U.S. Army Corps of Engineers
Detroit District

SECTION 216
REVIEW OF COMPLETED PROJECTS

Cornucopia Harbor, Bayfield County, Wisconsin

Section 905(b) Reconnaissance Report

August 2012

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such Third Parties. The Baird/URS Joint Venture accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

1.0 STUDY AUTHORITY

Cornucopia Harbor, Wisconsin is authorized per Section 1 of the Rivers and Harbors Act of 1937 (P.L. 75-392) and Section 101 of the Rivers and Harbors Act of 1954 (P.L. 83-780).

This Reconnaissance Study was prepared as an initial response to provisions of Section 216 of the Rivers and Harbors and Flood Control Act of 1970 (P.L. 91-611) which reads as follows:

- "The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects, the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and the related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

Funds in the amount of $100,000 were appropriated in FY10 to conduct the reconnaissance phase of the study.

- "The Committee has included $100,000 for the Corps to initiate a reconnaissance study of the operation of the completed project at Cornucopia Harbor, WI. The authorization for this study is Section 216, Review of Completed Projects, of the 1970 Flood Control Act (P. L. 91-611)."

2.0 STUDY PURPOSE

The purpose of this Section 216 reconnaissance study is to determine if there is a Federal (U.S.Army Corps of Engineers) interest in modifying the Cornucopia Harbor structures or their operation in order to improve the quality of the environment. The study will focus on reducing sedimentation in the shallow draft harbor through investigation of reestablishing the original river channel and evaluating the breakwater design.

3.0 LOCATION OF STUDY, NON-FEDERAL SPONSOR AND CONGRESSIONAL DISTRICTS

Cornucopia, WI is an unincorporated area in the Town of Bell, Bayfield County. The community has a harbor located at the mouth of the Siskiwit River (Figures 3.1 and 3.2).

Figure 3.1 Cornucopia Harbor Location

The Siskiwit River discharges into Siskiwit Bay through a navigation channel and shallow-draft harbor at Cornucopia (Figures 3.2 and 3.3).

Cornucopia Harbor, Wisconsin is authorized per Section 1 of the Rivers and Harbors Act of 1937 (P.L. 75-392) and Section 101 of the Rivers and Harbors Act of 1954 (P.L. 83-780). The entrance jetties and approximately 2,000 feet of navigation channel within the harbor are Federally-maintained. The Federal harbor is authorized to be maintained at 8 feet and the Federal navigation channel is authorized at a depth of 10 feet. The harbor contains the following three major elements (Figure 3.3):

1. Two jetties that fix the entrance channel;

2. An entrance channel and turning basin; and

3. Two inner channels.

Additional information is contained in Section 5.3.The non-Federal sponsor for the feasibility phase of the study has not been determined. A potential non-Federal sponsor is the Town of Bell.

The study area lies within the jurisdiction of Wisconsin's 7th Congressional District.

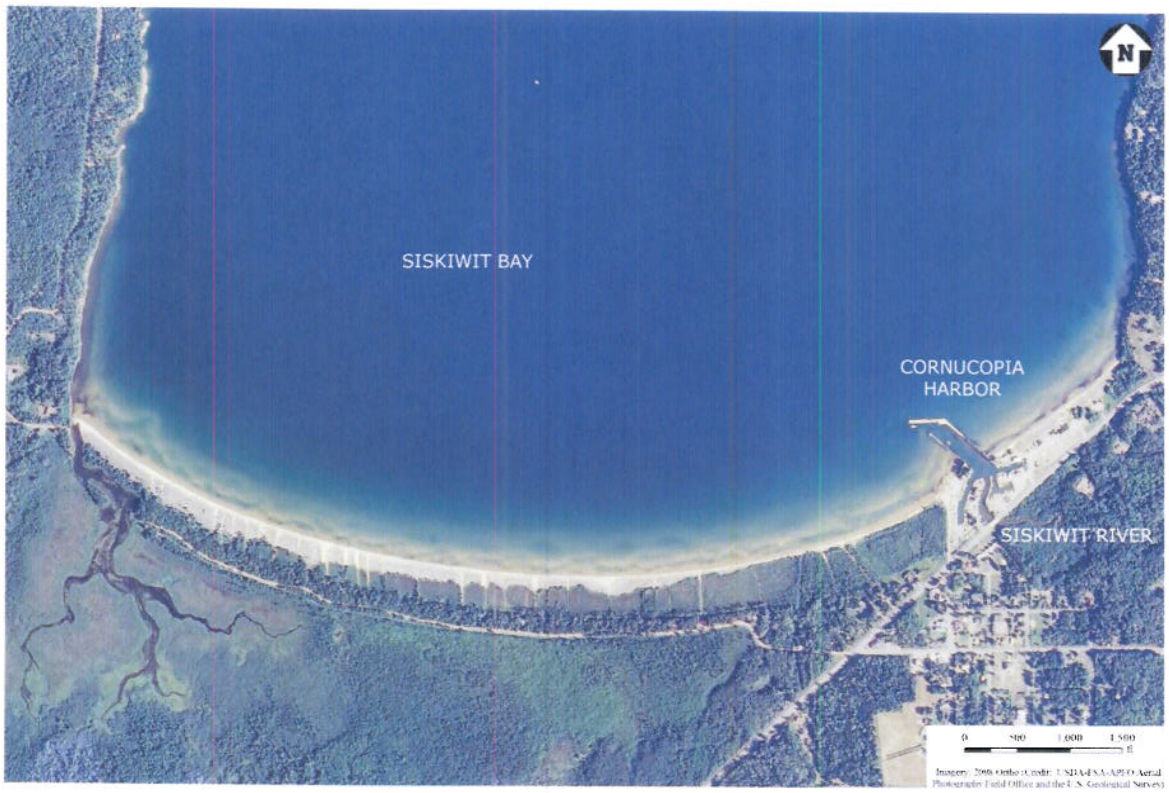

Figure 3.2 Siskiwit Bay

(Cornucopia Harbor is located on the east side of the Bay)

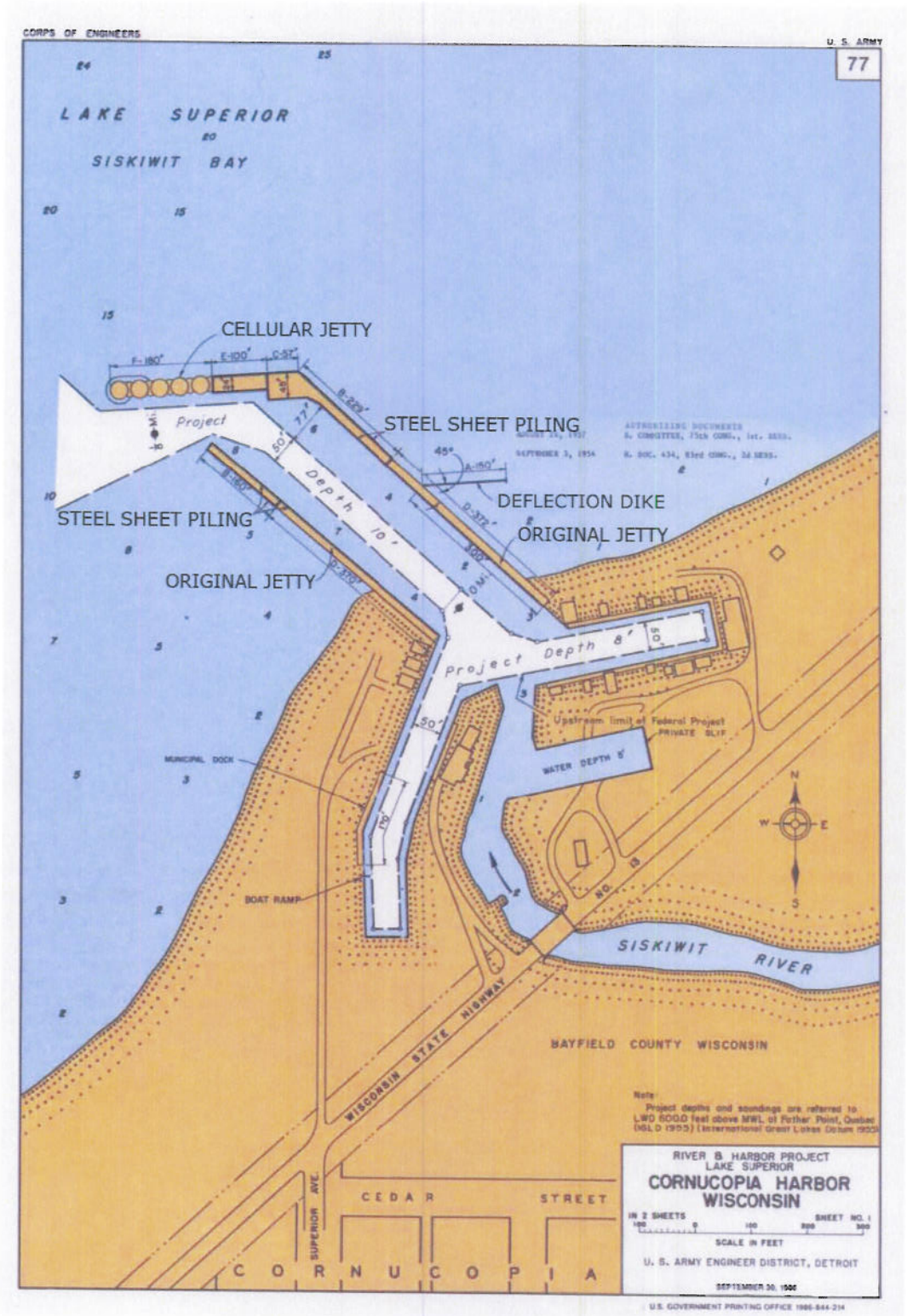

Figure 3.3 Layout of Cornucopia Harbor

4.0 PREVIOUS REPORTS AND AVAILABLE INFORMATION

To assist in the determination of existing conditions, several activities were undertaken, including a site visit and review of previous information. Four key areas of focus were:

1. Cornucopia Harbor layout – structure length and orientation, navigation channel dimensions and depths;
2. Cornucopia Harbor dredging – frequency, volume, location and material characteristics;
3. Shoreline adjacent to Cornucopia Harbor – photographs of shoreline, trends in shoreline movement; and
4. Siskiwit River – overall understanding of the Siskiwit River watershed, hydraulics and sediment transport, from USACE Detroit District 516(e) study.

4.1 Site Visit

Information regarding local commercial and recreational use of the harbor, harbor layout, dredging records and stakeholder viewpoints were obtained during a meeting held on September 8, 2010. USACE-Detroit and Baird/URS Joint Venture (JV) staff met with various stakeholders in the community and then conducted a site visit of Cornucopia Harbor to assess existing conditions. For further details, refer to minutes of the meeting in Appendix A.

4.2 Telephone Communications

The District gave permission to the AE to communicate directly with two local stakeholders, via telephone, to further discuss harbor operation, history and concerns. Specifically, discussions with David Tillmans of Siskiwit Bay Marina and Mark Halvorson of Halvorson Fisheries were conducted on multiple dates. The District participated in many of these discussions. Summaries of these discussions are provided in Appendix B.

4.3 Previous Reports

The reports described below have been reviewed as part of this study. A summary of the contents of each report is presented below. The summaries provide relevant statements and information related to the reports and do not contain any interpretation of the information. Expanded summaries are provided in Appendix C.

1. "Letter from the Secretary of the Army – Saxon Harbor, Wis." U.S. House of Representatives Document No. 169. 20 April, 1957. This report summarizes correspondence leading up to the construction of a breakwater and harbor system at Saxon Harbor, Wisconsin. The harbor is located at the mouth of two small creeks.

2. "Cornucopia Harbor, Wis. and Port Wing Harbor, Wis.: Condition of Improvement, 30 September, 1977." USACE. This report summarizes the USACE structures at Cornucopia Harbor and structures at Port Wing Harbor, a similar facility roughly 15 miles west of Cornucopia.

3. "Cornucopia Breakwall Proposal." (Author and Date Unknown). The Town of Bell is proposing construction of an eight foot wide walkway to provide access to the existing "East Pier" of the Cornucopia Harbor breakwater system.

4. "Great Lakes Recreational Boating – In response to Public Law 106-53, Water Resources Development Act of 1999, Section 455(c), John Glenn Great Lakes Basin Program, Great Lakes Recreational Boating." USACE Main Report. Final, December 2008. The purpose of the report was to detail the economic benefits of recreational boating in the Great Lakes basin, particularly at harbors benefiting from operation and maintenance projects of the Army Corps of Engineers.

5. "Wave Information Study (WIS) Report 23, Hindcast Wave Information for the Great Lakes: Lake Superior." USACE Waterways Experiment Station. Final, January 1992. The purpose of the WIS report was to provide a comprehensive database of the long-term wave climate for Lake Superior. The goal of the exercise was to establish a reliable estimate of mean values of wave height, period and direction.

6. "Design Water Level Determination on the Great Lakes." USACE Detroit District. September 1993. The purpose of the report was to provide an update to design water levels throughout the Great Lakes at numerous locations. The goal of the study was to establish a reliable estimate of design water levels for return periods up to 100 years. Data from 34 gaging stations operated by the National Ocean Service were utilized in the generation of the water levels. The station closest to Cornucopia is at Duluth. The program used by the USACE to compute the water levels was HYDSTAT.

7. "Cornucopia Harbor, Wisconsin." USACE. February 2008. This one page document summarizes key features of the Harbor. Cornucopia Harbor serves as an important Harbor of Refuge and supports charter fishing and recreational navigational interests. The local community has established a significant infrastructure around the harbor facilities that generates income from harbor users and visitors to the area.

8. "Siskiwit River Watershed 516(e) Sediment Study." USACE Great Lakes Hydraulics and Hydrology Office. November 2010. The purpose of the 516(e) study was to investigate techniques and develop recommendations and tools to reduce sediment loadings to Cornucopia Harbor from the Siskiwit River.

9. "Comprehensive Plan – Town of Bell, Bayfield County, Wisconsin. Policy Document 2010 to 2029." Approved by the Town of Bell's Board of Supervisors on December 8, 2009. This report summarizes the existing conditions (geographic, geologic, socioeconomic, etc.) and outlines a comprehensive plan for the next 20 years.

4.4 Harbor Surveys

The USACE completed various periodic hydrographic surveys of Cornucopia Harbor from 1999 - 2010. A list of surveys is included in Appendix C.

5.0 PLAN FORMULATION

5.1 Project Objectives

1. To reduce sedimentation and associated dredging costs for Cornucopia Harbor;
2. To reduce disruption to vessel movements by having channel dimensions that are consistently available throughout the boating season; and
3. To provide future accessibility to the harbor for distressed boaters by providing a reliable depth and width in the entrance channel.

5.2 Existing Conditions for Cornucopia Harbor

5.2.1 General

Cornucopia Harbor is located at the mouth of the Siskiwit River in the Village of Cornucopia, Wisconsin, as indicated in Figures 3.1 through 3.3. It is situated on a fairly isolated reach of coastline, 18 miles northeast of Port Wing, WI and 31 miles northwest of Bayfield, WI. The Village has a population of approximately 270 and a land area of approximately 60.4 square miles.

Two marinas occupy the harbor: Bell Township Marina and Siskiwit Bay Marina. Halvorson Fisheries is the primary commercial fishing operation being conducted out of the harbor. These organizations are discussed further in Section 5.2.4.

The Wisconsin Department of Natural Resources owns and operates two vessels out of Siskiwit Bay Marina, a 28′ game warden vessel responsible for law enforcement and a 55′ research vessel.

The US Coast Guard Auxiliary utilizes three vessels within the harbor and performs local search and rescue operations. The vessels are privately owned and offered for use by the Coast Guard. The Coast Guard's own vessels will occasionally moor within the harbor as well.

5.2.2 Harbor Dimensions

The inner channel of the harbor is authorized to be maintained at a water depth of eight feet and the entrance channel at a water depth of 10 feet, as shown in Figure 3.3. The authorized width of the channel is 50 feet. The distance between the two jetties varies up to approximately 150 feet.

5.2.3 Sedimentation and Dredging

5.2.3.1 Sedimentation

A brief assessment of the sedimentation of the harbor channel is provided in Appendix D. A summary of the work is included in this section. The series of hydrographic surveys of the harbor listed in Appendix C were imported into GIS and reviewed. In many cases, interpretation of the results required information on river discharge and local wave conditions, which are not available for this study. Therefore, a selection of surveys was used to provide a reconnaissance level understanding of the harbor sedimentation patterns.

An assessment of fluvial sediment transport processes was done by comparing channel dredging surveys and reviewing the 516(e) Study report. Preliminary findings are as follows:

1. Comparing the surveys from August 1999 and May 2001 indicates that the majority of the sediment accumulated in the inner portions of the harbor for this period (Figure 5.1). The annual accumulation rate of material for this period is approximately 5,500 cu yds/yr.

2. The majority of the sedimentation in the harbor channel is derived from sediments coming from the Siskiwit River. The future land use patterns in the watershed are provided in the Town of Bell Comprehensive Plan and indicate that the vast majority of the land will remain as forest. However, near the harbor, it is anticipated that the surrounding land use will be mixed use or residential.

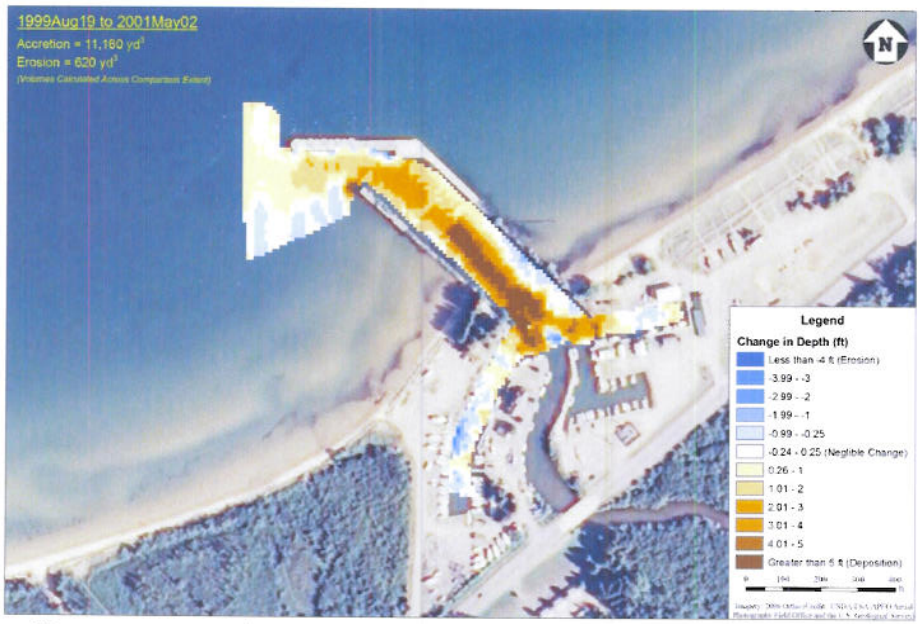

Figure 5.1 Surface Comparison between August 1999 and May 2001 Hydrographic Surveys

To gain an initial understanding of how littoral sediment transport may affect sedimentation of the harbor, a historical shoreline analysis was performed by Baird, the 516(e) Study for the Siskiwit River was reviewed and dredging surveys were compared. Preliminary findings are as follows:

1. The shoreline west of the harbor is relatively stable. The shoreline east of the harbor has grown since 1992, which may be due to disposal of dredged material from the harbor.

2. It is possible that a weak to moderate nearshore current system has been established in the bay. Since the current direction and magnitude will fluctuate according to incoming waves, it has the potential to carry sediment from the middle of the bay to either side. Figure 5.2 shows the presence of an underwater bar feature developing around the end of the west jetty, which would allow littoral sediment deposition in the outer part of the channel.

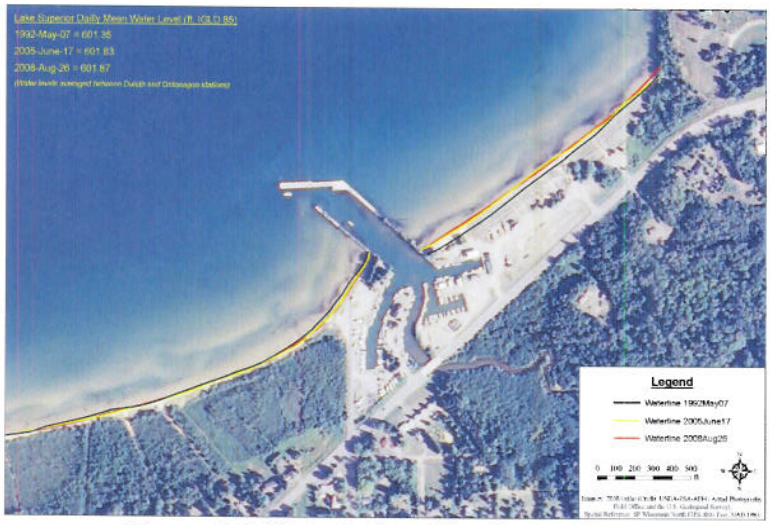

Figure 5.2 Historic Shoreline Comparison

3. Comparing the surveys from June 2001 and October 2004 indicates the majority of the sedimentation occurred in the outer portions of the channel for this period (Figure 5.3). The material may have been derived from littoral sources. The annual accumulation rate of material for this period is approximately 1,700 cy/ year.

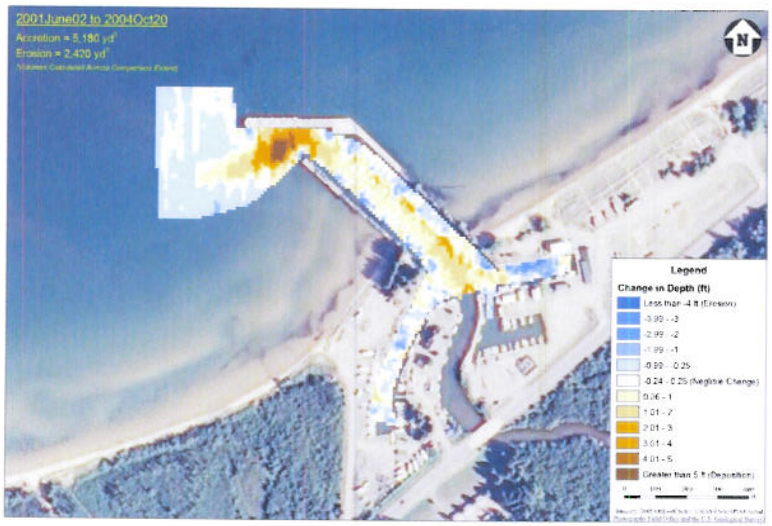

Figure 5.3 Surface Comparison Between June 2001 and October 2004 Hydrographic Surveys

The USACE (2010) completed a sediment gradation study in Cornucopia Harbor. Three field studies from 1985 to 1995 were used to analyze and classify the harbor sediment. The majority of the sediment at the sampling sites was classified as fine to medium sand with a D_{50} size between 0.14 and 0.33 mm. The remaining material is classified as silt and clay. Table 5.1 shows a summary of the results.

A map indicating sample locations was not available for the 1990 data. However, the locations for the samples taken in 1985 and 1995 are shown in Figures 13 and 14 in Appendix G.

The 1985 survey showed that the sand at the lakeward end of the harbor (Station 4) was finer than the sand in the inner harbor (Stations 2 and 3), which might represent the deposition pattern of river sediment. The 1995 survey showed relatively coarser sand at the harbor entrance (samples CG9505 and CG9506) than in the inner harbor (CG9502 and CG9503) with very fine sand in between (CG9504) these two areas. The 1995 survey indicates contributions from both river sediment (in the inner harbor) and littoral zone sediment (at the harbor entrance).

Table 5.1 D50 Values for Each Site Based Upon Study Year (from USACE, 2010)

1985		1990		1995	
Site #	D50 (mm)	Site #	D50 (mm)	Site #	D50 (mm)
Station 1	0.14	SN.1	0.08	CG9501	0.06
Station 2	0.33	SN.3	0.22	CG9502	0.22
Station 3	0.23	SN.4		CG9503	0.25
Station 4	0.14	SN.5	0.18	CG9504	0.15
		SN.6	0.20	CG9505	0.27
		SN.7	0.20	CG9506	0.28

5.2.3.2 Dredging

Federal Channel Dredging - The USACE has been involved with dredging of Cornucopia Harbor since 1963. The interval between dredging episodes varies from one to seven years. A tabularized summary of the dredging records obtained from the USACE is provided in Table 5.2. The dredging volume during the last 15 years ranges from a minimum of 4,576 cubic yards in 2005 to a maximum of 10,350 cubic yards in 2001. Furthermore, there were eleven dredging operations conducted to remove the accumulated sediment between 1963 and 2005, a difference of 42 years. Note that no material was dredged in 1965 per the USACE record. The average time between operations is approximately four years.

Table 5.2 Cornucopia Harbor Annual Report/Contract Dredging Report
USACE Detroit District, Operations Office

FY	Start	Completion	Cubic Yards	CPY	Placement/Dredge Area
1963			3,125	$2.40	
1965			0	$0.00	
1967			2,170	$0.00	
1970			5,275	$2.56	
1974			4,130	$5.48	Open Water
1975			4,120	$6.77	Open Water
1976			6,260	$7.38	Open Water
1981	6/16/1981	6/22/1981	2,881	$10.74	Upland
1985	6/11/1985	6/21/1985	6,564	$11.86	Upland Site Near Harbor, Entire Channel
1992	5/27/1992	6/26/1992	7,848	$4.71	Beach 0-300′ E of E Pier 4′ CNTR-OHWM 12+00W – 3+00E
1997	6/3/1997	6/11/1997	6,459	$8.15	Beach 0-300′ E of E Breakwater 4′ CNTR-OHWM, Critical Shoals Within Channel
2001	7/3/2001	7/9/2001	10,350	$9.56	Beach 0-300′ E of E Breakwater 4′ CNTR-OHWM, Critical Shoals
2005	8/3/2005	9/2/2005	4,576	$18.11	Beach, Critical Shoals
2008	10/20/2008				Beach, Critical Shoals
2011			0	$0.00	Beach, Critical Shoals
Total			**63,578**		

The cumulative dredging volumes were plotted and are shown in Figure 5.4. The average yearly volume of sediment dredged from the harbor, based on a linear trend, is estimated at 1,500 cubic yards per year. This volume represents a gross annualized amount of material that must be removed within the limits of the channel in order to maintain its use.

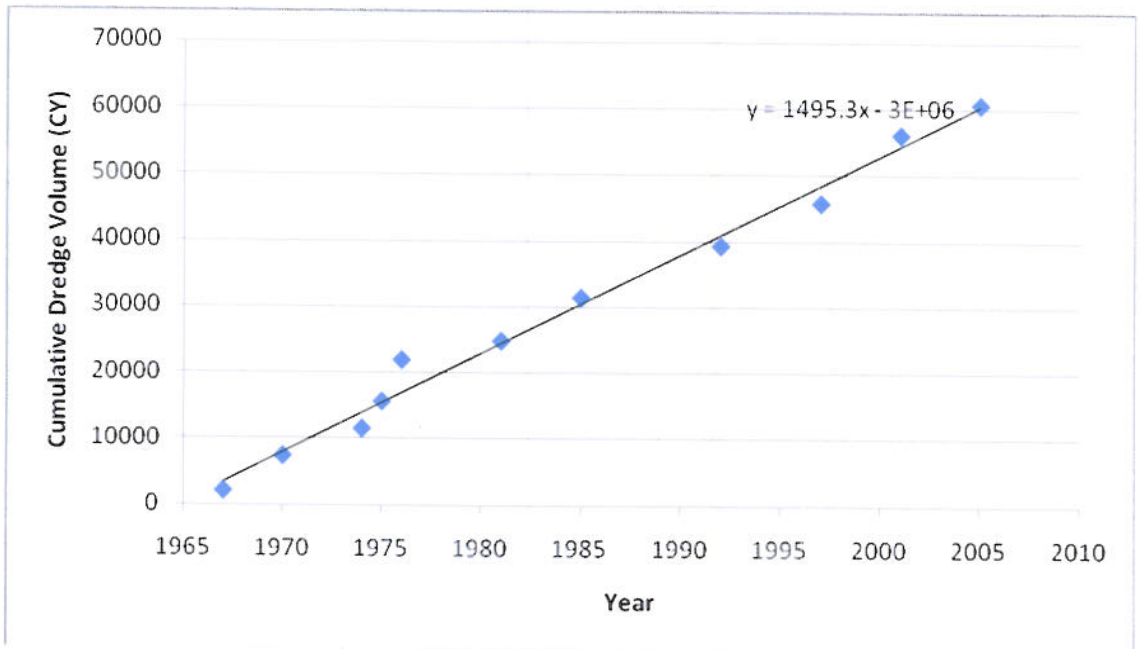

Figure 5.4 Cumulative Dredging Record

Additional Dredging - Cornucopia Harbor is dredged annually in certain locations outside of the Federally-maintained channel, downstream of the Highway 13 bridge. The operator of Siskiwit Bay Marina annually dredges approximately 800 cubic yards of the material from the river, by permit, to maintain accessibility to the alongside berths. The current practice is to place the dredge material on the beach, east of Cornucopia Harbor.

The operator noted that in the spring or summer of 1988, sediment within the harbor had accumulated to a degree where the maximum permissible draft was only three feet, thereby precluding larger vessels from utilizing the harbor. After approximately two months, the USACE dredged a narrow access channel to restore access for the remainder of the year.

In May of 2011, harbor operators removed an additional 500 cubic yards of sediment from the Federal channel, at the mouth of the harbor, through a DNR permit. The shoaling was becoming a significant problem requiring an immediate resolution and any further delay would risk suspension of harbor operations. The entrance channel had narrowed to approximately 20 feet and was sufficient for vessels drawing no more than 4.5 feet.

Historically, an average of 20-30 vessels will run aground at the entrance shoals each year during the two years prior to dredging by the USACE. Vessels will typically be towed off the shoals. A privately maintained buoy was installed at the harbor entrance to ward vessels away from the shoals, though this has had only limited success as the entrance becomes narrower and shallower.

5.2.3.3 Conclusions

From a review of the available information described above, it appears the amount of material that needs to be removed from the harbor to maintain use of the Federal channel and harbor is approximately 2,300 cy/yr (1,500 cy from Federal dredging and 800 cy from additional dredging.) The 800 cy is included in the calculation because this additional dredging, downstream of the Highway 13 bridge, will trap sediment and reduce the amount of material that enters into the Federal channel). There may be occasions that require removing more than 2,300 cy to maintain minimal functionality. To account for this, the study solutions should allow for a 20 percent increase to 2,750 cy/yr.

The Siskiwit River watershed accounts for a significant amount of the dredged material in the harbor. This is likely to continue as there is an available supply of sediment due to bank erosion and mobile riverbed material. Additionally, the sediment that was mobilized in the early 20th century logging practices may take decades to move through the river system. Alternatives to reduce the amount of river borne sediment getting into the harbor are described later in Section 5.8. Development of a watershed model during the feasibility phase will increase understanding of how sediment yields could be influenced by changes in land use.

5.2.4 Economy

The current economy in Cornucopia is primarily based on recreation, tourism, and commercial and charter fishing, which is integrated with the harbor operation. With close proximity to the Apostle Islands, Cornucopia is a well-known tourist destination and popular location for both sail and power boats.

Siskiwit Bay Marina, a private facility, consists of roughly 50 permanent and seven transient slips. The slips cater to vessels ranging from 27 to 50 feet in length, with drafts up to seven feet. Occupancy is generally near 100% throughout the duration of the boating season, which typically extends from April to October. Commercial and charter vessels occasionally moor within the marina; however, the marina generally caters only to recreational and sport-fishing craft. Nearly 100 vessels utilize the marina's haul-out and storage services during the winter. The marina's rates are as follows:

- Daily Rate = $1.40/ft
- Season Rate = $52.00/ft
- Winter Haul-out and Storage = $29.00/ft

The Bell Township Marina has approximately 40 slips, primarily permanent but with some transients, and caters to vessels up to 50 feet in length. The occupancy rate is typically near 100%, especially on holiday weekends. Township Marina rates are as follows:

- Daily Rate = $1.00/ft

- Season Rate = $23.00/ft to $31.00/ft
- Daily Launch Fee = $5.00

Should the harbor become unusable, these operations would cease to exist and patrons would need to relocate to another harbor or remove their boats from the water. However, adjacent harbors are also operating at close to capacity, which limits the ability of patrons to relocate.

Halvorson Fisheries operates seven commercial vessels ranging from 28 to 55 feet in length with drafts up to six feet, from March through January. The annual gross revenue from the fish catch is estimated to be between $500,000 and $750,000. Owners have stated that if the harbor is not usable, they would cease fishing operations because of the increased cost to travel from another harbor to the fishing grounds, which is located near Cornucopia Harbor.

Red Cliff Fisheries, while not permanently moored in the harbor, frequents the harbor on a transient basis.

There is some evidence suggesting that subsistence fishing is performed by local residents to supplement food supply and income.

Specific values for the total direct marina revenue resulting from slip rates, utility usage, launching, storage, etc. were not immediately available from the individual operators. However, the USACE Great Lakes Recreational Boating Study indicates that the approximated 911,000 recreational craft on the Great Lakes are responsible for a $9.4 billion economic impact and 60,000 jobs if both direct and secondary effects are considered, or $10,300 per vessel on average. For the 90 slips in the harbor operating near capacity between the two marinas, this translates to an economic impact of over $900,000 annually. It should be noted that the additional economic benefit associated with the fishery, charters and other operations have not been accounted for in this value.

5.2.5 Coastal Conditions

Information on waves and water levels were obtained from previous reports prepared by the USACE, as described in Section 4.0. The reports were prepared in the early 1990s and provide general information in the region of Cornucopia Harbor, not specifically at the site. During the feasibility study, an updated and more detailed analysis will be required to accurately define the water level and wave conditions.

Deepwater Waves – The existing hindcast report provided extreme deepwater wave conditions for various return periods, as indicated in Table 5.3.

Table 5.3 Deepwater Wave Heights in the Cornucopia Region (from USACE, 1992)

Return Period (Years)	Wave Height (Feet)
5	20.3
10	22.3
20	24.7
50	26.9

Water Levels – Design water levels on the Great Lakes (Duluth Gage) were provided by an existing USACE study. These are reported in Table 5.4, rounded to the nearest tenth of a foot.

Table 5.4 Design Water Levels at Duluth (from USACE, 1993)

Return Period (Years)	Design Water Level Annual (Feet-IGLD 1985)
10	602.8
20	602.9
50	603.2
100	603.3

5.2.6 Environment

The environment surrounding Cornucopia is representative of a coastal environment on the Great Lakes. Recent detailed data at Cornucopia Harbor is not available, but a general understanding of the surrounding environment, obtained from the Town of Bell Plan and the site visit, can be described as follows:

Fish - Below Siskiwit Falls to the river mouth at Cornucopia, the Siskiwit River is considered a Class II stream. Trout and salmon migrate from Lake Superior to the river to spawn. The Siskiwit River also contains habitat that supports other fish such as northern pike and bullhead.

Sediment – According to the Wisconsin DNR, the most recent sediment sampling in the harbor did not indicate contaminants at levels higher than background levels typical of the region.

Beaches - Cornucopia Beach is within a two mile reach along Lake Superior and is a major feature in the Town of Bell. About a half mile of the beach is public and includes a marina. Privately owned beach land is the most intensely developed area in the Town of Bell.

Threatened Species – The Wisconsin DNR has identified several threatened species and species of special concern in the town of Bell, but concludes that there are no endangered species. Most species are associated with environments similar to Siskiwit River watershed and along the shoreline of Lake Superior.

During the feasibility phase, a detailed inventory of the environment should be recorded to define a baseline condition for the area at and near Cornucopia harbor.

5.3 Public Concerns

Public concerns were identified at the September 8, 2010 kick-off meeting held at Bell Township Hall in Cornucopia that are related to the establishment of planning objectives and constraints, which include:

1. *Channel Configuration:* The channel is used by vessels for entering and exiting the harbor as well as for maneuvering of vessels. The primary concern discussed at the public project kick-off meeting was that the dimensions of the channel are not consistent and can vary greatly from year to year. The reason for the variability is due to sedimentation of the harbor channel. Operators within the harbor and other businesses outside the harbor, such as restaurants, are immediately impacted because vessels cannot enter or exit the harbor on a reliable basis. The effect of a highly variable channel width and depth results in disruption to the local economy.

2. *Navigation Safety:* With the channel width and depth changing frequently, vessel maneuvering room can become restricted leading to unsafe conditions. The harbor serves as a home to the U.S. Coast Guard Auxiliary and requires reliable access to Lake Superior, which is impacted by unreliable channel dimensions.

3. *Wave Protection:* According to the operators of both Siskiwit Bay Marina and the Bell Township Marina, the harbor is exposed to waves from the west and northwest, which can cause disruption to boats and boaters using the facility. The problem is of particular concern at the turning area and is a navigation safety concern to vessels entering the harbor.

4. *Access to Jetties:* The Town of Bell would like to expand public access to the existing jetties for recreational and fishing opportunities. Access is currently possible, but not universally accessible (it is noted that improving public access to the jetty structures is not within the scope of this study).

5.4 Problems and Opportunities

The evaluation of public concerns often reflects a range of needs perceived by the public. This section describes these needs in the context of problems and opportunities that can be addressed through water and related land resource management. The problems and opportunities that have been identified are:

5.4.1 Channel Configuration

Problem: Sedimentation prevents reliable channel access throughout the boating season. Local operators indicate that sedimentation regularly restricts access to some vessels, especially those with larger drafts. In the late 1980s, the harbor was shut down completely for a period of two months, suspending all operations. More recently, the harbor was closed between two and three weeks after a period of heavy rainfall in late spring 2007.

Opportunity: A more dependable channel configuration:

- will result in a more consistent and reliable use of the channel by all existing operators and substantially reduce the risk of shutting down harbor operations.
- should enable more frequent recreational vessel use of the harbor and assist in reducing the local economic impacts to businesses that use the harbor everyday and those businesses that are patronized by boaters, such as restaurants, lodging and marine supply stores.

5.4.2 Navigation Safety

Problem: Navigation safety is compromised when sedimentation narrows the navigable space available to all vessels using the harbor because it increases the risk of vessel grounding and makes it a more time consuming process to exit and enter the harbor. This issue especially affects the rescue call response time for the Coast Guard Auxiliary vessels located at the harbor. Three nearby water based fatalities underscore the necessity for safe and reliable access to open water. However, it is recognized that a reliable channel depth and width will not reduce the number or severity of rescue calls.

Opportunity: A reliable channel depth and width will:

- reduce emergency response times since rescue vessels will be not be delayed by slowly maneuvering through the harbor nor will they risk running aground.
- improve navigation safety by providing greater maneuverability for other vessels (commercial, charter, and recreational).

5.4.3 Harbor of Refuge

Problem: There is no designated Harbor of Refuge between Port Wing and Bayfield, a distance of approximately 49 miles. A Harbor of Refuge is defined as "A proper degree of navigation safety for light-draft craft cruising along shore requires that Harbors of Refuge, or sheltered waters, should be available to such craft at intervals of about 30 or 40 miles" (Committee on Rivers and Harbors, 1944).

Opportunity: Allow Cornucopia Harbor to become an official Harbor of Refuge, providing a safe haven for distressed mariners, by establishing a channel depth and width that is more reliable than the existing conditions.

5.4.4 Environment

Problem: Water in the harbor is currently laden with fine sediment, especially after major rainfall events. The sediment increases the turbidity of the water, thereby decreasing water quality.

Opportunity: Potential solutions for long-term reduction in sedimentation may also improve water quality within the harbor and Siskiwit Bay by decreasing the turbidity of the flow. One example involves utilizing bank stabilization (root wads, revegetation, or vanes) in the upper reaches of the Siskiwit River to reduce the sediment loading from this area.

Another long-term concept involves beaver population management. Beaver dams located on the Siskiwit River retain sediment and reduce the overall sedimentation of Cornucopia Harbor. Beaver trapping will reduce the number of future dams and likely lead to the failure of existing ones. This could result in the release of trapped sediment into the river, thereby increasing the amount of sedimentation in the harbor. Therefore, beaver population should be monitored. If, due to trapping, the population begins to decrease significantly, measures should be taken to stabilize the number of beavers.

5.5 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 positive changes in the project conditions.

The planning objectives are specified as follows:

1. To reduce sedimentation and associated dredging costs for Cornucopia Harbor;
2. To reduce disruption to vessel movements by having channel dimensions that are consistently available throughout the boating season; and
3. To provide future accessibility to the harbor entrance for distressed boaters by providing a reliable depth and width in the entrance channel.

5.6 Constraints

Planning and implementation constraints for solutions to sedimentation issues at Cornucopia Harbor are related to:

1. Reducing adverse impacts to beaches adjacent to the harbor as a result of the proposed solution;
2. Reducing adverse impacts to commercial and public use of the harbor during implementation of the proposed solution;
3. Reducing adverse environmental consequences related to the proposed solution;
4. Cornucopia Harbor appears on the Wisconsin Inventory of Historic Places. Proposed solutions will need to accommodate relevant requirements or mitigate impacts;
5. Identification of a local sponsor, willing and able to provide funding for the non-Federal portion of the project; and
6. Not having sufficient funding for the Federal portion of the project from Federal authorities.

5.7 Preliminary Measures

The descriptions and results of the evaluations of the preliminary measures that were considered in this study are presented below. These are based on assumptions which are initial approximations and will need to be confirmed by detailed study during the feasibility phase.

Measure 1- This measure is subdivided into two potential future scenarios in order to represent uncertainty in the Federal funding stream.

Measure 1a – No Action: This measure assumes that no Federally-supported maintenance dredging would occur at Cornucopia Harbor due to a decline in Federal funding.

Measure 1b – Periodic Dredging: Federally-supported maintenance of the Federal channel would occur as it has previously, with a dredging occurring every three to four years.

Measure 2 – Jetty Extensions: Extension of the jetties (see Figure 5.5) to reduce the flow of littoral sediment towards the harbor entrance and into the navigation channel. This measure is based on the following assumptions:

- The eastern and western jetties are extended with rubblemound structures by 150 feet and 450 feet, respectively for a total length of 600 feet.
- The jetty extensions will prevent 1,250 cu yds/yr from entering the outer portion of the entrance channel, which accounts for approximately 45% of the annual amount of material (2,750 cu yds) that needs to be removed to maintain use of the Federal channel, per Section 5.2.3.3.

Benefits related to this measure are:

- Reduces sedimentation and associated dredging costs.

- Under the stated assumptions, the jetty extensions will prevent approximately 45% of the annual amount of material (2,750 cu yds) that needs to be removed to maintain use of the Federal channel, per Section 5.2.3.3.
- Improvement of navigation safety within the outer portion of the channel.
- Increases viability of Cornucopia as a Harbor of Refuge.
- Voids in stone may increase habitat for fish and other freshwater marine life

Potential Impacts related to this measure are:

- Construction of the extensions could result in disruption to the existing harbor operations
- Construction processes related to trucking and storing of stone may be disruptive to existing habitat
- Existing habitat on the lakebed may be covered by the extension of the structures

Measure 3 – Sediment Trap: Locating and constructing sediment traps (Figure 5.6) to receive sediments from the river, upstream of the harbor. This measure was also suggested by the 516(e) Study described in Section 4.0. This measure is based on the following assumptions:

- Three sediment traps would be constructed. Figure 5.6 indicates the approximate location of the traps.
- The total gross volume of the traps is 5,000 cy with the majority of the volume being provided by the trap near the Highway 13 bridge. The efficiency of the traps can vary substantially. For this study, it is assumed that the traps are 60 percent efficient. Under this scenario, the reduction in river borne sedimentation into the harbor is 3,000 cy.
- The traps are assumed to reach capacity in two years, providing an annualized reduction of harbor sedimentation of 1,500 cy.

Benefits related to this measure are:

- Reduces sedimentation and associated dredging costs.
- Under the stated assumptions, the sediment traps will prevent approximately 55% of the annual amount of material (2,750 cy) that needs to be removed to maintain use of the Federal channel, per Section 5.2.3.3.
- Reduces disruption to vessel movements by increasing reliability of the channel depth and width in the inner portions of the harbor.

Potential impacts related to this measure are:

- Damage to habitat as a result of trap construction

- Damage to habitat at material disposal site
- Decrease in safety during trap maintenance due to substantial increase in truck traffic along Highway 13.

Measure 4 – Re-routing River Flow: Realigning the river flow to bypass the harbor entirely (Figure 5.7). This measure was also suggested by the 516(e) Study described in Section 4.0. The measure is based on the following assumptions:

- Alteration of the river flow could be accomplished through the establishment of a new river channel entering Lake Superior east of the existing harbor. However, a final route for the river channel should be determined from analyses in the feasibility phase of the project.
- Approximately 30,000 cy of material will be excavated.
- A new bridge will be required where Highway 13 crosses the re-routed Siskiwit River.

Benefits related to this measure are:

- Under the stated assumptions, the re-routed river will prevent 100% of the river borne sediment from reaching the inner portions of the Federal channel.
- Reduces sedimentation and associated dredging costs.
- Reduces disruption to vessel movements by increasing reliability of the channel depth and width in the inner portions of the harbor

Potential impacts related to this measure are:

- A new bridge would be needed
- The new river discharge point will change the existing habitat of the lakebed by covering it with sediment or scouring due to an increase in currents
- Existing habitat downstream of the re-routing point will be impacted due to changing from a riverine environment to a non-riverine environment

Watershed Management measures, as suggested by the 516(e) Study described in Section 4.0, involve the preparation and implementation of a watershed management plan with the intention of decreasing mass wasting of the river bank soils, thereby reducing sediment entering the harbor. These measures were not considered further or analyzed from a cost perspective due to a lack of information and an inability to quantify or practically estimate the scope of work required. It is possible that watershed management methods may be employed to some degree in a final solution; however, this will need to be investigated further in the feasibility study phase to better understand the full effects to the harbor and river system.

Figure 5.5 Measure #2, Extension of the Harbor Jetties

Figure 5.6 Measure #3, Indicative Locations of Sediment Traps (Orange), per USACE 516(e) Study

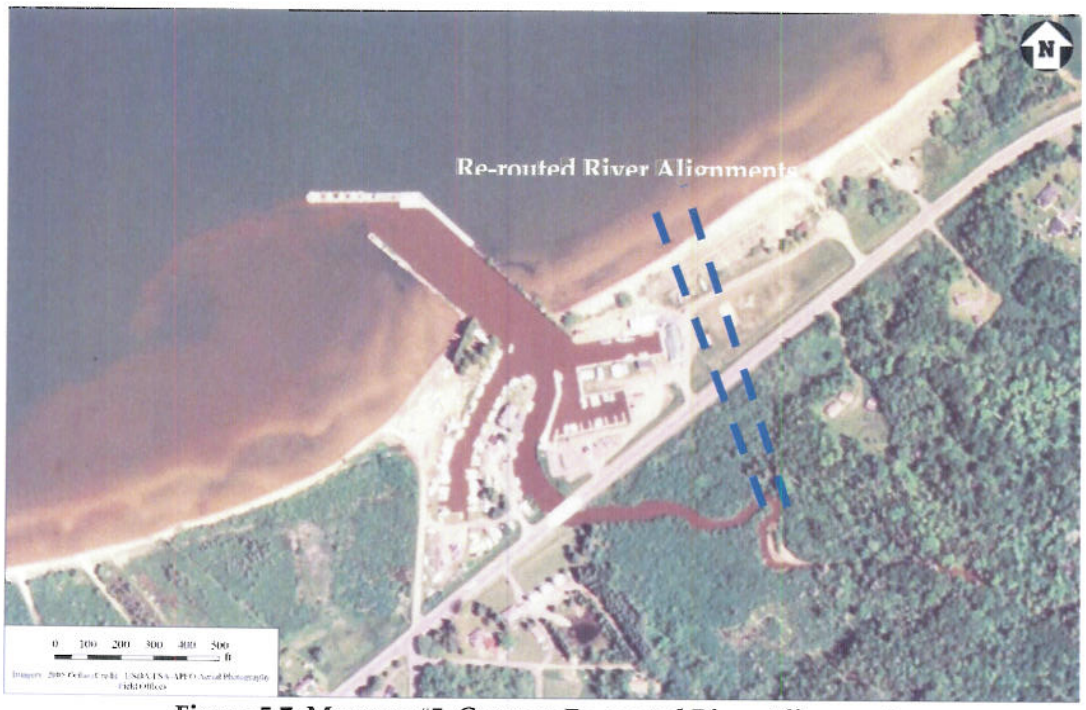

Figure 5.7 Measure #5, Concept Re-routed River Alignments

Each measure has been compared against the Project Objectives in Section 5.1 to determine if they should be considered a viable solution. Table 5.5 provides the results of the screening of Measures 1 through 4.

Table 5.5 Screening of Measures

Measure	Objective 1 Reduction of Sedimentation and Dredging Costs	Objective 2 Provides consistent configuration in the Inner Portions of the Channel throughout the boating season	Objective 3 Improves Harbor Accessibility for Distressed Boaters at Outer Portions of the Channel
1a – No Maintenance Dredging	Does not meet objective	Does not meet objective	Does not meet objective
1b – Periodic Maintenance Dredging Every 3-4 years	Does not meet objective	Does not meet objective	Does not meet objective
2 – Jetty Extensions	Meets objective	Does not meet objective	Meets objective
3 – Sediment Traps	Meets objective	Meets objective	Does not meet objective
4- Rerouting Flow of River to East of Cornucopia Harbor	Meets objective	Meets objective	Does not meet objective

From a review of Table 5.5, if each measure were considered solely on its own merits, none would meet all three objectives if implemented. However, all objectives would be met if certain measures were combined, forming alternatives, which are discussed in the following section.

5.8 Alternatives

The following combinations should be considered for evaluations and comparison of benefit-cost.

5.8.1.1 Alternative 1

Alternative 1 (no maintenance dredging) – this alternative shall be the basis to determine the benefits to be achieved with the other alternatives. Under this alternative the harbor channel will become unusable. Measure 1b was removed from further consideration since Federal funds for maintenance dredging of Cornucopia Harbor are not currently provided nor are further funds anticipated in the foreseeable future. If reliable funding for maintenance dredging becomes available, this may become the preferred alternative. A review of other dredging solutions would be evaluated in the feasibility phase.

5.8.1.2 Alternative 2

Alternative 2 combines Measure 2 (Jetty Extensions) and Measure 3 (Sediment Trap). The individual measures are described in Section 5.7. This alternative involves implementing sediment

traps to reduce river borne sediment deposition in the inner portions of the channel and jetty extensions to reduce the volume of littoral sediments entering the outer portions of the channel.

5.8.1.3 Alternative 3

Alternative 3 combines Measure 2 (Jetty Extensions) and Measure 4 (Re-routing River Flow). The individual measures are described in Section 5.7. This alternative involves implementing jetty extensions to reduce the volume of littoral coastal sediments from entering the outer portions of the channel and re-routing of the river flow to prevent river borne sediments from entering inner portions of the channel.

5.9 Preliminary Benefit–Cost Evaluation of Alternatives

For the purposes of performing a benefit-cost analysis, an estimated cost based on assumed parameters was calculated for the alternatives described in Section 5.8. The assumed base year for the project is 2013 and the period of analysis is 50 years. Furthermore, a Fiscal Year (FY) 2012 discount rate of 4.0% was utilized. The benefits of Cornucopia Harbor are presented in Section 5.9.1, while the costs and economic evaluation are presented with the discussion of each alternative.

The estimated benefits and costs are preliminary and do not reflect a detailed and rigorous analysis. All design conditions are assumed. Rates used for determining costs for the alternatives are based on experience and did not include detailed quotes from the contracting community.

5.9.1 Benefits of Cornucopia Harbor

Benefits were established based on the value of service provided by the harbor to its users. The users consist of recreational users, a charter fishing boat, commercial fishing boats, the Coast Guard and Wisconsin DNR. The estimated benefits generated by each of these harbor users are the total benefits associated with the continued, regular operation of the harbor. For the purposes of the economic evaluation, the benefits were categorized as National Economic Development (NED) benefits and Recreational benefits. The primary benefits are those that can be utilized in the National Economic Development (NED) analysis to justify the cost effectiveness of an alternative project. Additional benefits are those that can be counted in the NED analysis, but cannot be used to justify the cost effectiveness of an alternative. The following benefits were considered:

- NED benefits
  - Commercial fishing activities
  - Business income from charter fishing activities
  - Business income from marina operation
  - Harbor of refuge

- Recreational benefits
  - Recreational benefit for slip renters

There are other benefits associated with the harbor that were not evaluated for this preliminary study, such as the operation of the DNR and Coast Guard Auxiliary vessels, storage and haulage revenues, and recreational benefits for transient boaters. Including these benefit categories could increase the total net benefits of the alternatives, and therefore the following analysis is a conservative estimate of benefits.

5.9.1.1 Commercial Fishing Activities

As discussed in Section 5.2.4, commercial fishing vessels operate out of Cornucopia Harbor. Based on discussions with the owners, it is estimated that the annual fish catch is valued between $500,000 and $750,000. This gross revenue for fish is a benefit to the nation as production of a good.

The fishing grounds for these vessels are located in close proximity to the harbor. Owners have stated that if the harbor is not usable, they would cease fishing operations because of the increased cost to travel from another harbor to the fishing grounds. Therefore, an annual benefit of $500,000 was estimated for commercial fishing activities. However, further investigation is needed during the feasibility study to determine if commercial fishing vessels operating from other harbors would be able to take advantage of the reduced competition, thus reducing the overall impact.

5.9.1.2 Business Income from Charter Fishing Activities

A charter fishing company currently operates out of the Cornucopia Harbor. Based on discussions with the operator, approximately 50 trips originate from the harbor on an annual basis. Owners stated that their business would close if the harbor was not usable. The loss of business income (e.g., net revenue) can be considered a NED benefit. Although there would be a loss of total trips, these benefits were not included in this analysis because it is uncertain if the customers could use a similar service out of another harbor. Further investigation is needed during the feasibility study to determine the extent of the NED impact.

5.9.1.3 Business Income from Marina Operation

As discussed in Section 5.2.4, various marina services are provided at Cornucopia Harbor, including annual slip rental, transient slip rental, launching services, storage services, and boating services (e.g., fuel, sanitary disposal). Discussions were held with marina operators to determine the business income associated with their operations. The annual net revenue associated with each slip is estimated to be $1,000.

There are 90 slips in the harbor which are typically close to 100 percent capacity during the boating season. Should the harbor become unusable, these operations would cease to exist and patrons would need to relocate to another harbor or remove their boats from the water. However, adjacent harbors are also operating at close to capacity, which limits the ability of patrons to relocate. For this analysis, it was assumed that 25 percent of the patrons would be able to be accommodated at adjacent harbors and result in no net loss of business income from an NED perspective. However,

the patrons not able to relocate would represent a business loss. It is estimated that the continued operation of the harbor presents an annual benefit of $67,500 (90 slips x 75 percent loss x $1,000 annual loss). The benefits do not account for haulage and storage services provided by the marinas and are therefore considered conservative estimates.

5.9.1.4 Harbor of Refuge

As indicated in Section 5.4.3, the recommended distance between two Harbors of Refuge is 30 to 40 miles. The distance between Port Wing to Bayfield is about 49 miles. Cornucopia is located between these two communities. Therefore, having Cornucopia Harbor as a recognized Harbor of Refuge would meet the recommendation of the Committee on Rivers and Harbors report.

The Section 107 study for Two Harbors, Minnesota[1] contained data applicable to the Cornucopia Harbor that facilitated the evaluation of benefits, such as Harbor of Refuge benefits and recreational benefits to boaters. Since the Cornucopia Harbor area has a similar population density and distance to population centers, many of the values presented in the report were considered appropriate for use in the Cornucopia Harbor evaluation.

The Two Harbors study estimated the value of the harbor serving as a Harbor of Refuge using a standard value of $10,000 annually, which was also applied to Cornucopia. However, the value was not updated to 2012 dollars because the original base year of the value could not be determined.

5.9.1.5 Recreational Benefit to Slip Renters

The Two Harbors study conducted a meta-regression analysis which forecasted the average willingness to pay per activity occasion per person for motor boating in the northeast area of Lake Superior. A consumer surplus per person associated with a single recreational boating activity of $29.95, in 2006 dollars, was determined as the slip renter benefit in that study. This value was based on surveys of boaters for various studies throughout the United States, adjusted for the Two Harbors region. Thus, a value of $29.95 was assumed to be representative of the recreational value to slip renters at Cornucopia Harbor. This value was updated to 2012 dollars using the consumer price index (CPI) resulting in a value of $33.71.

In addition to the per activity value, the Two Harbors study also provided use characteristics of boaters in the region, such as estimated number of boat usages per year and the average occupancy per boat. These use characteristics were also used in the analysis for Cornucopia Harbor. To calculate the recreational benefits, the number of annual activity occasions was calculated by multiplying the number of estimated boat usages (34) per boating season (April-October) and the

[1] Section 107 – Navigation Economic Evaluation, Two Harbors Harbor, Two Harbors, Minnesota, USACE Buffalo District, August 2007.

average occupancy of each boat (3.7 persons) and the number of seasonal slips (67). The annual value of all activity occasions is estimated as $382,000. The calculations are shown in Figure 5.8.

Persons/boat		3.7
No. of boat usages/season	x	34
Activity occasions/boat		125.8
Recreational Value of activity occasion	x	$33.82
Annual Recreational Value per boat		$4,254.56
No. of yearly slips	x	67
Annual Value		**$285,055.25**

Figure 5.8 Annual Recreational Value to Slip Renters

5.9.1.6 Summary of Benefits

The total annual NED benefits from the categories discussed above were estimated to be $959,000 (Table 5.6). The value of the benefits remains the same for each year the harbor is in operation.

Table 5.6 Total Annual Benefits

Category	Benefit
Commercial Fishing	$500,000
Marina Operations	$68,000
Harbor of Refuge	$10,000
Recreational	$285,000
Total Annual Benefits without Recreational	**$578,000**
Total Annual Benefits with Recreational	**$863,000**

Note: Values rounded to the nearest $1,000; 2012 dollars

5.9.2 Alternative 1 – No Action (Discontinue Dredging)

Under this alternative, Federally-supported maintenance dredging will not occur. There will be no surveying of the channel, nor periodic dredging of any kind. The cost for this alternative is $0.00. The benefit of this alternative is $0.00.

5.9.3 Alternative 2 – Combine Measures 2 (Jetty Extensions) and Measure 3 (Sediment Traps)

Under this alternative, jetty extensions will be constructed and the sediment traps will be excavated.

Cost (Jetties): A preliminary cost of $3,000 per linear foot has been assumed for a total of 600 ft of rubblemound structures, yielding a total estimated cost of $1.8 million.

Cost (Sediment Traps): Sediment trap costs are defined be the initial cost of excavation and maintenance excavation. The initial construction of the three sediment traps is estimated to be $200,000, which includes creating access to the trap sites, excavation and disposal.

The traps would require maintenance excavation of 3,000 cu yds every two years. The excavation costs for the main channel and sediment traps over the lifespan of the project are given below in Table 5.7. The unit rate of maintenance excavation is taken at $23.23/cu yd, based on the most recent rate in Table 5.2 and increased to account for inflation and reduction in volume.

Table 5.7 Estimated Excavation Costs of Sediment Traps

Operation	Year	Volume (CY)	Unit Rate	Cost	Present Value
0	2013	0	-	$0	$0
2	2015	3000	$23.23	$69,700	$62,000
4	2017	3000	$23.23	$69,700	$57,300
6	2019	3000	$23.23	$69,700	$53,000
8	2021	3000	$23.23	$69,700	$49,000
10	2023	3000	$23.23	$69,700	$45,300
12	2025	3000	$23.23	$69,700	$41,900
14	2027	3000	$23.23	$69,700	$38,700
16	2029	3000	$23.23	$69,700	$35,800
18	2031	3000	$23.23	$69,700	$33,100
20	2033	3000	$23.23	$69,700	$30,600
22	2035	3000	$23.23	$69,700	$28,300
24	2037	3000	$23.23	$69,700	$26,100
26	2039	3000	$23.23	$69,700	$24,200
28	2041	3000	$23.23	$69,700	$22,300
30	2043	3000	$23.23	$69,700	$20,700
32	2045	3000	$23.23	$69,700	$19,100
34	2047	3000	$23.23	$69,700	$17,700
36	2049	3000	$23.23	$69,700	$16,300
38	2051	3000	$23.23	$69,700	$15,100
40	2053	3000	$23.23	$69,700	$14,000
42	2055	3000	$23.23	$69,700	$12,900
44	2057	3000	$23.23	$69,700	$11,900
46	2059	3000	$23.23	$69,700	$11,000
48	2061	3000	$23.23	$69,700	$10,200
50	2063	3000	$23.23	$69,700	$9,400
				Total	**$705,900**

Table 5.8 Comparison of Benefit-Cost for Alternative 2

	Initial Cost	Present Value of Trap Excavation	Equivalent Annual Cost	Equivalent Annual Benefits	BCR
Without Recreational Benefits	$2,000,000	$706,000	$126,000	$527,000	4.2
With Recreational Benefits	$2,000,000	$706,000	$126,000	$787,000	6.2

The BCR for Alternative 2 is estimated at 6.2, indicating that this alternative is cost effective (Table 5.8). If recreational benefits are not included in the equivalent annual benefits, Alternative 2 is still cost effective with a BCR of 4.2.

5.9.4 Alternative 3 – Combine Measures 2 (Jetty Extensions) and Measure 4 (Re-routing River Flow)

Under this alternative, jetty extensions will be constructed and the Siskiwit River will be re-routed.

Cost (Jetties): A preliminary cost of $3,000 per linear foot has been assumed for a total of 600 ft of rubblemound structures, yielding a total estimated cost of $1.8 million.

Cost (River Re-routing): The total associated volume of excavated material is approximately 30,000 cubic yards. If an excavation cost of $15 per cubic yard is assumed, this translates to a cost of $450,000. The cost for the new bridge needed for the existing highway to span the diverted river is assumed to be $1,000,000. All other costs, including any land purchasing, demolition, etc., is assumed at $550,000 for a total river re-routing cost of $2,000,000.

Benefit: A summary of potential benefits is listed below:

- Reduces sedimentation and associated dredging costs
- Provided the assumptions in 5.8.1.3 are realized, Alternative 3 will remove 100% of the 2,750 cu yds/yr of material to maintain use of the Federal channel
- Reduces disruption to vessel movements by increasing reliability of the harbor channel depth and width
- Improvement of navigation safety within the channel
- Increases viability of Cornucopia as a Harbor of Refuge

The BCR for Alternative 3 is estimated as 4.4 indicating that this alternative is cost effective (Table 5.9). If recreational benefits are not included in the equivalent annual benefits, Alternative 3 is still cost effective with a BCR of 3.0.

Table 5.9 Comparison of Benefit-Cost for Alternative 3

	Initial Cost	Equivalent Annual Cost	Equivalent Annual Benefit	BCR
Without Recreational Benefits	$3,800,000	$177,000	$527,000	3.0
With Recreational Benefits	$3,800,000	$177,000	$787,000	4.4

5.10 Preliminary Screening Summary

A summary of a comparison between all three alternative is provided in Table 5.10. Key findings include:

- The range in the BCR's without recreational benefits is 3.0 (Alternative 3) to 4.2 (Alternative 2).
- Alternatives 2 and 3 meet all three planning objectives.

Table 5.10 Alternative Comparison

Alternative	Benefit/ Cost (Without Rec. Benefits)	Benefit/Cost (With Rec. Benefits)	Planning Objective 1 Management of Sedimentation	Planning Objective 2 Consistent Channel Configuration	Planning Objective 3 Improves Future Harbor Accessibility for Distressed Boaters
1 – No Dredging	N/A	N/A	Does not meet objective	Does not meet objective	Does not meet objective
2 – Jetty Extensions and Sediment Traps	4.2	6.2	Meets objective	Meets objective	Meets objective
3 - Jetty Extensions and River Re-routing	3.0	4.4	Meets objective	Meets objective	Meets objective

6.0 FEASIBILITY PHASE

6.1 Federal Interest

From the analysis described in Section 5.0 and the summary provided in Table 5.10, Alternatives 2 and 3 appear to meet all the objectives and have a BCR greater than 1.0. Based on this, it is determined that there is a Federal interest in the project.

6.2 Local Sponsor/Cost Sharing

At this time, a local sponsor has not been identified. A potential non-Federal sponsor is the Town of Bell. A generic draft letter of intent is provided in Appendix E. It indicates that the local sponsor is willing to pursue the feasibility study and to share in its cost and an understanding of the cost sharing that is required for project construction.

Also, the Town of Bell has been contacted to check if they would be willing to assume the responsibility of maintaining the Federal channel dredging. Town authorities have indicated that they would not be willing, nor able, to assume the responsibility to maintain the Federal channel dredging.

6.3 Assumptions

6.3.1 Feasibility Phase - Assumptions

The assumptions for the Feasibility Phase include the following:

- The feasibility study will be carried out per the requirements and guidelines of USACE Regulation (ER 1105-2-100 and ER 200-2-2) and related planning phase guidance;
- Any cost sharing would be arranged through a Federal Cost Sharing Agreement with a willing, non-Federal sponsor;
- Extensive collaboration would be required between local stakeholders, regulatory agencies and the USACE; and
- Field data collection will be carried out during the feasibility phase.

6.3.2 Feasibility Phase – Key Technical Tasks

The critical efforts for the feasibility phase will include a rigorous technical analysis (modeling, engineering, cost estimating) to improve the understanding of the sediment transport processes for Cornucopia Harbor and to further define the benefit-cost analysis. A partial task list is described below:

- Hydrographic survey of Siskiwit Bay, Siskiwit River and Cornucopia Harbor;
- Sediment sampling and grain size analysis in Siskiwit Bay and along its southern shoreline;

- Complete wave hindcasting and nearshore wave modeling for the study area;
- River modeling (hydrodynamic and sediment transport) to quantify the amount of sediment coming into Cornucopia Harbor from the Siskiwit River and littoral environment;
- Environmental assessment related to alternatives;
- Detailed evaluation of maintenance dredging requirements;
- Preliminary design of any structures associated with the alternatives; and
- A more integrated benefit-cost analysis of the above proposed alternatives in combination with recommendations for controlling sediment volumes generated in the watershed.

6.4 Feasibility Phase Milestones

The durations presented in Table 6.1 below are based on professional experience related to completing technical and planning tasks as well as and a qualitative review of project requirements. These may vary considerably based on the project management plan, detailed studies and future findings.

Table 6.1 Feasibility Phase Milestones

Milestone	Description	Duration (mo)	Cumulative (mo)
Milestone F1	Initiate Study	0	0
Milestone F2	Public Workshop/Scoping	2	2
Milestone F3	Feasibility Scoping Meeting	2	4
Milestone F4	Alternative Review Conference	3	7
Milestone F4A	Alternative Formulation Briefing	2	9
Milestone F5	Draft Feasibility Report	4	13
Milestone F6	Final Public Meeting	1	14
Milestone F7	Feasibility Review Conference	1	15
Milestone F8	Final Report	3	18
Milestone F9	DE's Public Notice	1	19
	Chief's Report	2	21
	Project Authorization	3	24

6.5 Feasibility Phase Cost Estimate

The costs presented in Table 6.2 below are based on professional experience and a qualitative review of project requirements. These may vary considerably based on the project management plan, alternative selection, detailed studies and future findings.

Table 6.2 Feasibility Phase Cost Estimate

WBS#	Description	Cost
JAA00	Feas – Surveys and Mapping	$39,500
JAB00	Feas – Hydrology, Hydraulic and Coastal Studies/Report	$87,000
JAC00	Feas – Geotechnical and Structural Studies/Report	$31,500
JAE00	Feas – Engineering and Design Analysis Report	$15,500
JB000	Feas – Socioeconomic Studies	$19,900
JC000	Feas – Real Estate Analysis/Report	$2,700
JD000	Feas – Environmental Studies/Report (Except USF&WL)	$12,000
JE000	Feas – Fish & Wildlife Coordination Act Report	$1,900
JF000	Feas – HTRW Studies/Report	$18,700
JG000	Feas – Cultural Resources Studies/Report	$2,500
JH000	Feas – Cost Estimates	$2,500
JI000	Feas – Public Involvement Documents	$17,600
JJ000	Feas – Plan Formulation and Evaluation	$8,900
JK000	Feas – Draft Report Documentation	$15,500
JL000	Feas – Final Report Documentation	$16,400
JLD00	Feas – Technical Review Documents	$9,500
JM000	Feas – Washington Level Report Approval (Review Support)	$1,900
JPA00	Project Management and Budget Documents	$10,400
JPB00	Supervision and Administration	$9,500
Q0000	PED Cost Sharing Agreement	$2,600
	Subtotal	$326,000
	Contingencies at 10% of Subtotal	$32,600
	TOTAL	**$358,600**

6.6 Views of Other Resource Agencies

A scoping letter was sent by the USACE Detroit District to various Federal, state and local agencies and private interest groups (full listing of all the groups is provided in Appendix F). The scoping letter solicited comments to help in the identification of significant water resource issues and in the development of the Project Management Plan.

Views that have been expressed were obtained via telephone conversations and can be found in Appendix F. They are summarized as follows:

1. *Aquatic Resources (U.S. Fish & Wildlife Service (USFWS)):* Any proposed work at the harbor should be designed, scheduled and constructed in a manner so as not to disrupt any native aquatic resources in the area. The most likely resources requiring attention are native trout.
2. *Historic Resources (Wisconsin Historical Society):* Any proposed work at the harbor should be designed and constructed in a manner so as not to disrupt any historic resources in the area. Cornucopia Harbor appears on the Wisconsin Inventory of Historic Places and any modifications to the harbor or structures must respect this classification. Furthermore, many historic objects exist in the vicinity of the harbor and must be respected when constructing new structures or disposing of dredge material.
3. *Endangered Species (USFWS):* Preliminary comments from U.S. Fish and Wildlife Service indicate that there will likely be no impact to endangered species; however, additional analysis and surveys will likely be required in future phases of the project.
4. *Tribal Resources:(Ho-Chunk Nation, Lac de Flambeau Band of Lake Superior Chippewa, Sokaogon Chippewa (Mole Lake) Community of Wisconsin, Red Cliff Band of Lake Superior Chippewa Indians, St. Croix Chippewa Indians of Wisconsin, Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin, Bad River Band of Lake Superior Chippewa Indians of Wisconsin):* The above tribal communities have been contacted, but no response has been received.
5. *Commercial Impact (U.S. Department of Agriculture (USDA)):* Preliminary comments from the U.S. Department of Agriculture (USDA) Rural Development representatives indicate that significant impacts to commercial activity would need to be demonstrated to receive any type of grants or cost sharing agreements from USDA Rural Development.

6.7 Potential Issues Affecting Initiation of Feasibility Phase

1. Congressional appropriations for funding of the Federal portion; and
2. Identifying a local sponsor that is willing to cost share in the project.

7.0 RECOMMENDATIONS

A reconnaissance level study was undertaken to review the effectiveness of potential alternatives that would help reduce the rate of sedimentation in the navigation channel in the harbor at Cornucopia, WI. The alternatives are:

- *Alternative 1 – No Action:* For this alternative, Federally-supported maintenance dredging would not occur. The harbor channel would eventually be unusable. If reliable funding for maintenance dredging becomes available, this may become the preferred alternative over structural solutions. A review of other dredging solutions would be evaluated in the feasibility phase.

- *Alternative 2 – Jetty Extensions and Sediment Traps:* This alternative meets all objectives and has a BCR of 4.2.

- *Alternative 3 Jetty Extensions and Re-routing River Flow:* This alternative meets all project objectives and has a BCR of 3.0.

This investigation has demonstrated a Federal Interest in pursuing sedimentation and dredging solutions for Cornucopia Harbor, Wisconsin with both structural alternatives resulting in benefit-cost ratios greater than 1.0. Should a non-federal sponsor be identified as willing and able to participate in a feasibility study and a Letter of Intent (LOI) received, the District will request funds to develop a Project Management Plan (PMP) for the feasibility study in order to proceed with the feasibility cost sharing agreement (FCSA).

The recommendations contained herein reflect the information available at this time and current departmental policies governing the formulation of individual projects. They do 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 higher authority for authorization and/or implementation funding.

Date: 31AUG12

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