Price Level: 1 OCT 11

Program Year (Budget EC): 2011
Effective Price Level Date: 1 OCT 10

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE: Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1													
10	BREAKWATER & SEAWALLS	$1,740	$191	11%	$1,931		$1,740	$191	$1,931	2012Q2	1.7%	$1,770	$195	$1,965
	#N/A													
	#N/A													
	CONSTRUCTION ESTIMATE TOTALS:	$1,740	$191	11%	**$1,931**		$1,740	$191	$1,931			$1,770	$195	$1,965
01	LANDS AND DAMAGES	$10	$0	3%	$10		$10	$0	$10	2011Q4	1.0%	$10	$0	$10
30	PLANNING, ENGINEERING & DESIGN													
	Project Management	$35	$2	5%	$37		$35	$2	$37	2011Q4	0.9%	$35	$2	$37
	Planning & Environmental Compliance	$58	$6	11%	$64		$58	$6	$64	2011Q4	0.9%	$59	$6	$65
	Engineering & Design	$153	$21	14%	$174		$153	$21	$174	2011Q4	0.9%	$154	$22	$176
	Engineering Tech Review ATR & VE	$25	$4	15%	$29		$25	$4	$29	2011Q4	0.9%	$25	$4	$29
	Contracting & Reprographics	$7	$0	3%	$7		$7	$0	$7	2011Q4	0.9%	$7	$0	$7
	Engineering During Construction	$10	$2	17%	$12		$10	$2	$12	2012Q2	1.4%	$10	$2	$12
	Planning During Construction													
31	CONSTRUCTION MANAGEMENT													
6.5%	Construction Management	$133	$13	10%	$146		$133	$13	$146	2012Q2	1.4%	$135	$13	$148
	Project Operation:													
	Project Management	$25	$3	12%	$28		$25	$3	$28	2012Q2	1.4%	$25	$3	$28
	CONTRACT COST TOTALS:	$2,196	$243		**$2,439**		$2,196	$243	$2,439			$2,231	$247	**$2,478**

NORTWESTERN MICHIGAN COLLEGE BREAKWATER CONSTRUCTION
PROPOSED ALTERNATIVE 1, DOUBLE STEEL SHEET PILE WALL
Updated 20 June 2011

No.	Item Feature/Description	Quantities	Unit		
	CONSTRUCTION COST				
10	BREAKWATERS & SEAWALLS				
1.0	Mobilization, Demobilization & Prepatory	1.00	LS	$	225,610.00
2.0	Breakwater	1.00	LS	$	910,495.00
3.0	Concrete Walkway	1.00	LS	$	375,556.00
4.0	Dredging	1.00	LS	$	228,822.00
	SUB TOTAL			$	1,740,483.00
	CONTINGENCY (15% assumed)			$	261,072.45
	CONSTRUCTION COST			**$**	**2,001,555.45**
	NON CONSTRUCTION COST				
30	PLANNING, ENGINEERING & DESIGN				
	Feasibility Phase			$	105,000.00
	Project Management			$	34,500.00
	Planning & Environmental Compliance			$	57,500.00
	Engineering & Design			$	153,000.00
	Engineering Tech Review ATR & VE			$	25,000.00
	Contracting			$	7,000.00
	Planning During Construction			$	-
	LEERDS			$	9,582.00
31	CONSTRUCTION MANAGEMENT				
6.5%	Construction Management			$	130,101.00
0.5%	Engineering During Construction			$	10,008.00
	Project Operation			$	-
	Project Management			$	25,000.00
0.4%	Lifecycle O&M			$	8,006.00
	TOTAL NON CONSTRUCTION COST			**$**	**564,697.00**
	TOTAL PROJECT COST			**$**	**2,566,252.45**

NORTWESTERN MICHIGAN COLLEGE BREAKWATER CONSTRUCTION
PROPOSED ALTERNATIVE 4, SINGLE SSP WALL WITH CONCRETE
Updated 20 June 2011

Item No.	Feature/Description	Quantities	Unit		
	CONSTRUCTION COST				
10	BREAKWATERS & SEAWALLS				
1.0	Mobilization, Demobilization & Prepatory	1.00	LS	$	207,257.00
2.0	Breakwater	1.00	LS	$	802,372.00
3.0	Concrete Walkway	1.00	LS	$	135,597.00
4.0	Stone	1.00	LS	$	412,787.00
5.0	Dredging	1.00	LS	$	228,363.00
	SUB TOTAL			$	1,786,376.00
	CONTINGENCY (15% assumed)			$	267,956.40
	CONSTRUCTION COST			**$**	**2,054,332.40**
	NON CONSTRUCTION COST				
30	PLANNING, ENGINEERING & DESIGN				
	Feasibility Phase			$	105,000.00
	Project Management			$	34,500.00
	Planning & Environmental Compliance			$	57,500.00
	Engineering & Design			$	153,000.00
	Engineering Tech Review ATR & VE			$	25,000.00
	Contracting			$	7,000.00
	Planning During Construction			$	-
	LEERDS			$	9,582.00
31	CONSTRUCTION MANAGEMENT				
6.5%	Construction Management			$	133,532.00
0.5%	Engineering During Construction			$	10,272.00
	Project Operation			$	-
	Project Management			$	25,000.00
0.4%	Lifecycle O&M			$	8,217.00
	TOTAL NON CONSTRUCTION COST			**$**	**568,603.00**
	TOTAL PROJECT COST			**$**	**2,622,935.40**

NWM College Alt 1 Preferred

Updated with QTO's revised 12 April 2011

Title Page

Estimated by GSE Branch

Designed by GSE Branch

Prepared by Julie Udell

Preparation Date 6/28/2011

Effective Date of Pricing 6/28/2011

Estimated Construction Time 210 Days

MII Notes Northwestern Michigan College, Great Lakes Maritime Academy Harbor Feasibility Study, Alts 1 & 4

Estimator: Julie Udell

Alternative 1 (PREFERRED) – Double SSP Wall (280 ft): Design proposes two parallel ssp walls with a concrete cap and scour stone at the toe. Concrete anchor blocks would be place to resist mooring loads.

Alternative 4 – Single SSP Wall with Concrete Walkway Supported by H-Piles (280 ft): Design proposes a concrete cap supported by an ssp wall on the harbor side and steel h-piles on the lake side. Scour stone would provide scour protection at the toe of the ssp. Concrete anchor blocks are needed for anchoring of mooring bollards.

Estimator assumes majority of work will be accomplished with a marine plant and crew.

Assume project duration will be approximately 5 months for either alternative not including the winter work exclusion. Calculated JOOH is also based on this 5 month assumption. Assume work will be done in 1, 10 hr shift, 5 days per week .

Work requires dredging of approximately 16,000 cy of material; estimator assumes dredging will be performed hydraulically and EAB has specified that material will be disposed of west of the Traverse City Marina at the 2-8 ft depth contour. CEDEP was used to find the burdened unit cost which is then reflected in MII. Profit was 10%, OH was 15% and bond was 1.5%. Assume dredge crew is working 1, 12 hour shift, 6 days per week. Dredging mob & demob from CEDEP has been added to MII file mob cost.

Wages: MI-141 dated 1-7-2011 and IL-18 dated 1-21-11 has been applied.

Sales tax of 6% has been applied.

Equipment Region 2, 2009 version has been applied.

Profit of 8.5% has been applied.

JOOH has been applied with 2% small tools and is calculated based on 5 month construction duration for both alternatives.

HOOH has been applied at 10% as a typical, reasonable value.

No contingency has been applied within the MII estimate. 29.7% contingency has been added to the summary sheet and is developed from the cost risk analysis meeting held for this project.

Contractor Markups Report

[] Current NWM College Preferred Alt 1

Q:\b) On Going Projects\Northwestern Michigan College, Sect 107\Current Estimate August 2010\Estimate\Current NWM College Preferred Alt 1.mlp

Prime Alt 1

Markup	Own Work	Sub Work
JOOH (Small Tools) [Small Tools]	2.00%	0.00%
JOOH [JOOH]	7.95%	7.95%
HOOH [Running %]	10.00%	4.00%
Profit [Running %]	8.50%	6.00%
Bond [Running %]	1.50%	1.50%

Library Properties i
Markup Properties ii
IGE WITH PROFIT 1
10 Breakwaters and Seawalls 1
1000 ALTERNATIVE 1 Breakwaters & Seawalls 1
100001 MOB, DEMOB, PREP 1
Mobilization & Demobilization 1
Demolition 1
Temporary Access 2
10004602 BREAKWATER 2
10004605 Metals 2
10004605 01 Steel Framing for Piling Misc Metal 2
100099 Associated General Items 2
10009902 Site Work 2
Egress Ladders 2
Timber Bumper 3
10009905 Metals 3
10009905 01 Mooring Rings and Cleats 3

10009902 03 Guard Rail 3
RGS Conduit 3
10004602 06 Piling 4
10004602 02 Salvage and Reset Scour Stone 4
10004603 CONCRETE 4
10004603 01 Concrete, in Place 4
10004603 02 Reinforcing Steel 6
Concrete Anchor Blocks 6
Granular Fill for Concrete Walk 6
Fill Stone for Concrete Walk 7
10004602 01 DREDGING 7
Overhead 8
10 Breakwaters and Seawalls 8
1000 ALTERNATIVE 1 Breakwaters & Seawalls 8
100001 MOB, DEMOB, PREP 8
Mobilization & Demobilization 8
Demolition 8
Temporary Access 8

10004602 BREAKWATER 9
10004605 Metals 9
10004605 01 Steel Framing for Piling Misc Metal 9
100099 Associated General Items 9
10009902 Site Work 9
Egress Ladders 9
Timber Bumper 9
10009905 Metals 10
10009905 01 Mooring Rings and Cleats 10
10009902 03 Guard Rail 10
RGS Conduit 10
10004602 06 Piling 10
10004602 02 Salvage and Reset Scour Stone 11
10004603 CONCRETE 11
10004603 01 Concrete, in Place 11
10004603 02 Reinforcing Steel 12
Concrete Anchor Blocks 12
Granular Fill for Concrete Walk 13

Fill Stone for Concrete Walk 13
10004602 01 DREDGING 13
Labor Rates 15
10 Breakwaters and Seawalls 15
1000 ALTERNATIVE 1 Breakwaters & Seawalls 15
100001 MOB, DEMOB, PREP 15
Mobilization & Demobilization 15
Demolition 15
Temporary Access 16
10004602 BREAKWATER 16
10004605 Metals 16
10004605 01 Steel Framing for Piling Misc Metal 16
100099 Associated General Items 16
10009902 Site Work 16
Egress Ladders 16
Timber Bumper 17
10009905 Metals 17
10009905 01 Mooring Rings and Cleats 17

10009902 03 Guard Rail 17
RGS Conduit 18
10004602 06 Piling 18
10004602 02 Salvage and Reset Scour Stone 18
10004603 CONCRETE 19
10004603 01 Concrete, in Place 19
10004603 02 Reinforcing Steel 19
Concrete Anchor Blocks 19
Granular Fill for Concrete Walk 20
Fill Stone for Concrete Walk 20
Material Rates 22
10 Breakwaters and Seawalls 22
1000 ALTERNATIVE 1 Breakwaters & Seawalls 22
100001 MOB, DEMOB, PREP 22
Mobilization & Demobilization 22
Demolition 22
Temporary Access 22
10004602 BREAKWATER 23

10004605 Metals 23
10004605 01 Steel Framing for Piling Misc Metal 23
100099 Associated General Items 23
10009902 Site Work 23
Egress Ladders 23
Timber Bumper 23
10009905 Metals 24
10009905 01 Mooring Rings and Cleats 24
10009902 03 Guard Rail 24
RGS Conduit 24
10004602 06 Piling 24
10004602 02 Salvage and Reset Scour Stone 24
10004603 CONCRETE 25
10004603 01 Concrete, in Place 25
10004603 02 Reinforcing Steel 26
Concrete Anchor Blocks 26
Granular Fill for Concrete Walk 26
Fill Stone for Concrete Walk 27

10004602 01 DREDGING 27
Equipment Rates 28
10 Breakwaters and Seawalls 28
1000 ALTERNATIVE 1 Breakwaters & Seawalls 28
100001 MOB, DEMOB, PREP 28
Mobilization & Demobilization 28
Demolition 28
Temporary Access 28
10004602 BREAKWATER 29
10004605 Metals 29
10004605 01 Steel Framing for Piling Misc Metal 29
100099 Associated General Items 29
10009902 Site Work 29
Egress Ladders 29
Timber Bumper 29
10009905 Metals 30
10009905 01 Mooring Rings and Cleats 30
10009902 03 Guard Rail 30

RGS Conduit 30
10004602 06 Piling 30
10004602 02 Salvage and Reset Scour Stone 30
10004603 CONCRETE 31
10004603 01 Concrete, in Place 31
10004603 02 Reinforcing Steel 32
Concrete Anchor Blocks 32
Granular Fill for Concrete Walk 32
Fill Stone for Concrete Walk 32
10004602 01 DREDGING 33

Designed by
GSE Branch

Estimated by
GSE Branch

Prepared by
Julie Udell

Design Document

Document Date 6/28/2011

District Detroit District
Contact Julie Udell

Budget Year 2011
UOM System Original

Direct Costs

LaborCost
EQCost
MatlCost
SubBidCost

Timeline/Currency

Preparation Date 6/28/2011
Escalation Date 6/28/2011
Eff. Pricing Date 6/28/2011
Estimated Duration 210 Day(s)

Currency US dollars
Exchange Rate 1.000000

Costbook CB10EB: MII English Cost Book 2010

Labor : MI-141 dated 1-7-2011

Note: http://www.wdol.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes

Labor Rates

LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP09R02: MII Equipment Region 2 2009

02 MIDEAST

Sales Tax	5.80
Working Hours per Year	1,450
Labor Adjustment Factor	1.02
Cost of Money	4.88
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.094
Gas	2.200
Diesel Off-Road	3.450
Diesel On-Road	3.950

Shipping Rates

Over 0 CWT	9.19
Over 240 CWT	8.46
Over 300 CWT	7.61
Over 400 CWT	6.83
Over 500 CWT	4.13
Over 700 CWT	4.13
Over 800 CWT	6.14

Currency in US dollars

Direct Cost Markups

Overtime

	Days/Week	Hours/Shift	Shifts/Day	1st Shift	2nd Shift	3rd Shift
Standard	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*
Actual	*5.00*	*8.00*	*1.00*	*10.00*	*0.00*	*0.00*

Day	OT Factor	Working	OT Percent	FCCM Percent
Monday	*1.50*	*Yes*	*10.00*	*(20.00)*
Tuesday	*1.50*	*Yes*		
Wednesday	*1.50*	*Yes*		
Thursday	*1.50*	*Yes*		
Friday	*1.50*	*Yes*		
Saturday	*1.50*	*No*		
Sunday	*2.00*	*No*		

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

Contractor Markups

	Category	Method
JOOH (Small Tools)	JOOH	% of Labor
JOOH	JOOH	JOOH (Calculated)
HOOH	HOOH	Running %
Profit	Profit	Running %
Bond	Bond	Running %

Currency in US dollars

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
IGE WITH PROFIT			240,185.57	193,062.22	557,062.19	207,571.90	133,011.20	1,330,893.07	1,740,483.86
			240,185.57	*193,062.22*	*557,062.19*	*207,571.90*	*133,011.20*	*1,330,893.07*	*1,740,483.86*
10 Breakwaters and Seawalls	EA	1.0	240,185.57	193,062.22	557,062.19	207,571.90	133,011.20	1,330,893.07	1,740,483.86
			857.81	*689.51*	*1,989.51*	*741.33*	*475.04*	*4,753.19*	*6,216.01*
1000 ALTERNATIVE 1 Breakwaters & Seawalls	LF	280.0	240,185.57	193,062.22	557,062.19	207,571.90	133,011.20	1,330,893.07	1,740,483.86
			55,930.03	*60,894.52*	*888.00*	*31,950.90*	*22,853.61*	*172,517.06*	*225,610.28*
100001 MOB, DEMOB, PREP	EA	1.0	55,930.03	60,894.52	888.00	31,950.90	22,853.61	172,517.06	225,610.28
Mobilization & Demobilization	LS	1.0	22,603.84	21,088.16	0.00	0.00	8,935.60	52,627.60	68,824.08
			27.76	*29.37*	*0.00*	*0.00*	*15.12*	*72.25*	*94.48*
RSM 015436501150 Mobilization or demobilization, delivery charge for small equipment on flatbed trailer, maximum	EA	4.0	111.04	117.48	0.00	0.00	60.47	288.99	377.93
			104.40	*169.57*	*0.00*	*0.00*	*43.31*	*317.28*	*414.92*
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.P., up to 50 miles	EA	2.0	208.80	339.14	0.00	0.00	86.62	634.56	829.85
RSM 352023130100 Marine Plant, mobilization and demobilization, add to below, maximum	LS	1.0	22,284.00	20,631.54	0.00	0.00	8,788.52	51,704.06	67,616.31
			32,894.76	*39,753.97*	*0.00*	*31,950.90*	*13,692.34*	*118,291.96*	*154,697.07*
Demolition	EA	1.0	32,894.76	39,753.97	0.00	31,950.90	13,692.34	118,291.96	154,697.07
			6.53	*6.61*	*0.00*	*39.30*	*2.65*	*55.08*	*72.03*
RSM 024119180500 Selective demolition, disposal only, urban buildings with salvage value allowed, wood frame, includes loading and 5 mile haul to dump	CY	813.0	5,309.05	5,370.56	0.00	31,950.90	2,151.83	44,782.35	58,564.40
(Note: timber disposal; Assume $7/cy disposal cost. Area = pi x r^2; 3.14159 x 1.4 ft ^2 = 6.2 sf x 140 ea x 20 lf /27 cf/cy = 643 cy + 10 % + 15% swell = 813 cy. Quote from Waste Management, Glen's Landfill, Maple City, MI = $28.06/ton, includes all fees and fuel surcharge. x 1.4 ton/cy = $39.30/cy)									
			2.23	*1.73*	*0.00*	*0.00*	*0.86*	*4.81*	*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator	BCY	1,035.0	2,309.57	1,786.32	0.00	0.00	885.57	4,981.46	6,514.54
(Note: Assume all stone/broken concrete must first be removed; 390 cy will eventually be reused as scour stone protection, 510 cy will be disposed of. Total 900 cy, add 15% for clearing driveline = 1035 cy)									
			4.02	*4.81*	*0.00*	*0.00*	*1.68*	*10.50*	*13.74*
RSM 312323181255 Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.5 loads/hour, 20 C.Y. dump trailer, highway haulers, excludes loading	LCY	742.0	2,979.42	3,567.47	0.00	0.00	1,247.43	7,794.32	10,193.07
(Note: 510 bcy + 135 cy from driveline = 645 + 15% for swell = 742 lcy)									
			182.76	*237.95*	*0.00*	*0.00*	*77.11*	*497.82*	*651.03*
USR Marine Crew - General	HR	122.0	22,296.72	29,029.61	0.00	0.00	9,407.50	60,733.84	79,425.06
(Note: This custom crew includes an operator, deckhand, barge, crane & tug to assist with demo for the duration based on MII's production rate for these activities. Includes timber pile removal - 38									

Currency in US dollars

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
hour duration per MII production rate for calculated quantity in vlf. Avg length of each timber = 20 vlf assuming removal to lake bottom only. Required removal along 140 ft length avg 14" timber, assume 140 timbers x 20 vlf = 2800 vlf. Assume remaining time use for rock/concrete removal and disposal also per MII production rate for these activities.)									
			431.43	*52.39*	*888.00*	*0.00*	*225.67*	*1,597.49*	*2,089.13*
Temporary Access	EA	1.0	431.43	52.39	888.00	0.00	225.67	1,597.49	2,089.13
			1.94	*0.24*	*4.00*	*0.00*	*1.02*	*7.20*	*9.41*
RSM 015523500050 Temporary, roads, gravel fill, 4" gravel depth, excl surfacing	SY	222.0	431.43	52.39	888.00	0.00	225.67	1,597.49	2,089.13
(Note: assume 100 ft long x 20 ft wide / 9 sf/sy = 222 sy)									
			107,719.95	*70,298.89*	*446,736.50*	*0.00*	*71,471.58*	*696,226.91*	*910,495.16*
10004602 BREAKWATER	EA	1.0	107,719.95	70,298.89	446,736.50	0.00	71,471.58	696,226.91	910,495.16
			4,386.24	*3,779.78*	*68,913.00*	*0.00*	*6,036.07*	*83,115.09*	*108,694.28*
10004605 Metals	EA	1.0	4,386.24	3,779.78	68,913.00	0.00	6,036.07	83,115.09	108,694.28
			4,386.24	*3,779.78*	*68,913.00*	*0.00*	*6,036.07*	*83,115.09*	*108,694.28*
10004605 01 Steel Framing for Piling Misc Metal	EA	1.0	4,386.24	3,779.78	68,913.00	0.00	6,036.07	83,115.09	108,694.28
			0.00	*0.00*	*2,790.00*	*0.00*	*167.40*	*2,957.40*	*3,867.56*
HNC 051223758270 Structural steel member, channels MC10x22, C & MC, 21 to 58 plf, A992 steel, shop fabricated, incl shop primer, bolted connections	TON	15.4	0.00	0.00	42,966.00	0.00	2,577.96	45,543.96	59,560.40
(Note: 14 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)									
			0.00	*0.00*	*3,180.00*	*0.00*	*190.80*	*3,370.80*	*4,408.19*
HNC 051223758260 Structural steel member, channels C12x20.7, C & MC, 11 to 21 plf, A992 steel, shop fabricated, incl shop primer, bolted connections	TON	6.9	0.00	0.00	21,942.00	0.00	1,316.52	23,258.52	30,416.48
(Note: 6.3 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)									
			0.00	*0.00*	*2,225.00*	*0.00*	*133.50*	*2,358.50*	*3,084.34*
RSM 314116103000 Sheet piling, steel, tie rod, not upset, with turnbuckle, 1-1/2" to 4", excludes wales	TON	1.8	0.00	0.00	4,005.00	0.00	240.30	4,245.30	5,551.82
(Note: 1.65 ton required + 10% for cutting & waste)									
			182.76	*157.49*	*0.00*	*0.00*	*79.22*	*419.47*	*548.57*
USR Marine Crew - Pile Install	HR	24.0	4,386.24	3,779.78	0.00	0.00	1,901.29	10,067.31	13,165.58
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with channel for the duration; assume 1 ton/hr.)									
			15,514.92	*5,740.83*	*33,741.30*	*0.00*	*8,587.01*	*63,584.07*	*83,152.47*
100099 Associated General Items	EA	1.0	15,514.92	5,740.83	33,741.30	0.00	8,587.01	63,584.07	83,152.47
			6,845.81	*5,197.19*	*2,648.00*	*0.00*	*3,115.74*	*17,806.75*	*23,286.88*
10009902 Site Work	EA	1.0	6,845.81	5,197.19	2,648.00	0.00	3,115.74	17,806.75	23,286.88
			630.57	*472.47*	*248.00*	*0.00*	*286.21*	*1,637.26*	*2,141.13*
Egress Ladders	EA	1.0	630.57	472.47	248.00	0.00	286.21	1,637.26	2,141.13

Labor ID: EQ ID: EP09R02 | Currency in US dollars | TRACES MII Version 4.1

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
			41.15	*0.00*	*124.00*	*0.00*	*24.27*	*189.42*	*247.72*
RSM 355933501520 Jetties, dock accessories, ladder, crown top, 5 to 7 step, maximum	EA	2.0	82.29	0.00	248.00	0.00	48.55	378.84	495.43
			182.76	*157.49*	*0.00*	*0.00*	*79.22*	*419.47*	*548.57*
USR Marine Crew - Site Work	HR	3.0	548.28	472.47	0.00	0.00	237.66	1,258.41	1,645.70
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done.)									
			6,215.24	*4,724.72*	*2,400.00*	*0.00*	*2,829.53*	*16,169.49*	*21,145.75*
Timber Bumper	EA	1.0	6,215.24	4,724.72	2,400.00	0.00	2,829.53	16,169.49	21,145.75
(Note: Assume marine crew placement; marine crew cost covered in demo and concrete items.)									
			488.29	*0.00*	*1,600.00*	*0.00*	*301.95*	*2,390.24*	*3,125.85*
RSM 061323100020 Single 6" x 10" wood beam, heavy mill timber framing	MBF	1.5	732.44	0.00	2,400.00	0.00	452.92	3,585.36	4,688.77
(Note: 300 lf = 3600 in; 6 x 10 x 3600 / 144 cu in/board foot = 1500 board feet / 1000 = 1.5 mbf)									
			182.76	*157.49*	*0.00*	*0.00*	*79.22*	*419.47*	*548.57*
USR Marine Crew - Site Work	HR	30.0	5,482.80	4,724.72	0.00	0.00	2,376.61	12,584.13	16,456.98
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done. Assume 10 LF/hr installation rate.)									
			8,669.11	*543.64*	*31,093.30*	*0.00*	*5,471.27*	*45,777.32*	*59,865.58*
10009905 Metals	EA	1.0	8,669.11	543.64	31,093.30	0.00	5,471.27	45,777.32	59,865.58
			700.56	*0.00*	*3,675.00*	*0.00*	*523.28*	*4,898.84*	*6,406.48*
10009905 01 Mooring Rings and Cleats	EA	1.0	700.56	0.00	3,675.00	0.00	523.28	4,898.84	6,406.48
			54.52	*0.00*	*735.00*	*0.00*	*66.41*	*855.93*	*1,119.34*
RSM 355933502080 Jetties, dock accessories, mooring whip, 60,000 lb. boat	PR	5.0	272.60	0.00	3,675.00	0.00	332.03	4,279.63	5,596.71
			106.99	*0.00*	*0.00*	*0.00*	*47.81*	*154.80*	*202.44*
USR Mooring Installation (Note: 1 foreman & 2 laborers)	HR	4.0	427.96	0.00	0.00	0.00	191.25	619.21	809.77
			6,750.55	*543.64*	*26,056.30*	*0.00*	*4,316.96*	*37,667.45*	*49,259.84*
10009902 03 Guard Rail	EA	1.0	6,750.55	543.64	26,056.30	0.00	4,316.96	37,667.45	49,259.84
			8.39	*0.53*	*42.00*	*0.00*	*5.94*	*56.86*	*74.36*
RSM 055213500090 Railing, pipe, aluminum, clear finish, 2 rails, 1-1/2" dia, shop fabricated	LF	615.0	5,159.85	323.83	25,830.00	0.00	3,654.09	34,967.77	45,729.32
			25.66	*3.55*	*3.65*	*0.00*	*10.69*	*43.54*	*56.94*
RSM 038213100100 Concrete core drilling, core, reinforced concrete slab, 1 1/2" diameter, up to 6" thick slab, includes bit, layout and set up (Note: Assume every 10 feet)	EA	62.0	1,590.70	219.81	226.30	0.00	662.87	2,699.68	3,530.52
			1,218.00	*0.00*	*1,362.00*	*0.00*	*631.04*	*3,211.04*	*4,199.25*
RGS Conduit	EA	1.0	1,218.00	0.00	1,362.00	0.00	631.04	3,211.04	4,199.25

Currency in US dollars

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
			4.06	*0.00*	*4.54*	*0.00*	*2.10*	*10.70*	*14.00*
RSM 260533100580 Rigid galvanized steel conduit, 1-1/2" diameter, to 15' high, incl couplings only	LF	300.0	1,218.00	0.00	1,362.00	0.00	631.04	3,211.04	4,199.25
			85,583.93	*58,451.52*	*344,082.20*	*0.00*	*55,930.72*	*544,048.37*	*711,482.71*
10004602 06 Piling	EA	1.0	85,583.93	58,451.52	344,082.20	0.00	55,930.72	544,048.37	711,482.71
			185.59	*136.61*	*1,100.00*	*0.00*	*140.94*	*1,563.14*	*2,044.21*
RSM 314116100300 sheet piling, steel, 22 psf, 30' excavation, left in place, excludes wales	TON	278.0	51,593.37	37,977.74	305,800.00	0.00	39,181.77	434,552.87	568,289.28
(Note: 252.89 ton + 10% for cutting & waste. Driveline excavation was considered in demo item above. Quote on 3 Aug 2010 from Riley Nelson of Skyline Steel RNelson@skylinesteel.com; cold rolled, $0.55/lb delivered.)									
			33.16	*0.00*	*125.00*	*0.00*	*20.96*	*179.12*	*234.24*
RSM 024556006400 Piles, steel, shoes	EA	306.0	10,146.96	0.00	38,250.00	0.00	6,413.66	54,810.62	71,678.94
(Note: Total wall length of 280 ft. / sheet width of 1.833' = 153 shoes x 2 sides = 306 shoes)									
			0.61	*0.00*	*0.23*	*0.00*	*0.26*	*1.10*	*1.44*
RSM 024119270020 Selective demolition, torch cutting, steel, 1" thick plate	LF	140.0	84.81	0.00	32.20	0.00	36.63	153.64	200.92
(Note: Assume 1/2 will require torch cutting at the top Length 280 lf)									
			182.76	*157.49*	*0.00*	*0.00*	*79.22*	*419.47*	*548.57*
USR Marine Crew - Pile Installation	HR	130.0	23,758.80	20,473.78	0.00	0.00	10,298.66	54,531.24	71,313.57
(Note: This custom crew includes an operator, deckhand, barge & tug to assist pile driving operations for the duration based on placement rate of 45 lf/day. Pile driving equipment is not included in this item as it is used in pile driving item above.)									
			5.73	*5.97*	*0.00*	*0.00*	*2.35*	*14.05*	*18.37*
10004602 02 Salvage and Reset Scour Stone	CY	390.0	2,234.85	2,326.76	0.00	0.00	917.78	5,479.39	7,165.70
			2.23	*1.73*	*0.00*	*0.00*	*0.86*	*4.81*	*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator	BCY	390.0	870.27	673.11	0.00	0.00	333.69	1,877.07	2,454.75
(Note: 390 cy existing stone/broken concrete to be reused as scour stone protection.)									
			129.96	*157.49*	*0.00*	*0.00*	*55.63*	*343.08*	*448.66*
USR Floating Plant to support excavator	HR	10.5	1,364.58	1,653.65	0.00	0.00	584.08	3,602.31	4,710.95
			490.61	*396.59*	*701.52*	*4.15*	*247.99*	*1,840.87*	*2,407.41*
10004603 CONCRETE	CY	156.0	76,535.59	61,868.81	109,437.69	648.00	38,686.02	287,176.11	375,556.38
			112.49	*13.04*	*336.56*	*4.15*	*67.70*	*533.95*	*698.27*
10004603 01 Concrete, in Place	CY	156.0	17,548.99	2,034.38	52,503.60	648.00	10,560.65	83,295.62	108,930.38
			0.00	*0.00*	*200.00*	*0.00*	*12.00*	*212.00*	*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	CY	164.0	0.00	0.00	32,800.00	0.00	1,968.00	34,768.00	45,468.07
(Note: 156 cy required; add 5% for waste)									

Currency in US dollars

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
			3.72	*0.00*	*0.72*	*0.00*	*1.60*	*6.05*	*7.91*
RSM 031113652150 C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning (Note: 15 ft wide x 2 ends; 280 ft long x 2 sides x 1 ft depth)	SFC	590.0	2,196.43	0.00	424.80	0.00	945.96	3,567.20	4,665.02
			10.34	*5.83*	*0.00*	*0.00*	*4.20*	*20.38*	*26.65*
RSM 033105704650 Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	CY	164.0	1,696.52	956.51	0.00	0.00	689.09	3,342.12	4,370.68
			0.84	*0.01*	*3.88*	*0.00*	*0.60*	*5.33*	*6.97*
RSM 033053404900 Finishing, Structural concrete, in place, slab on grade, 12" thick, includes finishing only	SF	4,200.0	3,533.28	37.11	16,296.00	0.00	2,509.74	22,376.14	29,262.54
			6.83	*0.00*	*2.00*	*0.00*	*2.98*	*11.81*	*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: Assume every 10 feet, 21 each x 15 ft width)	LF	312.0	2,129.42	0.00	624.00	0.00	929.83	3,683.25	4,816.80
			0.00	*0.00*	*0.00*	*18.00*	*0.00*	*18.00*	*23.54*
RSM 014523501950 Concrete testing, compressive strength test, incl. picked up by lab, average (Note: Assume 6 per day for 6 days, 10 hrs/day)	EA	36.0	0.00	0.00	0.00	648.00	0.00	648.00	847.43
			4.59	*0.00*	*6.10*	*0.00*	*2.24*	*12.94*	*16.92*
RSM 033923130300 Concrete surface treatment, curing, sprayed membrane compound	CSF	42.0	192.83	0.00	256.20	0.00	94.26	543.29	710.49
			0.00	*0.00*	*119.00*	*0.00*	*7.14*	*126.14*	*164.96*
RSM 032105101202 High chairs, for reinforcing steel, individual (HC), galvanized, 3" high, includes material only (Note: 1ft oc 208 lf x 15 lf wide. Jack advises to divide this quantity by 1/2 to obtain cost)	CCT	16.0	0.00	0.00	1,904.00	0.00	114.24	2,018.24	2,639.37
			6.83	*0.00*	*2.00*	*0.00*	*2.98*	*11.81*	*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: spaced every 50 ft c-c)	LF	60.0	409.50	0.00	120.00	0.00	178.81	708.32	926.31
			0.27	*0.05*	*0.06*	*0.00*	*0.12*	*0.50*	*0.66*
RSM 033529350120 Control joint, concrete floor slab, sawcut in green concrete, 1" depth	LF	60.0	16.38	2.81	3.60	0.00	7.45	30.24	39.54
			1.07	*0.00*	*1.25*	*0.00*	*0.55*	*2.87*	*3.75*
RSM 033529350380 Control joint, joint sealant, polyurethane, 1" x 1/2" (154 LF/Gal)	LF	60.0	64.23	0.00	75.00	0.00	32.92	172.15	225.13
			7,310.40	*1,037.94*	*0.00*	*0.00*	*3,090.33*	*11,438.67*	*14,958.99*
USR Marine Crew - Standby	WK	1.0	7,310.40	1,037.94	0.00	0.00	3,090.33	11,438.67	14,958.99

Currency in US dollars

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
			5,247.93	*0.00*	*6,916.00*	*0.00*	*2,545.10*	*14,709.03*	*19,235.83*
10004603 02 Reinforcing Steel	EA	1.0	5,247.93	0.00	6,916.00	0.00	2,545.10	14,709.03	19,235.83
			576.70	*0.00*	*760.00*	*0.00*	*279.68*	*1,616.38*	*2,113.83*
RSM 032110600600 Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	TON	9.1	5,247.93	0.00	6,916.00	0.00	2,545.10	14,709.03	19,235.83
(Note: #4: 8.3 ton required + 10% for waste; Assume quantity includes steel for anchor blocks as well.)									
			18.94	*7.53*	*210.31*	*0.00*	*20.38*	*257.17*	*336.31*
Concrete Anchor Blocks	CY	30.6	578.90	230.19	6,427.00	0.00	622.96	7,859.04	10,277.70
			0.00	*0.00*	*200.00*	*0.00*	*12.00*	*212.00*	*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	0.00	0.00	6,400.00	0.00	384.00	6,784.00	8,871.82
			12.76	*7.19*	*0.00*	*0.00*	*5.18*	*25.13*	*32.87*
RSM 033105702650 Structural concrete, placing, spread footing, pumped, over 5 C.Y., includes vibrating, excludes material (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	408.27	230.19	0.00	0.00	165.83	804.28	1,051.81
			1.71	*0.00*	*0.27*	*0.00*	*0.73*	*2.71*	*3.54*
RSM 031113653000 C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erecting, bracing, stripping and cleaning	LF	100.0	170.63	0.00	27.00	0.00	73.13	270.75	354.08
			63.84	*56.87*	*14.55*	*0.00*	*28.41*	*163.66*	*214.03*
Granular Fill for Concrete Walk	CY	155.6	9,930.54	8,846.17	2,263.09	0.00	4,419.78	25,459.57	33,294.92
			0.00	*0.00*	*12.65*	*0.00*	*0.76*	*13.41*	*17.54*
RSM 312323171400 Fill, granular fill (Note: 155.56 ccy required; + 15% for swell = 178.9 lcy)	LCY	178.9	0.00	0.00	2,263.09	0.00	135.79	2,398.87	3,137.14
			0.64	*1.11*	*0.00*	*0.00*	*0.24*	*2.00*	*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	155.6	100.30	173.26	0.00	0.00	37.93	311.48	407.35
			2.51	*3.92*	*0.00*	*0.00*	*1.05*	*7.47*	*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	178.9	448.25	700.87	0.00	0.00	188.11	1,337.23	1,748.78
			0.69	*0.45*	*0.00*	*0.00*	*0.27*	*1.40*	*1.83*
HNC 312323145510 Backfill, structural, 6" lifts, backfill around foundation, with hydraulic excavator	LCY	178.9	122.83	80.61	0.00	0.00	47.44	250.89	328.10
			0.78	*0.11*	*0.00*	*0.00*	*0.32*	*1.21*	*1.58*

Currency in US dollars

Description	UOM	Quantity	LaborCost	EQCost	MatlCost	SubBidCost	DirectMU	DirectCost	ProjectCost
RSM 312323237240 Compaction, 4 passes, 18" wide, 12" lifts, walk behind, vibrating plate	ECY	155.6	121.16	16.89	0.00	0.00	49.49	187.54	245.26
			182.76	*157.49*	*0.00*	*0.00*	*79.22*	*419.47*	*548.57*
USR Marine Crew - Granular Fill	HR	50.0	9,138.00	7,874.53	0.00	0.00	3,961.02	20,973.55	27,428.30
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of granular fill under the concrete walkway.)									
			25.26	*29.66*	*24.15*	*0.00*	*12.00*	*91.08*	*119.11*
Fill Stone for Concrete Walk	CY	1,711.1	43,229.23	50,758.08	41,328.00	0.00	20,537.53	155,852.84	203,817.54
			4.97	*8.90*	*21.00*	*0.00*	*3.13*	*38.01*	*49.70*
RSM 353116196000 Steel sheet piling seawalls, crushed stone, placed behind bulkhead by clam bucket	LCY	1,968.0	9,780.96	17,518.68	41,328.00	0.00	6,167.98	74,795.62	97,814.45
(Note: 1711.11 cy reqr'd + 15% for void space = 1968 lcy)									
			0.64	*1.11*	*0.00*	*0.00*	*0.24*	*2.00*	*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	1,711.1	1,103.25	1,905.81	0.00	0.00	417.17	3,426.23	4,480.68
			2.51	*3.92*	*0.00*	*0.00*	*1.05*	*7.47*	*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	1,968.0	4,931.02	7,709.99	0.00	0.00	2,069.32	14,710.33	19,237.52
			182.76	*157.49*	*0.00*	*0.00*	*79.22*	*419.47*	*548.57*
USR Marine Crew - Fill Stone	HR	150.0	27,414.00	23,623.59	0.00	0.00	11,883.06	62,920.66	82,284.89
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of stone fill under the concrete walkway.)									
			0.00	*0.00*	*0.00*	*11.07*	*0.00*	*11.07*	*14.48*
10004602 01 DREDGING	CY	15,800.0	0.00	0.00	0.00	174,973.00	0.00	174,973.00	228,822.05
			0.00	*0.00*	*0.00*	*7.26*	*0.00*	*7.26*	*9.49*
USR Dredging	CY	15,800.0	0.00	0.00	0.00	114,708.00	0.00	114,708.00	150,010.11
(Note: Production rate and cost per cubic yard derived from CDEP estimating software; includes labor & equipment; Sub-bid cost does not include labor & equipment, profit, overhead and bond; these are applied within MII file. Mob & demob not included in this CEDEP cost and is listed separately in MII estimate.)									
USR Hydraulic Dredging Mob & Demob	LS	1.0	0.00	0.00	0.00	60,265.00	0.00	60,265.00	78,811.94
(Note: Derived from CEDEP estimate.)									

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
Overhead			1,330,893.07	0.00	143,675.11	134,336.23	25,721.44	1,740,483.86
			1,330,893.07					*1,740,483.86*
10 Breakwaters and Seawalls	EA	1.0	1,330,893.07	0.00	143,675.11	134,336.23	25,721.44	1,740,483.86
			4,753.19					*6,216.01*
1000 ALTERNATIVE 1 Breakwaters & Seawalls	LF	280.0	1,330,893.07	0.00	143,675.11	134,336.23	25,721.44	1,740,483.86
			172,517.06					*225,610.28*
100001 MOB, DEMOB, PREP	EA	1.0	172,517.06	0.00	18,623.89	17,413.34	3,334.14	225,610.28
Mobilization & Demobilization	LS	1.0	52,627.60	0.00	5,681.36	5,312.07	1,017.10	68,824.08
			72.25		*10.80%*	*10.09%*	*1.93%*	*94.48*
RSM 015436501150 Mobilization or demobilization, delivery charge for small equipment on flatbed trailer, maximum	EA	4.0	288.99	0.00	31.20	29.17	5.59	377.93
			317.28		*10.80%*	*10.09%*	*1.93%*	*414.92*
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.P., up to 50 miles	EA	2.0	634.56	0.00	68.50	64.05	12.26	829.85
RSM 352023130100 Marine Plant, mobilization and demobilization, add to below, maximum	LS	1.0	51,704.06	0.00	5,581.66	5,218.85	999.26	67,616.31
			118,291.96					*154,697.07*
Demolition	EA	1.0	118,291.96	0.00	12,770.08	11,940.02	2,286.16	154,697.07
			55.08		*10.80%*	*10.09%*	*1.93%*	*72.03*
RSM 024119180500 Selective demolition, disposal only, urban buildings with salvage value allowed, wood frame, includes loading and 5 mile haul to dump	CY	813.0	44,782.35	0.00	4,834.43	4,520.19	865.48	58,564.40
(Note: timber disposal; Assume $7/cy disposal cost. Area = pi x r^2; 3.14159 x 1.4 ft ^2 = 6.2 sf x 140 ea x 20 lf /27 cf/cy = 643 cy + 10 % + 15% swell = 813 cy. Quote from Waste Management, Glen's Landfill, Maple City, MI = $28.06/ton, includes all fees and fuel surcharge. x 1.4 ton/cy = $39.30/cy)								
			4.81		*10.80%*	*10.09%*	*1.93%*	*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator	BCY	1,035.0	4,981.46	0.00	537.77	502.81	96.27	6,514.54
(Note: Assume all stone/broken concrete must first be removed; 390 cy will eventually be reused as scour stone protection, 510 cy will be disposed of. Total 900 cy, add 15% for clearing driveline = 1035 cy)								
			10.50		*10.80%*	*10.09%*	*1.93%*	*13.74*
RSM 312323181255 Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.5 loads/hour, 20 C.Y. dump trailer, highway haulers, excludes loading	LCY	742.0	7,794.32	0.00	841.43	786.73	150.64	10,193.07
(Note: 510 bcy + 135 cy from driveline = 645 + 15% for swell = 742 lcy)								
			497.82		*10.80%*	*10.09%*	*1.93%*	*651.03*
USR Marine Crew - General	HR	122.0	60,733.84	0.00	6,556.46	6,130.29	1,173.77	79,425.06
(Note: This custom crew includes an operator, deckhand, barge, crane & tug to assist with demo for the duration based on MII's production rate for these activities. Includes timber pile removal - 38 hour duration per MII production rate for calculated quantity in vlf. Avg length of each timber = 20 vlf assuming removal to lake bottom only. Required removal along 140 ft length avg 14" timber, assume 140 timbers x 20 vlf = 2800 vlf. Assume remaining time use for rock/concrete removal and disposal also per MII production rate for these activities.)								
			1,597.49					*2,089.13*
Temporary Access	EA	1.0	1,597.49	0.00	172.46	161.25	30.87	2,089.13
			7.20		*10.80%*	*10.09%*	*1.93%*	*9.41*

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
RSM 015523500050 Temporary, roads, gravel fill, 4" gravel depth, excl surfacing (Note: assume 100 ft long x 20 ft wide / 9 sf/sy = 222 sy)	SY	222.0	1,597.49	0.00	172.46	161.25	30.87	2,089.13
			696,226.91					*910,495.16*
10004602 BREAKWATER	EA	1.0	696,226.91	0.00	75,160.42	70,274.99	13,455.59	910,495.16
			83,115.09					*108,694.28*
10004605 Metals	EA	1.0	83,115.09	0.00	8,972.60	8,389.38	1,606.32	108,694.28
			83,115.09					*108,694.28*
10004605 01 Steel Framing for Piling Misc Metal	EA	1.0	83,115.09	0.00	8,972.60	8,389.38	1,606.32	108,694.28
			2,957.40		*10.80%*	*10.09%*	*1.93%*	*3,867.56*
HNC 051223758270 Structural steel member, channels MC10x22, C & MC, 21 to 58 plf, A992 steel, shop fabricated, incl shop primer, bolted connections (Note: 14 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)	TON	15.4	45,543.96	0.00	4,916.65	4,597.07	880.20	59,560.40
			3,370.80		*10.80%*	*10.09%*	*1.93%*	*4,408.19*
HNC 051223758260 Structural steel member, channels C12x20.7, C & MC, 11 to 21 plf, A992 steel, shop fabricated, incl shop primer, bolted connections (Note: 6.3 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)	TON	6.9	23,258.52	0.00	2,510.85	2,347.64	449.50	30,416.48
			2,358.50		*10.80%*	*10.09%*	*1.93%*	*3,084.34*
RSM 314116103000 Sheet piling, steel, tie rod, not upset, with turnbuckle, 1-1/2" to 4", excludes wales (Note: 1.65 ton required + 10% for cutting & waste)	TON	1.8	4,245.30	0.00	458.30	428.51	82.05	5,551.82
			419.47		*10.80%*	*10.09%*	*1.93%*	*548.57*
USR Marine Crew - Pile Install (Note: This custom crew includes an operator, deckhand, barge & tug to assist with channel for the duration; assume 1 ton/hr.)	HR	24.0	10,067.31	0.00	1,086.80	1,016.16	194.57	13,165.58
			63,584.07					*83,152.47*
100099 Associated General Items	EA	1.0	63,584.07	0.00	6,864.15	6,417.98	1,228.85	83,152.47
			17,806.75					*23,286.88*
10009902 Site Work	EA	1.0	17,806.75	0.00	1,922.31	1,797.36	344.14	23,286.88
			1,637.26					*2,141.13*
Egress Ladders	EA	1.0	1,637.26	0.00	176.75	165.26	31.64	2,141.13
			189.42		*10.80%*	*10.09%*	*1.93%*	*247.72*
RSM 355933501520 Jetties, dock accessories, ladder, crown top, 5 to 7 step, maximum	EA	2.0	378.84	0.00	40.90	38.24	7.32	495.43
			419.47		*10.80%*	*10.09%*	*1.93%*	*548.57*
USR Marine Crew - Site Work (Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done.)	HR	3.0	1,258.41	0.00	135.85	127.02	24.32	1,645.70
			16,169.49					*21,145.75*
Timber Bumper (Note: Assume marine crew placement; marine crew cost covered in demo and concrete items.)	EA	1.0	16,169.49	0.00	1,745.56	1,632.10	312.50	21,145.75

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
			2,390.24		*10.80%*	*10.09%*	*1.93%*	*3,125.85*
RSM 061323100020 Single 6" x 10" wood beam, heavy mill timber framing	MBF	1.5	3,585.36	0.00	387.05	361.89	69.29	4,688.77
(Note: 300 lf = 3600 in; 6 x 10 x 3600 / 144 cu in/board foot = 1500 board feet / 1000 = 1.5 mbf)								
			419.47		*10.80%*	*10.09%*	*1.93%*	*548.57*
USR Marine Crew - Site Work	HR	30.0	12,584.13	0.00	1,358.51	1,270.20	243.21	16,456.98
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done. Assume 10 LF/hr installation rate.)								
			45,777.32					*59,865.58*
10009905 Metals	EA	1.0	45,777.32	0.00	4,941.84	4,620.62	884.71	59,865.58
			4,898.84					*6,406.48*
10009905 01 Mooring Rings and Cleats	EA	1.0	4,898.84	0.00	528.85	494.47	94.68	6,406.48
			855.93		*10.80%*	*10.09%*	*1.93%*	*1,119.34*
RSM 355933502080 Jetties, dock accessories, mooring whip, 60,000 lb. boat	PR	5.0	4,279.63	0.00	462.00	431.97	82.71	5,596.71
			154.80		*10.80%*	*10.09%*	*1.93%*	*202.44*
USR Mooring Installation (Note: 1 foreman & 2 laborers)	HR	4.0	619.21	0.00	66.85	62.50	11.97	809.77
			37,667.45					*49,259.84*
10009902 03 Guard Rail	EA	1.0	37,667.45	0.00	4,066.35	3,802.04	727.98	49,259.84
			56.86		*10.80%*	*10.09%*	*1.93%*	*74.36*
RSM 055213500090 Railing, pipe, aluminum, clear finish, 2 rails, 1-1/2" dia, shop fabricated	LF	615.0	34,967.77	0.00	3,774.91	3,529.54	675.80	45,729.32
			43.54		*10.80%*	*10.09%*	*1.93%*	*56.94*
RSM 038213100100 Concrete core drilling, core, reinforced concrete slab, 1 1/2" diameter, up to 6" thick slab, includes bit, layout and set up (Note: Assume every 10 feet)	EA	62.0	2,699.68	0.00	291.44	272.50	52.18	3,530.52
			3,211.04					*4,199.25*
RGS Conduit	EA	1.0	3,211.04	0.00	346.64	324.11	62.06	4,199.25
			10.70		*10.80%*	*10.09%*	*1.93%*	*14.00*
RSM 260533100580 Rigid galvanized steel conduit, 1-1/2" diameter, to 15' high, incl couplings only	LF	300.0	3,211.04	0.00	346.64	324.11	62.06	4,199.25
			544,048.37					*711,482.71*
10004602 06 Piling	EA	1.0	544,048.37	0.00	58,732.15	54,914.56	10,514.52	711,482.71
			1,563.14		*10.80%*	*10.09%*	*1.93%*	*2,044.21*
RSM 314116100300 sheet piling, steel, 22 psf, 30' excavation, left in place, excludes wales	TON	278.0	434,552.87	0.00	46,911.68	43,862.42	8,398.36	568,289.28
(Note: 252.89 ton + 10% for cutting & waste. Driveline excavation was considered in demo item above. Quote on 3 Aug 2010 from Riley Nelson of Skyline Steel RNelson@skylinesteel.com; cold rolled, $0.55/lb delivered.)								
			179.12		*10.80%*	*10.09%*	*1.93%*	*234.24*
RSM 024556006400 Piles, steel, shoes	EA	306.0	54,810.62	0.00	5,917.02	5,532.41	1,059.29	71,678.94

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
(Note: Total wall length of 280 ft. / sheet width of 1.833' = 153 shoes x 2 sides = 306 shoes)								
			1.10		*10.80%*	*10.09%*	*1.93%*	*1.44*
RSM 024119270020 Selective demolition, torch cutting, steel, 1" thick plate	LF	140.0	153.64	0.00	16.59	15.51	2.97	200.92
(Note: Assume 1/2 will require torch cutting at the top Length 280 lf)								
			419.47		*10.80%*	*10.09%*	*1.93%*	*548.57*
USR Marine Crew - Pile Installation	HR	130.0	54,531.24	0.00	5,886.86	5,504.21	1,053.90	71,313.57
(Note: This custom crew includes an operator, deckhand, barge & tug to assist pile driving operations for the duration based on placement rate of 45 lf/day. Pile driving equipment is not included in this item as it is used in pile driving item above.)								
			14.05					*18.37*
10004602 02 Salvage and Reset Scour Stone	CY	390.0	5,479.39	0.00	591.52	553.07	105.90	7,165.70
			4.81		*10.80%*	*10.09%*	*1.93%*	*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator	BCY	390.0	1,877.07	0.00	202.64	189.47	36.28	2,454.75
(Note: 390 cy existing stone/broken concrete to be reused as scour stone protection.)								
			343.08		*10.80%*	*10.09%*	*1.93%*	*448.66*
USR Floating Plant to support excavator	HR	10.5	3,602.31	0.00	388.88	363.61	69.62	4,710.95
			1,840.87					*2,407.41*
10004603 CONCRETE	CY	156.0	287,176.11	0.00	31,001.78	28,986.67	5,550.09	375,556.38
			533.95					*698.27*
10004603 01 Concrete, in Place	CY	156.0	83,295.62	0.00	8,992.09	8,407.60	1,609.81	108,930.38
			212.00		*10.80%*	*10.09%*	*1.93%*	*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	CY	164.0	34,768.00	0.00	3,753.34	3,509.37	671.94	45,468.07
(Note: 156 cy required; add 5% for waste)								
			6.05		*10.80%*	*10.09%*	*1.93%*	*7.91*
RSM 031113652150 C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning	SFC	590.0	3,567.20	0.00	385.09	360.06	68.94	4,665.02
(Note: 15 ft wide x 2 ends; 280 ft long x 2 sides x 1 ft depth)								
			20.38		*10.80%*	*10.09%*	*1.93%*	*26.65*
RSM 033105704650 Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	CY	164.0	3,342.12	0.00	360.80	337.34	64.59	4,370.68
			5.33		*10.80%*	*10.09%*	*1.93%*	*6.97*
RSM 033053404900 Finishing, Structural concrete, in place, slab on grade, 12" thick, includes finishing only	SF	4,200.0	22,376.14	0.00	2,415.59	2,258.58	432.45	29,262.54
			11.81		*10.80%*	*10.09%*	*1.93%*	*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler	LF	312.0	3,683.25	0.00	397.62	371.78	71.18	4,816.80
(Note: Assume every 10 feet, 21 each x 15 ft width)								
			18.00		*10.80%*	*10.09%*	*1.93%*	*23.54*

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
RSM 014523501950 Concrete testing, compressive strength test, incl. picked up by lab, average (Note: Assume 6 per day for 6 days, 10 hrs/day)	EA	36.0	648.00	0.00	69.95	65.41	12.52	847.43
			12.94		*10.80%*	*10.09%*	*1.93%*	*16.92*
RSM 033923130300 Concrete surface treatment, curing, sprayed membrane compound	CSF	42.0	543.29	0.00	58.65	54.84	10.50	710.49
			126.14		*10.80%*	*10.09%*	*1.93%*	*164.96*
RSM 032105101202 High chairs, for reinforcing steel, individual (HC), galvanized, 3" high, includes material only (Note: 1ft oc 208 lf x 15 lf wide. Jack advises to divide this quantity by 1/2 to obtain cost)	CCT	16.0	2,018.24	0.00	217.88	203.71	39.01	2,639.37
			11.81		*10.80%*	*10.09%*	*1.93%*	*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: spaced every 50 ft c-c)	LF	60.0	708.32	0.00	76.47	71.50	13.69	926.31
			0.50		*10.80%*	*10.09%*	*1.93%*	*0.66*
RSM 033529350120 Control joint, concrete floor slab, sawcut in green concrete, 1" depth	LF	60.0	30.24	0.00	3.26	3.05	0.58	39.54
			2.87		*10.80%*	*10.09%*	*1.93%*	*3.75*
RSM 033529350380 Control joint, joint sealant, polyurethane, 1" x 1/2" (154 LF/Gal)	LF	60.0	172.15	0.00	18.58	17.38	3.33	225.13
			11,438.67		*10.80%*	*10.09%*	*1.93%*	*14,958.99*
USR Marine Crew - Standby	WK	1.0	11,438.67	0.00	1,234.85	1,154.58	221.07	14,958.99
			14,709.03					*19,235.83*
10004603 02 Reinforcing Steel	EA	1.0	14,709.03	0.00	1,587.90	1,484.68	284.27	19,235.83
			1,616.38		*10.80%*	*10.09%*	*1.93%*	*2,113.83*
RSM 032110600600 Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories (Note: #4: 8.3 ton required + 10% for waste; Assume quantity includes steel for anchor blocks as well.)	TON	9.1	14,709.03	0.00	1,587.90	1,484.68	284.27	19,235.83
			257.17					*336.31*
Concrete Anchor Blocks	CY	30.6	7,859.04	0.00	848.41	793.27	151.89	10,277.70
			212.00		*10.80%*	*10.09%*	*1.93%*	*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	6,784.00	0.00	732.36	684.76	131.11	8,871.82
			25.13		*10.80%*	*10.09%*	*1.93%*	*32.87*
RSM 033105702650 Structural concrete, placing, spread footing, pumped, over 5 C.Y., includes vibrating, excludes material (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	804.28	0.00	86.83	81.18	15.54	1,051.81
			2.71		*10.80%*	*10.09%*	*1.93%*	*3.54*
RSM 031113653000 C.I.P. concrete forms, slab on grade, edge,	LF	100.0	270.75	0.00	29.23	27.33	5.23	354.08

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
wood, to 6" high, 4 use, includes erecting, bracing, stripping and cleaning								
			163.66					*214.03*
Granular Fill for Concrete Walk	CY	155.6	25,459.57	0.00	2,748.46	2,569.81	492.04	33,294.92
			13.41		*10.80%*	*10.09%*	*1.93%*	*17.54*
RSM 312323171400 Fill, granular fill (Note: 155.56 ccy required; + 15% for swell = 178.9 lcy)	LCY	178.9	2,398.87	0.00	258.97	242.13	46.36	3,137.14
			2.00		*10.80%*	*10.09%*	*1.93%*	*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	155.6	311.48	0.00	33.63	31.44	6.02	407.35
			7.47		*10.80%*	*10.09%*	*1.93%*	*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	178.9	1,337.23	0.00	144.36	134.98	25.84	1,748.78
			1.40		*10.80%*	*10.09%*	*1.93%*	*1.83*
HNC 312323145510 Backfill, structural, 6" lifts, backfill around foundation, with hydraulic excavator	LCY	178.9	250.89	0.00	27.08	25.32	4.85	328.10
			1.21		*10.80%*	*10.09%*	*1.93%*	*1.58*
RSM 312323237240 Compaction, 4 passes, 18" wide, 12" lifts, walk behind, vibrating plate	ECY	155.6	187.54	0.00	20.25	18.93	3.62	245.26
			419.47		*10.80%*	*10.09%*	*1.93%*	*548.57*
USR Marine Crew - Granular Fill (Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of granular fill under the concrete walkway.)	HR	50.0	20,973.55	0.00	2,264.18	2,117.01	405.34	27,428.30
			91.08					*119.11*
Fill Stone for Concrete Walk	CY	1,711.1	155,852.84	0.00	16,824.92	15,731.30	3,012.08	203,817.54
			38.01		*10.80%*	*10.09%*	*1.93%*	*49.70*
RSM 353116196000 Steel sheet piling seawalls, crushed stone, placed behind bulkhead by clam bucket (Note: 1711.11 cy reqr'd + 15% for void space = 1968 lcy)	LCY	1,968.0	74,795.62	0.00	8,074.48	7,549.64	1,445.53	97,814.45
			2.00		*10.80%*	*10.09%*	*1.93%*	*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	1,711.1	3,426.23	0.00	369.88	345.83	66.22	4,480.68
			7.47		*10.80%*	*10.09%*	*1.93%*	*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	1,968.0	14,710.33	0.00	1,588.04	1,484.81	284.30	19,237.52
			419.47		*10.80%*	*10.09%*	*1.93%*	*548.57*
USR Marine Crew - Fill Stone (Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of stone fill under the concrete walkway.)	HR	150.0	62,920.66	0.00	6,792.53	6,351.02	1,216.03	82,284.89
			11.07					*14.48*
10004602 01 DREDGING	CY	15,800.0	174,973.00	0.00	18,889.02	17,661.23	3,381.61	228,822.05
			7.26		*10.80%*	*10.09%*	*1.93%*	*9.49*
USR Dredging (Note: Production rate and cost per cubic yard derived from CDEP estimating software; includes labor & equipment; Sub-bid cost does not include labor & equipment, profit, overhead and bond; these	CY	15,800.0	114,708.00	0.00	12,383.18	11,578.27	2,216.90	150,010.11

Currency in US dollars

Description	UOM	Quantity	DirectCost	SubCMU	HOOH_PRM	Profit_PRM	Bond_PRM	ProjectCost
are applied within MII file. Mob & demob not included in this CEDEP cost and is listed separately in MII estimate.)								
USR Hydraulic Dredging Mob & Demob	LS	1.0	60,265.00	0.00	6,505.84	6,082.96	1,164.71	78,811.94
(Note: Derived from CEDEP estimate.)								

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
Labor Rates	5,995.7	146,227.68	93,957.90	48,549.05	0.00	342,035.78
10 Breakwaters and Seawalls	5,995.7	146,227.68	93,957.90	48,549.05	0.00	342,035.78
1000 ALTERNATIVE 1 Breakwaters & Seawalls	5,995.7	146,227.68	93,957.90	48,549.05	0.00	342,035.78
100001 MOB, DEMOB, PREP	1,445.5	33,595.95	22,334.08	11,154.19	0.00	79,395.60
Mobilization & Demobilization	653.3	12,886.37	9,717.47	4,278.40	0.00	31,768.67
		21.64	*18.90*		*0.00*	*56.32*
MIL B-EQOPRMED Equip. Operators, Medium	160.0	3,462.40	3,024.00	1,149.55	0.00	9,010.50
(Note: Assumed Davis Bacon Power Equip. Operators: Group 2)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	80.0	1,399.20	1,512.00	464.55	0.00	3,974.86
(Note: A laborer or an Oiler can be a grade checker.)						
		16.77	*11.49*		*0.00*	*40.01*
MIL B-LABORER Laborers, (Semi-Skilled)	80.0	1,341.60	919.20	445.42	0.00	3,200.83
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORER Laborers, (Semi-Skilled)	160.0	2,523.20	1,838.40	837.73	0.00	6,146.04
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		24.55	*14.60*		*0.00*	*56.03*
MIL B-TRKDVRHV Truck Drivers, Heavy	165.3	4,058.93	2,413.87	1,347.61	0.00	9,263.51
(Note: Assumed Davis Bacon Truck Drivers: Group 1)						
		12.63	*1.25*		*0.00*	*21.62*
MIL B-TRKDVRLT Truck Drivers, Light	8.0	101.04	10.00	33.55	0.00	172.92
(Note: Assumed Davis Bacon Truck Drivers: Group 2)						
Demolition	777.3	20,467.79	12,426.97	6,795.51	0.00	47,022.47
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	122.0	3,111.00	2,025.20	1,032.88	0.00	7,300.00
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	122.0	4,270.00	2,171.60	1,417.68	0.00	9,320.01
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	122.0	4,683.58	1,595.76	1,555.00	0.00	9,318.22
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		28.39	*18.90*		*0.00*	*67.10*
MIL B-EQOPRCRN Equip. Operators, Heavy	27.6	783.56	521.64	260.15	0.00	1,851.94
(Note: Assumed Davis Bacon Power Equip. Operators Group 1)						
		21.64	*18.90*		*0.00*	*56.32*
MIL B-EQOPRMED Equip. Operators, Medium	26.3	569.82	497.67	189.19	0.00	1,482.90
(Note: Assumed Davis Bacon Power Equip. Operators: Group 2)						
		17.49	*18.90*		*0.00*	*49.73*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	149.6	2,616.50	2,827.44	868.71	0.00	7,440.26
(Note: A laborer or an Oiler can be a grade checker.)						
		16.77	*11.49*		*0.00*	*40.01*
MIL B-LABORER Laborers, (Semi-Skilled)	26.3	441.59	302.55	146.61	0.00	1,053.55

Currency in US dollars

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORER Laborers, (Semi-Skilled)	52.7	830.51	605.11	275.74	0.00	2,022.97
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		24.55	*14.60*		*0.00*	*56.17*
MIL B-TRKDVRHV Truck Drivers, Heavy	128.8	3,161.22	1,879.99	1,049.56	0.00	7,232.62
(Note: Assumed Davis Bacon Truck Drivers: Group 1)						
Temporary Access	14.9	241.78	189.65	80.27	0.00	604.45
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPRLT Equip. Operators, Light	2.5	43.44	46.95	14.42	0.00	123.42
(Note: Assumed Davis Bacon Power Equip. Operators Group 3)						
		16.77	*11.49*		*0.00*	*40.01*
MIL B-LABORER Laborers, (Semi-Skilled)	2.5	41.66	28.54	13.83	0.00	99.38
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORER Laborers, (Semi-Skilled)	9.9	156.69	114.16	52.02	0.00	381.66
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
10004602 BREAKWATER	2,680.3	65,108.34	42,611.61	21,616.62	0.00	153,087.08
10004605 Metals	96.0	2,793.12	1,593.12	927.34	0.00	6,295.06
10004605 01 Steel Framing for Piling Misc Metal	96.0	2,793.12	1,593.12	927.34	0.00	6,295.06
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	24.0	612.00	398.40	203.19	0.00	1,436.07
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	24.0	840.00	427.20	278.89	0.00	1,833.44
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	24.0	921.36	313.92	305.90	0.00	1,833.09
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	24.0	419.76	453.60	139.36	0.00	1,192.46
(Note: A laborer or an Oiler can be a grade checker.)						
100099 Associated General Items	390.2	9,487.07	6,027.85	3,149.80	0.00	22,091.21
10009902 Site Work	156.8	4,332.58	2,513.23	1,438.46	0.00	9,813.03
Egress Ladders	15.0	396.75	233.83	131.72	0.00	902.85
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	3.0	76.50	49.80	25.40	0.00	179.51
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	3.0	105.00	53.40	34.86	0.00	229.18
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	3.0	115.17	39.24	38.24	0.00	229.14
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	3.0	52.47	56.70	17.42	0.00	149.06

Currency in US dollars

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
(Note: A laborer or an Oiler can be a grade checker.)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORERG Laborers, General (Lowest paid)	3.0	47.61	34.69	15.81	0.00	115.96
(Note: Assumed Davis Bacon Laborers: Group 2)						
Timber Bumper	141.8	3,935.84	2,279.40	1,306.74	0.00	8,910.18
(Note: Assume marine crew placement; marine crew cost covered in demo and concrete items.)						
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	30.0	765.00	498.00	253.99	0.00	1,795.08
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	30.0	1,050.00	534.00	348.61	0.00	2,291.81
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	30.0	1,151.70	392.40	382.38	0.00	2,291.37
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		20.37	*13.20*		*0.00*	*47.73*
MIL B-CARPNTER Carpenters	21.8	444.44	288.00	147.56	0.00	1,041.36
(Note: Assumed Davis Bacon CARPENTER)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	30.0	524.70	567.00	174.21	0.00	1,490.57
(Note: A laborer or an Oiler can be a grade checker.)						
10009905 Metals	233.4	5,154.49	3,514.63	1,711.34	0.00	12,278.18
10009905 01 Mooring Rings and Cleats	22.0	441.42	259.14	146.56	0.00	1,003.34
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	4.0	153.56	52.32	50.98	0.00	305.52
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		16.77	*11.49*		*0.00*	*40.01*
MIL B-LABORER Laborers, (Semi-Skilled)	4.0	67.08	45.96	22.27	0.00	160.04
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORER Laborers, (Semi-Skilled)	4.0	63.08	45.96	20.94	0.00	153.65
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORERG Laborers, General (Lowest paid)	10.0	157.70	114.90	52.36	0.00	384.13
(Note: Assumed Davis Bacon Laborers: Group 2)						
10009902 03 Guard Rail	181.4	3,894.37	2,856.19	1,292.97	0.00	9,507.52
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORER Laborers, (Semi-Skilled)	29.2	460.11	335.24	152.76	0.00	1,120.75
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-SKILLWKR Skilled Workers	29.2	460.11	335.24	152.76	0.00	1,120.75
(Note: Assumed Davis Bacon CARPENTER)						
		25.68	*17.77*		*0.00*	*61.47*
MIL B-STRSTEEL Structural Steel Workers	30.8	789.66	546.43	262.18	0.00	1,890.19

Currency in US dollars

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
(Note: Assume Davis Bacon IRONWORKER)						
		23.68	*17.77*		*0.00*	*58.27*
MIL B-STRSTEEL Structural Steel Workers	92.3	2,184.48	1,639.28	725.27	0.00	5,375.83
(Note: Assume Davis Bacon IRONWORKER)						
RGS Conduit	30.0	818.70	399.30	271.82	0.00	1,767.32
		27.29	*13.31*		*0.00*	*58.91*
MIL B-ELECTRN Electricians	30.0	818.70	399.30	271.82	0.00	1,767.32
(Note: Assumed Davis Bacon ELECTRICIAN)						
10004602 06 Piling	2,141.8	51,496.51	34,087.43	17,097.36	0.00	121,531.55
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	130.0	3,315.00	2,158.00	1,100.61	0.00	7,778.69
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	130.0	4,550.00	2,314.00	1,510.65	0.00	9,931.16
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	130.0	4,990.70	1,700.40	1,656.96	0.00	9,929.25
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		28.39	*18.90*		*0.00*	*67.10*
MIL B-EQOPRCRN Equip. Operators, Heavy	343.5	9,751.25	6,491.68	3,237.51	0.00	23,046.88
(Note: Assumed Davis Bacon Power Equip. Operators Group 1)						
		17.49	*18.90*		*0.00*	*49.84*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	301.7	5,277.39	5,702.84	1,752.15	0.00	15,037.26
(Note: A laborer or an Oiler can be a grade checker.)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORERG Laborers, General (Lowest paid)	3.1	49.06	35.75	16.29	0.00	119.51
(Note: Assumed Davis Bacon Laborers: Group 2)						
		21.97	*13.20*		*0.00*	*50.28*
MIL B-PILEDRVR Pile Drivers	171.7	3,773.07	2,266.93	1,252.70	0.00	8,635.82
(Note: Assumed Davis Bacon PILEDRIVERMAN)						
		20.37	*13.20*		*0.00*	*47.73*
MIL B-PILEDRVR Pile Drivers	686.9	13,993.17	9,067.74	4,645.87	0.00	32,787.36
(Note: Assumed Davis Bacon PILEDRIVERMAN)						
		23.68	*17.77*		*0.00*	*58.27*
MIL B-WELDERS Welders, Structural Steel	244.8	5,796.86	4,350.10	1,924.62	0.00	14,265.62
(Note: Assume Davis Bacon IRONWORKER)						
10004602 02 Salvage and Reset Scour Stone	52.3	1,331.64	903.21	442.12	0.00	3,169.26
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	10.5	267.75	174.30	88.90	0.00	628.28
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	10.5	403.10	137.34	133.83	0.00	801.98
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		28.39	*18.90*		*0.00*	*67.10*
MIL B-EQOPRCRN Equip. Operators, Heavy	10.4	295.26	196.56	98.03	0.00	697.83

Currency in US dollars

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
(Note: Assumed Davis Bacon Power Equip. Operators Group 1)						
		17.49	*18.90*		*0.00*	*49.82*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	20.9	365.54	395.01	121.36	0.00	1,041.17
(Note: A laborer or an Oiler can be a grade checker.)						
10004603 CONCRETE	1,869.9	47,523.39	29,012.20	15,778.24	0.00	109,553.11
10004603 01 Concrete, in Place	484.8	10,891.26	6,657.74	3,616.01	0.00	25,221.76
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	40.0	1,020.00	664.00	338.65	0.00	2,393.44
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	40.0	1,400.00	712.00	464.81	0.00	3,055.74
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	40.0	1,535.60	523.20	509.83	0.00	3,055.15
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		20.37	*13.20*		*0.00*	*48.15*
MIL B-CARPNTER Carpenters	111.0	2,261.29	1,465.34	750.77	0.00	5,345.30
(Note: Assumed Davis Bacon CARPENTER)						
		22.29	*11.83*		*0.00*	*49.90*
MIL B-CEMTFINR Cement Finishers	83.2	1,854.36	984.17	615.67	0.00	4,151.50
(Note: Assumed Davis Bacon CEMENT MASON/CONCRETE FINISHER)						
		21.64	*18.90*		*0.00*	*56.32*
MIL B-EQOPRMED Equip. Operators, Medium	7.1	153.47	134.04	50.95	0.00	399.38
(Note: Assumed Davis Bacon Power Equip. Operators: Group 2)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	40.0	699.60	756.00	232.27	0.00	1,987.43
(Note: A laborer or an Oiler can be a grade checker.)						
		15.77	*11.49*		*0.00*	*39.00*
MIL B-LABORER Laborers, (Semi-Skilled)	97.0	1,530.36	1,115.02	508.09	0.00	3,784.83
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		16.77	*11.49*		*0.00*	*40.10*
MIL B-LABORER Laborers, (Semi-Skilled)	19.4	325.03	222.69	107.91	0.00	777.25
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.41*
MIL B-LABORERG Laborers, General (Lowest paid)	7.1	111.55	81.28	37.04	0.00	271.72
(Note: Assumed Davis Bacon Laborers: Group 2)						
10004603 02 Reinforcing Steel	126.6	2,998.09	2,249.84	995.40	0.00	7,378.07
		23.68	*17.77*		*0.00*	*58.27*
MIL B-RODMAN Rodmen, (Reinforcing)	126.6	2,998.09	2,249.84	995.40	0.00	7,378.07
(Note: Assume Davis Bacon IRONWORKER)						
Concrete Anchor Blocks	19.0	340.67	238.22	113.11	0.00	820.35
		20.37	*13.20*		*0.00*	*47.73*
MIL B-CARPNTER Carpenters	4.0	81.48	52.80	27.05	0.00	190.92
(Note: Assumed Davis Bacon CARPENTER)						

Currency in US dollars

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
		22.29	*11.83*		*0.00*	*49.22*
MIL B-CEMTFINR Cement Finishers	1.7	38.04	20.19	12.63	0.00	84.00
(Note: Assumed Davis Bacon CEMENT MASON/CONCRETE FINISHER)						
		21.64	*18.90*		*0.00*	*56.32*
MIL B-EQOPRMED Equip. Operators, Medium	1.7	36.93	32.26	12.26	0.00	96.11
(Note: Assumed Davis Bacon Power Equip. Operators: Group 2)						
		16.77	*11.49*		*0.00*	*40.01*
MIL B-LABORER Laborers, (Semi-Skilled)	1.7	28.62	19.61	9.50	0.00	68.28
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		15.77	*11.49*		*0.00*	*38.62*
MIL B-LABORER Laborers, (Semi-Skilled)	9.9	155.60	113.37	51.66	0.00	381.03
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
Granular Fill for Concrete Walk	221.5	6,296.94	3,633.61	2,090.65	0.00	14,241.48
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	50.0	1,275.00	830.00	423.31	0.00	2,991.80
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	50.0	1,750.00	890.00	581.02	0.00	3,819.68
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	50.0	1,919.50	654.00	637.29	0.00	3,818.94
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		28.39	*18.90*		*0.00*	*67.30*
MIL B-EQOPRCRN Equip. Operators, Heavy	2.8	79.87	53.17	26.52	0.00	189.34
(Note: Assumed Davis Bacon Power Equip. Operators Group 1)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	51.5	900.17	972.74	298.87	0.00	2,557.61
(Note: A laborer or an Oiler can be a grade checker.)						
		15.77	*11.49*		*0.00*	*38.47*
MIL B-LABORER Laborers, (Semi-Skilled)	5.8	91.31	66.53	30.32	0.00	222.73
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		24.55	*14.60*		*0.00*	*56.02*
MIL B-TRKDVRHV Truck Drivers, Heavy	11.4	281.09	167.16	93.32	0.00	641.38
(Note: Assumed Davis Bacon Truck Drivers: Group 1)						
Fill Stone for Concrete Walk	1,017.9	26,996.43	16,232.80	8,963.08	0.00	61,891.45
		25.50	*16.60*		*0.00*	*59.84*
CIV MC-CLMDK Clamshell Dredge- Deckhand	150.0	3,825.00	2,490.00	1,269.94	0.00	8,975.41
		35.00	*17.80*		*0.00*	*76.39*
CIV MC-CLMOP Clamshell Dredge- Operator	150.0	5,250.00	2,670.00	1,743.05	0.00	11,459.03
		38.39	*13.08*		*0.00*	*76.38*
FOP FA-AGENS General Superintendents (P.M.)	150.0	5,758.50	1,962.00	1,911.88	0.00	11,456.83
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)						
		28.39	*18.90*		*0.00*	*67.48*
MIL B-EQOPRCRN Equip. Operators, Heavy	146.0	4,144.91	2,759.38	1,376.15	0.00	9,852.46

Currency in US dollars

Description	ManHours	BaseWage	TaxableFringe	WCI	NonTaxFringe	Total
(Note: Assumed Davis Bacon Power Equip. Operators Group 1)						
		17.49	*18.90*		*0.00*	*49.69*
MIL B-EQOPROIL Equip. Operators, Oilers / Grade Checker	150.0	2,623.50	2,835.00	871.03	0.00	7,452.87
(Note: A laborer or an Oiler can be a grade checker.)						
		15.77	*11.49*		*0.00*	*38.63*
MIL B-LABORER Laborers, (Semi-Skilled)	146.0	2,302.40	1,677.53	764.42	0.00	5,639.36
(Note: Assumed Davis Bacon Laborers: Group 3: General Laborer)						
		24.55	*14.60*		*0.00*	*56.02*
MIL B-TRKDVRHV Truck Drivers, Heavy	126.0	3,092.12	1,838.90	1,026.62	0.00	7,055.50
(Note: Assumed Davis Bacon Truck Drivers: Group 1)						

Currency in US dollars

Description	UOM	Quantity	MatlCost	TaxAdj	DirectCost	ProjectCost
Material Rates			557,062.19	33,423.73	1,330,893.07	1,740,483.86
			557,062.19		*1,330,893.07*	*1,740,483.86*
10 Breakwaters and Seawalls	EA	1.0	557,062.19	33,423.73	1,330,893.07	1,740,483.86
			1,989.51		*4,753.19*	*6,216.01*
1000 ALTERNATIVE 1 Breakwaters & Seawalls	LF	280.0	557,062.19	33,423.73	1,330,893.07	1,740,483.86
			888.00		*172,517.06*	*225,610.28*
100001 MOB, DEMOB, PREP	EA	1.0	888.00	53.28	172,517.06	225,610.28
Mobilization & Demobilization	LS	1.0	0.00	0.00	52,627.60	68,824.08
			0.00	*0.00%*	*72.25*	*94.48*
RSM 015436501150 Mobilization or demobilization, delivery charge for small equipment on flatbed trailer, maximum	EA	4.0	0.00	0.00	288.99	377.93
			0.00	*0.00%*	*317.28*	*414.92*
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.P., up to 50 miles	EA	2.0	0.00	0.00	634.56	829.85
RSM 352023130100 Marine Plant, mobilization and demobilization, add to below, maximum	LS	1.0	0.00	0.00	51,704.06	67,616.31
			0.00		*118,291.96*	*154,697.07*
Demolition	EA	1.0	0.00	0.00	118,291.96	154,697.07
			0.00	*0.00%*	*55.08*	*72.03*
RSM 024119180500 Selective demolition, disposal only, urban buildings with salvage value allowed, wood frame, includes loading and 5 mile haul to dump	CY	813.0	0.00	0.00	44,782.35	58,564.40
(Note: timber disposal; Assume $7/cy disposal cost. Area = pi x r^2; 3.14159 x 1.4 ft ^2 = 6.2 sf x 140 ea x 20 lf /27 cf/cy = 643 cy + 10 % + 15% swell = 813 cy. Quote from Waste Management, Glen's Landfill, Maple City, MI = $28.06/ton, includes all fees and fuel surcharge. x 1.4 ton/cy = $39.30/cy)						
			0.00	*0.00%*	*4.81*	*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator	BCY	1,035.0	0.00	0.00	4,981.46	6,514.54
(Note: Assume all stone/broken concrete must first be removed; 390 cy will eventually be reused as scour stone protection, 510 cy will be disposed of. Total 900 cy, add 15% for clearing driveline = 1035 cy)						
			0.00	*0.00%*	*10.50*	*13.74*
RSM 312323181255 Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.5 loads/hour, 20 C.Y. dump trailer, highway haulers, excludes loading	LCY	742.0	0.00	0.00	7,794.32	10,193.07
(Note: 510 bcy + 135 cy from driveline = 645 + 15% for swell = 742 lcy)						
			0.00	*0.00%*	*497.82*	*651.03*
USR Marine Crew - General	HR	122.0	0.00	0.00	60,733.84	79,425.06
(Note: This custom crew includes an operator, deckhand, barge, crane & tug to assist with demo for the duration based on MII's production rate for these activities. Includes timber pile removal - 38 hour duration per MII production rate for calculated quantity in vlf. Avg length of each timber = 20 vlf assuming removal to lake bottom only. Required removal along 140 ft length avg 14" timber, assume 140 timbers x 20 vlf = 2800 vlf. Assume remaining time use for rock/concrete removal and disposal also per MII production rate for these activities.)						
			888.00		*1,597.49*	*2,089.13*
Temporary Access	EA	1.0	888.00	53.28	1,597.49	2,089.13
			4.00	*53.28%*	*7.20*	*9.41*
RSM 015523500050 Temporary, roads, gravel fill, 4" gravel depth, excl surfacing	SY	222.0	888.00	53.28	1,597.49	2,089.13
(Note: assume 100 ft long x 20 ft wide / 9 sf/sy = 222 sy)						

Currency in US dollars

Description	UOM	Quantity	MatlCost	TaxAdj	DirectCost	ProjectCost
			446,736.50		*696,226.91*	*910,495.16*
10004602 BREAKWATER	EA	1.0	446,736.50	26,804.19	696,226.91	910,495.16
			68,913.00		*83,115.09*	*108,694.28*
10004605 Metals	EA	1.0	68,913.00	4,134.78	83,115.09	108,694.28
			68,913.00		*83,115.09*	*108,694.28*
10004605 01 Steel Framing for Piling Misc Metal	EA	1.0	68,913.00	4,134.78	83,115.09	108,694.28
			2,790.00	*2,577.96%*	*2,957.40*	*3,867.56*
HNC 051223758270 Structural steel member, channels MC10x22, C & MC, 21 to 58 plf, A992 steel, shop fabricated, incl shop primer, bolted connections	TON	15.4	42,966.00	2,577.96	45,543.96	59,560.40
(Note: 14 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)						
			3,180.00	*1,316.52%*	*3,370.80*	*4,408.19*
HNC 051223758260 Structural steel member, channels C12x20.7, C & MC, 11 to 21 plf, A992 steel, shop fabricated, incl shop primer, bolted connections	TON	6.9	21,942.00	1,316.52	23,258.52	30,416.48
(Note: 6.3 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)						
			2,225.00	*240.30%*	*2,358.50*	*3,084.34*
RSM 314116103000 Sheet piling, steel, tie rod, not upset, with turnbuckle, 1-1/2" to 4", excludes wales	TON	1.8	4,005.00	240.30	4,245.30	5,551.82
(Note: 1.65 ton required + 10% for cutting & waste)						
			0.00	*0.00%*	*419.47*	*548.57*
USR Marine Crew - Pile Install	HR	24.0	0.00	0.00	10,067.31	13,165.58
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with channel for the duration; assume 1 ton/hr.)						
			33,741.30		*63,584.07*	*83,152.47*
100099 Associated General Items	EA	1.0	33,741.30	2,024.48	63,584.07	83,152.47
			2,648.00		*17,806.75*	*23,286.88*
10009902 Site Work	EA	1.0	2,648.00	158.88	17,806.75	23,286.88
			248.00		*1,637.26*	*2,141.13*
Egress Ladders	EA	1.0	248.00	14.88	1,637.26	2,141.13
			124.00	*14.88%*	*189.42*	*247.72*
RSM 355933501520 Jetties, dock accessories, ladder, crown top, 5 to 7 step, maximum	EA	2.0	248.00	14.88	378.84	495.43
			0.00	*0.00%*	*419.47*	*548.57*
USR Marine Crew - Site Work	HR	3.0	0.00	0.00	1,258.41	1,645.70
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done.)						
			2,400.00		*16,169.49*	*21,145.75*
Timber Bumper	EA	1.0	2,400.00	144.00	16,169.49	21,145.75
(Note: Assume marine crew placement; marine crew cost covered in demo and concrete items.)						
			1,600.00	*144.00%*	*2,390.24*	*3,125.85*
RSM 061323100020 Single 6" x 10" wood beam, heavy mill timber framing	MBF	1.5	2,400.00	144.00	3,585.36	4,688.77
(Note: 300 lf = 3600 in; 6 x 10 x 3600 / 144 cu in/board foot = 1500 board feet / 1000 = 1.5 mbf)						
			0.00	*0.00%*	*419.47*	*548.57*
USR Marine Crew - Site Work	HR	30.0	0.00	0.00	12,584.13	16,456.98
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this						

Currency in US dollars

Description	UOM	Quantity	MatlCost	TaxAdj	DirectCost	ProjectCost
equipment because the site work items contain the necessary equipment for work being done. Assume 10 LF/hr installation rate.)						
			31,093.30		*45,777.32*	*59,865.58*
10009905 Metals	EA	1.0	31,093.30	1,865.60	45,777.32	59,865.58
			3,675.00		*4,898.84*	*6,406.48*
10009905 01 Mooring Rings and Cleats	EA	1.0	3,675.00	220.50	4,898.84	6,406.48
			735.00	*220.50%*	*855.93*	*1,119.34*
RSM 355933502080 Jetties, dock accessories, mooring whip, 60,000 lb. boat	PR	5.0	3,675.00	220.50	4,279.63	5,596.71
			0.00	*0.00%*	*154.80*	*202.44*
USR Mooring Installation (Note: 1 foreman & 2 laborers)	HR	4.0	0.00	0.00	619.21	809.77
			26,056.30		*37,667.45*	*49,259.84*
10009902 03 Guard Rail	EA	1.0	26,056.30	1,563.38	37,667.45	49,259.84
			42.00	*1,549.80%*	*56.86*	*74.36*
RSM 055213500090 Railing, pipe, aluminum, clear finish, 2 rails, 1-1/2" dia, shop fabricated	LF	615.0	25,830.00	1,549.80	34,967.77	45,729.32
			3.65	*13.58%*	*43.54*	*56.94*
RSM 038213100100 Concrete core drilling, core, reinforced concrete slab, 1 1/2" diameter, up to 6" thick slab, includes bit, layout and set up (Note: Assume every 10 feet)	EA	62.0	226.30	13.58	2,699.68	3,530.52
			1,362.00		*3,211.04*	*4,199.25*
RGS Conduit	EA	1.0	1,362.00	81.72	3,211.04	4,199.25
			4.54	*81.72%*	*10.70*	*14.00*
RSM 260533100580 Rigid galvanized steel conduit, 1-1/2" diameter, to 15' high, incl couplings only	LF	300.0	1,362.00	81.72	3,211.04	4,199.25
			344,082.20		*544,048.37*	*711,482.71*
10004602 06 Piling	EA	1.0	344,082.20	20,644.93	544,048.37	711,482.71
			1,100.00	*18,348.00%*	*1,563.14*	*2,044.21*
RSM 314116100300 sheet piling, steel, 22 psf, 30' excavation, left in place, excludes wales	TON	278.0	305,800.00	18,348.00	434,552.87	568,289.28
(Note: 252.89 ton + 10% for cutting & waste. Driveline excavation was considered in demo item above. Quote on 3 Aug 2010 from Riley Nelson of Skyline Steel RNelson@skylinesteel.com; cold rolled, $0.55/lb delivered.)						
			125.00	*2,295.00%*	*179.12*	*234.24*
RSM 024556006400 Piles, steel, shoes (Note: Total wall length of 280 ft. / sheet width of 1.833' = 153 shoes x 2 sides = 306 shoes)	EA	306.0	38,250.00	2,295.00	54,810.62	71,678.94
			0.23	*1.93%*	*1.10*	*1.44*
RSM 024119270020 Selective demolition, torch cutting, steel, 1" thick plate (Note: Assume 1/2 will require torch cutting at the top Length 280 lf)	LF	140.0	32.20	1.93	153.64	200.92
			0.00	*0.00%*	*419.47*	*548.57*
USR Marine Crew - Pile Installation	HR	130.0	0.00	0.00	54,531.24	71,313.57
(Note: This custom crew includes an operator, deckhand, barge & tug to assist pile driving operations for the duration based on placement rate of 45 lf/day. Pile driving equipment is not included in this item as it is used in pile driving item above.)						
			0.00		*14.05*	*18.37*
10004602 02 Salvage and Reset Scour Stone	CY	390.0	0.00	0.00	5,479.39	7,165.70

Currency in US dollars

Description	UOM	Quantity	MatlCost	TaxAdj	DirectCost	ProjectCost
			0.00	*0.00%*	*4.81*	*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator (Note: 390 cy existing stone/broken concrete to be reused as scour stone protection.)	BCY	390.0	0.00	0.00	1,877.07	2,454.75
			0.00	*0.00%*	*343.08*	*448.66*
USR Floating Plant to support excavator	HR	10.5	0.00	0.00	3,602.31	4,710.95
			701.52		*1,840.87*	*2,407.41*
10004603 CONCRETE	CY	156.0	109,437.69	6,566.26	287,176.11	375,556.38
			336.56		*533.95*	*698.27*
10004603 01 Concrete, in Place	CY	156.0	52,503.60	3,150.22	83,295.62	108,930.38
			200.00	*1,968.00%*	*212.00*	*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments (Note: 156 cy required; add 5% for waste)	CY	164.0	32,800.00	1,968.00	34,768.00	45,468.07
			0.72	*25.49%*	*6.05*	*7.91*
RSM 031113652150 C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning (Note: 15 ft wide x 2 ends; 280 ft long x 2 sides x 1 ft depth)	SFC	590.0	424.80	25.49	3,567.20	4,665.02
			0.00	*0.00%*	*20.38*	*26.65*
RSM 033105704650 Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	CY	164.0	0.00	0.00	3,342.12	4,370.68
			3.88	*977.76%*	*5.33*	*6.97*
RSM 033053404900 Finishing, Structural concrete, in place, slab on grade, 12" thick, includes finishing only	SF	4,200.0	16,296.00	977.76	22,376.14	29,262.54
			2.00	*37.44%*	*11.81*	*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: Assume every 10 feet, 21 each x 15 ft width)	LF	312.0	624.00	37.44	3,683.25	4,816.80
			0.00	*0.00%*	*18.00*	*23.54*
RSM 014523501950 Concrete testing, compressive strength test, incl. picked up by lab, average (Note: Assume 6 per day for 6 days, 10 hrs/day)	EA	36.0	0.00	0.00	648.00	847.43
			6.10	*15.37%*	*12.94*	*16.92*
RSM 033923130300 Concrete surface treatment, curing, sprayed membrane compound	CSF	42.0	256.20	15.37	543.29	710.49
			119.00	*114.24%*	*126.14*	*164.96*
RSM 032105101202 High chairs, for reinforcing steel, individual (HC), galvanized, 3" high, includes material only (Note: 1ft oc 208 lf x 15 lf wide. Jack advises to divide this quantity by 1/2 to obtain cost)	CCT	16.0	1,904.00	114.24	2,018.24	2,639.37
			2.00	*7.20%*	*11.81*	*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: spaced every 50 ft c-c)	LF	60.0	120.00	7.20	708.32	926.31
			0.06	*0.22%*	*0.50*	*0.66*

Currency in US dollars

Description	UOM	Quantity	MatlCost	TaxAdj	DirectCost	ProjectCost
RSM 033529350120 Control joint, concrete floor slab, sawcut in green concrete, 1" depth	LF	60.0	3.60	0.22	30.24	39.54
			1.25	*4.50%*	*2.87*	*3.75*
RSM 033529350380 Control joint, joint sealant, polyurethane, 1" x 1/2" (154 LF/Gal)	LF	60.0	75.00	4.50	172.15	225.13
			0.00	*0.00%*	*11,438.67*	*14,958.99*
USR Marine Crew - Standby	WK	1.0	0.00	0.00	11,438.67	14,958.99
			6,916.00		*14,709.03*	*19,235.83*
10004603 02 Reinforcing Steel	EA	1.0	6,916.00	414.96	14,709.03	19,235.83
			760.00	*414.96%*	*1,616.38*	*2,113.83*
RSM 032110600600 Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories (Note: #4: 8.3 ton required + 10% for waste; Assume quantity includes steel for anchor blocks as well.)	TON	9.1	6,916.00	414.96	14,709.03	19,235.83
			210.31		*257.17*	*336.31*
Concrete Anchor Blocks	CY	30.6	6,427.00	385.62	7,859.04	10,277.70
			200.00	*384.00%*	*212.00*	*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	6,400.00	384.00	6,784.00	8,871.82
			0.00	*0.00%*	*25.13*	*32.87*
RSM 033105702650 Structural concrete, placing, spread footing, pumped, over 5 C.Y., includes vibrating, excludes material (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	0.00	0.00	804.28	1,051.81
			0.27	*1.62%*	*2.71*	*3.54*
RSM 031113653000 C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erecting, bracing, stripping and cleaning	LF	100.0	27.00	1.62	270.75	354.08
			14.55		*163.66*	*214.03*
Granular Fill for Concrete Walk	CY	155.6	2,263.09	135.79	25,459.57	33,294.92
			12.65	*135.79%*	*13.41*	*17.54*
RSM 312323171400 Fill, granular fill (Note: 155.56 ccy required; + 15% for swell = 178.9 lcy)	LCY	178.9	2,263.09	135.79	2,398.87	3,137.14
			0.00	*0.00%*	*2.00*	*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	155.6	0.00	0.00	311.48	407.35
			0.00	*0.00%*	*7.47*	*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	178.9	0.00	0.00	1,337.23	1,748.78
			0.00	*0.00%*	*1.40*	*1.83*
HNC 312323145510 Backfill, structural, 6" lifts, backfill around foundation, with hydraulic excavator	LCY	178.9	0.00	0.00	250.89	328.10
			0.00	*0.00%*	*1.21*	*1.58*
RSM 312323237240 Compaction, 4 passes, 18" wide, 12" lifts, walk behind, vibrating plate	ECY	155.6	0.00	0.00	187.54	245.26
			0.00	*0.00%*	*419.47*	*548.57*
USR Marine Crew - Granular Fill (Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of granular fill under the concrete walkway.)	HR	50.0	0.00	0.00	20,973.55	27,428.30

Currency in US dollars

Description	UOM	Quantity	MatlCost	TaxAdj	DirectCost	ProjectCost
			24.15		*91.08*	*119.11*
Fill Stone for Concrete Walk	CY	1,711.1	41,328.00	2,479.68	155,852.84	203,817.54
			21.00	*2,479.68%*	*38.01*	*49.70*
RSM 353116196000 Steel sheet piling seawalls, crushed stone, placed behind bulkhead by clam bucket	LCY	1,968.0	41,328.00	2,479.68	74,795.62	97,814.45
(Note: 1711.11 cy reqr'd + 15% for void space = 1968 lcy)						
			0.00	*0.00%*	*2.00*	*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	1,711.1	0.00	0.00	3,426.23	4,480.68
			0.00	*0.00%*	*7.47*	*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	1,968.0	0.00	0.00	14,710.33	19,237.52
			0.00	*0.00%*	*419.47*	*548.57*
USR Marine Crew - Fill Stone	HR	150.0	0.00	0.00	62,920.66	82,284.89
(Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of stone fill under the concrete walkway.)						
			0.00		*11.07*	*14.48*
10004602 01 DREDGING	CY	15,800.0	0.00	0.00	174,973.00	228,822.05
			0.00	*0.00%*	*7.26*	*9.49*
USR Dredging	CY	15,800.0	0.00	0.00	114,708.00	150,010.11
(Note: Production rate and cost per cubic yard derived from CDEP estimating software; includes labor & equipment; Sub-bid cost does not include labor & equipment, profit, overhead and bond; these are applied within MII file. Mob & demob not included in this CEDEP cost and is listed separately in MII estimate.)						
USR Hydraulic Dredging Mob & Demob	LS	1.0	0.00	0.00	60,265.00	78,811.94
(Note: Derived from CEDEP estimate.)						

Currency in US dollars

Description	UOM	Quantity	EQCost	ContractorOwnCost	ProjectCost
Equipment Rates			193,062.22	1,740,483.86	1,740,483.86
			193,062.22		*1,740,483.86*
10 Breakwaters and Seawalls	EA	1.0	193,062.22	1,740,483.86	1,740,483.86
			689.51		*6,216.01*
1000 ALTERNATIVE 1 Breakwaters & Seawalls	LF	280.0	193,062.22	1,740,483.86	1,740,483.86
			60,894.52		*225,610.28*
100001 MOB, DEMOB, PREP	EA	1.0	60,894.52	225,610.28	225,610.28
Mobilization & Demobilization	LS	1.0	21,088.16	68,824.08	68,824.08
			29.37		*94.48*
RSM 015436501150 Mobilization or demobilization, delivery charge for small equipment on flatbed trailer, maximum	EA	4.0	117.48	377.93	377.93
			169.57		*414.92*
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.P., up to 50 miles	EA	2.0	339.14	829.85	829.85
RSM 352023130100 Marine Plant, mobilization and demobilization, add to below, maximum	LS	1.0	20,631.54	67,616.31	67,616.31
			39,753.97		*154,697.07*
Demolition	EA	1.0	39,753.97	154,697.07	154,697.07
			6.61		*72.03*
RSM 024119180500 Selective demolition, disposal only, urban buildings with salvage value allowed, wood frame, includes loading and 5 mile haul to dump (Note: timber disposal; Assume $7/cy disposal cost. Area = pi x r^2; 3.14159 x 1.4 ft ^2 = 6.2 sf x 140 ea x 20 lf /27 cf/cy = 643 cy + 10 % + 15% swell = 813 cy. Quote from Waste Management, Glen's Landfill, Maple City, MI = $28.06/ton, includes all fees and fuel surcharge. x 1.4 ton/cy = $39.30/cy)	CY	813.0	5,370.56	58,564.40	58,564.40
			1.73		*6.29*
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator (Note: Assume all stone/broken concrete must first be removed; 390 cy will eventually be reused as scour stone protection, 510 cy will be disposed of. Total 900 cy, add 15% for clearing driveline = 1035 cy)	BCY	1,035.0	1,786.32	6,514.54	6,514.54
			4.81		*13.74*
RSM 312323181255 Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.5 loads/hour, 20 C.Y. dump trailer, highway haulers, excludes loading (Note: 510 bcy + 135 cy from driveline = 645 + 15% for swell = 742 lcy)	LCY	742.0	3,567.47	10,193.07	10,193.07
			237.95		*651.03*
USR Marine Crew - General (Note: This custom crew includes an operator, deckhand, barge, crane & tug to assist with demo for the duration based on MII's production rate for these activities. Includes timber pile removal - 38 hour duration per MII production rate for calculated quantity in vlf. Avg length of each timber = 20 vlf assuming removal to lake bottom only. Required removal along 140 ft length avg 14" timber, assume 140 timbers x 20 vlf = 2800 vlf. Assume remaining time use for rock/concrete removal and disposal also per MII production rate for these activities.)	HR	122.0	29,029.61	79,425.06	79,425.06
			52.39		*2,089.13*
Temporary Access	EA	1.0	52.39	2,089.13	2,089.13
			0.24		*9.41*
RSM 015523500050 Temporary, roads, gravel fill, 4" gravel depth, excl surfacing (Note: assume 100 ft long x 20 ft wide / 9 sf/sy = 222 sy)	SY	222.0	52.39	2,089.13	2,089.13
			70,298.89		*910,495.16*

Currency in US dollars

Description	UOM	Quantity	EQCost	ContractorOwnCost	ProjectCost
10004602 BREAKWATER	EA	1.0	70,298.89	910,495.16	910,495.16
			3,779.78		*108,694.28*
10004605 Metals	EA	1.0	3,779.78	108,694.28	108,694.28
			3,779.78		*108,694.28*
10004605 01 Steel Framing for Piling Misc Metal	EA	1.0	3,779.78	108,694.28	108,694.28
			0.00		*3,867.56*
HNC 051223758270 Structural steel member, channels MC10x22, C & MC, 21 to 58 plf, A992 steel, shop fabricated, incl shop primer, bolted connections (Note: 14 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)	TON	15.4	0.00	59,560.40	59,560.40
			0.00		*4,408.19*
HNC 051223758260 Structural steel member, channels C12x20.7, C & MC, 11 to 21 plf, A992 steel, shop fabricated, incl shop primer, bolted connections (Note: 6.3 ton required + 10% for cutting & waste; unit cost updated 28 July 2010 per http://www.get-a-quote.net for Michigan region.)	TON	6.9	0.00	30,416.48	30,416.48
			0.00		*3,084.34*
RSM 314116103000 Sheet piling, steel, tie rod, not upset, with turnbuckle, 1-1/2" to 4", excludes wales (Note: 1.65 ton required + 10% for cutting & waste)	TON	1.8	0.00	5,551.82	5,551.82
			157.49		*548.57*
USR Marine Crew - Pile Install (Note: This custom crew includes an operator, deckhand, barge & tug to assist with channel for the duration; assume 1 ton/hr.)	HR	24.0	3,779.78	13,165.58	13,165.58
			5,740.83		*83,152.47*
100099 Associated General Items	EA	1.0	5,740.83	83,152.47	83,152.47
			5,197.19		*23,286.88*
10009902 Site Work	EA	1.0	5,197.19	23,286.88	23,286.88
			472.47		*2,141.13*
Egress Ladders	EA	1.0	472.47	2,141.13	2,141.13
			0.00		*247.72*
RSM 355933501520 Jetties, dock accessories, ladder, crown top, 5 to 7 step, maximum	EA	2.0	0.00	495.43	495.43
			157.49		*548.57*
USR Marine Crew - Site Work (Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done.)	HR	3.0	472.47	1,645.70	1,645.70
			4,724.72		*21,145.75*
Timber Bumper (Note: Assume marine crew placement; marine crew cost covered in demo and concrete items.)	EA	1.0	4,724.72	21,145.75	21,145.75
			0.00		*3,125.85*
RSM 061323100020 Single 6" x 10" wood beam, heavy mill timber framing (Note: 300 lf = 3600 in; 6 x 10 x 3600 / 144 cu in/board foot = 1500 board feet / 1000 = 1.5 mbf)	MBF	1.5	0.00	4,688.77	4,688.77
			157.49		*548.57*
USR Marine Crew - Site Work (Note: This custom crew includes an operator, deckhand, barge & tug to assist with site work for the duration based on MII's production rate for site work activity. Crane is not included in this equipment because the site work items contain the necessary equipment for work being done. Assume 10 LF/hr installation rate.)	HR	30.0	4,724.72	16,456.98	16,456.98

Currency in US dollars

Description	UOM	Quantity	EQCost	ContractorOwnCost	ProjectCost
			543.64		*59,865.58*
10009905 Metals	EA	1.0	543.64	59,865.58	59,865.58
			0.00		*6,406.48*
10009905 01 Mooring Rings and Cleats	EA	1.0	0.00	6,406.48	6,406.48
			0.00		*1,119.34*
RSM 355933502080 Jetties, dock accessories, mooring whip, 60,000 lb. boat	PR	5.0	0.00	5,596.71	5,596.71
			0.00		*202.44*
USR Mooring Installation (Note: 1 foreman & 2 laborers)	HR	4.0	0.00	809.77	809.77
			543.64		*49,259.84*
10009902 03 Guard Rail	EA	1.0	543.64	49,259.84	49,259.84
			0.53		*74.36*
RSM 055213500090 Railing, pipe, aluminum, clear finish, 2 rails, 1-1/2" dia, shop fabricated	LF	615.0	323.83	45,729.32	45,729.32
			3.55		*56.94*
RSM 038213100100 Concrete core drilling, core, reinforced concrete slab, 1 1/2" diameter, up to 6" thick slab, includes bit, layout and set up (Note: Assume every 10 feet)	EA	62.0	219.81	3,530.52	3,530.52
			0.00		*4,199.25*
RGS Conduit	EA	1.0	0.00	4,199.25	4,199.25
			0.00		*14.00*
RSM 260533100580 Rigid galvanized steel conduit, 1-1/2" diameter, to 15' high, incl couplings only	LF	300.0	0.00	4,199.25	4,199.25
			58,451.52		*711,482.71*
10004602 06 Piling	EA	1.0	58,451.52	711,482.71	711,482.71
			136.61		*2,044.21*
RSM 314116100300 sheet piling, steel, 22 psf, 30' excavation, left in place, excludes wales (Note: 252.89 ton + 10% for cutting & waste. Driveline excavation was considered in demo item above. Quote on 3 Aug 2010 from Riley Nelson of Skyline Steel RNelson@skylinesteel.com; cold rolled, $0.55/lb delivered.)	TON	278.0	37,977.74	568,289.28	568,289.28
			0.00		*234.24*
RSM 024556006400 Piles, steel, shoes (Note: Total wall length of 280 ft. / sheet width of 1.833' = 153 shoes x 2 sides = 306 shoes)	EA	306.0	0.00	71,678.94	71,678.94
			0.00		*1.44*
RSM 024119270020 Selective demolition, torch cutting, steel, 1" thick plate (Note: Assume 1/2 will require torch cutting at the top Length 280 lf)	LF	140.0	0.00	200.92	200.92
			157.49		*548.57*
USR Marine Crew - Pile Installation (Note: This custom crew includes an operator, deckhand, barge & tug to assist pile driving operations for the duration based on placement rate of 45 lf/day. Pile driving equipment is not included in this item as it is used in pile driving item above.)	HR	130.0	20,473.78	71,313.57	71,313.57
			5.97		*18.37*
10004602 02 Salvage and Reset Scour Stone	CY	390.0	2,326.76	7,165.70	7,165.70
			1.73		*6.29*

Currency in US dollars

Description	UOM	Quantity	EQCost	ContractorOwnCost	ProjectCost
HNC 312316440130 Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excavator (Note: 390 cy existing stone/broken concrete to be reused as scour stone protection.)	BCY	390.0	673.11	2,454.75	2,454.75
			157.49		*448.66*
USR Floating Plant to support excavator	HR	10.5	1,653.65	4,710.95	4,710.95
			396.59		*2,407.41*
10004603 CONCRETE	CY	156.0	61,868.81	375,556.38	375,556.38
			13.04		*698.27*
10004603 01 Concrete, in Place	CY	156.0	2,034.38	108,930.38	108,930.38
			0.00		*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments (Note: 156 cy required; add 5% for waste)	CY	164.0	0.00	45,468.07	45,468.07
			0.00		*7.91*
RSM 031113652150 C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning (Note: 15 ft wide x 2 ends; 280 ft long x 2 sides x 1 ft depth)	SFC	590.0	0.00	4,665.02	4,665.02
			5.83		*26.65*
RSM 033105704650 Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	CY	164.0	956.51	4,370.68	4,370.68
			0.01		*6.97*
RSM 033053404900 Finishing, Structural concrete, in place, slab on grade, 12" thick, includes finishing only	SF	4,200.0	37.11	29,262.54	29,262.54
			0.00		*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: Assume every 10 feet, 21 each x 15 ft width)	LF	312.0	0.00	4,816.80	4,816.80
			0.00		*23.54*
RSM 014523501950 Concrete testing, compressive strength test, incl. picked up by lab, average (Note: Assume 6 per day for 6 days, 10 hrs/day)	EA	36.0	0.00	847.43	847.43
			0.00		*16.92*
RSM 033923130300 Concrete surface treatment, curing, sprayed membrane compound	CSF	42.0	0.00	710.49	710.49
			0.00		*164.96*
RSM 032105101202 High chairs, for reinforcing steel, individual (HC), galvanized, 3" high, includes material only (Note: 1ft oc 208 lf x 15 lf wide. Jack advises to divide this quantity by 1/2 to obtain cost)	CCT	16.0	0.00	2,639.37	2,639.37
			0.00		*15.44*
RSM 321313230730 Concrete paving surface treatment, transverse expansion joints, includes premolded bituminous joint filler (Note: spaced every 50 ft c-c)	LF	60.0	0.00	926.31	926.31
			0.05		*0.66*
RSM 033529350120 Control joint, concrete floor slab, sawcut in green concrete, 1" depth	LF	60.0	2.81	39.54	39.54
			0.00		*3.75*
RSM 033529350380 Control joint, joint sealant, polyurethane, 1" x 1/2" (154 LF/Gal)	LF	60.0	0.00	225.13	225.13

Currency in US dollars

Description	UOM	Quantity	EQCost	ContractorOwnCost	ProjectCost
			1,037.94		*14,958.99*
USR Marine Crew - Standby	WK	1.0	1,037.94	14,958.99	14,958.99
			0.00		*19,235.83*
10004603 02 Reinforcing Steel	EA	1.0	0.00	19,235.83	19,235.83
			0.00		*2,113.83*
RSM 032110600600 Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories (Note: #4: 8.3 ton required + 10% for waste; Assume quantity includes steel for anchor blocks as well.)	TON	9.1	0.00	19,235.83	19,235.83
			7.53		*336.31*
Concrete Anchor Blocks	CY	30.6	230.19	10,277.70	10,277.70
			0.00		*277.24*
RSM 033105350300 Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	0.00	8,871.82	8,871.82
			7.19		*32.87*
RSM 033105702650 Structural concrete, placing, spread footing, pumped, over 5 C.Y., includes vibrating, excludes material (Note: 30.56 cy x 5% for waste = 32 cy)	CY	32.0	230.19	1,051.81	1,051.81
			0.00		*3.54*
RSM 031113653000 C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erecting, bracing, stripping and cleaning	LF	100.0	0.00	354.08	354.08
			56.87		*214.03*
Granular Fill for Concrete Walk	CY	155.6	8,846.17	33,294.92	33,294.92
			0.00		*17.54*
RSM 312323171400 Fill, granular fill (Note: 155.56 ccy required; + 15% for swell = 178.9 lcy)	LCY	178.9	0.00	3,137.14	3,137.14
			1.11		*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	155.6	173.26	407.35	407.35
			3.92		*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	178.9	700.87	1,748.78	1,748.78
			0.45		*1.83*
HNC 312323145510 Backfill, structural, 6" lifts, backfill around foundation, with hydraulic excavator	LCY	178.9	80.61	328.10	328.10
			0.11		*1.58*
RSM 312323237240 Compaction, 4 passes, 18" wide, 12" lifts, walk behind, vibrating plate	ECY	155.6	16.89	245.26	245.26
			157.49		*548.57*
USR Marine Crew - Granular Fill (Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of granular fill under the concrete walkway.)	HR	50.0	7,874.53	27,428.30	27,428.30
			29.66		*119.11*
Fill Stone for Concrete Walk	CY	1,711.1	50,758.08	203,817.54	203,817.54
			8.90		*49.70*

Currency in US dollars

Description	UOM	Quantity	EQCost	ContractorOwnCost	ProjectCost
RSM 353116196000 Steel sheet piling seawalls, crushed stone, placed behind bulkhead by clam bucket (Note: 1711.11 cy reqr'd + 15% for void space = 1968 lcy)	LCY	1,968.0	17,518.68	97,814.45	97,814.45
			1.11		*2.62*
RSM 312323155000 Loading base course, 1 C.Y. bucket	BCY	1,711.1	1,905.81	4,480.68	4,480.68
			3.92		*9.78*
RSM 312323180500 Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loads/hour, 12 C.Y. truck, highway haulers, excludes loading	LCY	1,968.0	7,709.99	19,237.52	19,237.52
			157.49		*548.57*
USR Marine Crew - Fill Stone (Note: This custom crew includes an operator, deckhand, barge & tug to assist with placement of stone fill under the concrete walkway.)	HR	150.0	23,623.59	82,284.89	82,284.89
			0.00		*14.48*
10004602 01 DREDGING	CY	15,800.0	0.00	228,822.05	228,822.05
			0.00		*9.49*
USR Dredging (Note: Production rate and cost per cubic yard derived from CDEP estimating software; includes labor & equipment; Sub-bid cost does not include labor & equipment, profit, overhead and bond; these are applied within MII file. Mob & demob not included in this CEDEP cost and is listed separately in MII estimate.)	CY	15,800.0	0.00	150,010.11	150,010.11
USR Hydraulic Dredging Mob & Demob (Note: Derived from CEDEP estimate.)	LS	1.0	0.00	78,811.94	78,811.94

Currency in US dollars

U.S. Army Corps of Engineers
Project : Current NWM College Preferred Alt 1

Jacks Overhead Items Report

Updated with QTO's revised 12 April 2011

Estimated by	GSE Branch
Designed by	GSE Branch
Prepared by	Julie Udell
Preparation Date	6/28/2011
Effective Date of Pricing	6/28/2011
Estimated Construction Time	210 Days

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost
Job Office Overhead Direct Cost Report								
Prime Alt 1								
			76,548.87	*6,181.29*	*7,404.06*	*15,723.80*		*105,858.02*
JOOH	1.00	EA	76,549	6,181	7,404	15,724	0	105,858
			0.00	*3,733.91*	*0.00*	*0.00*		*3,733.91*
USR ST Small Tools	1.00	EA	0	3,734	0	0	0	3,734
			74,113.94	*0.00*	*0.00*	*0.00*		*74,113.94*
On -Site Personnel	1.00	EA	74,114	0	0	0	0	74,114
(Note: JOOH values are based on the average durations for Alt 1 & Alt 2. Alt 1 duration = 12.3 mo; Alt 2 duration = 9.2 mo. Average = 10.75 mo)								
			737.19	*0.00*	*0.00*	*0.00*		*737.19*
RSM 017123131100 Boundary & survey markers, crew for building layout, 2 person crew	6.00	DAY	4,423	0	0	0	0	4,423
			12,473.43	*0.00*	*0.00*	*0.00*		*12,473.43*
FOP FA-AGENS General Superintendents (P.M.)	5.00	MO	62,367	0	0	0	0	62,367
(Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)								
			7,323.65	*0.00*	*0.00*	*0.00*		*7,323.65*
FOP FD-SAENG Safety Engineers	1.00	MO	7,324	0	0	0	0	7,324
(Note: Assumed a Occupation Code of #29086 Engineer Technician III 30083)								
			0.00	*0.00*	*605.16*	*0.00*		*605.16*
Personal Protective Equipment	1.00	EA	0	0	605	0	0	605
			0.00	*0.00*	*31.16*	*0.00*		*31.16*
HTW 019413201106 Eye and body wash stations, body wash stations, hand held eye wash station, 1 - 32 ounce bottles	1.00	EA	0	0	31	0	0	31
			0.00	*0.00*	*26.66*	*0.00*		*26.66*
HTW 019413205601 PPE, ear protection, ear muffs	10.00	EA	0	0	267	0	0	267
			0.00	*0.00*	*32.00*	*0.00*		*32.00*
HTW 019413205602 PPE, ear protection, ear plugs, disposable, box of 200	2.00	EA	0	0	64	0	0	64
			0.00	*0.00*	*7.53*	*0.00*		*7.53*
HTW 019413205402 PPE, eye protection, safety glasses	10.00	EA	0	0	75	0	0	75
			0.00	*0.00*	*9.31*	*0.00*		*9.31*
HTW 019413205801 PPE, hard hats	10.00	EA	0	0	93	0	0	93
			0.00	*0.00*	*25.00*	*0.00*		*25.00*
RSM 015623101300 Barricades, barricade tape, polyethylene, 7 mils thick, 3" wide x 500' long roll	3.00	EA	0	0	75	0	0	75
			0.00	*0.00*	*405.90*	*0.00*		*405.90*
Emergency Equipment	1.00	EA	0	0	406	0	0	406
			0.00	*0.00*	*24.50*	*0.00*		*24.50*
RSM 015409606220 Safety Nets, safety supplies and first aid kits, stock sizes	5.00	MO	0	0	123	0	0	123
			0.00	*0.00*	*141.70*	*0.00*		*141.70*

Labor ID: EQ ID: EP09R02 | Currency in US dollars | TRACES MII Version 4.1

Description	Quantity	UOM	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost
HTW 019413201204 Fire extinguisher, dry chemical, 20 lb	2.00	EA	0	0	283	0	0	283
			158.49	*14.08*	*4,905.00*	*5,338.80*		*10,416.37*
Miscellaneous Field Overhead	1.00	EA	158	14	4,905	5,339	0	10,416
			0.00	*0.00*	*0.00*	*13.98*		*13.98*
HTW 019413301111 Project Photo Documentation, photographs processing, color, 24 count, 3-1/2" x 5", includes film	60.00	EA	0	0	0	839	0	839
USR 014505000071 As-Built Documents	1.00	LS	0	0	0	3,000	0	3,000
USR 014505000073 Operations and Maintenance Manuals	1.00	LS	0	0	0	1,500	0	1,500
			0.00	*0.00*	*16.35*	*0.00*		*16.35*
AF 015807000010 Project Signs, sign, Hi-intensity reflectorized, buy, excl. posts	300.00	SF	0	0	4,905	0	0	4,905
			316.98	*28.15*	*0.00*	*0.00*		*345.14*
HNC 017413200300 Cleaning Up, site debris clean up and removal	0.50	ACR	158	14	0	0	0	173
			2,127.72	*2,433.30*	*0.00*	*0.00*		*4,561.02*
Air Quality Control	1.00	EA	2,128	2,433	0	0	0	4,561
			425.54	*486.66*	*0.00*	*0.00*		*912.20*
RSM 312323202500 Hauling, light, dust control, includes loading	5.00	DAY	2,128	2,433	0	0	0	4,561
			148.72	*0.00*	*1,488.00*	*10,385.00*		*12,021.72*
Field Office	1.00	EA	149	0	1,488	10,385	0	12,022
			0.00	*0.00*	*80.00*	*0.00*		*80.00*
RSM 015213400140 Field Office Expense, telephone bill; avg. bill/month, incl. long dist.	5.00	MO	0	0	400	0	0	400
			0.00	*0.00*	*193.00*	*0.00*		*193.00*
RSM 015213200350 Office Trailer, furnished, rent per month, 32' x 8', excl. hookups	5.00	EA	0	0	965	0	0	965
			148.72	*0.00*	*123.00*	*0.00*		*271.72*
RSM 015113500880 Temporary electrical power equipment (pro-rated per job), connections, office trailer, 100 amp	1.00	EA	149	0	123	0	0	272
			0.00	*0.00*	*0.00*	*88.50*		*88.50*
HNC 015213201400 Toilet, portable, chemical, rent per month	10.00	EA	0	0	0	885	0	885
			0.00	*0.00*	*0.00*	*2,000.00*		*2,000.00*
USR 015940450 Office Trailer, Setup/Breakdown	1.00	EA	0	0	0	2,000	0	2,000
			0.00	*0.00*	*0.00*	*3,000.00*		*3,000.00*
USR 015940451 Utility Services Hookup	1.00	EA	0	0	0	3,000	0	3,000
USR 0100 Computers (Note: Includes: 2000 - computer 2000 - software 500 - printer 500 - internet)	1.00	LS	0	0	0	2,000	0	2,000
USR Office Supply Equipment (Note: Fax, copier, drinking water)	1.00	LS	0	0	0	2,500	0	2,500

Labor ID: EQ ID: EP09R02 | Currency in US dollars | TRACES MII Version 4.1

Description	Quantity	UOM	BareCost	Productivity	Overtime	TaxAdj	MiscDirect	Payroll	WCI	DirectCost
Job Office Overhead Bare to Direct Report										
Prime Alt 1										
			84,166.33	*0.00%*	*0.00%*					*105,858.02*
JOOH	1.00	EA	84,166	0	0	0	0	8,256	13,436	105,858
			3,733.91	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*3,733.91*
USR ST Small Tools	1.00	EA	3,734	0	0	0	0	0	0	3,734
			53,065.55	*0.00%*	*0.00%*					*74,113.94*
On -Site Personnel	1.00	EA	53,066	0	0	0	0	7,986	13,062	74,114
(Note: JOOH values are based on the average durations for Alt 1 & Alt 2. Alt 1 duration = 12.3 mo; Alt 2 duration = 9.2 mo. Average = 10.75 mo)										
			549.68	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*15.05%*	*33.20%*	*737.19*
RSM 017123131100 Boundary & survey markers, crew for building layout, 2 person crew	6.00	DAY	3,298	0	0	0	0	496	629	4,423
			8,921.47	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*15.05%*	*33.20%*	*12,473.43*
FOP FA-AGENS General Superintendents (P.M.) (Note: Assumed a Carpenter / Millwright Wages plus $3.00 / hour)	5.00	MO	44,607	0	0	0	0	6,713	11,046	62,367
			5,160.13	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*15.05%*	*33.20%*	*7,323.65*
FOP FD-SAENG Safety Engineers (Note: Assumed a Occupation Code of #29086 Engineer Technician III 30083)	1.00	MO	5,160	0	0	0	0	777	1,387	7,324
			605.16	*0.00%*	*0.00%*					*605.16*
Personal Protective Equipment	1.00	EA	605	0	0	0	0	0	0	605
			31.16	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*31.16*
HTW 019413201106 Eye and body wash stations, body wash stations, hand held eye wash station, 1 - 32 ounce bottles	1.00	EA	31	0	0	0	0	0	0	31
			26.66	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*26.66*
HTW 019413205601 PPE, ear protection, ear muffs	10.00	EA	267	0	0	0	0	0	0	267
			32.00	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*32.00*
HTW 019413205602 PPE, ear protection, ear plugs, disposable, box of 200	2.00	EA	64	0	0	0	0	0	0	64
			7.53	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*7.53*
HTW 019413205402 PPE, eye protection, safety glasses	10.00	EA	75	0	0	0	0	0	0	75
			9.31	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*9.31*
HTW 019413205801 PPE, hard hats	10.00	EA	93	0	0	0	0	0	0	93
			25.00	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*25.00*
RSM 015623101300 Barricades, barricade tape, polyethylene, 7 mils thick, 3" wide x 500' long roll	3.00	EA	75	0	0	0	0	0	0	75
			405.90	*0.00%*	*0.00%*					*405.90*
Emergency Equipment	1.00	EA	406	0	0	0	0	0	0	406
			24.50	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*24.50*
RSM 015409606220 Safety Nets, safety supplies and first aid kits, stock sizes	5.00	MO	123	0	0	0	0	0	0	123

Currency in US dollars

Description	Quantity	UOM	BareCost	Productivity	Overtime	TaxAdj	MiscDirect	Payroll	WCI	DirectCost
			141.70	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*141.70*
HTW 019413201204 Fire extinguisher, dry chemical, 20 lb	2.00	EA	283	0	0	0	0	0	0	283
			10,375.24	*0.00%*	*0.00%*					*10,416.37*
Miscellaneous Field Overhead	1.00	EA	10,375	0	0	0	0	18	23	10,416
			13.98	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*13.98*
HTW 019413301111 Project Photo Documentation, photographs processing, color, 24 count, 3-1/2" x 5", includes film	60.00	EA	839	0	0	0	0	0	0	839
USR 014505000071 As-Built Documents	1.00	LS	3,000	0	0	0	0	0	0	3,000
USR 014505000073 Operations and Maintenance Manuals	1.00	LS	1,500	0	0	0	0	0	0	1,500
			16.35	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*16.35*
AF 015807000010 Project Signs, sign, Hi-intensity reflectorized, buy, excl. posts	300.00	SF	4,905	0	0	0	0	0	0	4,905
			262.89	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*15.05%*	*33.20%*	*345.14*
HNC 017413200300 Cleaning Up, site debris clean up and removal	0.50	ACR	131	0	0	0	0	18	23	173
			3,999.30	*0.00%*	*0.00%*					*4,561.02*
Air Quality Control	1.00	EA	3,999	0	0	0	0	236	326	4,561
			799.86	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*15.05%*	*33.20%*	*912.20*
RSM 312323202500 Hauling, light, dust control, includes loading	5.00	DAY	3,999	0	0	0	0	236	326	4,561
			11,981.27	*0.00%*	*0.00%*					*12,021.72*
Field Office	1.00	EA	11,981	0	0	0	0	16	24	12,022
			80.00	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*80.00*
RSM 015213400140 Field Office Expense, telephone bill; avg. bill/month, incl. long dist.	5.00	MO	400	0	0	0	0	0	0	400
			193.00	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*193.00*
RSM 015213200350 Office Trailer, furnished, rent per month, 32' x 8', excl. hookups	5.00	EA	965	0	0	0	0	0	0	965
			231.27	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*15.05%*	*33.20%*	*271.72*
RSM 015113500880 Temporary electrical power equipment (pro-rated per job), connections, office trailer, 100 amp	1.00	EA	231	0	0	0	0	16	24	272
			88.50	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*88.50*
HNC 015213201400 Toilet, portable, chemical, rent per month	10.00	EA	885	0	0	0	0	0	0	885
			4,000.00	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*2,000.00*
USR 015940450 Office Trailer, Setup/Breakdown	1.00	EA	2,000	0	0	0	0	0	0	2,000
			6,000.00	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*3,000.00*
USR 015940451 Utility Services Hookup	1.00	EA	3,000	0	0	0	0	0	0	3,000
USR 0100 Computers (Note: Includes: 2000 - computer 2000 - software 500 - printer 500 - internet)	1.00	LS	2,000	0	0	0	0	0	0	2,000
USR Office Supply Equipment (Note: Fax, copier, drinking water)	1.00	LS	2,500	0	0	0	0	0	0	2,500

Labor ID: EQ ID: EP09R02 | Currency in US dollars | TRACES MII Version 4.1

63,858 pay c.y. per month	UNIT COST..	$7.26	PER C.Y.	**Select Dredge**
130 cy per hour	EXCAV. COST	$114,708		12" Cutter-Suction (Det)
12" Cutter-Suction (Det) Dredge	TIME.....	0.24	MONTHS	

PROJECT TITLES: PG 1 of 11

Project Name.....	Northwestern Michigan Harbor Dredging
Project Location.....	Traverse City, MI
Invit. or Contr. No.....	
Date of Estimate.....	20 July 2010
Estimator.....	Julie Udell
Checked by.....	William D. Merte

Ver. 1.0

For Information, Call:
Julie Davin
Ph: 509-527-7514

(Input Project Descriptions on Sheet A) **Goto Sheet A**

Mobilization Bid Item.....	1
Excavation Bid Item.....	1

Goto Area Factors

TYPE OF ESTIMATE PG 2 of 11

Type of Estimate..... 1 Planning Estimate
(1) Planning, (2) Bid, or (3) Mod

Estimate Descriptions

INDIRECT COSTS:

Contractor's Overhead...	0.0	Percent of contract
Contractor's Profit.....	0.0	Percent of contract
Contractor's Bond.....	0.0	Percent of contract

ESTIMATED DREDGING QUANTITY: PG 3 of 11

Non-Pay Computation Method: 1
(1) Surface Area, (2) % of Pay O.D., (3) % of Net Pay, (4) % of Gross

DREDGING AREA: 140,778 SQ. FT.

DREDGING PRISM:

Required....	11,060	C.Y.			
+ Pay O.D....	4,740	C.Y.			
Bid Quantity	15,800	C.Y.			
- Not Dug..	474	C.Y.		AVE. BANK HEIGHT:	
Net Pay	15,326	C.Y.	@	2.9	ft pay
+ Non-Pay	1,000	C.Y.	@	0.2	ft overdig
Gross Volume	16,326	C.Y.		3.1	FT. BANK HT.

63,858 pay c.y. per month	UNIT COST..	$7.26	PER C.Y.	Select Dredge
130 cy per hour	EXCAV. COST	$114,708		12" Cutter-Suction (Det)
12" Cutter-Suction (Det) Dredge	TIME.....	0.24	MONTHS	

MATERIAL FACTORS: PG 4 of 11

DESCRIPTION	FACTOR	PERCENTAGE		
MUD & SILT	3	0	%	
MUD & SILT	2.5	0	%	
MUD & SILT	2	20	%	DIRECT ENTRY
LOOSE SAND	1.1	40	%	FACTOR= 0.00
LOOSE SAND	1	35	%	
COMP. SAND	0.9	5	%	
STIFF CLAY	0.6	0	%	
COMP. SHELL	0.5	0	%	RESULTANT MATERIAL
SOFT ROCK	0.4	0	%	FACTOR= 1.15
BLAST. ROCK	0.25	0	%	

PIPELINE CONSIDERATIONS: PG 5 of 11

MAXIMUM PIPELINE REQUIRED:

Floating Pipeline.....	0	Feet
Submerged Pipeline.....	2,500	Feet
Shore Pipeline.....	1,000	Feet
Total Pipeline on Job:	3,500	Feet

Ave Pumping Distance....	2,000	Feet of Pipeline
Pipeline Cost Category.....	2	SAND
(0) Computed from Material Factor, (1) Mud, (2) Sand, or (3) Rock		
Equivalent Pipe.....	40	Feet (Theoretical)
Description.....	Vertical Lift of Discharge Pipe.	
Basis of Production:	2,040	Feet (Ave + Equiv)

PRODUCTION ANALYSIS: PG 6 of 11

1 BOOSTER(S) — 14,111 L.F. POSSIBLE based on 1325 Tot. H.P.

2,040 Ft Ave Pumping Distance

3,500 L.F. Max. on jobsite

83.2 % X 730 HRS/MO = EWT OF (without Boosters) 607 HRS/MO

Goto HP Adjustments

X 0.85 Booster Factor

70.7 % X 730 HRS/MO = EWT OF (with Boosters) 516 HRS/MO

63,858 pay c.y. per month	UNIT COST..	$7.26	PER C.Y.	**Select Dredge**
130 cy per hour	EXCAV. COST	$114,708		12" Cutter-Suction (Det)
12" Cutter-Suction (Det) Dredge	TIME.....	0.24	MONTHS	

OTHER PRODUCTION FACTORS: PG 7 of 11

CURRENT DREDGE SELECTED: 12" Cutter-Suction (Det) Dredge

Bank Factor for 3.1 ft of Bank ---->		0.92	(From Chart)
Bank Factor Override....	0	0.92	(Used)
Description.....	>		
Other Factor.....	0.5		
Description.....	Wave Action - Boat Traffic		
Cleanup Dredging.....	10	Percent Additional Time	
		(Cleanup Factor = 0.91)	

HISTORICAL PRODUCTION OVERRIDES: PG 8 of 11

(In order to use this screen, Overrides must be entered for all three categories.)

	Override	Computed	Used
Production (Cy/Hr).....	0	130	130
Operating Time (Hrs/Mo).	0	516	516
Number of Boosters.....	0	1	1

OTHER PRICING ADJUSTMENTS: PG 9 of 11

Other Monthly Costs:

1st Input.....	$35,000	Per Month
Description.....	Dozer/Pickup/Laser, etc.	
(For Additional Inputs Go to Sheet D\4)	Goto Sheet D\4	

Fixed Costs:

1st Input.....	$0	Lump Sum
Description.....		
(For Additional Inputs Go to Sheet E)	Goto Sheet E	
(To Adjust Labor Go To Sheet DB_L)	Goto Sheet DB_L	
(To Adjust Equipment Go To Sheet DB_E)	Goto Sheet DB_E	

63,858 pay c.y. per month	UNIT COST..	$7.26	PER C.Y.	Select Dredge
130 cy per hour	EXCAV. COST	$114,708		12" Cutter-Suction (Det)
12" Cutter-Suction (Det) Dredge	TIME.....	0.24	MONTHS	

The Factors below normally will not change for every estimate.

LOCAL AREA FACTORS: PG 10 of 11

Present Year.....	2009	(Equipment Calculations)
Economic Index.....	7667	(EP-1110-1-8, APP E)
Labor Adjustment Factor.	1.070	(EP-1110-1-8, APP B)
Full Cost of Money Rate.	5.25	Percent per Year
Dates for Money Rate....	Dec 2008 to June 2009	
Annual Months Available for Dredging:		
Pipeline....	8	Months per Year
Bucket.....	8	Months per Year
Hopper.....	8	Months per Year
Current Fuel Price.....	$2.35	Per Gallon

Return

HP & BOOSTER FACTOR ADJUSTMENTS: PG 11 of 11

	Override	Database	Used
Total Available Pump Horsepower.....	0	625	625
Booster Pump HP.....		700	700
% Loss per booster, when job lasts:			
Less than 1 month (%)	0	15%	15%
More than 1 month (%)	0	10%	10%

Return

Without Booster Losses, this job would last 0.21 months, therefore, the 15% figure will be used.

A DESCRIPTION AND QUANTITY SUMMARY

1	PROJECT	Northwestern Michigan Harbor Dredging	DATE OF ESTIMATE	20 July 2010
2	LOCATION	Traverse City, MI	INVIT. OR CONTR. NO.	0
3	ESTIMATED BY	Julie Udell	CHECKED BY	William D. Merte
4	TYPE OF DREDGE	12" Cutter-Suction (Det) Dredge	TYPE OF ESTIMATE	Planning Estimate

5 DESCRIPTION OF WORK

To perform maintenance dredging within the Northwestern Michigan College Harbor

Material will be disposed of west of the Traverse City Marina from the 2 to 8 ft depth contour.

It is assumed that a 12" Hydraulic dredge will preform the work - operating on a schedule of 1 shift per day

twelve (12) hours per shift. Crew composition is 1 - Levermen, 1 Watch Engineer,

1 Deckhand and 1 dozer operator.

Equipment will be either owned or under Contractor's Control. Labor rates are as specified in Specifications.

All work will be performed in accordance with the Specification.

					REMARKS
6	EXCAVATION				
	A. REQUIRED		11,060	CY	140,778 s.f. of Dredging Area
	B. PAY OVERDEPTH	+	4,740	CY	
	C. MAX. PAY YARDAGE	=	15,800	CY	(YARDAGE USED ON BID FORM)
	D. O.D. NOT DREDGED	-	474	CY	
	E. NET PAY YARDAGE	=	15,326	CY	(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)
	F. NON-PAY YARDAGE	+	1,000	CY	0.2 ft overdig
	G. GROSS YARDAGE	=	16,326	CY	(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)

B DREDGING COST BID ITEM # 1

					REMARKS
1	GROSS YARDAGE		16,326	CY	FROM SHEET A, ITEM 6 G.
2	PRODUCTION RATE	/	67,080	CY/MO	FROM SHEET C, ITEM 8.
3	DREDGING TIME	=	0.24	MONTHS	15,326 Net Pay CY ÷ 0.24 MO = 63,858 Pay CY/MO
4	TOTAL MONTHLY COST	x	$463,445		FROM SHEET D, ITEM 5.
	SUBTOTAL.....=		$111,227		
5	FIXED COSTS	+	$0		FROM SHEET E, ITEM 15.
	SUBTOTAL.....=		$111,227		
6	OVERHEAD 0.0%	+	$0		
	SUBTOTAL.....=		$111,227		
7	PROFIT 0.0%	+	$0		
	SUBTOTAL.....=		$111,227		
8	BOND 0.0%	+	$0		
9	GROSS PRODUCTION COSTS	=	$111,227		
10	NET PAY YARDAGE	/	15,326	CY	FROM SHEET A, ITEM 6 E.
11	UNIT COST	=	$7.26	/CY	
12	MAX PAY YARDAGE	x	15,800	CY	FROM SHEET A, ITEM 6 C.
13	DREDGING COST	=	$114,708		

MATERIAL FACTOR CALCULATION

C \ 3 BID ITEM # 1

BANK FACTOR CALCULATION

1 MATERIAL FACTOR COMPUTATION:

A. MATERIAL FACTOR CHART:

DESCRIPTION	INPLACE DENSITY		FACTOR	%	QUANTITIES
MUD & SILT	1200	GR/L	3	0%	0 c.y.
MUD & SILT	1300	GR/L	2.5	0%	0 c.y.
MUD & SILT	1400	GR/L	2	20%	3,265 c.y.
LOOSE SAND	1700	GR/L	1.1	40%	6,530 c.y.
LOOSE SAND	1900	GR/L	1	35%	5,714 c.y.
COMP. SAND	2000	GR/L	0.9	5%	816 c.y.
STIFF CLAY	2000	GR/L	0.6	0%	0 c.y.
COMP. SHELL	2300	GR/L	0.5	0%	0 c.y.
SOFT ROCK	2400	GR/L	0.4	0%	0 c.y.
BLAST. ROCK	2000	GR/L	0.25	0%	0 c.y.

B. MATERIAL FACTOR.....> 1.15 100% 16,326 cy (Computed from Chart)

REMARKS

2 BANK FACTOR COMPUTATION:

A. SIZE OF DREDGE....PIPELINE.....> 12" Cutter-Suction (Det)

B. AVERAGE BANK HEIGHT.....> 3.1 FT

C. BANK FACTOR CHART:

BANK HEIGHT	1	2	3	4	5	6	7	8	9
FACTOR	0.45	0.66	0.9	1.1	1.1	1.1	1.1	1.1	1.1

D. BANK FACTOR.....> 0.92 Interpolated from chart

>

D MONTHLY COST SUMMARY BID ITEM # 1

DREDGE SIZE 12" Cutter-Suction (Det)

							REMARKS
1	LABOR COSTS		$218,817 /MO				FROM SHEET D \ 1
2	EQUIPMENT COSTS						FROM SHEET D \ 2
	A. DREDGE	+	$120,799 /MO	1 EA	@	$120,799 /MO	
	B. WORK TUG(S)	+	$14,882 /MO	1 EA	@	$14,882 /MO	
	C. CREW/SURVEY TUG	+	$0 /MO	0 EA	@	$13,264 /MO	
	D. DERRICK(S)	+	$0 /MO	0 EA	@	$4,843 /MO	
	E. FUEL/WATER BARGE	+	$0 /MO	0 EA	@	$2,153 /MO	
	F. WORK BARGE	+	$1,323 /MO	1 EA	@	$1,323 /MO	
	H. BOOSTER(S)	+	$66,812 /MO	1 EA	@	$66,812 /MO	
	G. ***Unused***	+	$0 /MO	0 EA	@	$0 /MO	
3	PIPELINE COSTS BASED ON PUMPING SAND			3,500 LF (ON JOB) - RATES TAKEN FROM SHEET D \ 3			
	A. (1) FLOATING (AVERAGE)	+	$0 /MO	0 LF	@	$6.37 /MO	
	(2) FLOATING (REMAINING)	+	$0 /MO	0 LF	@	$0.006 /HR X 730 HRS/MO	
	B. (1) SUBMERGED (AVERAGE)	+	$3,301 /MO	1,429 LF	@	$2.31 /MO	
	(2) SUBMERGED (REMAINING)	+	$1,564 /MO	1,071 LF	@	$0.002 /HR X 730 HRS/MO	
	C. (1) SHORE (AVERAGE)	+	$634 /MO	571 LF	@	$1.11 /MO	
	(2) SHORE (REMAINING)	+	$313 /MO	429 LF	@	$0.001 /HR X 730 HRS/MO	
4	OTHER MONTHLY COSTS	+	$35,000 /MO				FROM SHEET D \ 4
5	TOTAL MONTHLY COST	=	$463,445				

D \ 1 LABOR COSTS BID ITEM # 1

DREDGE SIZE: 12" Cutter-Suction (Det)

Overtime	16.67%
Holiday 8 Days/Yr	2.19%
Vacation	7.00%
COMPOSITE.....	25.86%

Management....

0	CAPTAIN	$0
0	CHIEF ENG	$0
1	CIVIL ENG	$6,000
0	OFFICE HELP	$0
	MONTHLY MANAGEMENT COST.....	$6,000

Social Security Tax	7.65%
Workman's Compensation	15.00%
State Unemployment Comp.	10.00%
Federal Unemployment Comp.	1.00%
COMPOSITE.....	33.65%

Each Crew Position is Manned: 12 Hrs per Day
x 6 Days per Week
= 72 Hrs per Week
x 4.345 Wks per Month
= 313 Hrs per Month

Last Update...Oct 98

EA	CREW POSITION	BASIC HOURLY WAGE		O.T. VACATION & HOLIDAY 25.86%		SUB-TOTAL		TAXES INSUR 33.65%		SUB-TOTAL		FRINGE BENEFITS #####		HRLY COST		HOURS PER MONTH		MONTHLY COST
2	LEVERMEN	$35.70	+	$9.23	=	$44.93	+	$15.12	=	$60.05	+	#####	=	$82.65	x	626	=	$51,739
2	WATCH ENG	31.80	+	8.22	=	40.02	+	13.47	=	53.49	+	22.60	=	76.09	x	626	=	47,632
0	DRDG MATE	19.00	+	4.91	=	23.91	+	8.05	=	31.96	+	22.60	=	54.56	x	0	=	0
0	TUG MASTER	13.95	+	3.61	=	17.56	+	5.91	=	23.47	+	22.60	=	46.07	x	0	=	0
0	LAUNCHMAN	8.19	+	2.12	=	10.31	+	3.47	=	13.78	+	22.60	=	36.38	x	0	=	0
0	MAINT ENG	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
0	WELDER	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
0	OILER	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
2	DECKHAND	26.45	+	6.84	=	33.29	+	11.20	=	44.49	+	22.60	=	67.09	x	626	=	41,998
0	ELECTRICIAN	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
0	G DUMP FRMN	8.68	+	2.24	=	10.92	+	3.67	=	14.59	+	22.60	=	37.19	x	0	=	0
0	DUMP FOREMN	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
1	EQUIP OPER	31.80	+	8.22	=	40.02	+	13.47	=	53.49	+	22.60	=	76.09	x	313	=	23,816
0	SHOREMAN	7.82	+	2.02	=	9.84	+	3.31	=	13.15	+	22.60	=	35.75	x	0	=	0
0	COOK	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
0	MESS COOK	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
0	MESSMAN	0.00	+	0.00	=	0.00	+	0.00	=	0.00	+	22.60	=	22.60	x	0	=	0
2	BOOSTER ENG	31.80	+	8.22	=	40.02	+	13.47	=	53.49	+	22.60	=	76.09	x	626	=	47,632

9 Total Crew

MONTHLY CREW LABOR COST = $212,817

(Average Gross Wage = $75.55 per manhour)

TOTAL MONTHLY LABOR COST = $218,817

D \ 2 EQUIPMENT COSTS BID ITEM # 1

DREDGE SIZE 12" Cutter-Suction (Det)

	|--DREDGE--|	|-----TUGS & TENDERS-----|	|----------BARGES----------|	|-BOOSTER-|	|--OTHER--|
1a. Plant Description.....	HYDRAULIC	WORK TUG	CREW/SURV	DERRICK	FUEL/WATER	WORK	FLOATING	***Unused***
1c. Prime Eng HP.....	625	100	100	100	0	0	700	0
1d. (1) Dredge El Gen HP....	50	--	--	--	--	--	--	--
1d. Total 2nd Eng HP.....	210	25	40	25	10	0	50	0
1e. Plant Value.....	$780,000	$88,000	$48,000	$163,000	$122,000	$81,000	$242,000	$0
1f. Acquis Year.....	1983	1991	1991	1985	1985	1985	1991	0
1g. Pres Year.....	2009	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
1h. Cost of Money Rate.....	5.250%	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
1i. Disc Money Rate:	4.200%	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
1j. Hrs Worked/Mo.....	516	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
2a. LAF.....	1.070	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
2b. Fuel Cost per Gal.....	$2.35	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
3a. Ec Index <for Acq Yr>..	3497	4438	4438	3749	3749	3749	4438	0
3b. Ec Index <for 2009>....	7667	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
4a. Mos Available/Year.....	8	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
5a. Useful Life (in Yrs)...	8	8	8	20	20	20	8	0
5b. Physical Life (in Hrs).	16,000	16,000	16,000	90,000	90,000	90,000	16,000	0
5c. SLV Factor.....	0.05	0.10	0.10	0.10	0.05	0.05	0.05	0.00
5d. Pr Eng Fuel Factor.....	0.045	0.045	0.045	0.011	0.011	0.011	0.045	0
5e. 2nd Eng Fuel Factor....	0.039	0.039	0.039	0.011	0.011	0.011	0.039	0
5f. WLS Factor.....	0.22	0.38	0.38	0.20	0.20	0.20	0.22	0.00
5g. RPR Factor.....	0.90	0.80	0.80	0.70	0.60	0.60	0.90	0.00
6a. Depreciation:	11.88%	11.25%	11.25%	4.50%	4.75%	4.75%	11.88%	0.00%
6b. FCCM:	2.45%	2.55%	2.55%	2.40%	2.30%	2.30%	2.45%	0.00%
6c. Total Ownership/Year:	14.33%	13.80%	13.80%	6.90%	7.05%	7.05%	14.33%	0.00%
7a. Yearly Ownership:	$111,774	$12,144	$6,624	$11,247	$8,601	$5,711	$34,679	$0
7b. Monthly Ownership:	$13,972	$1,518	$828	$1,406	$1,075	$714	$4,335	$0
8a. (1) Hrly Pr Eng Fuel:	$66.09	$10.58	$10.58	$2.59	$0.00	$0.00	$74.03	$0.00
8a. (2) Hrly 2nd Eng Fuel:	$19.25	$2.29	$3.67	$0.65	$0.26	$0.00	$4.58	$0.00
8b. (1) Hrly Pr Eng WLS:	$14.54	$4.02	$4.02	$0.52	$0.00	$0.00	$16.29	$0.00
8b. (2) Hrly 2nd Eng WLS:	$4.24	$0.87	$1.39	$0.13	$0.05	$0.00	$1.01	$0.00
8c. (1) EAF:	2.192	1.728	1.728	2.045	2.045	2.045	1.728	0.000
8c. (2) Hrly Repair:	$102.91	$8.14	$4.44	$2.77	$1.78	$1.18	$25.17	$0.00
8d. Total Hrly Operating:	$207.03	$25.90	$24.10	$6.66	$2.09	$1.18	$121.08	$0.00
8e. Monthly Operating:	$106,827	$13,364	$12,436	$3,437	$1,078	$609	$62,477	$0
11. MONTHLY RATE:	$120,799	$14,882	$13,264	$4,843	$2,153	$1,323	$66,812	$0
12a. HRLY STANDBY ALLOW:	$19.14	$2.08	$1.13	$1.93	$1.47	$0.98	$5.94	$0.00
12b. Gener Fuel Allowance:	$4.58	--	--	--	--	--	--	--
12c. DREDGE HRLY STANDBY:	$23.72	--	--	--	--	--	--	--

D \ 3 PIPELINE COSTS BID ITEM # 1

PIPELINE SIZE: 12" Cutter-Suction (Det MATERIAL PUMPED: SAND

		----------FLOATING PIPELINE----------				--SUBMERGED PIPELINE--			---SHORE---
1a. Plant Description.....	Pipeline	Joints	Pontoons	Pipeline	Joints	Pipeline
Quantity.....>	40	1	2	250	1	15
Fixed Units Per Item..>	LF	Set	Each	LF	Set	LF
Unit Price.....>	$14.00	$2,000.00	$2,000.00	$14.00	$2,000.00	$14.00
1e. Plant Value:	$560.00	$2,000.00	$4,000.00	$3,500.00	$2,000.00	$210.00
1f. Acquis Year.....	1992	1992	1992	1992	1992	1992
1g. Pres Year.....	2009	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
1h. Cost of Money Rate.....	5.250%	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
1i. Disc Money Rate:	4.200%	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
1j. Hrs Worked/Mo.....	516	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
2a. LAF.....	1.070	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
3a. Ec Index <for Acq Yr>...	4611	4611	4611	4611	4611	4611
3b. Ec Index <for 2009>....	7667	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
4a. Mos Available/Year.....	8	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->	----->---->
5a. Useful Life (in Yrs)...	1.0	3.0	12.0	1.0	3.0	1.5
5b. Physical Life (in Hrs).	4,500	12,000	60,000	4,500	12,000	6,000
5c. SLV Factor.....	0.10	0.10	0.10	0.10	0.10	0.10
5g. RPR Factor.....	0.05	0.30	0.05	0.05	0.30	0.05
6a. Depreciation:	90.00%	30.00%	7.50%	90.00%	30.00%	60.00%
6b. FCCM:	4.20%	2.94%	2.47%	4.20%	2.94%	3.57%
6c. Total Ownership/Year:	94.20%	32.94%	9.97%	94.20%	32.94%	63.57%
7a. Yearly Ownership:	$527.52	$658.80	$398.80	$3,297.00	$658.80	$133.50
7b. Monthly Ownership:	$65.94	$82.35	$49.85	$412.13	$82.35	$16.69
8c. (1) EAF:	1.663	1.663	1.663	1.663	1.663	1.663
8c. (2) Hrly Repair:	$0.01	$0.09	$0.01	$0.07	$0.09	$0.00
8e. Monthly Operating:	$5.16	$46.44	$5.16	$36.12	$46.44	$0.00
11. Monthly Rate (EA Item):	$71.10	$128.79	$55.01	$448.25	$128.79	$16.69
Monthly Rate Per Section (Sum Of Items):			$254.90		$577.04	$16.69
/ Section Length (In Linear Feet):			40		250	15
MONTHLY RATES PER LF OF PIPELINE:			$6.37		$2.31	$1.11
5a. Useful Life (in Yrs)...	2.0	3.0	12.0	2.0	3.0	1.5
6a. Depreciation:	45.00%	30.00%	7.50%	45.00%	30.00%	30.00%
6b. FCCM:	3.26%	2.94%	2.47%	3.26%	2.94%	2.94%
6c. Total Ownership/Year:	48.26%	32.94%	9.97%	48.26%	32.94%	32.94%
7a. Yearly Ownership:	$270.26	$658.80	$398.80	$1,689.10	$658.80	$69.17
7b. Monthly Ownership:	$33.78	$82.35	$49.85	$211.14	$82.35	$8.65
12a. HRLY STANDBY ALLOW:	$0.046	$0.113	$0.068	$0.289	$0.113	$0.012
Hrly Standby Rate Per Section (Sum Of Items):			$0.227		$0.402	$0.012
/ Section Length (In Linear Feet):			40		250	15
HOURLY STANDBY RATES PER LF OF PIPELINE:			$0.006		$0.002	$0.001

D \ 4 OTHER MONTHLY COSTS BID ITEM # 1

DREDGE SIZE 12" Cutter-Suction (Det)

				REMARKS
1	Dozer/Pickup/Laser, etc.	$35,000 /MO		
2	>	+ $0 /MO		
3	>	+ $0 /MO		
4	>	+ $0 /MO		
5	>	+ $0 /MO		
6	>	+ $0 /MO		
7	>	+ $0 /MO		
8	>	+ $0 /MO		
9	>	+ $0 /MO		
10	>	+ $0 /MO		
11	>	+ $0 /MO		
12	>	+ $0 /MO		
13	>	+ $0 /MO		
14	>	+ $0 /MO		
15	TOTAL OTHER MONTHLY COSTS	= $35,000 /MO		

E FIXED COSTS BID ITEM # 1

DREDGE SIZE 12" Cutter-Suction (Det)

					REMARKS
1		0		$0	
2	>		+	$0	
3	>		+	$0	
4	>		+	$0	
5	>		+	$0	
6	>		+	$0	
7	>		+	$0	
8	>		+	$0	
9	>		+	$0	
10	>		+	$0	
11	>		+	$0	
12	>		+	$0	
13	>		+	$0	
14	>		+	$0	
15	FIXED COSTS		=	$0	

MOB & DEMOB COST $60,265

SPECIAL ITEMS (USED FOR BOTH MOB & DEMOB):

Supplies & small tools @	$100	/day
Support equipment with operators @	$500	/day
Fuel (Plant Idle)	$100	per Day
Subsistence	$25	per Man

MOBILIZATION ITEMS:

1. PREPARE DREDGE FOR TRANSFER TO JOBSITE:

Time Required.....	0.5	Days
Crew Size.....	3	Men
Work Schedule.....	8	Hrs per Day

2. PREPARE PIPELINE FOR TRANSFER TO JOBSITE:

Time Required.....	0.5	Days
Crew Size.....	3	Men
Work Schedule.....	8	Hrs per Day

3. TRANSFER PLANT TO JOBSITE:

Distance.....	250	Miles
Towing Speed.....	72	Miles per Day
Crew Size.....	2	Men per Shift
Towing Vessel Size	4000	Horsepower
Towing Vessel Cost	$2,000	Per Day
Number of Vessels	1	Each

4. RELOCATE PERMANENT PERSONNEL & MISC. TO JOBSITE:

Travel Time.....	0	Hrs per Man
Travel Expenses...	$0	Per Man
Local Hire.....	$900	(Lump Sum)

MOBILIZATION ITEMS (Continued):

5. PREPARE DREDGE FOR WORK AT JOBSITE:

Time Required.....	0.5	Days
Crew Size.....	3	Men
Work Schedule.....	8	Hrs per Day

6. PREPARE PIPELINE AT JOBSITE:

Time Required.....	0.5	Days
Crew Size.....	3	Men
Work Schedule.....	8	Hrs per Day

7. OTHER:

Description.....	Towing Permit	
Lump Sum Cost.....	$2,000	

DEMOBILIZATION ITEMS:

1. PREPARE DREDGE FOR TRANSFER AWAY FROM JOBSITE:

Time Required.....	0.5	Days

2. PREPARE PIPELINE FOR TRANSFER AWAY FROM JOBSITE:

Time Required.....	0.5	Days

3. TRANSFER PLANT AWAY FROM JOBSITE:

Distance.....	125	Miles

4. RELOCATE PERMANENT PERSONNEL & MISC. AWAY FROM JOBSITE:

Include Computed Costs?....	0	NO (1=YES)

5. PREPARE DREDGE FOR STORAGE..... 0.5 Days

6. PREPARE PIPELINE FOR STORAGE..... 0.5 Days

7. OTHER:

Description.....	Towing Permit	
Lump Sum Cost.....	$2,000	

M MOB & DEMOB BID ITEM # 1

DREDGE SIZE 12" Cutter-Suction (Det)

	MOBILIZATION				DEMOBILIZATION			
	# DAYS		$/DAY	TOTAL	# DAYS		$/DAY	TOTAL
1. PREPARE DREDGE FOR TRANSFER	0.5	x	$3,225 =	$1,612	0.5	x	$3,300 =	$1,650
2. PREPARE PIPELINE FOR TRANSFER	0.5	x	$2,808 =	$1,404	0.5	x	$2,883 =	$1,442
3. TRANSFER ALL PLANT 250 MILES From Ludington					125 MILES To White Lake			
@ 72 miles/day =	3.5	x	$8,298 =	$29,042	1.7	x	$8,298 =	$14,106
4. PERMANENT PERSONNEL & MISC.	L.S.		=	$900	L.S.		=	$0
5. PREPARE DREDGE AFTER TRANSFER	0.5	x	$3,300 =	$1,650	0.5	x	$3,225 =	$1,612
6. PREPARE PIPELINE AFTER TRANSFER	0.5	x	$2,883 =	$1,442	0.5	x	$2,808 =	$1,404
7. OTHER	Towing Permit		=	$2,000	Towing Permit		=	$2,000
	SUBTOTAL MOBILIZATION			$38,051	SUBTOTAL DEMOBILIZATION			$22,215

				REMARKS
8. SUBTOTAL MOBILIZATION & DEMOBILIZATION		=	$60,265	
9. OVERHEAD	0.0%	+	$0	
SUBTOTAL.....=			$60,265	
10. PROFIT	0.0%	+	$0	
SUBTOTAL.....=			$60,265	
11. BOND	0.0%	+	$0	
12. TOTAL MOBILIZATION & DEMOBILIZATION		=	$60,265	

MOBIL & DEMOB COST:	$60,265		BID QUANTITY	15,800	C.Y.
			UNIT COST...	$7.26	PER C.Y.
	Northwestern Michigan Harbor Dredging		EXCAV. COST.	$114,708	
CHECKLIST FOR INPUT DATA.			TIME.....	0.24	MONTHS

PG 1 OF 11: PROJECT TITLES

PROJECT -	Northwestern Michigan Harbor Dredgin
LOCATION -	Traverse City, MI
INVIT # -	0
DATE OF EST. -	20 July 2010
EST. BY -	Julie Udell
MOB. BID ITEM # -	1
EXCAV. BID ITEM # -	1

PG 2 OF 11: TYPE OF EST & INDIRECT COSTS

TYPE OF EST. -	Planning Estimate
CONTRACTOR'S O.H. -	0.0%
CONTRACTOR'S PROFIT -	0.0%
CONTRACTOR'S BOND -	0.0%

PG 3 OF 11: EXCAVATION QTY'S

DREDGING AREA -	140,778	sf
REQ'D EXCAVATION -	11,060	cyds
PAY OVERDEPTH -	4,740	cyds
CONTRACT AMOUNT -	15,800	cyds
NOT DREDGED -	474	cyds
NET PAY -	15,326	cyds
NONPAY YARDAGE -	1,000	cyds
GROSS YARDAGE -	16,326	cyds
NONPAY HEIGHT -	0.2	ft overdig
TOTAL BANK HEIGHT -	3.1	ft

PG 4 OF 11: MATERIAL FACTOR

MUD & SILT -	3	0%
MUD & SILT -	2.5	0%
MUD & SILT -	2	20%
LOOSE SAND -	1.1	40%
LOOSE SAND -	1	35%
COMP. SAND -	0.9	5%
STIFF CLAY -	0.6	0%
COMP. SHELL -	0.5	0%
SOFT ROCK -	0.4	0%
BLAST. ROCK -	0.25	0%
RESULTANT FACTOR -	1.15	

PG 5 OF 11: PIPELINE CONSIDERATIONS

FLOATING -	0	ft
SUBMERGED -	2,500	ft
SHORE -	1,000	ft
TOTAL -	3,500	ft
AVE. PIPELINE -	2,000	ft
COST CATEGORY -	2	SAND
EQUIVALENT -	40	ft
DESCRIPTION -	Vertical Lift of Discharge Pipe.	
BASIS OF PRODUCTION -	2,040	Feet (Ave + Equiv)

PG 6 OF 11: PRODUCTION ANALYSIS

BOOSTER(S) -	1	
% EWT (NO BOOSTERS) -	83.2%	(607 HRS/MO)
BOOSTER FACTOR -	0.85	
% EWT (WITH BOOSTERS) -	70.7%	(516 HRS/MO)
MAX. POSSIBLE -	14,111	ft
TOTAL HP AVAIL -	1,325	hp

PG 7 OF 11: OTHER PRODUCTION FACTORS

DREDGE SELECTED -	12" Cutter-Suction (Det)	
COMPUTED BANK FACTOR -	0.92	
BANK FACTOR USED -	0.92	>
OTHER FACTOR -	0.5	Wave Action - Boat Traffic
CLEANUP -	10%	More Time

PG 8 OF 11: HISTORICAL PRODUCTION OVERRIDES

PRODUCTION OVERRIDE -	NO	
PRODUCTION -	130	cy per hour
OPERATING TIME -	516	hours per month
BASED ON -	1	booster(s)
PRODUCTION (GROSS) -	67,080	cy per month
PRODUCTION (CONTRACT) -	63,858	pay cy per month

PG 9 OF 11: OTHER ADJUSTMENTS

SPECIAL COST/MO (1ST) -	$35,000	Dozer/Pickup/Laser, etc.
SP COST/MO (2ND-14TH) -	$0	From Sheet D\4
SPECIAL COST LS (1ST) -	$0	0
SP COST LS (2ND-14TH) -	$0	From Sheet E

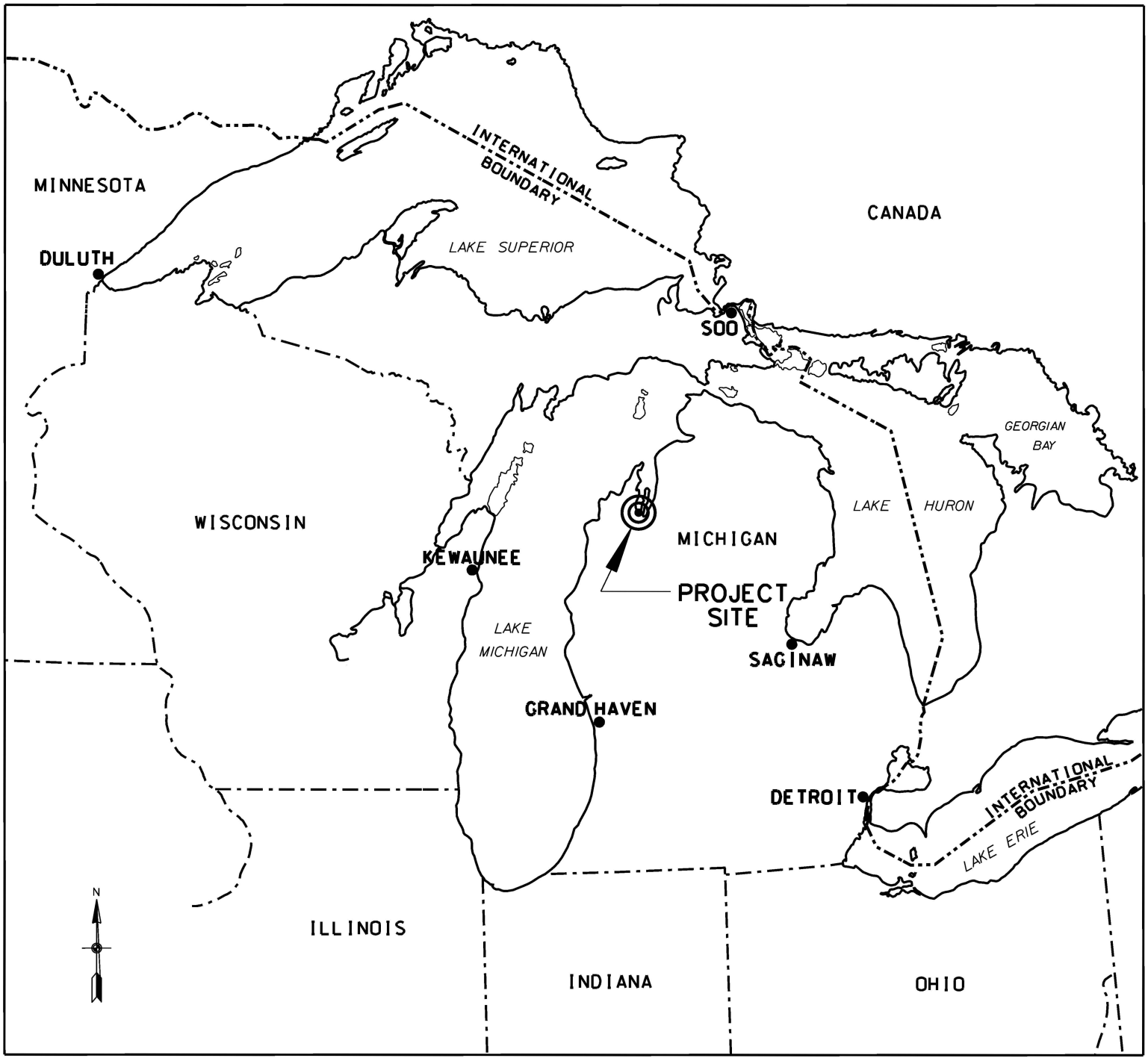
PG 10 OF 11: LOCAL AREA FACTORS

PRESENT YEAR -	2009	
ECONOMIC INDEX -	7667	
LAF -	1.070	
INTEREST RATE -	5.250%	/yr
TIME PERIOD -	Dec 2008 to June 2009	
PIPELINE AVAILABILITY -	8	mos/yr
BUCKET AVAILABILITY -	8	mos/yr
HOPPER AVAILABILITY -	8	mos/yr
FUEL PRICE -	$2.35	/gal

PG 11 OF 11: HP & BOOSTER FACTOR ADJUSTMENTS

AVAIL PUMP HP -	625	
BOOSTER HP -	700	hp(ea)
LOSS PER BOOSTER -	15%	

PRODUCTION -	130	gross cy per hour
OPERATING TIME -	516	hours per month
GROSS PRODUCTION -	67,080	cy per month
PAY PRODUCTION -	63,858	pay cy per month

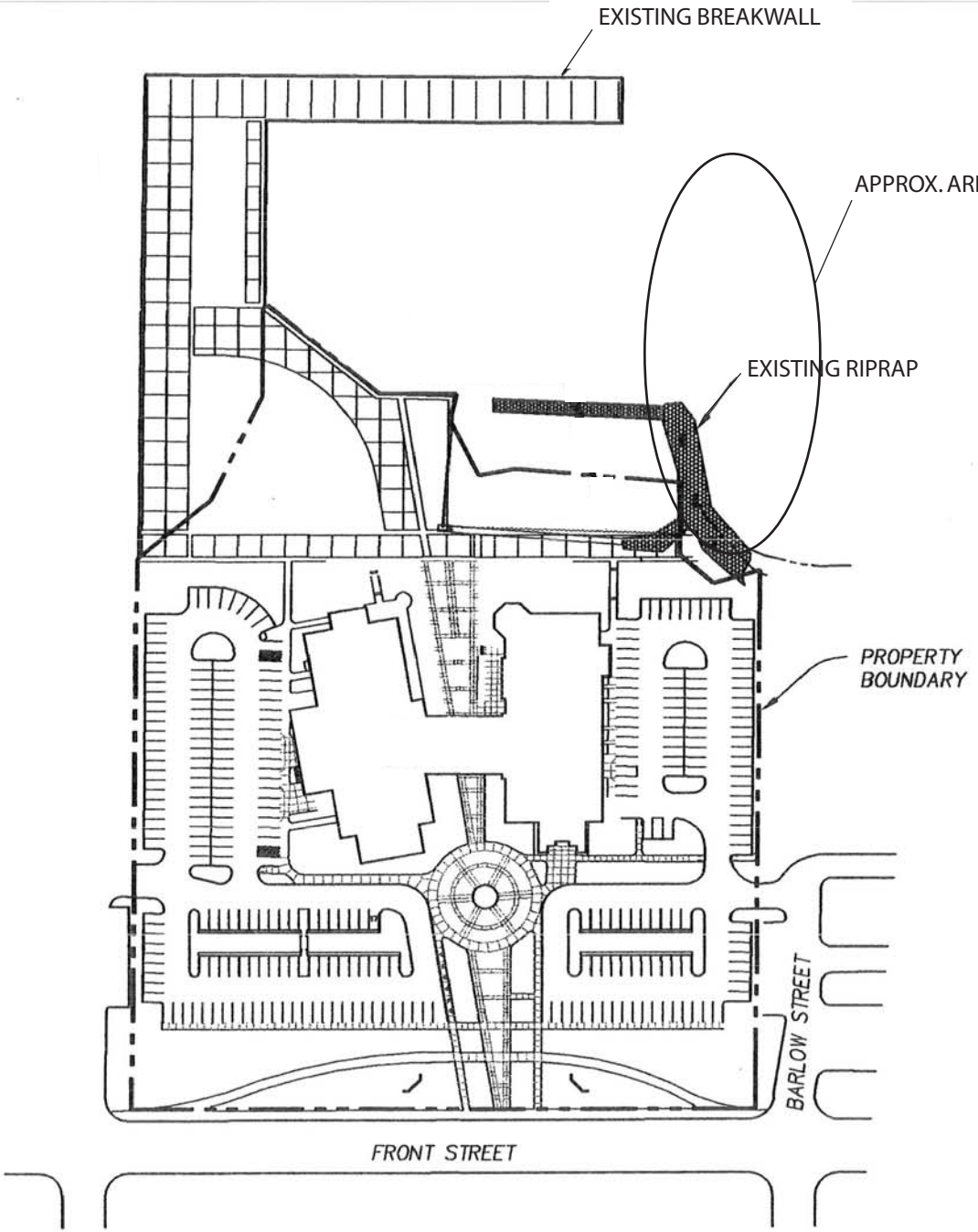


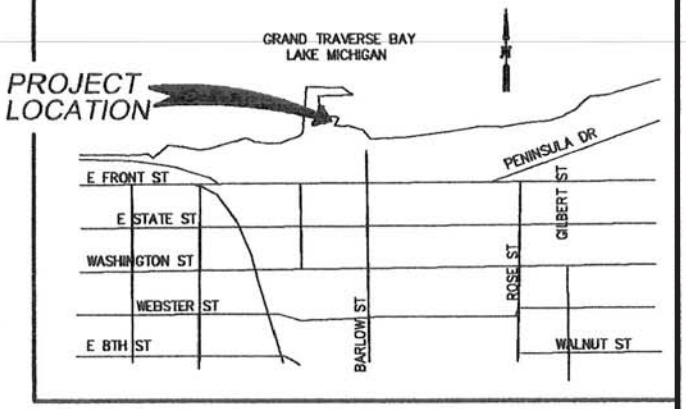
US Army Corps of Engineers
Detroit District

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
LOCATION MAP

0 25 50 75 100
SCALE OF MILES

PLATE 1



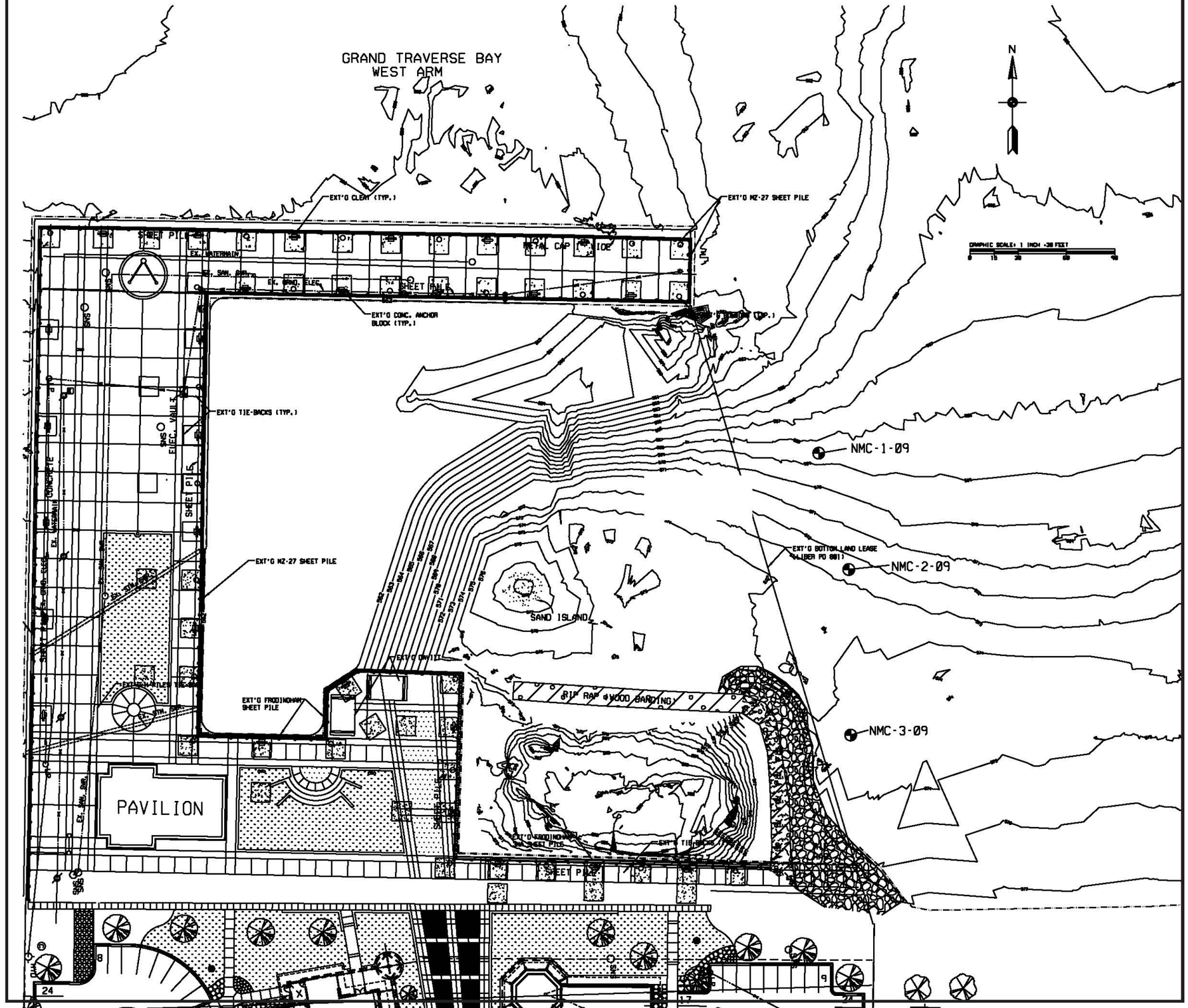


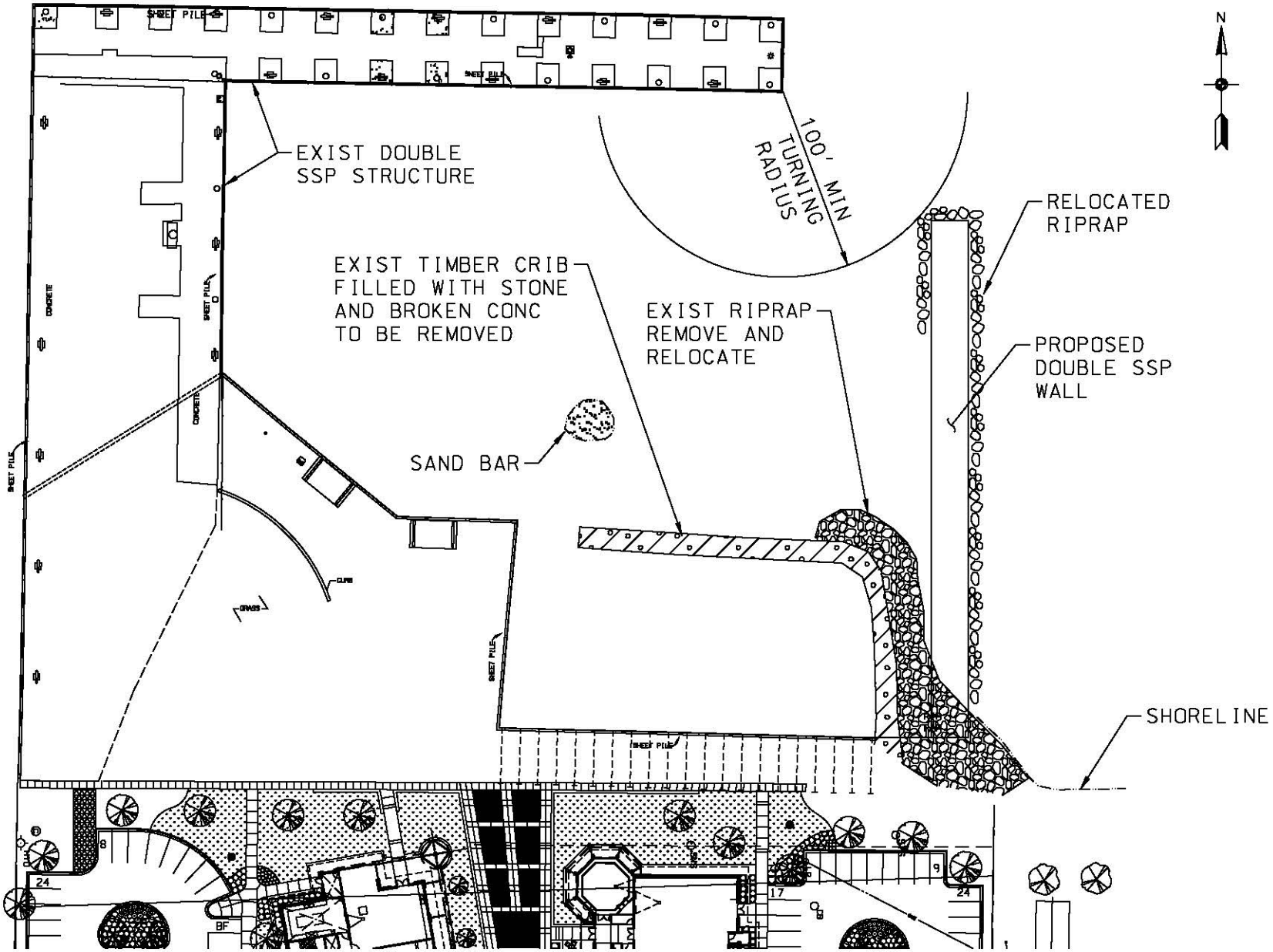
LOCATION MAP
NO SCALE

PLATE 1- Site Location

Northwestern Michigan College - Maritime Academy Campus
Traverse City, MI

PLATE 2 - Borehole Locations



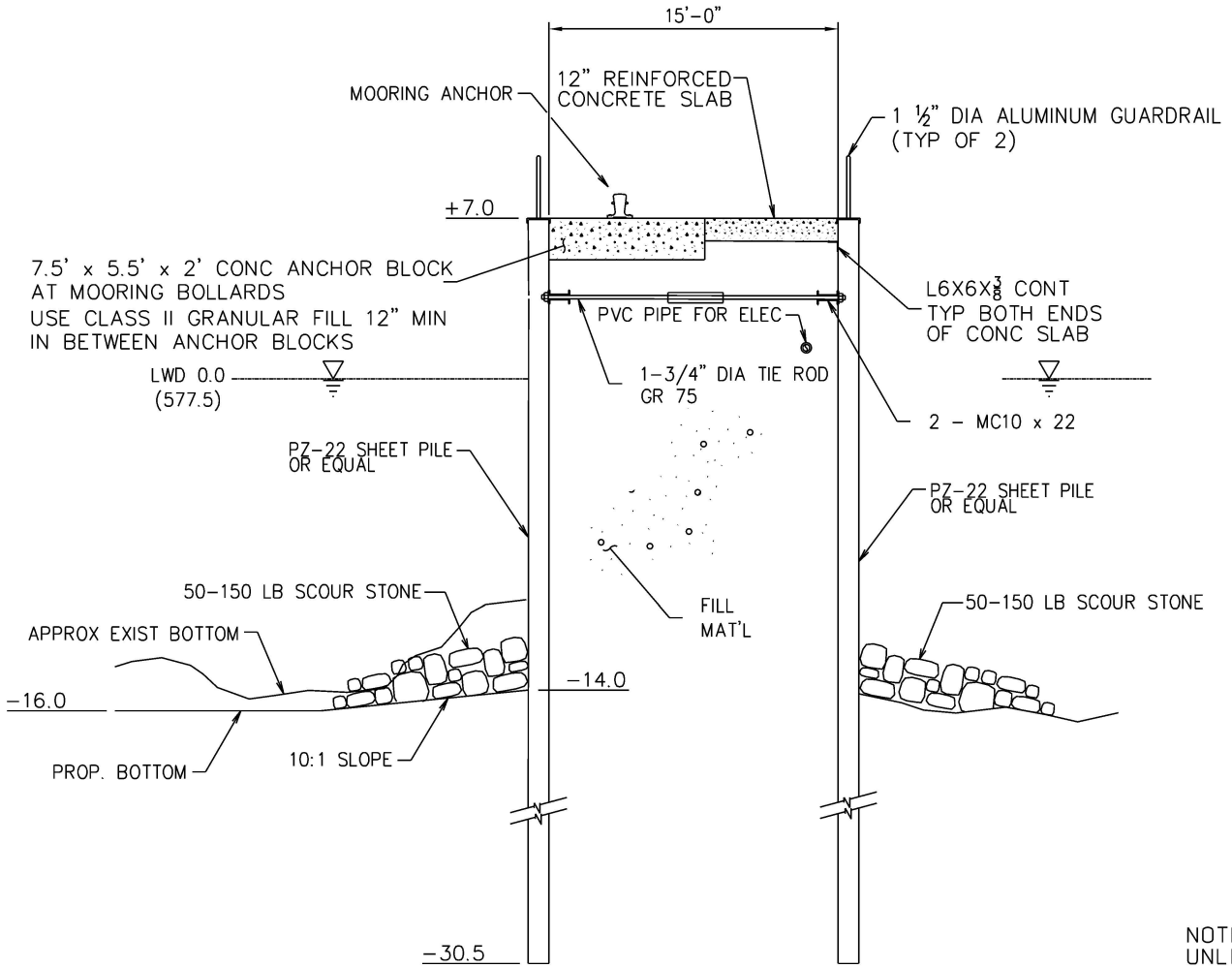


U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN

PROPOSED PLAN

DRAWN BY: HC	CHECKED BY:
18 MARCH 2009	PLATE 1



NOTE: ALL ITEMS PROPOSED UNLESS NOTED AS EXIST

ALTERNATIVE 1

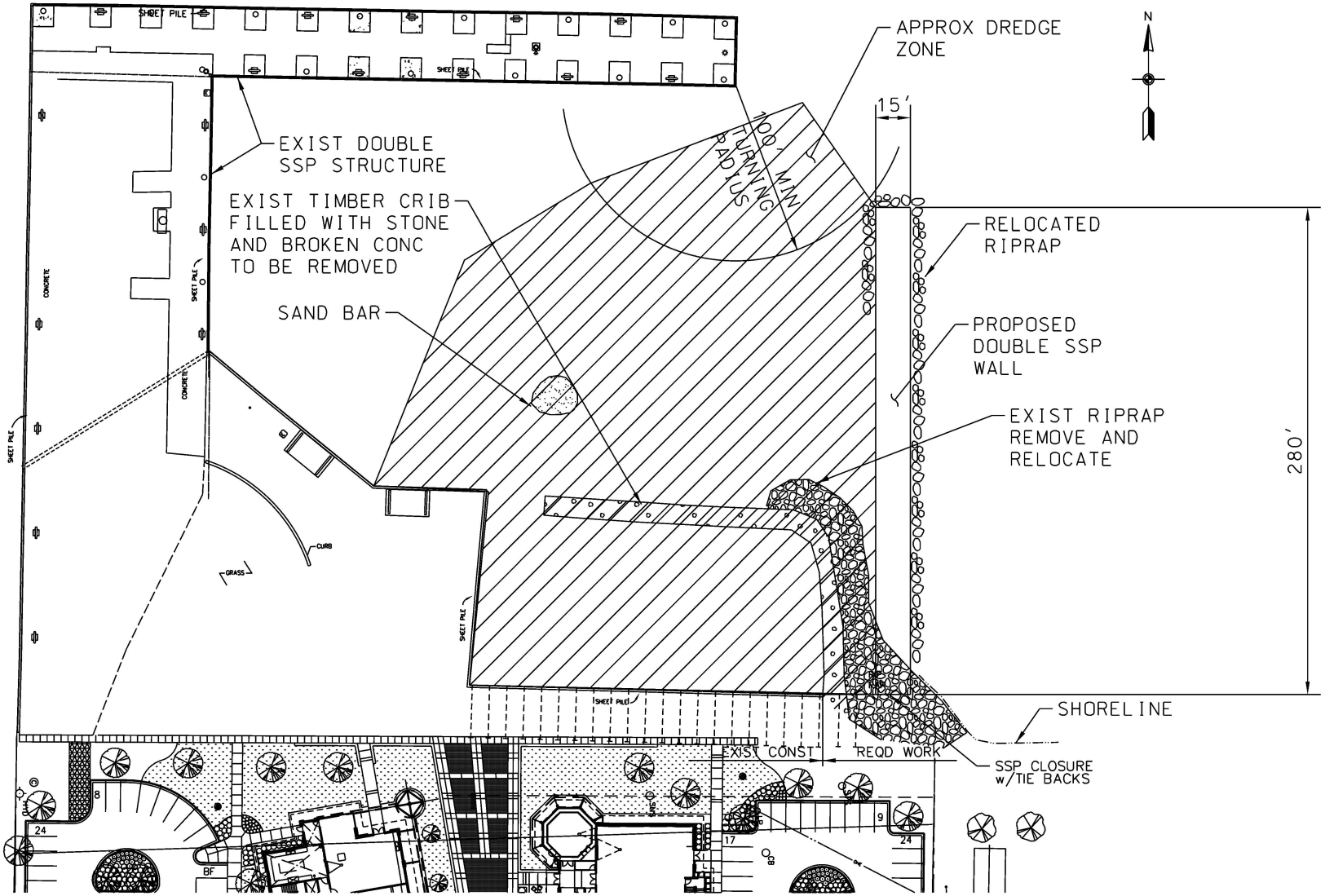
NOT TO SCALE

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN

ALTERNATIVE 1 - CROSS SECTION

DRAWN BY: HC	CHECKED BY:
22 FEBRUARY 2010	PLATE 3

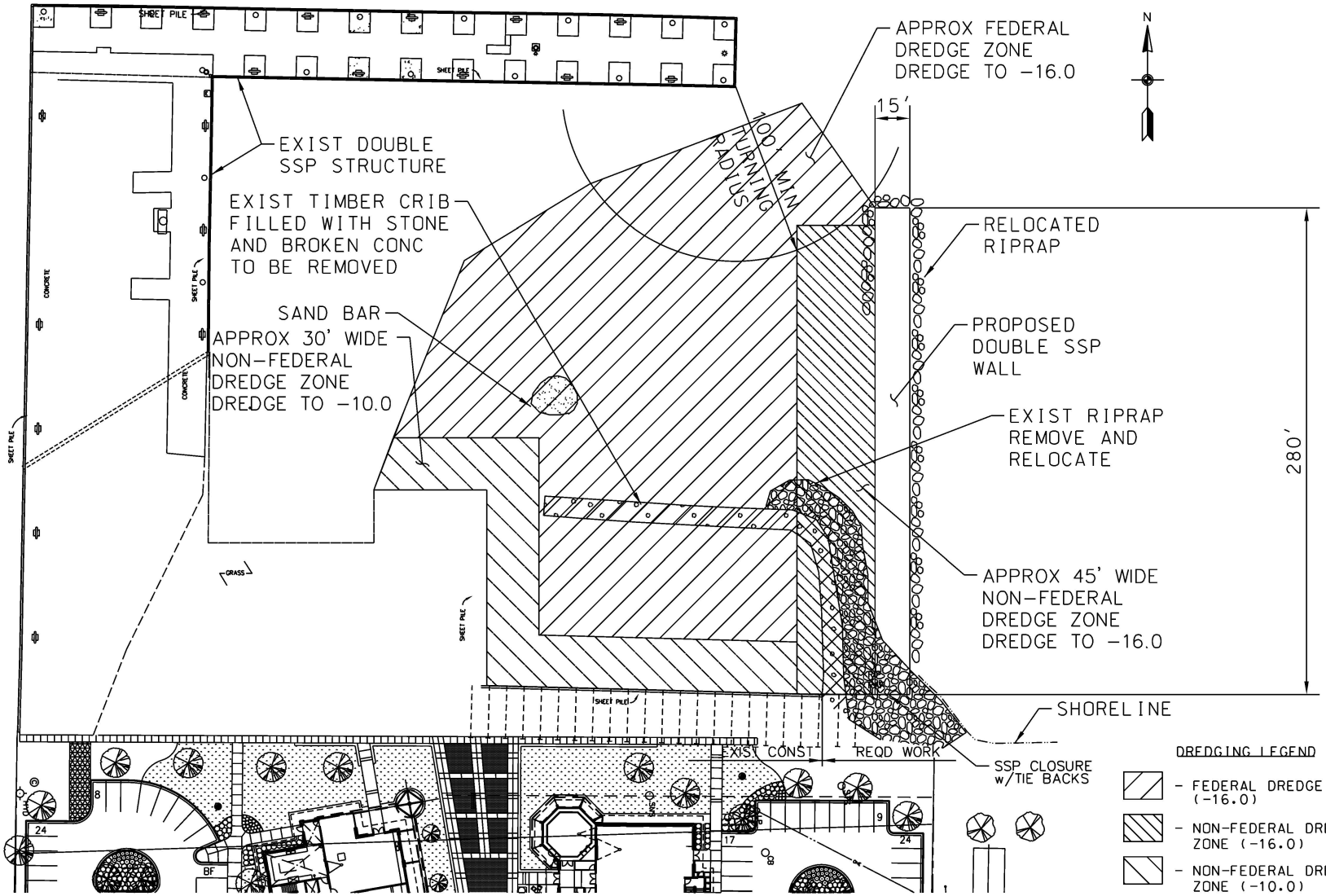


ALTERNATIVE 1 – PLAN
NOT TO SCALE

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN
ALTERNATIVE 1 PLAN

DRAWN BY: HC	CHECKED BY:
22 FEBRUARY 2010	PLATE 2



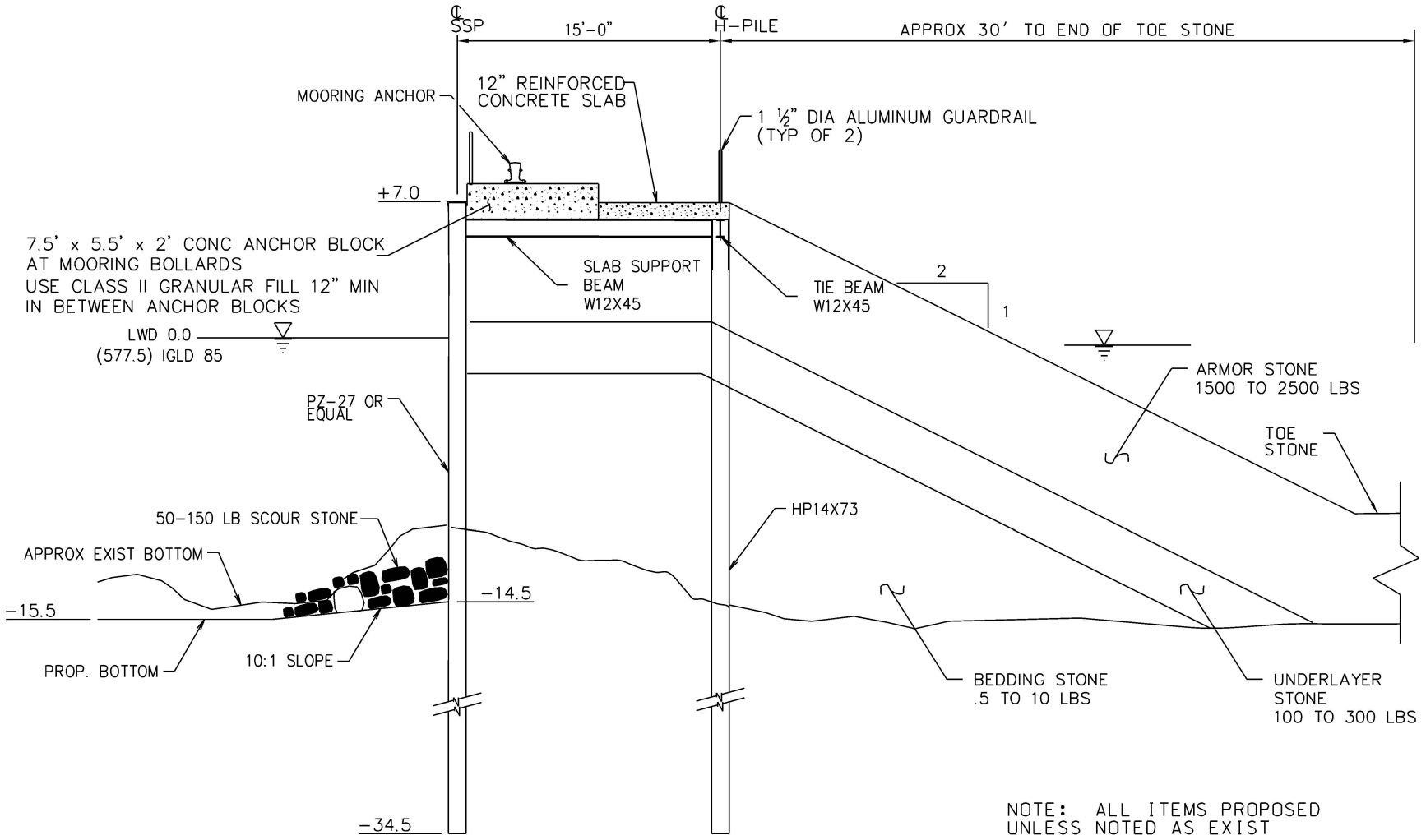
ALTERNATIVE 1 - PLAN

NOT TO SCALE

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN
ALTERNATIVE 1 PLAN

DRAWN BY: HC	CHECKED BY:
22 FEBRUARY 2010	PLATE 2



NOTE: ALL ITEMS PROPOSED UNLESS NOTED AS EXIST

ALTERNATIVE 4

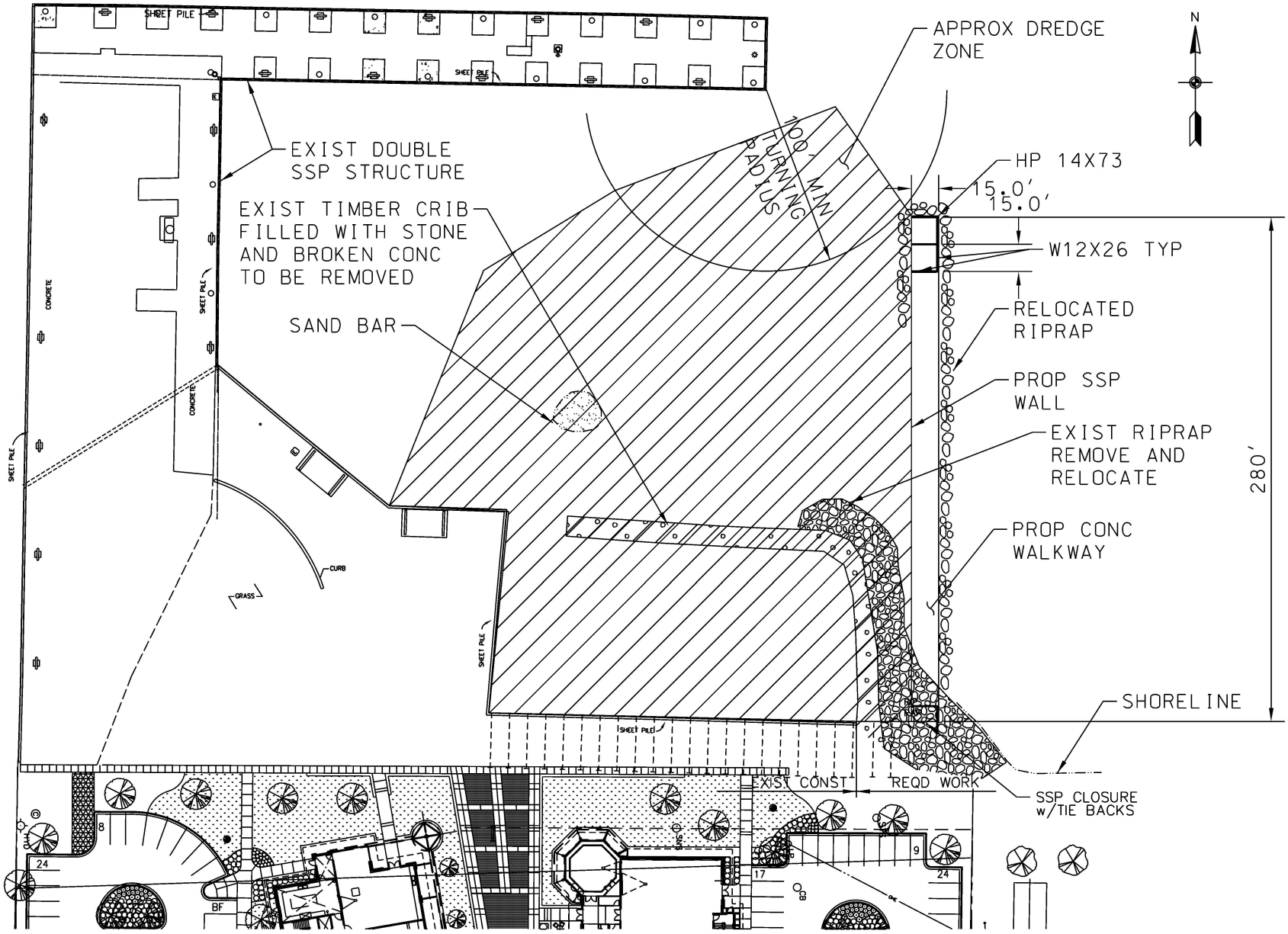
NOT TO SCALE

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN

ALTERNATIVE 4 - CROSS SECTION

DRAWN BY: HC	CHECKED BY:
22 FEBRUARY 2010	PLATE 5

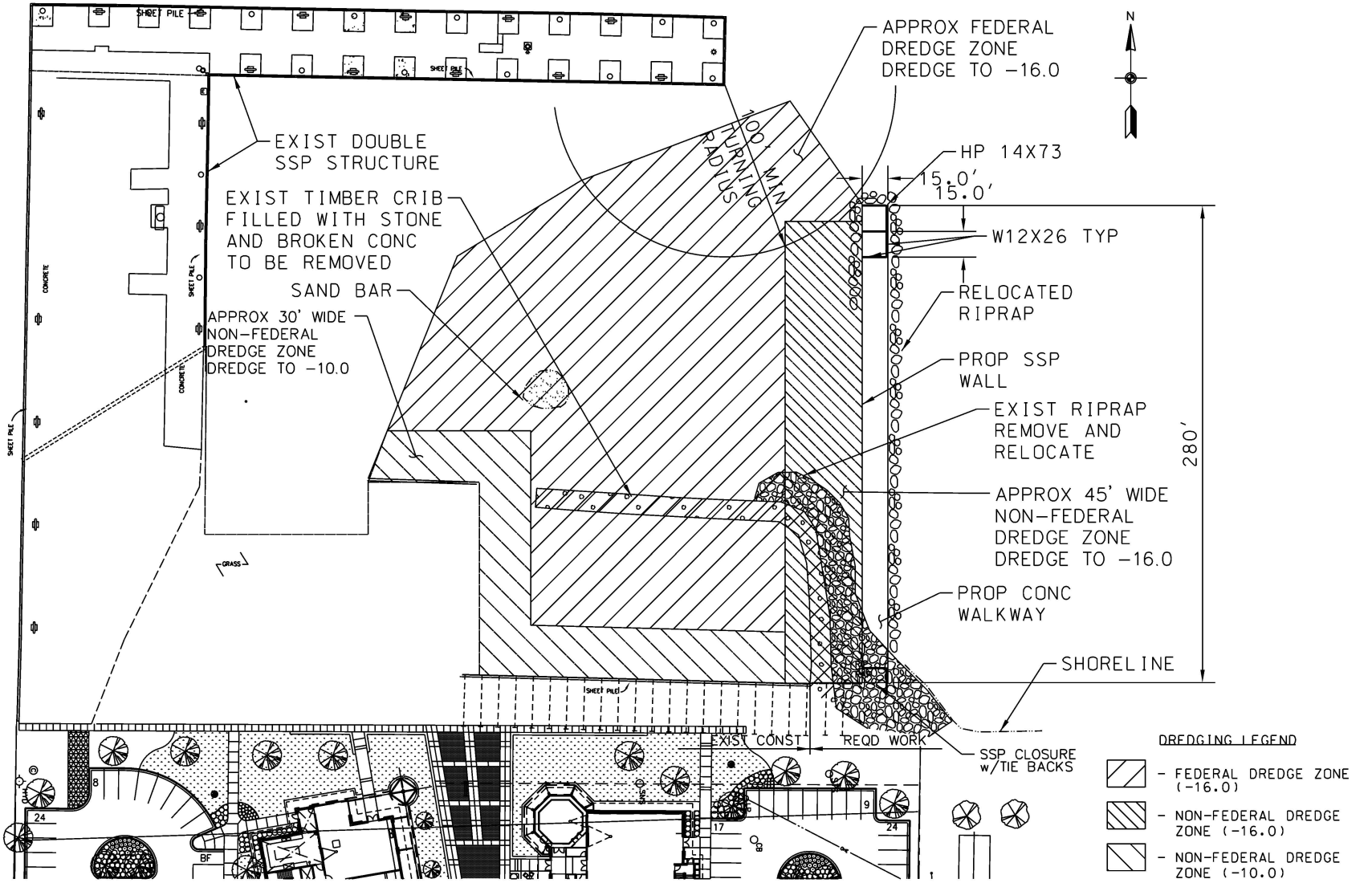


ALTERNATIVE 4 – PLAN

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN
ALTERNATIVE 4 PLAN

DRAWN BY: HC	CHECKED BY:
22 FEBRUARY 2010	PLATE 4



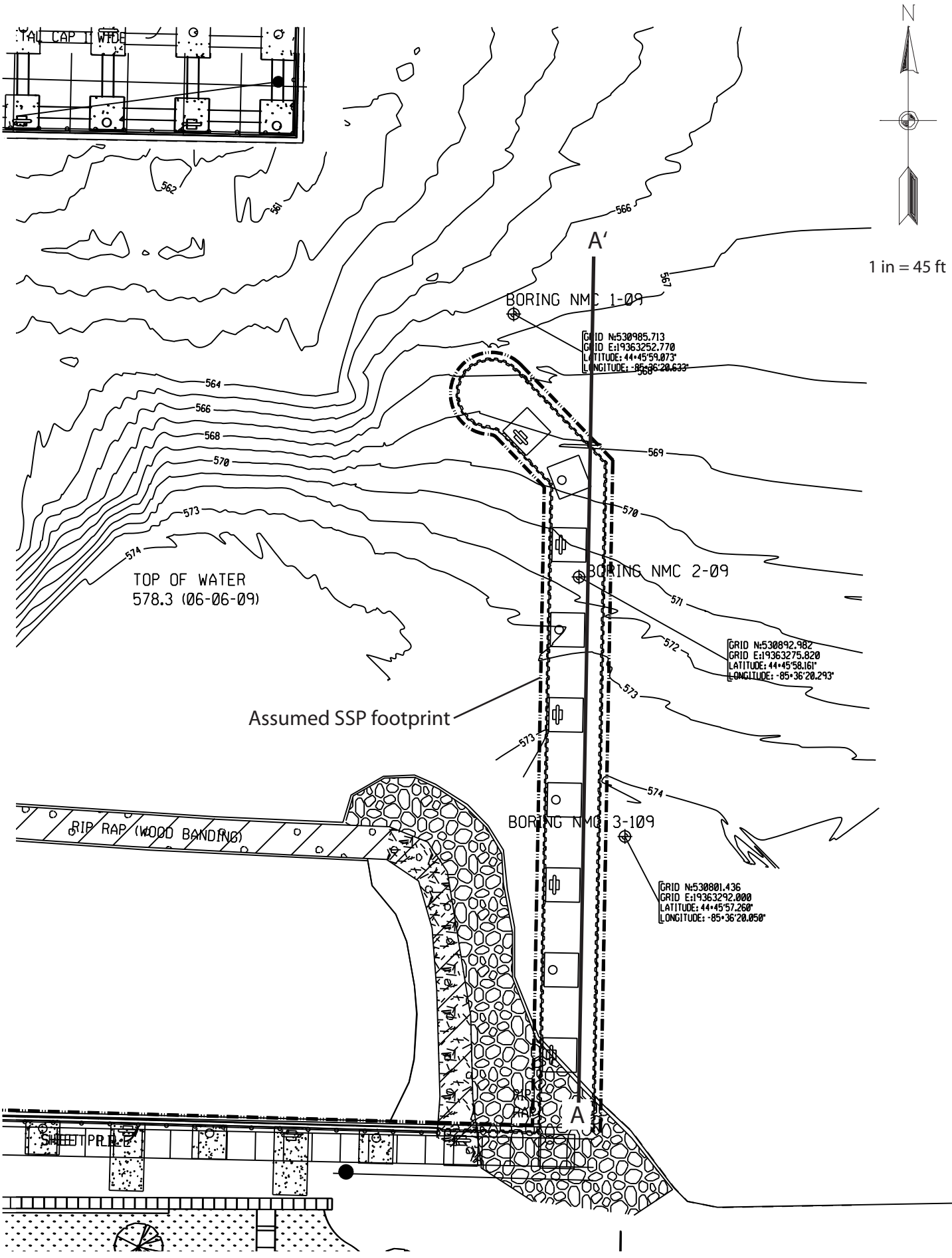
ALTERNATIVE 4 - PLAN

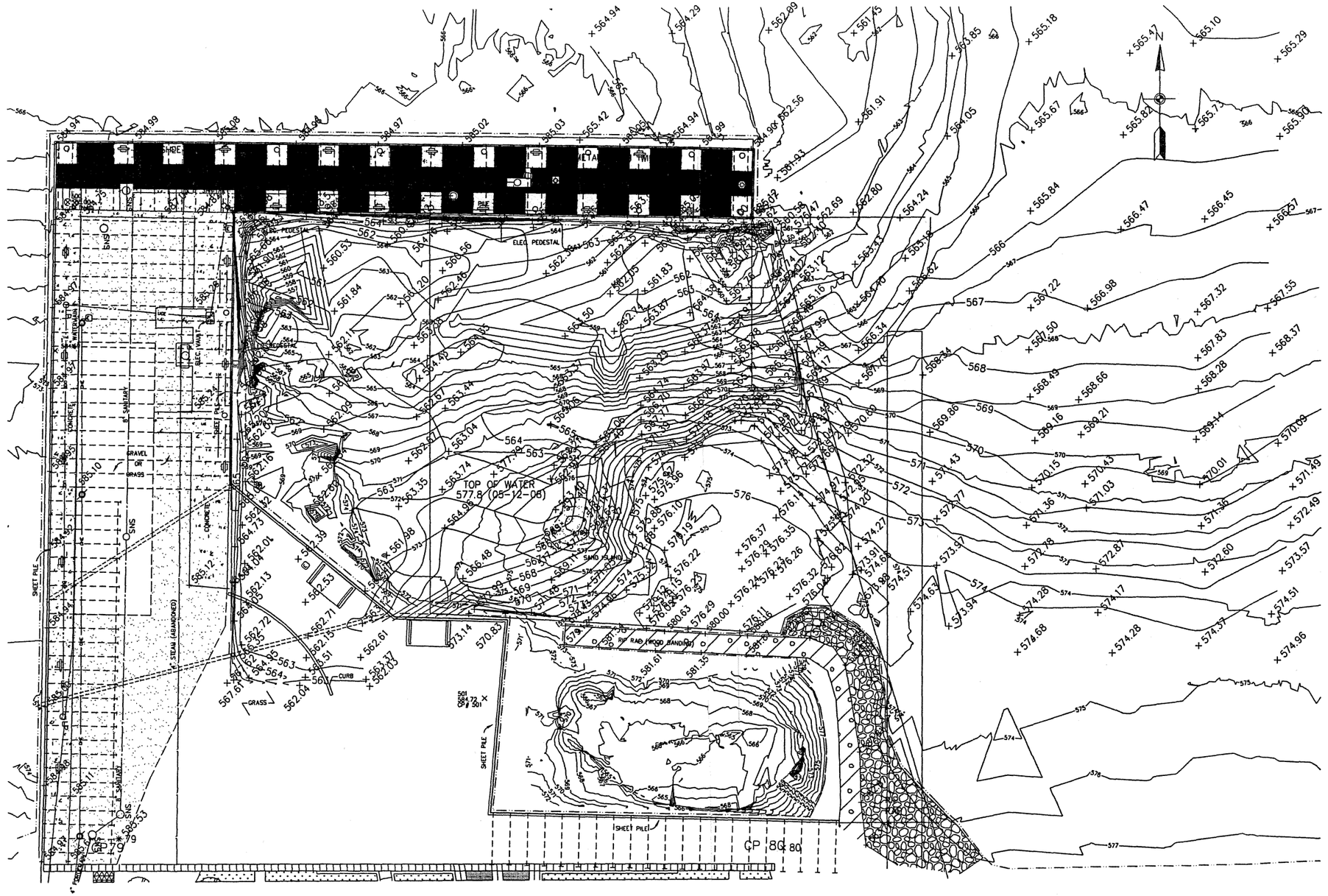
U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN
ALTERNATIVE 4 PLAN

DRAWN BY: HC	CHECKED BY:
22 FEBRUARY 2010	PLATE 4

Northwest Michigan College - Soil Profile Location





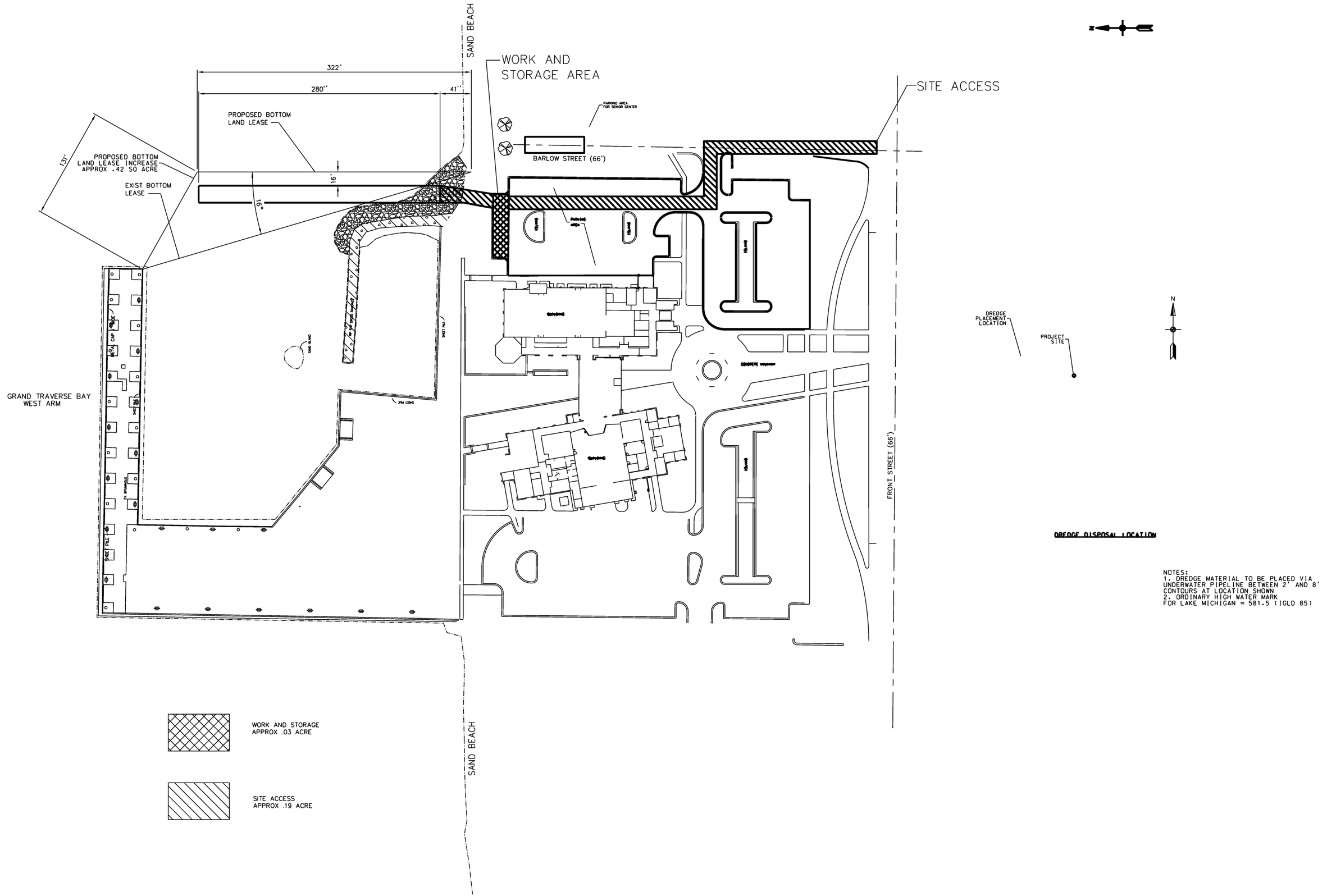
SITE SURVEY

NOTES:
1. SURVEY DATA REPRESENTATIVE OF CONDITIONS AT TIME OF SURVEY, MAY 2008.
2. SURVEY DATA COLLECTED BY GOURDIE-FRASER

U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
DETROIT, MICHIGAN

NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN
SITE SURVEY

DRAWN BY: HC	CHECKED BY:



DREDGE DISPOSAL LOCATION

NOTES:
1. DREDGE MATERIAL TO BE PLACED VIA UNDERWATER PIPELINE BETWEEN 2' AND 8' CONTOURS AT LOCATION SHOWN
2. ORDINARY HIGH WATER MARK FOR LAKE MICHIGAN = 581.5 (IGLD 85)

Northwestern Michigan College
Alternative 1
Double SSP Wall
QTO's

Prepared by:	HC	2/17/2010
Checked by:	AJ	2/26/2010
		REV: 6/20/11

SSP (PZ-22)

Top Elev		584.5	
Tip Elev		-546.5	
Length of ssp sheet		38	
Length of Wall		280	ft
Number of walls		2	
Length of End Wall		15	ft
Length of South Wall		30	ft
Total length of walls		605	ft
Area of ssp =	length of ssp sheet * length of wall		
=		22990	sft
Weight of ssp =		22	psf
Total weight of ssp =	area of ssp * weight of ssp		
=		252.89	ton

Wale (2-MC10x22)

Length of wale =	total length of wall		
=		605	ft
Weight of wale =		22	plf
Number of channels =		2	
Total weight of wale =	length of wale * weight of wale		
=		13.31	ton
Add 5% for spacers =		13.98	ton

Channel Cap (C12x20.7)

Length of cap =	total length of wall		
=		605	ft
Weight of cap =		20.7	plf
Total weight of cap =	length of cap * weight of cap		
=		6.26	ton

Tie Rods (1-3/4" dia Grade 75)

Spacing of tie rods =	12	ft
Length of tie rods =	16	ft
Weight of rod =	7.65	plf
Number of tie rods =	27	
	25 Main structure and 2 for south wall	
Weight of tie rods =	length of tie rods*weight of tie rods*number of tie rods	
=	1.65	ton

Concrete Slab

Width =	15	ft
Depth =	1	ft
Length =	280	ft
Volume =	155.56	cyd

Concrete Anchor Blocks

Width =	5.5	ft
Depth =	2	ft
Length =	7.5	ft
Quantity =	10	
Volume =	30.56	cyd

Reinforcement

Bar Size =	#7 @ 12" c/c		
Length =		15	ft
Qty =		280	
Weight of bar =		2.044	pfl
Total Weight of #7 bars =	length*qty*weight of bar		
=		4.29	ton

Bar Size =	#4 @ 12" c/c		
Length =		15	ft
Qty =		280	
Weight of bar =		0.668	pfl
Total Weight of #4 bars =	length*qty*weight of bar		
=		1.40	ton

Bar Size =	#4 @ 12" c/c		
Length =		280	ft
Qty =		14	
Weight of bar =		0.668	pfl
Number of faces =		2	
Total Weight of #4 bars =	length*qty*weight of bar*number of faces		
=		2.62	ton

Bollard (Macelroy CSB-9)

Qty =	10	

Granular Fill Below Conc (Class II)

Length of wall =		280	ft
Width of slab =		15	
Fill depth =		1	ft
Volume of fill =	length of wall*width of slab*fill depth		
=		155.56	cyd

Fill Material

Top of fill = underside of slab =		583	
Avg exist bottom elev =		-572	
Height of fill required =		11	ft
Length of wall =		280	ft
Width of wall =		15	ft
Volume of fill =	Height of fill * length of wall * width of wall		
=		1711.11	cyd

Wood Bumber (6x10)

300 lf

Aluminum Guardrail (1-1/2" dia x 3' high)

615 lf

Dredging (medium to dense sand - disposed of - see attached email)

Federal
Calculated in Microstation

Dredge to -16.0			
Volume of dredge =		11800	cyd **REV**

Non-federal
Calculated in Microstation

Dredge zone A, B and C (-10.0)			
Volume of dredge =		863	cyd
Dredge zone D and E (-16.0)			
Volume of dredge =		3100	cyd
Total Non-federal dredge volume =		3963	cyd **REV**

Existing Structure Removal

Timber Crib and Stone/Broken Conc	140	lf
Stone/broken conc removed and reused as scour stone	390	cy
Stone removed and disposed of	510	cy

Miscellaneous

RGS 1-1/2" conduit	300	lf
Emergency egress ladders	2	

Northwestern Michigan College
Alternative 4
Single H-Pile Wall with H-Piles supporting Conc Walkway
QTO's

Prepared by:	HC	2/17/2010
Checked by:	AJ	2/26/2010
		REV: 6/20/11

SSP (PZ-27)

Top Elev		584.5	
Tip Elev		-543	
Length of ssp sheet		41.5	
Length of Wall		280	ft
Number of walls		1	
Length of End Wall		15	ft
Length of South Wall		30	ft
Total length of walls		325	ft
Area of ssp =	length of ssp sheet * length of wall		
=		13487.5	sft
Weight of ssp =		27	psf
Total weight of ssp =	area of ssp * weight of ssp		
=		182.08125	ton

Channel Cap (C12x20.7)

Length of cap =	total length of wall		
=		325	ft
Weight of cap =		20.7	plf
Total weight of cap =	length of cap * weight of cap		
=		3.36	ton

H-Pile (HP14x73)

Top Elev		584.5	
Tip Elev		-548	
Length of h-pile		36.5	ft
Spacing of h-piles =		11	ft
Qty of h-piles =		25	
Weight of h-pile =		73	plf
Total weight of h-pile =	length of h-pile*qty of h-pile * weight of h-pile		
=		34	ton

Pile Load Test 1

Slab Support Beam (W12x45)

Length of beam =		15	
Weight of beam =		45	
Qty of beams =		19	
Total weight of slab support beam =	length *weight*qty		
=		6.4	ton

Tie beams (W12x45)

Length of beam =		15	
Weight of beam =		45	
Qty of beams =		18	
Total weight of slab support beam =	length *weight*qty		
=		6.1	ton

Concrete Slab

Width =		15	ft
Depth =		1	ft
Length =		280	ft
Volume =		155.56	cyd

Concrete Anchor Blocks

Width =		5.5	ft
Depth =		2	ft
Length =		7.5	ft
Quantity =		10	
Volume =		30.56	cyd

Reinforcement

Bar Size =	#7 @ 12" c/c		
Length =		15	ft
Qty =		280	
Weight of bar =		2.044	pfl
Total Weight of #7 bars =	length*qty*weight of bar		
=		4.29	ton

Bar Size =	#4 @ 12" c/c		
Length =		15	ft
Qty =		280	
Weight of bar =		0.668	pfl
Total Weight of #4 bars =	length*qty*weight of bar		
=		1.40	ton

Bar Size =	#4 @ 12" c/c		
Length =		280	ft
Qty =		14	
Weight of bar =		0.668	pfl
Total Weight of #4 bars =	length*qty*weight of bar		
=		1.31	ton

Armor Stone (1500 lb - 2500 lb)

Area of cross section =		171	sft
Length of wall =		280	ft
Void ratios =		0.35	
Unit weight of stone =		165	pcf
Total weight of stone =	area*length*(1-void ratio)*unit weight		
=		2567.57	ton

Underlayer Stone (140 lb - 260 lb)

Area of cross section =		104	sft
Length of wall =		280	ft
Void ratios =		0.35	
Unit weight of stone =		165	pcf
Total weight of stone =	area*length*(1-void ratio)*unit weight		
=		1561.56	ton

Bedding Stone (.5 lb - 10 lb)

Area of cross section =		290	sft
Length of wall =		280	ft
Void ratios =		0.35	
Unit weight of stone =		165	pcf
Total weight of stone =	area*length*(1-void ratio)*unit weight		
=		4354.35	ton

Bollard (Macelroy CSB-9)

Qty =	10	

Wood Bumber (6x10)

	300	lf

Aluminum Guardrail (1-1/2" dia x 4' high)

	615	lf

Dredging (medium to dense sand - disposed of - see attached email)

Federal
Calculated in Microstation

Dredge to -16.0			
Volume of dredge =	11800	cyd	**REV**

Non-federal
Calculated in Microstation

Dredge zone A, B and C (-10.0)			
Volume of dredge =	863	cyd	
Dredge zone D and E (-16.0)			
Volume of dredge =	3100	cyd	
Total Non-federal dredge volume =	3963	cyd	**REV**

Existing Structure Removal

Timber Crib and Stone/Broken Conc	140	lf
Stone/broken conc removed and reused as scour stone	390	cy
Stone removed and disposed of	510	cy

Miscellaneous

RGS 1-1/2" conduit	300	lf
Emergency egress ladders	2	

North West Michigan College Breakwater Construction A

Project Development Stage: Feasibility
Abbreviated Risk Analysis

Project Manager: Carl Platz

Meeting Date: 4-Mar-10

PDT Members (Typical Recommended)

Project Management:	Carl Platz
Contracting:	John Love
Real Estate:	Mark Brewer
Relocations:	No attendance
Engineering & Design:	Heather Calappi - Not able to attend
Cost Engineering:	Julie Udell
Construction:	Tom O'Bryan
Operations:	No attendance

Also in atte
Ashley Bini
Jim Schulz

North West Michigan College Breakwater Construction Alt 1

Project Development Stage: Feasibility

Abbreviated Risk Analysis

	WBS	Item	Contract Cost	% Contingency	$ Contingency	Total
1	10 BREAKWATERS AND SEAWALLS	**Mobilization/Demobilization/Prepatory**	**$ 225,202**	8.33%	$ 18,766.83	$ 243,968.83
2		**Breakwater**	**$ 908,848**	12.50%	$ 113,606.00	$ 1,022,454.00
3		**Concrete Walkway**	**$ 374,877**	8.33%	$ 31,239.75	$ 406,116.75
4		**Dredging**	**$ 272,128**	10.42%	$ 28,346.67	$ 300,474.67
5			**$ 1**	0.00%	$ -	$ 1.00
6			**$ 1**	0.00%	$ -	$ 1.00
7			**$ 1**	0.00%	$ -	$ 1.00
8			**$ 1**	0.00%	$ -	$ 1.00
9			**$ 1**	0.00%	$ -	$ 1.00
10			**$ 1**	0.00%	$ -	$ 1.00
11			**$ 1**	0.00%	$ -	$ 1.00
12		**Remaining Construction Items** **(Total Const. Contract Cost minus Σ of items #1-11)**	**$ -** 0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	**$ 391,582**	0.00%	$ -	$ 391,582.00
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	**$ 185,539**	0.00%	$ -	$ 185,539.00
		Total Construction Estimate	$ 1,781,062		$ 191,959	$ 1,973,021
		Total Planning, Engineering & Design	$ 391,582		$ -	$ 391,582
		Total Construction Management	$ 176,568		$ -	$ 185,539
		Total	$ 2,349,212		$ 191,959	$ 2,550,142

Weighted Construction Contingency = **10.8%**

Planning, Engineering & Design Contingency = **0.0%** Individual values have been given by each office for the

Construction Management Contingency = **0.0%** PED and CM contingencies

North West Michigan College Breakwater Construction Alt 1

Project Development Stage: Feasibility

Abbreviated Risk Analysis

Meeting Date: 4-Mar-10

Risk Level

	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	2	3	4	5	5
Likely	1	2	4	5	5
Unlikely	0	1	3	3	4
Very Unlikely	0	0	1	2	4

Risk Element	Affected WBS Item	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope						
PS-1	Mobilization/Demobilization/Preparatory	None	Breakwater construction is very common in the Detroit District. We have several regional Contractors with equipment very suitable for this work.	Very Unlikely	Negligible	0
PS-2	Breakwater	None	Breakwater construction is very common in the Detroit District. Within the year, breakwater reconstruction was just completed in nearby Petoskey, MI. The scope is well defined, surveys and soil tests exist. Our designers are very familiar with defining scopes for this type of construction.	Very Unlikely	Negligible	0
PS-3	Concrete Walkway	None	Breakwaters with concrete walkways are very common in this district. The project in Petoskey that recently finished included a concrete walkway. Our designers are very familiar with defining scopes for this type of construction.	Very Unlikely	Negligible	0
PS-4	Dredging	None	Dredging is the bulk of construction for the Detroit District. This northern region as well as the whole west coast of Michigan is reliably sandy material which primarily allows for efficient hydraulic dredging methods. Material is typically placed on the area beaches as nourishment.	Very Unlikely	Marginal	0
PS-5						FALSE
PS-6						FALSE
PS-7						FALSE
PS-8						FALSE
PS-9						FALSE
PS-10						FALSE
PS-11						FALSE
PS-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
PS-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
PS-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

Acquisition Strategy						
AS-1	Mobilization/Demobilization/Preparatory	If awarded this fiscal year, the schedule has gotten pushed back enough that it very likely be a late award. Also, this project has already been targeted by SBA to be an 8a set aside.	The late award will not likely have an impact on cost, it will just be a nuisance to contracting. The bulk of construction will likely begin in spring FY12 anyway. Impact of 8a setaside will likely drive the cost up. Assign marginal to average the impact of both concerns.	Very LIKELY	Marginal	3
AS-2	Breakwater	If awarded this fiscal year, the schedule has gotten pushed back enough that it very likely be a late award. Also, this project has already been targeted by SBA to be an 8a set aside.	The late award will not likely have an impact on cost, it will just be a nuisance to contracting. The bulk of construction will likely begin in spring FY12 anyway. Impact of 8a setaside will likely drive the cost up. Assign marginal to average the impact of both concerns.	Very LIKELY	Marginal	3
AS-3	Concrete Walkway	If awarded this fiscal year, the schedule has gotten pushed back enough that it very likely be a late award. Also, this project has already been targeted by SBA to be an 8a set aside.	The late award will not likely have an impact on cost, it will just be a nuisance to contracting. The bulk of construction will likely begin in spring FY12 anyway. Impact of 8a setaside will likely drive the cost up. Assign marginal to average the impact of both concerns.	Very LIKELY	Marginal	3
AS-4	Dredging	If awarded this fiscal year, the schedule has gotten pushed back enough that it very likely be a late award. Also, this project has already been targeted by SBA to be an 8a set aside.	The late award will not likely have an impact on cost, it will just be a nuisance to contracting. The bulk of construction will likely begin in spring FY12 anyway. Impact of 8a setaside will likely drive the cost up. Assign marginal to average the impact of both concerns.	Very LIKELY	Marginal	3
AS-5						FALSE
AS-6						FALSE
AS-7						FALSE
AS-8						FALSE
AS-9						FALSE
AS-10						FALSE
AS-11						FALSE
AS-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
AS-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

Construction Complexity						
CC-1	Mobilization/Demobilization/Preparatory	None	Marine equipment used for this work is widely available in the Great Lakes Region	Very Unlikely	Negligible	0
CC-2	Breakwater	None	Breakwaters in the Great Lakes are the bulk of the structural work that this district does. A similar project was just completed last year in Petoskey, MI with no issues, on time.	Very Unlikely	Negligible	0
CC-3	Concrete Walkway	None	Many Great Lakes breakwaters have concrete walkways, including the recent nearby project in Petoskey, MI. Our construction contractors are familiar with this feature.	Very Unlikely	Negligible	0
CC-4	Dredging	None	Not complex at all especially since the material is sand and can be dredged hydraulically in the summer months and deposited on a nearby beach. Very routine for our dredging contractors in the Great Lakes.	Very Unlikely	Negligible	0
CC-5						FALSE
CC-6						FALSE
CC-7						FALSE
CC-8						FALSE
CC-9						FALSE
CC-10						FALSE
CC-11						FALSE
CC-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
CC-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
CC-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

Volatile Commodities						
VC-1	Mobilization/Demobilization/Preparatory	Fuel volatility	As I have been updating this estimate, diesel fuel has fluctuated to historically high levels. The current fuel costs in the MII file reflect this, allowing us to not have to place as much weight within this contingency file.	LIKELY	Negligible	1
VC-2	Breakwater	Steel volatility	While there has been slight fluctuation, we haven't seen anything drastic in this region in the past 4 yrs.	Unlikely	Marginal	1
VC-3	Concrete Walkway	None	In this region, the only concern with the concrete would again be the fuel. Since the delivery cost is only a portion of the concrete cost, it seems negligible.	Very Unlikely	Negligible	0
VC-4	Dredging	None	Dredging cost in our region stayed pretty competitive during periods of high diesel fuel cost. Also the dredge volume is so small at 20K cy.	Very Unlikely	Negligible	0
VC-5						FALSE
VC-6						FALSE
VC-7						FALSE
VC-8						FALSE
VC-9						FALSE
VC-10						FALSE
VC-11						FALSE
VC-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
VC-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
VC-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

Quantities						
Q-1	Mobilization/Demobilization/Preparatory	None	Typical work, lots of historical data for marine mob/demob in the Great Lakes region.	Very Unlikely	Negligible	0
Q-2	Breakwater	None	surveys have been performed, LRE design branch has great experience developing breakwater scopes	Very Unlikely	Negligible	0
Q-3	Concrete Walkway	None	If the breakwater scope has no concerns, there's no reason for the concrete quantities to change.	Very Unlikely	Negligible	0
Q-4	Dredging	Additional shoaling since quantities estimated	Additional amount likely negligible; a small quantity to begin with	LIKELY	Marginal	2
Q-5						FALSE
Q-6						FALSE
Q-7						FALSE
Q-8						FALSE
Q-9						FALSE
Q-10						FALSE
Q-11						FALSE
Q-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
Q-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
Q-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

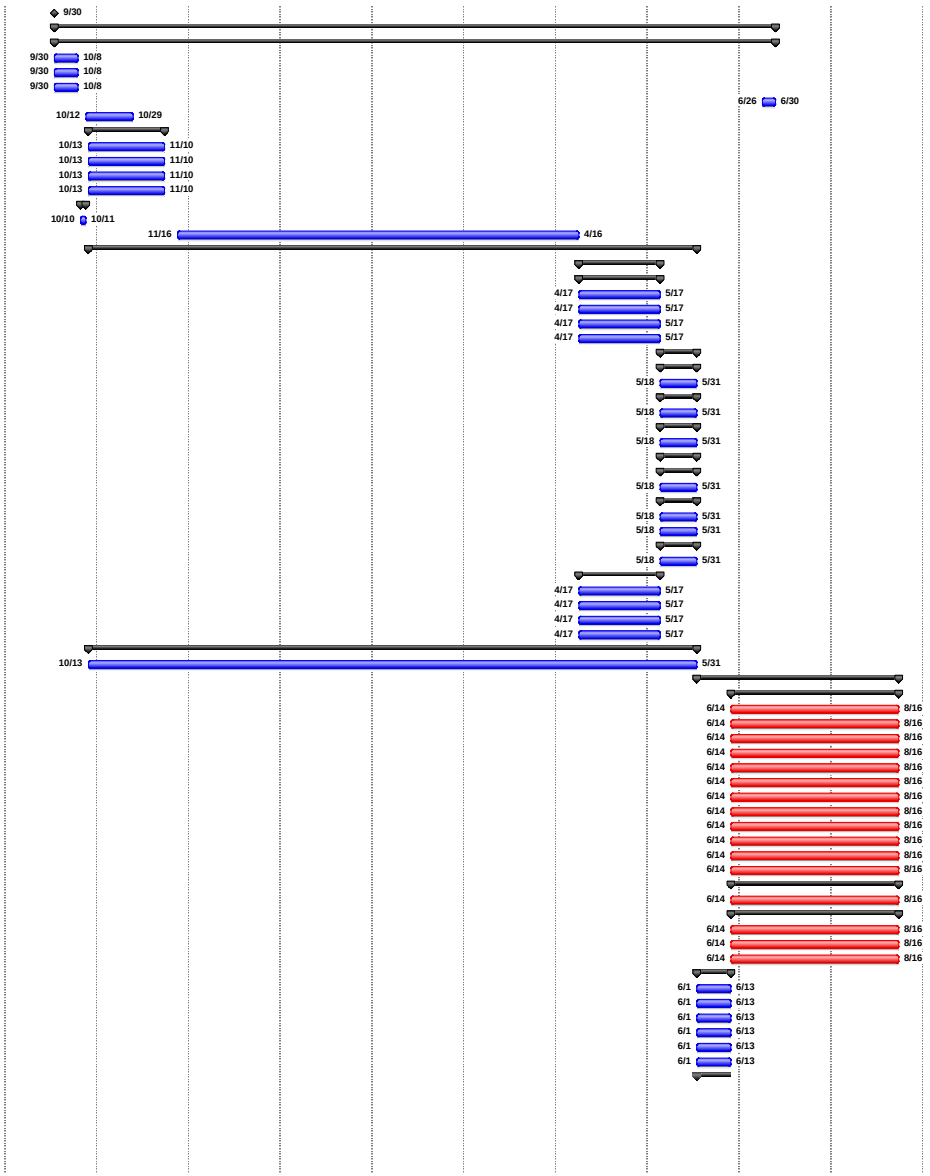
Fabrication & Project Installed Equipment						
FI-1	Mobilization/Demobilization/Preparatory	N/a		Very Unlikely	Negligible	0
FI-2	Breakwater	N/a		Very Unlikely	Negligible	0
FI-3	Concrete Walkway	N/a		Very Unlikely	Negligible	0
FI-4	Dredging	N/a		Very Unlikely	Negligible	0
FI-5						FALSE
FI-6						FALSE
FI-7						FALSE
FI-8						FALSE
FI-9						FALSE
FI-10						FALSE
FI-11						FALSE
FI-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
FI-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
FI-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

Cost Estimating Method

CE-1	Mobilization/Demobilization/Preparatory	None	Typical work with use of a marine crew, lots of recent & historical data for marine mob/demob in the Great Lakes region.	Very Unlikely	Negligible	0
CE-2	Breakwater	Production rate could differ from estimate assumption	Unlikely because a lot of recent data exists.	Unlikely	Marginal	1
CE-3	Concrete Walkway	None	Estimating based on recent data, typical for us to estimate this type of work.	Very Unlikely	Negligible	0
CE-4	Dredging	None	Very routine cost estimating with CEDEP, especially since hydraulic method used. A lot of recent data exists from this region on RMS.	Very Unlikely	Negligible	0
CE-5						FALSE
CE-6						FALSE
CE-7						FALSE
CE-8						FALSE
CE-9						FALSE
CE-10						FALSE
CE-11						FALSE
CE-12	Remaining Construction Items	None	All construction items are accounted for above.	Very Unlikely	Negligible	0
CE-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
CE-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

External Project Risks						
EX-1	Mobilization/Demobilization/Preparatory	None	Work scheduled for summer construction season, can't forsee any external risk	Very Unlikely	Negligible	0
EX-2	Breakwater	adverse weather	Work scheduled for summer construction season, adverse weather unlikely	Unlikely	Marginal	1
EX-3	Concrete Walkway	adverse weather	Work scheduled for summer construction season, adverse weather unlikely	Unlikely	Marginal	1
EX-4	Dredging	adverse weather	Work scheduled for summer construction season, adverse weather unlikely, such small quantity, impact is negligible.	Unlikely	Negligible	0
EX-5						FALSE
EX-6						FALSE
EX-7						FALSE
EX-8						FALSE
EX-9						FALSE
EX-10						FALSE
EX-11						FALSE
EX-12	Remaining Construction Items	Not sure where to insert this concern. In regards to schedule, if this project is not awarded by the end of this fiscal year, we may not have a project because the sec 107 authority will no longer exist in FY12.	It's unlikely this may happen unless the schedule keep getting pushed back but the impact would be negligable from a cost standpoint because the Government would no longer be spending money for it.	Unlikely	Negligible	0
EX-13	Planning, Engineering, & Design	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0
EX-14	Construction Management	N/a, these contingencies were obtained by each applicable office.		Very Unlikely	Negligible	0

ID	Task Name	Quantity	U of M	Cost	Duration	Start	Finish	Predecessors
1	ALTERNATIVE 1 Breakwaters & Seawalls	280	LF	$1,541,616.11	1852.7 hrs	Fri 9/30/11	Fri 9/30/11	
2	**MOB, DEMOB, PREP**	**1**	**EA**	**$290,747.51**	**348.9 hrs**	**Fri 9/30/11**	**Sat 6/30/12**	
3	**Mobilization & Demobilization**	**1**	**LS**	**$138,296.95**	**94.3 hrs**	**Fri 9/30/11**	**Sat 6/30/12**	
4	Mobilization or demobilization, delivery charge for small equipment on flatbed trail	4	EA	$593.66	8 hrs	Fri 9/30/11	Sat 10/8/11	
5	Mobilization or demobilization, dozer, loader, backhoe or excavator, above 250 H.	2	EA	$655.02	5.3 hrs	Fri 9/30/11	Sat 10/8/11	
6	Marine Plant, mobilization and demobilization, add to below, maximum	1	LS	$63,237.14	80 hrs	Fri 9/30/11	Sat 10/8/11	
7	Hydraulic Dredging Mob & Demob	1	LS	$73,811.13	40 hrs	Tue 6/26/12	Sat 6/30/12	
8	**Preconstruction Submittal Prep and Review**	0		$0.00	160 hrs	Wed 10/12/11	Sat 10/29/11	
9	**Demolition**	**1**	**EA**	**$150,070.31**	**252 hrs**	**Thu 10/13/11**	**Thu 11/10/11**	14
10	Selective demolition, disposal only, urban buildings with salvage value allowed, w	813	CY	$55,576.23	26.3 hrs	Thu 10/13/11	Thu 11/10/11	
11	Excavate and load, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic excа	1035	BCY	$6,650.42	27.6 hrs	Thu 10/13/11	Thu 11/10/11	
12	Hauling, excavated or borrow material, loose cubic yards, 20 mile round trip, 0.5 lo	742	LCY	$7,984.69	76.1 hrs	Thu 10/13/11	Thu 11/10/11	
13	Marine Crew - General	122	HR	$79,858.96	122 hrs	Thu 10/13/11	Thu 11/10/11	
14	**Temporary Access**	**1**	**EA**	**$2,380.26**	**2.5 hrs**	**Mon 10/10/11**	**Tue 10/11/11**	
15	Temporary, roads, gravel fill, 4" gravel depth, excl surfacing	222	SY	$2,380.26	2.5 hrs	Mon 10/10/11	Tue 10/11/11	
16	Winter No Work Period	0		$0.00	0 hrs	Wed 11/16/11	Mon 4/16/12	
17	**BREAKWATER**	**1**	**EA**	**$684,036.54**	**716.3 hrs**	**Thu 10/13/11**	**Thu 5/31/12**	
18	**Metals**	**1**	**EA**	**$81,389.12**	**33.2 hrs**	**Tue 4/17/12**	**Thu 5/17/12**	
19	**Steel Framing for Piling Misc Metal**	**1**	**EA**	**$81,389.12**	**33.2 hrs**	**Tue 4/17/12**	**Thu 5/17/12**	
20	Structural steel member, channels C10x25, C & MC, 21 to 58 plf, A992 steel,	7.7	TON	$34,307.84	7.7 hrs	Tue 4/17/12	Thu 5/17/12	
21	Structural steel member, channels C12x20.7, C & MC, 11 to 21 plf, A992 stee	6.4	TON	$33,297.42	8.5 hrs	Tue 4/17/12	Thu 5/17/12	
22	Sheet piling, steel, tie rod, not upset, with turnbuckle, 1-1/2" to 4", excludes w	1.7	TON	$4,195.33	0 hrs	Tue 4/17/12	Thu 5/17/12	
23	Marine Crew - Pile Install	17	HR	$9,588.54	17 hrs	Tue 4/17/12	Thu 5/17/12	
24	**Associated General Items**	**1**	**EA**	**$62,933.17**	**116.4 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
25	**Site Work**	**1**	**EA**	**$14,349.00**	**27.9 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
26	Marine Crew - Site Work	14	HR	$7,896.44	14 hrs	Fri 5/18/12	Thu 5/31/12	
27	**Egress Ladders**	**1**	**EA**	**$852.10**	**3 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
28	Jetties, dock accessories, ladder, crown top, 5 to 7 step, maximum	2	EA	$852.10	3 hrs	Fri 5/18/12	Thu 5/31/12	
29	**Timber Bumper**	**1**	**EA**	**$5,600.47**	**10.9 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
30	Single 6" x 10" wood beam, heavy mill timber framing	1.5	MBF	$5,600.47	10.9 hrs	Fri 5/18/12	Thu 5/31/12	
31	**Metals**	**1**	**EA**	**$48,584.16**	**88.5 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
32	**Mooring Rings and Cleats**	**1**	**EA**	**$4,952.65**	**10 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
33	Jetties, dock accessories, mooring whip, 60,000 lb. boat	5	PR	$4,952.65	10 hrs	Fri 5/18/12	Thu 5/31/12	
34	**Guard Rail**	**1**	**EA**	**$39,577.08**	**48.5 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
35	Railing, pipe, aluminum, clear finish, 2 rails, 1-1/2" dia, shop fabricated	615	LF	$36,765.41	30.8 hrs	Fri 5/18/12	Thu 5/31/12	
36	Concrete core drilling, core, reinforced concrete slab, 1 1/2" diameter, up	62	EA	$2,811.66	17.7 hrs	Fri 5/18/12	Thu 5/31/12	
37	**RGS Conduit**	**1**	**EA**	**$4,054.44**	**30 hrs**	**Fri 5/18/12**	**Thu 5/31/12**	
38	Rigid galvanized steel conduit, 1-1/2" diameter, to 15' high, incl coupling	300	LF	$4,054.44	30 hrs	Fri 5/18/12	Thu 5/31/12	
39	**Piling**	**1**	**EA**	**$537,208.30**	**556.3 hrs**	**Tue 4/17/12**	**Thu 5/17/12**	
40	sheet piling, steel, 22 psf, 30' excavation, left in place, excludes wales	193	TON	$377,450.66	119.2 hrs	Tue 4/17/12	Thu 5/17/12	
41	Piles, steel, shoes	380	EA	$86,204.79	304 hrs	Tue 4/17/12	Thu 5/17/12	
42	Selective demolition, torch cutting, steel, 1" thick plate	140	LF	$228.75	3.1 hrs	Tue 4/17/12	Thu 5/17/12	
43	Marine Crew - Pile Installation	130	HR	$73,324.10	130 hrs	Tue 4/17/12	Thu 5/17/12	
44	**Salvage and Reset Scour Stone**	**1**	**EA**	**$2,505.96**	**10.4 hrs**	**Thu 10/13/11**	**Thu 5/31/12**	
45	Excavate and place, bank measure, blasted rock, 1-1/2 C.Y. bucket, hydraulic exc	390	BCY	$2,505.96	10.4 hrs	Thu 10/13/11	Thu 5/31/12	
46	**CONCRETE**	**158**	**CY**	**$385,771.63**	**622.3 hrs**	**Fri 6/1/12**	**Thu 8/16/12**	
47	**Concrete, in Place**	**158**	**CY**	**$105,646.62**	**101.8 hrs**	**Thu 6/14/12**	**Thu 8/16/12**	
48	Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate	158	CY	$42,233.99	0 hrs	Thu 6/14/12	Thu 8/16/12	
49	C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 4 use, includes e	590	SFC	$4,799.75	17.2 hrs	Thu 6/14/12	Thu 8/16/12	
50	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrati	158	CY	$4,500.38	6.8 hrs	Thu 6/14/12	Thu 8/16/12	
51	Finishing, Structural concrete, in place, slab on grade, 12" thick, includes finishing	4200	SF	$30,026.43	12.3 hrs	Thu 6/14/12	Thu 8/16/12	
52	Concrete paving surface treatment, transverse expansion joints, includes premold	312	LF	$4,938.95	16.6 hrs	Thu 6/14/12	Thu 8/16/12	
53	Concrete testing, compressive strength test, incl. picked up by lab, average	36	EA	$817.04	0 hrs	Thu 6/14/12	Thu 8/16/12	
54	Concrete surface treatment, curing, sprayed membrane compound	42	CSF	$699.64	3.5 hrs	Thu 6/14/12	Thu 8/16/12	
55	High chairs, for reinforcing steel, individual (HC), galvanized, 3" high, includes mat	16	CCT	$2,352.27	0 hrs	Thu 6/14/12	Thu 8/16/12	
56	Concrete paving surface treatment, transverse expansion joints, includes premold	60	LF	$949.80	3.2 hrs	Thu 6/14/12	Thu 8/16/12	
57	Control joint, concrete floor slab, sawcut in green concrete, 1" depth	60	LF	$41.23	0.2 hrs	Thu 6/14/12	Thu 8/16/12	
58	Control joint, joint sealant, polyurethane, 1" x 1/2" (154 LF/Gal)	60	LF	$232.43	1.9 hrs	Thu 6/14/12	Thu 8/16/12	
59	Marine Crew - Standby	1	WK	$14,054.71	40 hrs	Thu 6/14/12	Thu 8/16/12	
60	**Reinforcing Steel**	**1**	**EA**	**$17,165.81**	**26.8 hrs**	**Thu 6/14/12**	**Thu 8/16/12**	
61	Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for a	7.7	TON	$17,165.81	26.8 hrs	Thu 6/14/12	Thu 8/16/12	
62	**Concrete Anchor Blocks**	**29.2**	**CY**	**$10,047.55**	**3 hrs**	**Thu 6/14/12**	**Thu 8/16/12**	
63	Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate	32	CY	$8,553.72	0 hrs	Thu 6/14/12	Thu 8/16/12	
64	Structural concrete, placing, spread footing, pumped, over 5 C.Y., includes vibratir	32	CY	$1,124.14	1.7 hrs	Thu 6/14/12	Thu 8/16/12	
65	C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erect	100	LF	$369.69	1.3 hrs	Thu 6/14/12	Thu 8/16/12	
66	**Granular Fill for Concrete Walk**	**1**	**EA**	**$34,016.50**	**68.7 hrs**	**Fri 6/1/12**	**Wed 6/13/12**	
67	Fill, granular fill	178.9	LCY	$3,467.00	0 hrs	Fri 6/1/12	Wed 6/13/12	
68	Loading base course, 1 C.Y. bucket	155.6	BCY	$391.12	1.3 hrs	Fri 6/1/12	Wed 6/13/12	
69	Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1.6 loa	178.9	LCY	$1,349.75	11.4 hrs	Fri 6/1/12	Wed 6/13/12	
70	Backfill, structural, 6" lifts, backfill around foundation, with hydraulic excavator	178.9	LCY	$308.70	1.5 hrs	Fri 6/1/12	Wed 6/13/12	
71	Compaction, 4 passes, 18" wide, 12" lifts, walk behind, vibrating plate	155.6	ECY	$298.35	4.4 hrs	Fri 6/1/12	Wed 6/13/12	
72	Marine Crew - Granular Fill	50	HR	$28,201.58	50 hrs	Fri 6/1/12	Wed 6/13/12	
73	**Fill Stone for Concrete Walk**	**1**	**EA**	**$218,895.16**	**422 hrs**	**Fri 6/1/12**	**Wed 6/13/12**	
74	**Steel sheet piling seawalls, crushed stone, placed behind bulkhead by clam**	**1968**	**LCY**	**$115,140.21**	**131.2 hrs**	**Fri 6/1/12**	**Wed 6/13/12**	
75	Loading base course, 1 C.Y. bucket	1711.1	BCY	$4,302.19	14.8 hrs	Fri 6/1/12	Wed 6/13/12	
76	Hauling, excavated or borrow material, loose cubic yards, 4 mile round trip, 1	1968	LCY	$14,848.02	126 hrs	Fri 6/1/12	Wed 6/13/12	
77	Marine Crew - Fill Stone	150	HR	$84,604.73	150 hrs	Fri 6/1/12	Wed 6/13/12	
78	**DREDGING**	**1**	**EA**	**$181,060.43**	**165.3 hrs**	**Fri 6/1/12**	**Mon 6/18/12**	
79	Dredging	20000	CY	$181,060.43	165.3 hrs	Fri 6/1/12	Mon 6/18/12	



NORTHWESTERN MICHIGAN COLLEGE, TRAVERSE CITY, MICHIGAN

ECONOMIC APPENDIX - D

EXECUTIVE SUMMARY

Northwestern Michigan College requested the assistance of the Detroit District, U.S. Army Corps of Engineers (USACE), to evaluate plans to construct a breakwater at their maritime harbor in Traverse City, Michigan. The harbor is home to the only freshwater maritime academy in the United States as well as several other freshwater academic programs intrinsically tied to the Great Lakes Region. The harbor's existing breakwater is severely dilapidated, unsafe, and poorly configured allowing sediment to build-up which, in turn, impedes the productivity of the harbor. More specifically, the shoaling and configuration of the harbor restricts the number of vessels that can berth/moor and permits wave action to enter the harbor, damaging vessels, piers and docks. The harbor's limited space also restricts the college's ability to use the water's edge to hold outdoor laboratory classes and train students how to use marine related equipment.

The feasibility study evaluates the demolition of the current eastern breakwater, dredging of the harbor to a depth of 16 feet and the construction of a new breakwater structure. Two different plans or alternatives for this structure were evaluated for their economic viability; a double steel sheet pile wall and a single steel sheet pile wall. Since both alternatives are similar in design and function, they produce virtually the same economic benefits. These benefits include: providing additional mooring and berthing space for the college and visiting vessels; eliminating the need for routine maintenance dredging; and decreasing the need for repairing piers and docks. More importantly, the eastern breakwater will prevent shoaling in the harbor and will allow the college to fully maximize the use of the harbor for vessels and educational activities.

Of the two alternatives evaluated in this Economic Appendix, the double steel sheet pile breakwater, or Alternative 1, produces the greatest number of net economic benefits ($7,039 in 2011 dollars) and has the highest benefits-cost ratio (1.06). As a result, the National Economic Development (NED) plan recommended for this Section 107 project is Alternative 1, the double steel sheet pile breakwater.

Although this proposed breakwater project provides important NED benefits, the project has a significant regional implication. The college is home to the only maritime academy in the nation designed to train Great Lakes maritime professionals. In addition, the harbor is also used to facilitate other regional education/training programs and provides an opportunity for regional research collaborations. Since the college is the only educational institution providing higher learning opportunities to the region, the proposed harbor improvement has a significant bearing on the college's ability to meet the region's educational needs.

TABLE OF CONTENTS

1. INTRODUCTION D-1
   a. Background D-1
   b. Location D-1
   c. Regional Demographic Profile D-2
   d. Northwestern Michigan College D-4
   e. Great Lakes Maritime Harbor D-6

2. CURRENT CONDITIONS D-7
   a. Harbor's Restriction on Vessel Use D-8
   b. Impairment to Other Harbor Activities D-9

3. WITH-OUT PROJECT CONDITIONS D-10
   a. Continued Shoaling D-10
   b. Wave Action D-10
   c. Harbor Capacity Impacts on Other Programs D-10
   d. Visiting Vessels and Research Collaboration D-11

4. WITH PROJECT CONDITIONS D-11
   a. Alternatives D-12
   b. Harbor Improvement Benefits D-13
      1. Dock & Pier Repairs D-13
      2. Maintenance Dredging Savings D-14
      3. Visiting Agency Vessel Savings D-14
      4. Average Annual Benefits & Total Project Life Benefits D-16
      5. Other Direct Benefits – Beach Nourishment D-16
      6. Other Direct Benefits – Harbor of Refuge D-17
      7. Other Direct Benefits – Labor Supply D-17
      8. Regional Impacts & Other Social Effects D-18
   c. Project Costs D-19

5. BENEFIT COST ANALYSIS D-20
6. CONCLUSION/RECOMMENDATION D-21

FIGURES

Figure

1 – State View of GLMA Harbor D-2
2 – Grand Traverse Bay D-2
3 – Higher Educational Institution Proximity to Northwestern Michigan College D-5
4 – T/S State of Michigan Berthed in Harbor D-6
5 – Harbor Shoaling & Eastern Breakwater's Configuration D-7
6 – Visiting Vessels (NOAA's Laurentian & EPA's Lake Guardian D-9
7 – Condition of the Eastern Breakwater D-9

TABLES

Table

1 – Grand Traverse Regional Demographic Profile D-2
2 – Grand Traverse Regional Education & Income Profile D-3
3 – Grand Traverse Regional Employment Profile D-4
4 – Institution & Agency Visiting Vessel Information D-15
5 – Institution & Agency Visiting Vessel Savings in 2010 Dollars D-15
6 – Economic Benefits in 2010 Dollars D-16
7 – Proposed Harbor Improvement Project Costs in 2010 Dollars D-19
8 – Economic Comparison of Alternatives in 2010 Dollars D-20
9 – Economic Summary of Alternative 1 D-20

1. INTRODUCTION

a. Background

The Great Lakes Maritime Academy Harbor is located on the southern shore of the West Branch of Grand Traverse Bay on Lake Michigan, in Traverse City, Michigan. The harbor is home to the only maritime academy that specializes in the training and education of Great Lakes maritime professionals (i.e. merchant marine officers). In addition, the recently added, one-of-a-kind, Freshwater Studies Program also utilizes the harbor as a backdrop for its laboratory and other education-related exercises. Both of these academic programs rely heavily on the harbor as a cornerstone for facilitating student training and education. More specifically, the harbor serves as a home base for maritime training vessels, an on-site freshwater laboratory and an access point to conduct research on the Grand Traverse Bay. In addition, other universities and various state and federal agencies utilize the harbor while conducting research or engaging in training exercises on Grand Traverse Bay.

In 1969, ten years after the St. Lawrence Seaway was completed, Northwestern Michigan College purchased the project site and opened the Great Lakes Maritime Academy. Built in 1972, the harbor is currently home to four training vessels used to give maritime cadets a "hands-on" experience in maneuvering, handling, navigating and maintaining vessels. Renovations to the harbor were completed in 2004-2005 to accommodate a newly acquired and much larger training vessel, the T/S State of Michigan.

Although the 2004-2005 renovations were a significant upgrade for the harbor, they did not address the dilapidated and poorly configured eastern breakwater. The breakwater does not extend far enough out into the water to prevent wave action from entering the harbor, causing damage to the docks and piers and generating large deposits of sediment. As a result, the college spends approximately $5,100 annually to repair damages induced by wave action and must also remove approximately 1,500 cubic yards of sediment per year.

b. Location

Situated on Northwestern Michigan College's Great Lakes Campus, the harbor is located on the southern most end of West Grand Traverse Bay, in Traverse City, Grand Traverse County, Michigan (see ***Figures 1 & 2***). Although Traverse City serves as the County Seat for Grand Traverse County, a small portion of the city is in Leelanau County. Traverse City's nearest major metropolitan neighbors are: Chicago (approximately 320 miles) and Detroit (approximately 260 miles). In addition, the city is about nine square miles (8.7 square miles) in size and has an estimated population of around 14,500 (2008 U.S. Census Bureau estimate).

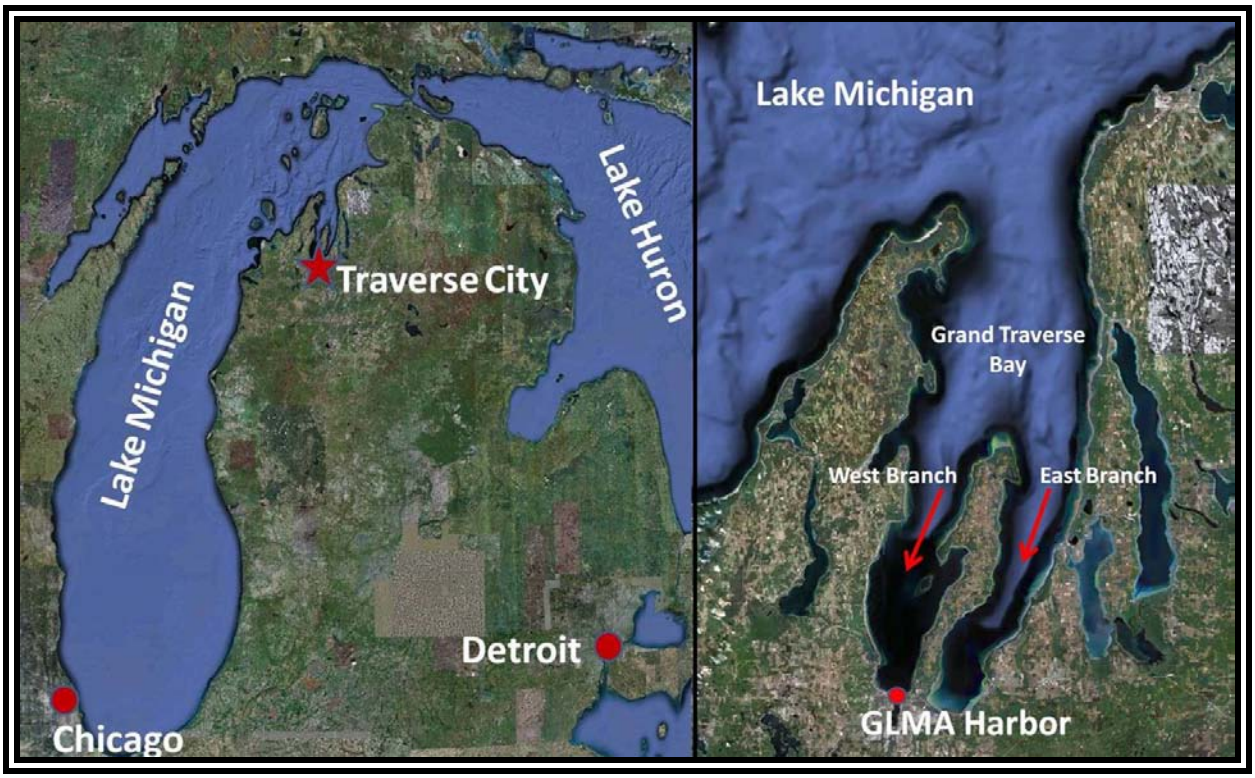


Figure 1 – State View of GLMA Harbor

Figure 2 – Grand Traverse Bay

c. Regional Demographic Profile

Grand Traverse County, plus the six surrounding counties (see **Table 1**), comprises what is commonly referred to as the "Grand Traverse Region". The region is a favorite summer-time destination for tourists offering: scenic beaches, out-door recreational opportunities, water sports, and popular festivals. The region also boasts some of the best wineries in the Mid-West and is world famous for its cherries. While there are many reasons to visit the Grand Traverse Region, it is the waters of Grand Traverse Bay and Lake Michigan that draw so many visitors.

Table 1 - Grand Traverse Regional Demographic Profile					
County	**Population (2009)**	**Median Household Income (2008)**	**Unemployment Rate (2010)**	**SQ Miles of Land**	**SQ Miles of Water**
Antrim	23,834	$42,732	16.5%	477	125
Benzie	17,227	$45,309	16.1%	321	538
Grand Traverse	86,333	$50,207	12.6%	465	136
Kalkaska	16,891	$40,618	14.7%	561	10
Leelanau	21,899	$56,056	10.4%	348	2,184
Wexford	31,553	$41,264	18.4%	565	10
Grand Traverse Region	197,737	$46,031	14.8%	2,737	3,003
State of Michigan	9,969,727	$48,606	14.0%	57,324	40,666
Source: U.S. Census Bureau's State & County Quick Facts, U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics					

Table 1 summarizes the demographic profile for the Grand Traverse Region. The region has a total area of 5,740 square miles, of which, over half is water (52.3%). Leelanau County is mostly comprised of water (86.3%) and nearly all (98%) of Kalkaska and Wexford counties are land. The Grand Traverse Region has a population of approximately 197,700 people, a median income of $46,000 and an unemployment rate consistent with the state average (14.8% vs. 14.0%). Notably, Leelanau County has the highest median household income, $56,056, and an unemployment rate well below the regional and state averages (10.4% vs. 14.8% and 14%).

Table 2 - Grand Traverse Regional Education & Income Profile				
County	**High School Diploma (2000)**	**Bachelors Degree (2000)**	**Percent of Population Below Poverty (2008)**	**Median House Hold Income (2008)**
Leelanau	90.7%	31.4%	8.5%	$56,056
Grand Traverse	89.3%	26.1%	9.5%	$50,207
Benzie	85.4%	20.0%	10.3%	$45,309
Antrim	84.9%	19.4%	12.9%	$42,732
Wexford	82.0%	15.3%	15.2%	$41,264
Kalkaska	80.0%	9.7%	15.0%	$40,618
Grand Traverse Region	85.4%	20.3%	11.9%	$46,031
State of Michigan	83.4%	21.8%	14.4%	$48,606
Source: U.S. Census Bureau's State & County Quick Facts, U.S. Bureau of Labor Statistic's Local Area Unemployment Statistics				

Statistics summarizing each county's education and income levels is shown in **Table 2**. Similar to the rest of the state, most (85.4%) of the population of the Grand Traverse Region has received a high school diploma and 20% have completed a bachelors degree. **Table 2** also

illustrates what other national studies consistently report, that with higher levels of education come higher incomes and lower levels of poverty. Specifically, Leelanau County has received the greatest number of high school diplomas (90.7%) and bachelor degrees (31.4%) and, thus, has the highest Median Household Income ($56,056) and the fewest people living in poverty (8.5%) in the region. Grand Traverse County is ranked second in terms of educational attainment and level of income.

As shown in **Table 3**, in 2007, the retail trade industry provided the greatest source of employment (12,139) for the Grand Traverse Region followed closely by manufacturing (11,586) and healthcare and social services based businesses (11,509). Businesses located within Grand Traverse County employed significantly more people than the other five counties combined. Consequently, the county will continue to attract more business and persons seeking employment compared to the other five counties.

Table 3 - Grand Traverse Regional Employment Profile							
Industry Type	**Antrim**	**Benzie**	**Grand Traverse**	**Kalkaska**	**Leelanau**	**Wexford**	**Region**
Total	4,618	2,989	43,466	3,498	4,341	13,839	72,751
Retail Trade	603	533	7,764	504	690	2,045	12,139
Manufacturing	1,022	634	4,901	421	215	4,393	11,586
Health Care and Social Assistance	25-499	334	7,577	464	545	2,214	11,509
Accommodation and Food Services	1,083	426	5,081	369	566	1,420	8,945
Administrative and Support and Waste Management and Remediation Services	209	167	2,906	217	284	598	4,381
Construction	387	287	2,463	195	677	262	4,271
Professional, Scientific, and Technical Services	146	93	2,907		264	440	3,850
Finance and Insurance	160	100-249	2,223	73	178	312	3,021
Other Services (except Public Administration)	266	137	1,704	196	161	389	2,853
Wholesale Trade	75	0-19	1,265	185	20-99	471	2,006
Arts, Entertainment, and Recreation	38	20-99	812	5	266	107	1,288
Information	39	0-19	974	0-19	100-249	188	1,446
Mining	9	0-19	522	564	20-99	22	1,187
Educational Services	0-19		728		80	245	1,063
Transportation and Warehousing	41	20-99	522	89	24	321	1,057
Real Estate and Rental and Leasing	96	70	508	55	20-99	115	904
Management of Companies and Enterprises	0-19	20-99	351	0-19	0-19	128	569
Utilities		0-19	216	62	0-19	149	447
Forestry, Fishing, Hunting, and Agriculture Support	0-19	0-19	20-99	0-19	3	0-19	103
Unclassified			0-19	0-19	0-19	0-19	40
Source: U.S. Census Bureau's 2007 County Business Patterns							

d. Northwestern Michigan College

Founded in 1851, Northwestern Michigan College serves the Grand Traverse Region with educational opportunities in: associate degree programs, courses designed for transfer accreditation, professional certification, and collaborative bachelor, masters and doctorial programs. Over 50,000 students take a course at the community college annually with 10,000 utilizing the other four extension/satellite campuses. The college partners with other larger

Michigan universities to offer area residents the opportunity to complete bachelor, masters, and doctorial degrees that they might otherwise not be able to complete given the region's proximity to other large four-year institutions.

Northwestern Michigan College is the only higher education institution within 90 miles to offer bachelor or post bachelor learning opportunities to this region. Although there is another community college, North Central Michigan College, located 50 miles away in East Jordan, students there can only complete an associate degree. Thus, the closest four-year institution is Ferris State University, shown in ***Figure 3,*** located 90 miles away in Big Rapids, Michigan. Central Michigan University, 120 miles away, is the second closest academic institution from Northwestern Michigan College offering a bachelor degree or higher.

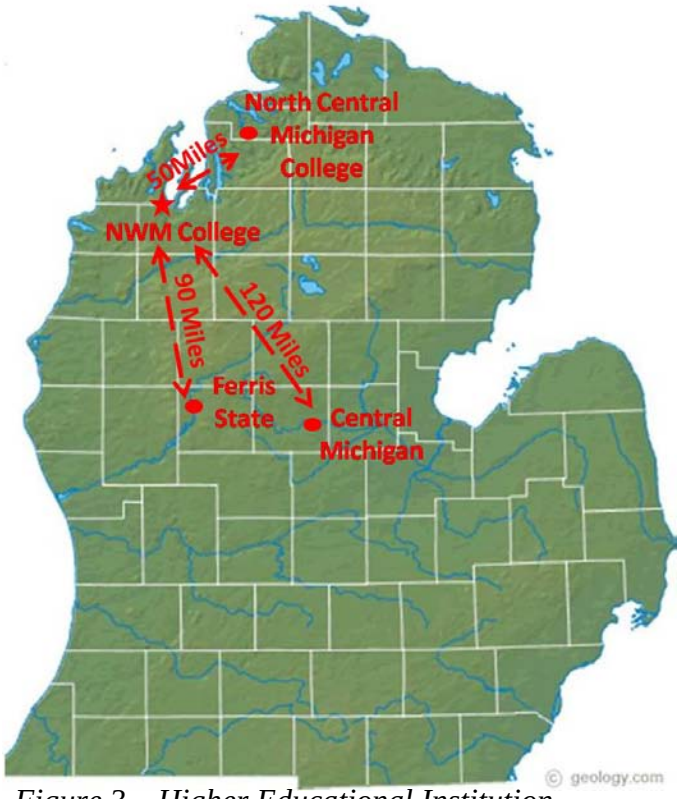


Figure 3 – Higher Educational Institution
Proximity to Northwestern Michigan College

Northwestern Michigan College's mission is to *"provide lifelong learning opportunities to our communities"*. As the only source of higher education in the region, they strive to respond to their community's learning needs by providing programs and educational opportunities that prepare students for future careers in highly marketable industries. For example, the Great Lakes Maritime Academy and Freshwater Studies Program is designed to give students the tools they need to acquire jobs that are tied to the Great Lakes Region. Furthermore, the college plans to begin offering two additional programs (Coastal Brownfield Technician and Great Lakes Marine

Technician) that also leverage the region's Freshwater resources. In summary, Northwestern Michigan College is a vital resource to the success of the region's economy and people.

e. Great Lakes Maritime Harbor

The college relies heavily on the Great Lakes Maritime Harbor as a resource or tool to deliver training and other related educational activities. The harbor is home to the T/S State of Michigan, a 224-foot training vessel (see ***Figure 4***) used as a floating classroom and a means for students to gain experience navigating the Great Lakes. The vessel has nearly a 15-foot draft and is berthed year round on the western and southern harbor piers. Because the T/S State of Michigan is affiliated with the Maritime Administration, it must be secured at all times and harbor access must be closed off during heightened security levels. To secure the harbor and restrict access, a fence surrounds the vessel at its berth and cadets with TWIC (Transportation Worker Identification Credential) stand security watch 24-hours a day, seven days a week. In addition, three other vessels used for training, research and educational purposes are docked at the harbor during spring and summer months.

Figure 4 – T/S State of Michigan Berthed in Harbor

The Great Lakes Maritime Harbor is not only used by the academy, but also plays an important role for the Freshwater Studies Program. This program utilizes the harbor to teach students how to operate and deploy marine-related equipment (i.e. remotely operated underwater vehicles or ROV's) and allows students to conduct experiments right at the water's edge. As the college prepares to roll out two new programs, Great Lakes Marine Technician and Coastal Brownfield Technician, the use of the harbor as a teaching tool will become even more central to the college's ability to respond to the region's educational needs.

2. CURRENT CONDITIONS

Given the natural sediment movements of the bay and the current configuration of the eastern breakwater (see ***Figure 5***), shoaling occurs at the eastern side of the harbor. The Hydrologic and Hydraulic (or H&H) Report indicates that the majority of the shoaling can be attributed to natural sediment movements, or littoral drift, which occurs in a westerly direction. This report estimates that, on average, approximately 1,500 cubic yards of this material moves into the harbor annually. The analysis (or CMS-Flow Model) also found that waves, produced by storms, could move up to six inches of sediment at a time. As a result, the college must dredge 1,500 cubic yards of sediment out of the harbor annually at a cost of approximately $53,500 per year in 2011 dollars. (Note: This cost was based on a bid the college received for dredging in 2007 and was adjusted for inflation using the Civil Works Construction Cost Index's Feature Code 12, Navigation Ports and Harbors).

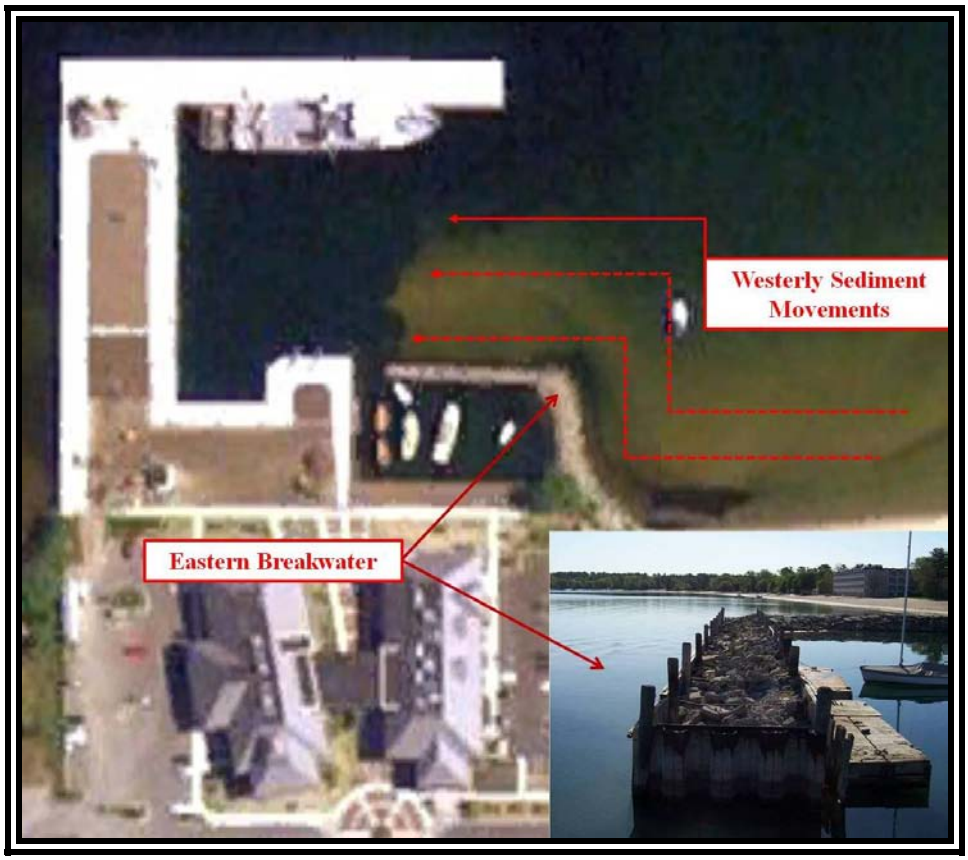


Figure 5 – Harbor Shoaling & Eastern Breakwater's Configuration

The eastern breakwater's configuration also allows for waves from the bay to surge into the harbor causing vessels to bounce and bang against piers and docks. The cost to repair the

damage to piers and docks has been, on average, about $5,100 per year (in 2011 dollars). Finally, the configuration of the breakwater and sediment build-up does not allow the college to fully maximize the harbor's use and, thus, restricts the number of activities and potential opportunities for the college.

a. Harbor's Restriction on Vessel Use

With a draft of approximately 15 feet, the T/S State of Michigan requires a minimum harbor depth of 16 feet in order for the training vessel to safely berth in the harbor. Soundings data, collected in 2008, reported that the harbor's depth ranged from 1.5 feet to 15.5 feet. Given the depth of this vessel's draft, it can easily become compromised by the sediment drifts when maneuvering in and out of the harbor. Thus, the college must dredge annually to maintain navigability of the T/S State of Michigan. More importantly, although the vessel has not sustained any damages yet, the sediment drifts are a significant hazard to the vessel and would be costly to repair if it were to run aground.

Not only does the shoaling impact the maneuverability of the T/S State of Michigan, it prevents the college from realizing the full productivity of the other harbor vessels. Because of the sheer size of the T/S State of Michigan and its security requirements, the college often has difficulties finding space to dock and berth other vessels that need to use the harbor. As a result, only the northern harbor wall and a small portion of the southern harbor wall are left for other vessels to moor and berth. Consequently, the college must coordinate and prioritize other vessel activities in order to accommodate their use in the harbor.

In the past, Northwestern Michigan College has encouraged other universities and government agencies (e.g. Environmental Protection Agency or EPA) to berth their vessels overnight (see ***Figure 6***) or for a couple of days at the harbor. Typically, these agencies are out on Grand Traverse Bay conducting scientific research, working on training or educational related exercises and/or are engaged in other bay related activities. By using the Great Lakes Maritime Harbor, these agencies forego the expense of having to traveling to another harbor farther away to moor overnight. Given the depth of their drafts, they are also frequently subject to only a limited number of harbors that can accommodate their size. Other marinas located on Grand Traverse Bay are typically operating at peak capacity during spring/summer months and, thus, obtaining a slip to accommodate their draft and size can be challenging. For example, according to the harbor master at Clinch Marina, located in the vicinity of the maritime harbor, their harbor tends to be at 100% capacity during the height of tourism season. Thus, without the maritime harbor, these vessels would need to utilize the next closest harbor which could be, at minimum, 44 miles away in Charlevoix.

Figure 6 – Visiting Vessels (NOAA's Laurentian and EPA's Lake Guardian)

b. Impairment to Other Harbor Activities

Northwestern Michigan College also uses the water's edge as an on-site laboratory for students to conduct experiments and to learn how to operate marine-related equipment. Due to the current configuration of the harbor and the number of vessels berthed, suitable access to the piers to perform these activities is severely limited. While the eastern breakwater may appear to be an appropriate access point to the water for these activities, it is severely deteriorated and unsafe (see ***Figure 7***). Notably, its condition is so questionable that the college discourages and restricts public access to it.

Figure 7 – Condition of the Eastern Breakwater

Although moving the training exercises and/or activities to another site may seem feasible, the vast majority of the marinas in the Traverse City area are operating at full capacity during the spring and summer months and frequently do not have the infrastructure to meet the college's needs. Some of the research equipment used on these vessels is heavy and requires a forklift to transport from the dock to the vessels. Equipment loads, estimated by the college, can be anywhere from 500 to 1,000 lbs and equipment could be easily dropped or damaged during transport and/or loading. The cost to replace and/or repair the equipment is significant and if this equipment was funded by grants, those same funding sources may no longer be available to repair or replace them. In addition, the alternative marina site may not have forklifts available to load and unload the research equipment and, thus, the college would need to transport the folk lifts in addition to the equipment.

3. WITH-OUT PROJECT CONDITIONS

Appendix D, of the Principals and Guidance Notebook, ER 1105-2-100 requires that the economic analysis identify the without project condition. This includes not only existing conditions, but also future without project conditions expected to occur over the 50-year analysis period.

a. Continued Shoaling

Northwestern Michigan College will continue to dredge nearly 1,500 cubic yards of sand out of the harbor every year at a cost of approximately $53,500 (in 2011 dollars) annually. When shoaling builds-up, maneuvering the vessels in and out of the harbor is extremely difficult and, if not managed properly, leads to costly damages to both the docks, piers and vessels. Although the T/S State of Michigan has managed to avoid any accidents since it was acquired six years ago, there have been a few close calls and inevitability the vessel will sustain some damage. The replacement value of this vessel is unknown, however; it received a significant upgrade of over $1,000,000 before the Navy turned it over the college in 2004.

b. Wave Action

The poor configuration of the eastern breakwater will continue to offer little or no protection from waves surging into the harbor causing damage to piers and docks. To repair these damages, the college will continue to spend approximately $5,100 per year (in 2011 dollars). Wave action will also pose serious risks to the vessels inside the harbor. Not only could these vessels incur damage, the expensive equipment they are outfitted with could very likely be destroyed and/or damaged. An example of such a vessel is the 56-foot Northwestern, recently outfitted with specialized sonar equipment used for ROV.

c. Harbor Capacity Impacts on Other Programs

The already constrained harbor will become even tighter once the college rolls out its two new academic programs; Coast Brownfield Technician and Great Lakes Marine Technician. In order to implement these two programs successfully, the college needs to add a third season of outdoor laboratory for students to gain technical competence in maneuvering vessels, utilizing state of the art marine equipment, docking and mooring boats and learning how to operate remote operated vehicles. However, the current configuration of the harbor and the dilapidated state of the eastern breakwater offers the college no place for additional students to perform and/or learn these activities. As a result, the college will need to pick and choose which training and educational activities they feel are absolutely necessary, while foregoing other training activities that are not essential. If the harbor is unable to sustain crucial training activities, the college may consider utilizing another marina or harbor in the Traverse City area vicinity. Unfortunately, most of the harbors in Traverse City operate at full capacity during the tourism season and do not have the infrastructure outlays to load and unload heavy equipment onto vessels with forklifts.

In summary, the college will continue working within the confines of the current harbor, restricting the number of training programs and students they can serve. As a last resort, the college may consider moving training activities that do not require heavy equipment to another marina or harbor located in the Traverse City area.

d. Visiting Vessels and Research Collaboration

Several state and government agencies have utilized the Great Lakes Maritime Academy Harbor as a place to moor their vessels (see ***Figure 7***) overnight while conducting research or when engaged in other water related activities out on Grand Traverse Bay. The two additional academic programs will put further pressure on the already constrained harbor and the once available mooring space these agencies used will become even scarcer. Given the college's prioritizes, they may continue to offer these agencies the same number of opportunities to use the harbor; however, it is highly unlikely that any additional harbor space will be available for these types of vessel visits.

Northwestern Michigan College benefits from the visiting state and government agency vessels through building relationships and leveraging research opportunities that might otherwise not exist. A recent research collaboration, brought in by NOAA (National Oceanic and Atmospheric Administration), gave students the opportunity to participate in a survey mapping project of the Grand Traverse Bay, which directly applied to their field of study. Moreover, both the college and these institutions are able to share knowledge and synergies which lead to a better understanding of the region's ecosystem. Therefore, by restricting or limiting the number of agency vessels, the college and these institutions forego the opportunity to build important research partnerships that ultimately impact both the nation and the Grand Traverse Region.

4. WITH PROJECT CONDITIONS

Section 107 of the River and Harbor Act of 1960 provides authority for the Corps to improve navigation including: dredging of channels, anchorage areas, and turning basins and construction of breakwaters, jetties and groins with the participation of a non-federal partner. Further, these improvements must be sound in their engineering and environmental acceptability and economically feasible.

Also, the Water Resources Development Act (WRDA) of 2007 gave the Secretary of the Army the authority to review plans for a harbor improvement project at Northwestern Michigan College and carry them forward if the project met the Corps standards and was economically justifiable.

> *"The Secretary shall review the locally prepared plan for the project for navigation, Traverse City Harbor, Michigan referred to in subsection (a), and, if the Secretary determines that the plan meets the evaluation and design standards of the Corps of Engineers and that the plan is feasible, the Secretary may use the plan to carry out the project and shall provide credit toward the non-Federal share of the cost of the project for the cost of work carried out by the non-Federal interest before the date of the partnership agreement for the project if the Secretary determines that the work is integral to the project."*

Thus, Northwestern Michigan College, the non-Federal sponsor, has requested the Detroit District's assistance to evaluate plans to demolish their existing eastern harbor's breakwater and construct a new one. (Notably, the project under study is defined as only the eastern breakwater and does not consider or assess any work or features associated with the harbor's western piers.) Built in 1972, the wooden crib structure has severely deteriorated over the years and is unsafe. More importantly, the configuration of the breakwater allows sediment to build-up inside the harbor - impeding the harbor's productivity.

a. Alternatives

Alternative 1 – Double Steel Sheet Pile Wall and Dredging

This alternative considers removing the wooden crib structure, constructing a 280-foot double steel sheet pile (SSP) wall, and dredging approximately 16,000 cubic yards of sediment out of the harbor to a depth of 16 feet. Dredge material will be hydraulically placed at a high erosion site identified by the Michigan Department of Environmental Quality (MDEQ), approximately 1.5 miles from the harbor.

Both SSP walls will be spaced approximately 15 feet apart and will also serve as a walkway and access point to the water's edge. The stone removed from the existing crib will be used to provide scour protection on the harbor-side SSP. In addition, concrete anchor blocks will be put in place where mooring anchors are located to offer additional stability to the wall when vessels berth or moor.

This is the locally preferred alternative because it will prevent shoaling of the harbor, offer additional access points for training/educational related activities and reduce the cost and risk of damages induced by waves entering the harbor from the bay. Notably, this alternative would be uniform with the 2004-2005 initial harbor restoration project implemented by the college.

Alternative 4 - Single Steel Sheet Pile Wall and Dredging

Alternative 4 involves removal of the existing wooden-crib structure and the construction of a 280-foot long cantilever wall supported by H-piles. Ties beams will be used to secure the H-piles to the SSP wall and will have a 15-foot span to provide the foundation for a concrete cap. The concrete cap will be utilized as a walk-way and access point to the water's edge. As in Alternative 1, 16,000 cubic yards of sediment will be dredged to a depth of 16 feet from the inner harbor and hydraulically pumped onto West End Beach (MDEQ's high erosion site). Riprap will be placed under the concrete cap to prevent ice buildup and to reduce wave action at the beach just east of the harbor. Concrete anchors blocks would be needed for anchoring of mooring bollards.

b. Harbor Improvement Benefits

National Economic Development (NED) benefits accrue to the project by damages prevented to vessels and docks, the reduction in maintenance dredging, and the savings that visiting vessels derive from using the harbor as a home base while visiting the Grand Traverse Bay.

In August of 2008, LRD was given Implementation Guidance by the Director of Public Works on how to approach the economic evaluation of the proposed project. Specifically, the guidance gave LRD & LRE the directive to fully evaluate all possible economic benefits and/or benefit users of the harbor during the feasibility stage.

> *"The feasibility study should concentrate on the evaluation of the locally prepared plan to confirm a Federal interest, to determine if the plan falls within a range of alternatives likely to be evaluated in a feasibility study, that the plan is economically justified and reasonably maximizes National Economic Development benefits, is environmentally sound, and engineeringly feasible. The District should note that a project implemented under Section 107 of the River and harbor Act of 1960, as amended, must demonstrate that the benefits of the project exceed the costs. In that regard, it will be particularly important that the district identify the benefit categories, and the benefits themselves, in sufficient detail to determine whether Federal participation is warranted. This extends, as well to identification of all users of the harbor, both public and private."*

1. Dock & Pier Maintenance Repair Savings

A newly constructed eastern harbor breakwater will prevent wave action from entering into the harbor and vessels banging against docks and piers. The college currently spends an estimated $5,100 (in 2011 dollars) annually on repairing this damage. More importantly, the risk of damaging vessels recently retro-fitted with expensive research equipment is significantly reduced. Even though accidents involving these vessels have not yet occurred, it is likely that such an event could arise in the near future. It should be noted, if the equipment is damaged, funding for repair or replacement might not be available and is typically contingent on grants.

2. Maintenance Dredging Savings

The proposed eastern breakwater will reduce the harbor shoaling by blocking the natural littoral sediment transport. This natural drift pattern will be forced northward, trapping the sediment between the newly constructed breakwater and the adjacent beach - creating an accretion fillet. The Detroit District's Hydrologic and Hydraulic Department estimates that this accretion fillet has enough capacity (73,000 cubic yards) that there will not be a need for maintenance dredging during the life of the project – 50 years. Thus, by constructing a new eastern breakwater the college will save nearly $58,000 annually (in 2011 dollars) by eliminating the need to remove 1,500 cubic yards of sediment from the harbor every year. Finally, the reduced shoaling will significantly decrease the risk of the T/S State of Michigan running aground in sediment drifts or sustaining damage from piers and docks when navigating around these drifts.

3. Visiting Agency Vessel Savings

Configuration of the existing breakwater and shoaling of the harbor reduces the overall productivity of the harbor. The size and security requirements of the T/S State of Michigan allows for very limited additional mooring space within the harbor. State and government agencies that utilize the harbor as a home base when conducting research are often limited as to when they have access to these valuable mooring spaces. An improvement in the harbor's configuration will allow for additional mooring space for these visiting vessels and an opportunity to save on operating costs by providing a home base in close proximity to the research site – Grand Traverse Bay. Not only will these agencies reduce their operating costs, the collaboration between the college and the agencies will create knowledge sharing, provide visibility to the college and its academic programs all while establishing an overall better understanding of regional ecology.

Table 4 presents a list of agencies that indicated they would increase the number of visits they make to the maritime harbor, in a given year, if the proposed project was constructed. Information on visiting vessels was obtained from each vessel's responsible party (i.e. captain) to determine if they would increase the frequency of their visits and how much their vessel would save in operating costs. Included in the table are the names of each agency's vessel, the vessel's respective size, draft, and beam width, the harbor they would travel to if the Great Lakes Maritime Academy (GLMA) harbor was not available and the number of miles they would need to travel to get there. Also listed are the reasons for each vessel's voyage. The EPA's Lake Guardian has the farthest to travel (256 miles) of all the institutions or government agencies that plan to increase their frequency of visits to the maritime harbor.

Table 4 - Institution & Agency Visiting Vessel Information

Institution/Agency	Vessel Name	Draft	Size	Beam Width	Alternative Harbor	No. of Miles to Bay	Reason for Vessel's Voyage
EPA	Lake Guardian	13 ft	180 ft	40 ft	Milwaukee	256	research
Navel Sea Cadet Corps	Greyfox	7 ft	120 ft	25 ft	St. Ignace/Port Huron	100	educational training
USFW	M/V Spencer F. Baird	10 ft	95 ft	30 ft	Charlevoix/Frankfort	64	fish stocking
NOAA	Laurentian	9 ft	80 ft	22.8 ft	Charlevoix/Frankfort	64	research
NOAA	R5501	5 ft	58 ft	16.1 ft	Charlevoix/Frankfort	64	research
MDNRE	Rich Asher/PB252	4 ft	40 ft	20 ft	Leeland	45	law enforcement

Source: Information provided by each institution/ agency vessel.

The economic benefits achieved by these state and government agencies when utilizing the maritime harbor, as opposed to another harbor miles away from Grand Traverse Bay, are shown below in **Table 5.** Of those agencies that plan to increase their vessel visits to the harbor, NOAA expressed the greatest interest and indicated that the opportunity would provide a substantial savings in their vessels' operating costs. By using the GLMA harbor, NOAA will save approximately $10,860 annually in operating their two vessels – the Laurentian and R5501. Noteworthy, the EPA's Lake Guardian vessel stands to gain the greatest operational cost savings ($37,498 in 2011 dollars) from utilizing the harbor.

Table 5 - Institution & Agency Visiting Vessel Savings in 2011 dollars

Institution/Agency	Vessel Name	Hourly Operating Costs	Miles Avoided by GLMA Harbor	Avg. Speed of Vessel	Hours of Travel Saved Per Trip	No. of Trips	Annual Savings
EPA	Lake Guardian	$421.40	256	12	22	4	$37,498
NOAA	Laurentian	$117.99	65	12	6	12	$7,998
MDNRE	Rich Asher/PB252	$168.56	45	30	2	20	$5,070
NOAA	R5501	$75.85	65	21	3	12	$2,856
Navel Sea Cadet Corps	Greyfox	$147.49	100	12	9	2	$2,563
USFW	M/V Spencer F. Baird	$210.70	65	14	5	2	$1,984
Total Annual Savings							**$57,968**

Source: Information provided by each institution/ agency vessel.

Annual Savings = (Hours of Travel Saved) X (No. of Trips) X (Hourly Operating Costs)

No. of Trips represents travel to and from the Grand Traverse Bay. Speed is miles per hour (knots X 1.150779 mph/knot)

Although EPA indicated that it will most likely utilize the harbor once, a proxy for two annual visits is more appropriate given EPA has no other place to moor during its expeditions out

on Lake Michigan. By providing the EPA this valuable mooring place, they have land access and a harbor of refuge. For example, the EPA's Lake Guardian Captain stated that their vessel had to drop anchor in Charlevoix Harbor and deploy their launch boat to transport one of their crew members to land for emergency medical treatment. Therefore, the GLMA harbor provides not only a savings in operations for EPA, but it also provides a place to moor during critical situations. The estimated economic benefits or savings that accrue by providing additional mooring space to state and government research vessels while they are in Grand Traverse Bay is $57,968 (in 2011 dollars).

4. Average Annual Benefits & Total Project Life Benefits

The alternatives differ only slightly with respect to their design elements and provide the same amount of reduction in shoaling, protection against wave action, and increase the productivity of the harbor. Therefore, the NED benefits derived from each alternative are essentially the same in quantity and quality.

Table 6 presents the average annual economic benefits that are expected to accrue if the project was put in place. The government or agency vessels visiting the harbor receive the most economic benefits from the proposed project ($57,968 in 2011 dollars) since they're able to reduce their vessel operational costs by using the harbor as a home base. Because the college will no longer need to dredge the harbor, they will also capture economic benefits by reducing their annual maintenance dredging costs ($53,539 in 2011 dollars). In addition, the college will save $5,057 annually (in 2011 dollars) in pier and dock repairs since the new eastern pier will provide protection against waves surging into the harbor.

Table 6 - Economic Benefits in 2011 dollars	
Benefit Type	**Average Annual Benefits**
Visiting Agency Vessel Savings	$57,968
Reduction in Maintenance Dredging	$53,539
Maintenance Savings for Repairs to Piers & Docks	$5,057
Average Annual Economic Benefits	**$116,564**

Other Direct Benefits

5. Beach Nourishment

Appendix E, of the Principals and Guidance Notebook, ER 1105-2-100 recommends that placement of dredge material be used for aquatic ecosystem restoration and/or, if beach quality, placed on beaches as a means of stabilizing areas prone to erosion. However, this method of placement is only encouraged if it is environmentally acceptable and is the least costly method available.

Both Alternatives 1 and 4, call for hydraulically placing the dredged sediment in a high erosion site identified by Michigan Department of Environmental Quality (MDEQ). This site, known as West End Beach, is situated on the western shore of the West Grand Traverse Bay, approximately 1.5 miles from the harbor, and currently serves as a public beach for Traverse City. The dredge placement plan involves hydraulically pumping 16,000 cubic yards of material from the harbor directly between the two and eight foot contours. Booster pumps will be utilized to transfer the material to the placement site.

This method of dredge material placement is environmentally beneficial, is the least costly and also provides recreational benefits to the surrounding community. However, recreational benefits were not quantified since this is a one-time nourishment activity and modeling data does not exist to determine the amount of sediment that would be deposited onto the beach. In addition, the costs to perform the modeling and to conduct recreational user survey are high and would increase the total project costs.

6. Harbor of Refuge

The Great Lakes Maritime Academy was identified as a possible Harbor of Refuge during the reconnaissance phase of this project. By utilizing historic Corps project maps, Google Earth and phone solicitation, it was determined that there are several nearby harbors available for mariners. Clinch Marina, located less than a half a mile away, recently received a significant renovation, increasing the number of vessel slips and drastically improved the harbor's breakwaters. Also located a few miles away from the project site, in Western Grand Traverse Bay, Greilickville-Elmwood Harbor currently serves as a federally authorized Harbor of Refuge. Given that the close proximity of these harbors, the Great Lakes Maritme Academy's harbor is not the only harbor of refuge available to boaters in the Grand Traverse Bay.

7. Labor Supply

Northwestern Michigan College is the only Freshwater maritime academy in the United States that specializes in training future Great Lakes Pilots. Although the educational resources and/or training that the academy provides to future Great Lakes cadets is unique and is not offered by any other maratime academies, any cadet can test for the Coast Guard's Great Lakes Pilotage license.

The Bureau of Labor Statistics's (BLS) *Occupational Outlook Handbook 2010-2011* projected that the future growth rate for water transportation occupations will be "higher-than-average" in the next decade. BLS indicated that the above-average job growth will come from a large proportion of the labor force reaching retirement age and an industry trend of high turnover. However, the source the BLS utilized in this study, the *State Occupational Projections*, did not forecast a significantly strong demand for "Captains, Mates, and Pilots of Water Vessels" for those states surrounding the Great Lakes; rather, the data shows that there will be only a slight increase in the need for these professionals. Notably, this data was compiled

in 2006, prior to the current economic crisis and the closure of many of the manufacturing plants along the Great Lakes. Therefore, it is believed that there will continue to be a demand for Great Lakes pilots and/or maritime professionals, but that the overall growth rate for this industry will remain flat in the foreseeable future.

8. Regional Impacts & Other Social Effects

As discussed in previous sections of this economic appendix, Northwestern Michigan College is the only higher educational institution serving the Grand Traverse Region. In collaboration with other state universities, the college is able to offer bachelors, masters and doctorial programs in addition to their standard associate degree curriculum. More specifically, the college has the only Freshwater maritime academy and the only associate level Freshwater studies program in the United States. Both programs rely heavily on the Great Lakes Maritime Academy Harbor as a resource to execute training and educational related activities. Furthermore, the college plans to roll-out two new programs, Coastal Brownfield Technician and Great Lakes Marine Technician, with a combined target enrollment rate of 250 students. Therefore, the proposed harbor improvement project has significant bearing on the college's ability to continue providing a quality education and highly marketable skills to its surrounding community.

An economic study was conducted by Economic Modeling Specialists, Inc. in December of 2009, on behalf of Northwestern Michigan College, to assess the economic contributions that the college has on the Grand Traverse Region. The study assessed the economic contributions in 2008 dollars. The study evaluated how higher education increased the earnings of its graduates, generated additional income within the region, and reduced societal costs (i.e. incarceration, unemployment, ect.). This study found that Northwestern Michigan College increased the regional economy by approximately $23.6 million dollars annually through direct wages, salaries, and benefits of its staff and spending on operations. In addition, the study calculated that each student graduating with an associate degree could expect to increase their annual wages by roughly $9,300 and would see a total increase of $353,400 over the course of their lifetime. Therefore, Northwestern Michgian Collage is a vital component to the overall economic viability of the Grand Traverse Region and provides significant national contributions in lifetime earnings.

Northwestern Michigan College's Strategic Vision states, in Strategic Initiative #2, *"NMC will proactively seek new and allocate current resources to provide changing learner needs"*. More specifically, one of this initiative's goals is to *"Define resource needs for priority areas and institutional sustainability and pursue new resources vigorously"*. By improving the maritime harbor, the college will expand upon an existing resource to provide new educational opportunities that are highly marketable in this region. Also, as the environmental movement or sustainability trend has become increasingly important over the last decade - the college has aligned its services accordingly. As the demand for these types of skills continues to grow, Northwestern Michigan College will be able to provide the education and training students need to acquire these positions and contribute to the economic viability of the region and the nation.

c. Project Costs

In order to determine whether a project is economically justifiable, costs associated with the proposed project's implementation must be assessed. The Corp's Planning Guidance Notebook, ER 1105-2-100, specifically states: *"Project measures, whether structural or nonstructural, require the use of various resources. NED costs are the opportunity costs of resource use."*

Displayed below in **Table 7** are the costs associated with constructing Alternatives 1 and 4. These costs were estimated in fiscal year 2011 dollars and include contingencies developed from a risk analysis. The economic costs developed in this analysis also differ from the cost estimate provided in this study's Cost Appendix. This economic analysis treats the funds spent on the feasibility study tasks as a sunk cost and, thus, these costs are eliminated in **Table 7**. The average annual costs were then determined for the project's 50-year lifecycle at the FY11 Federal Discount Rate of 4 1/8% (4.125%).

Because both alternatives share similar design elements, the disparity in terms of cost between the two plans only differs slightly; however, the average annual cost to construct Alternative 1 is still lower than in Alternative 4 ($113,125 vs. $115,858, respectively).

Table 7 - Proposed Harbor Improvement Project Costs in 2011 Dollars

Item	Alternative 1	Alternative 4
Construction Cost		
Mob & Demob	$225,610	$207,257
Breakwater	$910,495	$802,372
Concrete Walkway	$375,556	$135,597
Dredging	$228,822	$228,363
Stone		$412,787
Construction Contingency	$261,072	$267,956
Construction Implementation Costs	$2,001,555	$2,054,332
Interest During Construction	$6,105	$6,349
SubTotal	***$2,007,660***	***$2,060,682***
Non Construction Costs		
Contracting	$7,000	$7,000
LEERDs	$10,000	$10,000
Construction Management Costs	$146,000	$146,000
Engineering During Construction	$12,000	$12,000
Project Management	$28,000	$28,000
SubTotal	***$203,000***	***$203,000***
Total Costs	**$2,210,660**	**$2,263,682**
Present Value of Future O&M Costs	$168,371	$172,811
TOTAL PROJECT COSTS	**$2,379,032**	**$2,436,493**
Average Annualized Costs	**$113,125**	**$115,858**

5. BENEFIT COST ANALYSIS

To measure of economic efficiency, the Corp uses two decision metrics in its formulation process – the benefit-cost ratio and net benefits. The benefit-cost ratio (BCR) evaluates which alternative produces the greatest amount of benefits given its implementation costs. Net benefits are derived by subtracting the average annual benefits from the project's average annual costs. The most efficient plan to implement is the one that maximizes the overall economic benefits of the project.

Table 8- Economic Comparison of Alternatives in 2011 Dollars

Alternative	Average Annual Benefits	Average Annual Costs	Net Benefits	Benefits-Cost Ratio
1	$116,564	$113,125	$3,439	1.03
4	$116,564	$115,858	$707	1.01

Table 8 summarizes the average annual benefits, average annual costs, net benefits and the benefit-cost ratio (BCR) for Alternatives 1 and 4. As discussed earlier, both alternatives have similar design elements and produce comparable economic benefits; however, the plans do differ enough for there to be differences in costs. The economic costs to implement Alternative 4 are slightly higher compared to Alternative 1 and, consequently, this alternative's net benefits ($707 in 2011 dollars) and BCR (1.01) are slightly lower. Alternative 1, the locally preferred plan, produces the greatest net benefits, $3,439 (in 2011 dollars), and has the highest BCR of 1.03.

6.0 CONCLUSION/RECOMMENDATION

The Federal objective for plan selection is to recommend the NED plan or alternative "with the greatest net economic benefit consistent with protecting the Nation's environment". Since Alternative 1 is the plan that produces greatest net economic benefits and has the highest BCR, this alternative is identified as the NED plan for this Section 107 project in Traverse City, Michigan. Notably, the comparison of alternatives (in **Table 8**) were based on pre-determined construction contingency rate of 9.9%. Once the recommended or NED plan is identified, this alternative is then assessed to ensure that the project's estimated costs accurately account for any risk or uncertainty that may arise during the plan's implementation.

The benefits and costs of the proposed plan, Alternative 1, have been adjusted to reflect the risk-assessed contingency rate of 11%. **Table 9**, on the next page, contains the adjusted costs and benefits for the recommended plan, based on the final contingency rate of 11%, in terms of fiscal year 2011 at the 2011 Federal Discount rate of 4 1/8% or 4.125%.

Table 9 - Economic Summary of Recommended Alternative in 2011 Dollars	
Estimated Construction Costs	$1,931,936
Estimated Non-Construction Costs	$203,000
Interest During Construction	$5,865
Total Implementation Costs	$2,140,802
Present Value of Future O&M Costs	$162,515
Average Annual Cost	$109,525
Average Annual Benefits	$116,564
Net Benefits	**$7,039**
Benefit-Cost Ratio	**1.06**

APPENDIX E
REAL ESTATE PLAN

APPENDIX E

REAL ESTATE PLAN
SECTION 107 - SMALL NAVIGATION PROJECT
NORTHWESTERN MICHIGAN COLLEGE
TRAVERSE CITY, MICHIGAN

AUTHORITY

This study was conducted under the authority of Section 107, 1960 RHA (P.L. 86-645) as amended; U.S. Code 33 USC 577, Section 915(d), Water Resources Development Act (WRDA) 1986, (P.L. 99-662), and WRDA 2007, (P.L. 110-114). As such, the project is subject to the requirements of the National Environmental Policy Act of 1969 (NEPA), Section 404(b)(1) of the Clean water Act, Section 401 of the Clean Water Act, as well as U.S. Army Engineers Regulation 1102-5-100.

1. PURPOSE AND DISCRIPTION

Northwestern Michigan College, the proposed Non Federal Sponsor (NSF) for this project, has requested that Section 107 federal assistance be provided to evaluate the possibility of building a breakwater that would increase the effectiveness and life span of their docks and would also reduce the amount of shoaling in the harbor and the subsequent annual dredging. The NFS uses its docks to train approximately 50% of the pilots for the Great Lakes. The project consists of removing a wood cribbing breakwater filled with stones and building a double walled steel sheet pile breakwater perpendicular to the shore line which will be approximately 15 feet wide and 280 feet long. This report also presents details on Corps and sponsor participation needed to implement the Real Estate Plan. Several Possible Alternatives will be developed for evaluation. This Real Estate Plan is being submitted IAW Chapter 12 of ER 405-1-12 for approval. This REP is to be considered tentative in nature and for planning purposes only. The REP describes the lands, easements, rights-of-way, relocations and disposals areas (LERRDs) required for the construction, operation and maintenance of the Project.

EXISTING SITE CONDITIONS:

The project site is located within Traverse City, Grand Traverse County, Michigan. Traverse City is about 260 miles northwest of the City of Detroit. The harbor is home to the Great Lakes Maritime Academy (GLMA) school of Northwestern Michigan College (NMC) which is the nation's only freshwater Maritime Academy. The project site is on Northwestern Michigan College's campus located in Traverse City, MI on the southern shore of the west arm of Grand Traverse Bay (Plates 1 & 2) parcel # 28-15-794-001-00. The site is a typical college campus that has a manmade harbor. The proposed breakwater will be the eastern limit of that harbor. The campus is located in an area that is generally used for resorts and hotels; it is also a popular vacation destination. See Exhibit "B" for Real Estate site plan.

PLAN SELECTION:
Alternative 1 is the proposed alternative because:

- It maximizes net national economic development (NED) benefits
- It provides the best mix of contributions to net national economic development and ecosystem restoration per the "Trade-off Plan"
- It is the locally preferred plan
- This plan fall within the established economic range

DESCRIPTION OF THE WORK:
Alternative 1:
A double Sheet Pile Wall (SSP) wall will consist of two parallel steel sheet pile walls spaced approximately 15 feet apart and tied together running perpendicular to the shoreline for 280 feet. The shoreline side of the breakwater will abut an existing SSP wall however, there will be no physical connection. Additionally, concrete anchors blocks, 2 feet thick by 5.5 feet wide by 7.5 feet long, would be required in locations where mooring anchors are placed. The NFS's harbor will be hydraulically dredged as part of the project, the dredge material will be pumped to an area designated by the State of Michigan DNRE as a high erosion area and placed below the high water mark elevation. See Exhibit "B" for Real Estate site plan.

2. LEERDs REQUIRED FOR CONSTRUCTION, OPERATION AND MAINTENANCE
NMC will provide all easements and rights-of-way necessary for the construction, operation and maintenance of the new project. The bottomland will be acquired by the NFS thru a modification of an existing lease with MDNRE. However, the bottom land falls under Navigational Servitude.
Temporary 6 months:
Work and Storage: 0.09 acres
Access: 0.23 acres
Permanent:
Bottomland lease: 0.42

Temporary Work Area Easement: A temporary easement and right-of-way in, on, over and across the land described in Exhibit "B" for a period not to exceed the duration of construction, beginning with the date of possession of the land is granted to the United States, for use by the United States, its representatives, agents and contractors as a work area, including the right to move, store and remove equipment and supplies, and erect and remove temporary structures on the land to perform any other work necessary and incident to the construction of the Northwestern Michigan College located in Traverse City, Michigan, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, rail roads and pipelines.

3. LERRDs OWNERSHIP
The NMC currently owns the land needed for the work and storage and access areas. However, the College plans to apply with the MDNRE to expand their existing lease to include the 0.42 acres of bottom land needed for this project. Also the NFS does not own the high erosion area indentified by the MDNRE to receive the dredge material.

4. LERRDs ACQUIRED FOR, OR WITH THE USE OF FUNDS FROM, ANOTHER FEDERAL PROGRAMS OR PROJECT
No federal funds have been allocated for previous projects at this project site.

5. NON-STANDARD ESTATES
The project does not include the requirement to acquire non-standard estates.

6. EXISTING FEDERAL PROJECTS
No federal funds have been allocated for previous projects at this project site.

7. FEDERAL LAND
There is no federally owned land included within the LERRDs required for the project.

8. NAVIGATION SERVITUDE
Navigational servitude will apply to the construction of this project.

9. PROJECT MAP
Drawings depicting the project areas are attached.

10. INDUCED FLOODING
It is not expected that flooding would occur as a result of the project.

11. BASELINE COST ESTIMATE
The estimated LEERDs for this project (including any contingencies) is $9,582

REAL ESTATE COST ESTIMATE

Federal Administrative costs:	$ 12,000.00
Non-Federal Sponsor costs:	
LERRDs value	$ 9,582.00
Administrative	1,000.00
Total Non-Federal Sponsor	$ 10,582.00
Grand Total (Federal and Non-Federal)	**$ 22,582.00**

This estimate is only for determining an estimated total project cost for planning purposes. It cannot be used in determining the amount of land, easements, and rights-or-way plus incidental costs for inclusion in the final total project costs.

12. RELOCATION ASSISTANCE
The project, as designed, will not require relocation of any residences or business.

13. MINERALS
No extractable minerals are known to exist within the Project lands. There is no standing timber of vegetation on the Project lands.

14. CAPABILITY ASSESSMENT
The sponsor has the full power, authority and capability to operate and maintain the finished project, and has the legal capability to provide its share of total project costs and comply with the other required assurances. In addition, the NFS has the capability to complete its portion of the project within the designated time frames. It is capable of providing all required LERRD's necessary for the construction, operation and maintenance of the project as the sponsor is a legally constituted public body with the full power, authority, and capability to perform of the terms of the PPA. Requirements of PL 91-646, acquisition policies and procedures, LERRD crediting procedures, and the requirements for land acquisition have not been discussed with the sponsor as there is no acquisition occurring for the proposed project. See Exhibit A

15. ZONING
The enactment of zoning ordinances will not be required for this project.

16. SCHEDULE
A schedule of the land acquisition milestones and LERRDs certification will be completed after any issues involving real estate are resolved. The Non-Federal Sponsor has been given detailed information regarding the requirements for LERRDs necessary for completion of the Project and fully anticipates meeting the current District schedule. The USACE Detroit Real Estate Division will monitor and assist the NFS with all acquisition activities which will assure that the acquisition process complies with Federal and State laws. The schedule for land acquisition will be coordinated with the project PM and the non-federal sponsor, after the project has been authorized, and the PPA signed, the non-federal sponsor will be notified to acquire the LEERDs required for the project. At the conclusion of acquisition, the Non-Federal sponsor will certify in writing to the Government that all LERRDs have been acquired. Potential dates for Real Estate Certification is expected to be reasonable and conformable with project milestones and requirements.

17. FACILITY OR UTILITY RELOCATIONS
The project as designed does not identify any utilities/facilities that will need to be relocated.

18. ENVIRONMENTAL
All environmental items associated with the project will be addressed by the Environmental Analysis Branch.

19. PROJECT SUPPORT
The Non-Federal Sponsor is a willing sponsor and fully supportive of this project and there is no opposition on record or anticipated to the project.

20. RISK NOTIFICATION FOR ADVANCE NOTIFICATION
The non-Federal sponsor will be notified in writing about the risks associated with acquiring land before the execution of the PPA. Requirements of PL 91-646, acquisition policies and procedures, LERRDs crediting procedures, and the requirements for land acquisition have been discussed with the sponsor.

21. OTHER RELEVANT REAL ESTATE ISSUES

a. There are no special aquatic sites, including wetlands impacted by the acquisition.
b. There are no cemeteries or public facilities within the Project area requiring relocation.
c. Plans and specifications do not identify any relocation of public utilities or roadways.
d. If additional land and/or land rights that are required for construction of this project which the NFS does not have authority to acquire or otherwise provide the USACE will enter into an additional agreement to facilitate the acquisition of the required land and/or land rights.

Real Estate Division will further assess real estate requirements for the recommended plan, as well as, provide detailed information regarding LERRDs identified as necessary for the Project. In addition, the Real Estate Division will coordinate, monitor, and assist with all acquisition activities undertaken by the Non-Federal Sponsor. This will assure that the acquisition process complies with Federal and State laws specifically the requirements under the Federal Uniform Relocation and Acquisition Act (P.L. 91-646). The Real Estate Division will also attend District team meetings, review and provide input into draft and final reports prepared by the team, and participate in the internal technical review.

EXHIBIT "A"

DETROIT DISTRICT REAL ESTATE
ASSESSMENT OF NON-FEDERAL SPONSOR
REAL ESTATE ACQUISITION CAPABILITY

PROJECT: Northwestern Michigan College, Traverse City, Michigan Section 107 Small Navigation Project, Grand Traverse County, Michigan

I. LEGAL AUTHORITY

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes?

(X) Yes
( ) No.
Initials MB Date: 15 June, 2010

b. Does the sponsor have the power of eminent domain for this project?

( ) Yes
(X) No.
Initials MB Date: 15 June, 2010

c. Does the sponsor have "quicktake" authority for this project?

( ) Yes
(X) No.

Initials MB Date: 15 June, 2010

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary?

(X) N/A
Initials MB Date: 15 June, 2010

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn?

(X) Yes
( ) No
Initials MB Date: 15 June, 2010

II. HUMAN RESOURCE REQUIREMENTS

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended?

( ) Yes
(X) No

Initials MB Date 15 June, 2010

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training?

(X) N/A

Initials MB Date: 15 June, 2010

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project?

(X) N/A.
Initials MB Date: 15 June, 2010

d. Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule?

(X) Yes See a. above.
( ) No
Initials MB Date: 15 June, 2010

e. Can the sponsor obtain contractor support, if required in a timely fashion?

(X) Yes
( ) No

Initials MB Date: 15 June, 2010

f. Will the sponsor likely request USACE assistance in acquiring real estate?

( ) Yes
(X) No

Initials MB Date: 15 June, 2010

III. OTHER PROJECT VARIABLES

a. Will the sponsor's staff be located within reasonable proximity to the project site?

(X) Yes
( ) No

Initials MB Date: 15 June, 2010

b. Has the sponsor approved the project/real estate schedule/milestones?

(X) Yes
( ) No

Initials MB Date: 15 June, 2010

c. Has the sponsor performed satisfactorily on other USACE projects?

( ) Yes
(X) No

Initials MB Date : 15 June, 2010

d. With regard to this project, the sponsor is anticipated to be: highly capable / capable/moderately capable/marginally capable/insufficiently capable

e. The sponsor has performed successfully on other Corps of Engineers projects and has a full Real Estate Staff from the Northwestern Michigan College, Traverse City, Michigan performing Real Estate functions.

( ) Yes
(X) No

Initials MB Date: 15 June, 2010

Prepared by:

/s/

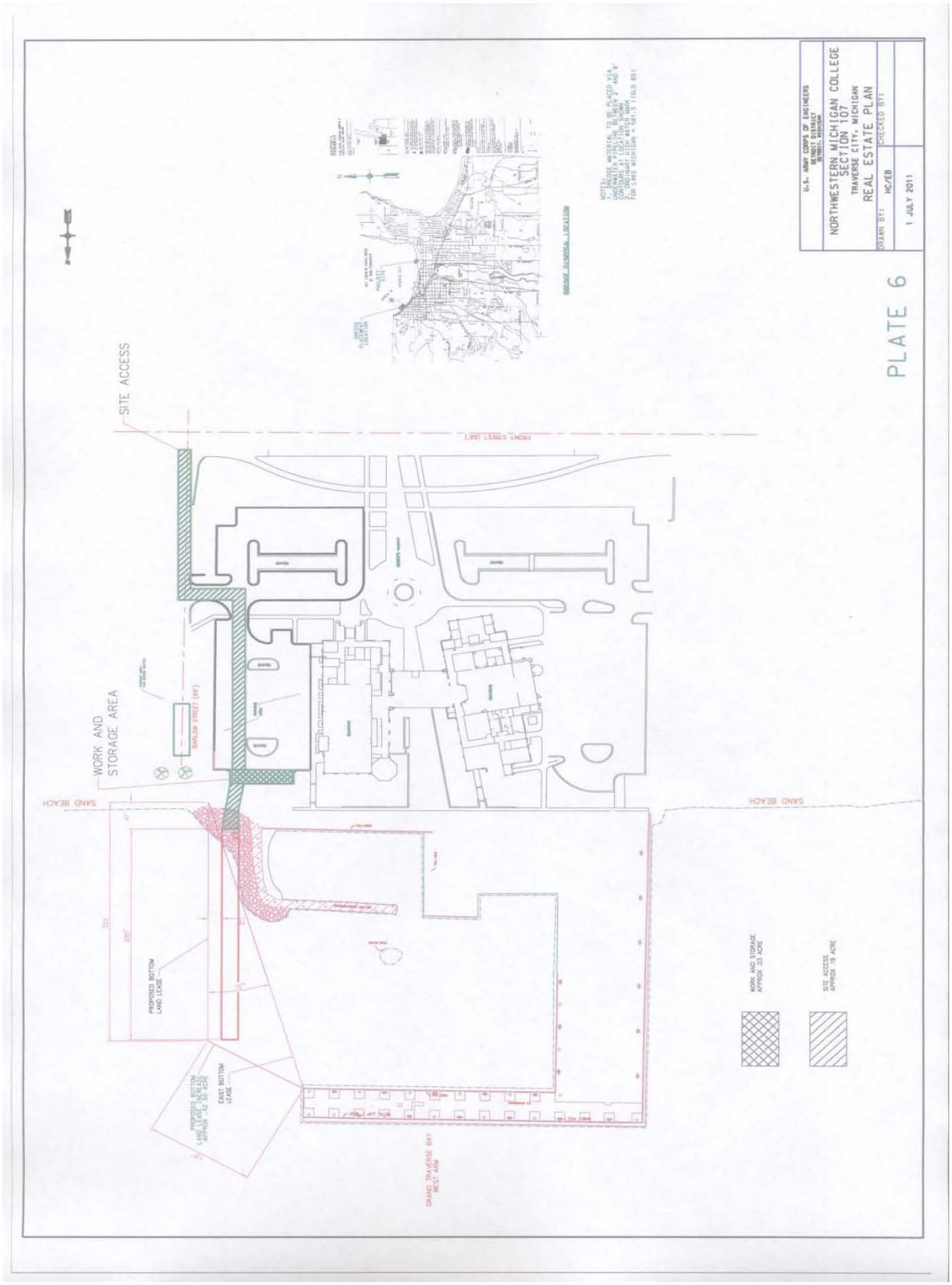
MARK BREWER
Realty Specialist

Reviewed and approved by:

/s/

GLENN SPENCE
Chief, Real Estate Division,
Detroit, Buffalo and Chicago Districts

EXHIBIT "B"


U.S. ARMY CORPS OF ENGINEERS
DETROIT DISTRICT
NORTHWESTERN MICHIGAN COLLEGE
SECTION 107
TRAVERSE CITY, MICHIGAN
REAL ESTATE PLAN
DRAWN BY: HC/EB
CHECKED BY:
1 JULY 2011
PLATE 6
SITE ACCESS
WORK AND STORAGE AREA
SAND BEACH
SAND BEACH
FRONT STREET (M-22)
BARLOW STREET (M-37)
PROPOSED BOTTOM LAND LEASE
EXIST. BOTTOM LEASE
PROPOSED BOTTOM LAND LEASE APPROX. 42.50 ACRE
GRAND TRAVERSE BAY WEST ARM
WORK AND STORAGE APPROX 03 ACRE
SITE ACCESS APPROX 10 ACRE