NATURAL RESOURCE TECHNOLOGY
ENVIRONMENTAL CONSULTANTS

23713 W. PAUL ROAD, SUITE D
PEWAUKEE, WI 53072
(P) 262.523.9000
(F) 262.523.9001

July 24, 2012
(2098)

Ms. Margaret Gielniewski
Remedial Project Manager
United States Environmental Protection Agency (USEPA), Region 5
77 W. Jackson Boulevard – SR-6J
Chicago, IL 60604-3590

RE: Engineering Evaluation / Cost Analysis: Non-Time-Critical Sediment Removal Action
Marinette Former Manufactured Gas Plant Site, Marinette, Wisconsin
USEPA ID No.: WIN000509952

Dear Ms. Gielniewski:

On behalf of Integrys Business Support, LLC (IBS), managing Wisconsin Public Service Corporation's Marinette Former Manufactured Gas Plant (MGP) Site, please find enclosed the Engineering Evaluation / Cost Analysis (EE/CA) Report for a non-time-critical removal action to address Menominee River sediments impacted by MGP residuals. This submittal was authorized by USEPA's EE/CA Approval Memorandum dated April 26, 2012.

If you have any questions, please contact Mr. Naren Prasad at IBS (312-240-4569).

Sincerely,

NATURAL RESOURCE TECHNOLOGY, INC.

Eric J. Tlachac, PE
Senior Engineer/ Project Manager

Jennifer M. Kahler, PE
Senior Engineer

Encl: (2 hard copies including 2 CDs, EE/CA Report)

cc: Mr. Naren Prasad, IBS (electronic only)

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Engineering Evaluation/Cost Analysis Report
Non-Time Critical Sediment Removal Action
Revision 0
Former Marinette MGP Site
Marinette, Wisconsin

July 24, 2012

NRT Project Number: 2098

NATURAL RESOURCE TECHNOLOGY

ENVIRONMENTAL CONSULTANTS

EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) Report addresses contaminated sediment within the Menominee River, associated with the former manufactured gas plant (MGP) site located in Marinette, Wisconsin (Figure 1), formerly owned by Wisconsin Public Service Corporation (WPSC), a subsidiary of Integrys Energy Group. It was prepared in accordance with USEPA's "Guidance on Conducting Non-Time Critical Removal Actions under CERCLA", EPA/540-R-93-057, Publication 9360.32, PB 93-963402, dated August 1993

The goals of the EE/CA are to: identify removal action objectives and alternatives; provide a detailed evaluation of the effectiveness, implementability, and cost of the alternatives being evaluated; closely document the selection process of the preferred removal action alternative; ensure evaluations comply with environmental regulations; and allow the public an opportunity to provide comments during the selection process.

Site Background

The Marinette Site is one of six former MGP sites being addressed by WPSC in a Settlement Agreement and Administrative Order on Consent (Settlement Agreement) for Remedial Investigations and Feasibility Studies (RI/FS), CERCLA Docket No. V-W-06-C-847effective May 5, 2006. Under the RI/FS Settlement Agreement, sediment at the Marinette Site has been investigated in accordance with the USEPA-approved Site-Specific Work Plan, Revision 3, dated May 7, 2012. This EE/CA is based on data from that investigation.

The former MGP was located within 700 feet of the Menominee River (Figure 2). MGP residuals in the Menominee River likely migrated from the MGP via a former slough that drained into the Menominee River at approximate river mile 185+00 (United States Army Corps of Engineers [USACE]) through what is now the City of Marinette's Boom Landing boat launch facility (Figure 3). Previous site investigation data suggest that upland MGP residuals do not actively contribute to condition of river sediments at this time.

Removal Action Objectives

The purpose of this non-time-critical removal action is to address potential impacts to benthic organisms and recreational human exposure pathways.

The scope of the removal action is removal of non-aqueous phase liquid (NAPL) and targeted removal of polycyclic aromatic hydrocarbon (PAH) concentrations.

For purposes of the EE/CA, the discussion of PAH concentrations focuses on total PAH(13) results compared to the generic sediment screening value of 22.8 mg/kg total PAH(13) (Figure 4), which was selected as a reference screening valued because the ongoing baseline risk assessment associated with the RI has not been finalized. When the baseline risk assessment is complete, it is anticipated the site-specific risk-based level will be higher than the generic value used for this removal action, making this removal action compatible with any future long-term actions and corresponding cleanup levels.

Removal Action Alternatives (RAA)

The focused approach used in this EE/CA identifies three possible general response options, namely:

- Dredging and Disposal
- Dredging and Capping
- Capping

The removal action alternative selected includes dredging and off-site disposal of the NAPL-containing sediments and the adjacent sediments containing PAHs (all of Area 1, Figure 4), as well as upstream near-shore sediments containing PAHs located near Nest Egg Marine (Area 2, Figure 4). The projected dredge volume is approximately 6,945 cubic yards.

Due to the presence and pervasive nature of wood debris in the sediment, dredging would be accomplished by mechanical methods, in the wet is assumed, employing a temporary sheet pile cofferdam or other containment system surrounding the NAPL-containing sediments and adjacent PAH-containing sediments. The temporary containment system would be designed to effectively contain suspended sediment and NAPL in the work area so that downstream impacts from these dredging residuals would be minimized or avoided altogether. Silt curtains would be employed for this purpose in any areas dredged outside of the temporary containment system.

Dredging would be followed by placement of a minimum 6-inch sand layer to manage dredging residuals. Dredged sediment would be stabilized on site with amendments, if required, and loaded for off-site disposal. Contact water generated during dredging/dewatering activities would be treated on site and then discharged to the Menominee River.

USEPA will select the final removal action alternative to be implemented in an Action Memorandum after public comments and evaluation.

The removal action is tentatively scheduled to be implemented no later than October 2012.

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ABBREVIATIONS / ACRONYMS

AOC	Administrative Order on Consent
ARAR	applicable relevant and appropriate requirement
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
COPC	constituent/contaminant of potential concern
cfs	cubic feet per second
DGPS	differential global positioning system
EE/CA	Engineering Evaluation/Cost Analysis
FEMA	Federal Emergency Management Agency
FS	feasibility study
MGP	manufactured gas plant
msl	mean sea level
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRT	Natural Resource Technology, Inc.
PAH	polycyclic aromatic hydrocarbon
RAAs	removal action alternatives
RCM	reactive core mat
RI	remedial investigation
SSWP	site-specific work plan
TBC	to be considered
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation
WWTP	wastewater treatment plant

1 INTRODUCTION

1.1 Overview

This Engineering Evaluation/Cost Analysis (EE/CA) Report addresses the former manufactured gas plant (MGP) site located in Marinette, Wisconsin (Figure 1), formerly owned by Wisconsin Public Service Corporation (WPSC), a subsidiary of Integrys Energy Group. Specifically, this EE/CA addresses contaminated sediment within the Menominee River, associated with the former MGP, as described in USEPA's EE/CA Approval Memorandum, dated April 26, 2012. This EE/CA Report has been prepared in accordance with "Guidance on Conducting Non-Time Critical Removal Actions under CERCLA", EPA/540-R-93-057, Publication 9360.32, PB 93-963402, dated August 1993. Relevant guidance documents are referenced in Section 6.

The goals of the EE/CA are to: identify removal action objectives and alternatives; provide a detailed evaluation of the effectiveness, implementability, and cost of the alternatives being evaluated; closely document the selection process of the preferred removal action alternative; ensure evaluations comply with environmental regulations; and allow the public an opportunity to provide comments during the selection process.

The Marinette Site is one of six former MGP sites being addressed by WPSC in a Settlement Agreement and Administrative Order on Consent (Settlement Agreement) for Remedial Investigations and Feasibility Studies (RI/FS), CERCLA Docket No. V-W-06-C-847effective May 5, 2006. Under the RI/FS Settlement Agreement, sediment at the Marinette Site has been investigated in accordance with the USEPA-approved Site-Specific Work Plan, Revision 3, dated May 7, 2012. This EE/CA is based on data from that investigation, completed in accordance with applicable federal regulations, including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund) as amended by SARA and the National Contingency Plan (NCP).

1.2 Site Characterization

As part of the RI/FS planning process, the available data was summarized in the *Completion Report, Former Marinette Manufactured Gas Plant Site, Marinette, Wisconsin*, prepared by NRT, dated May 11, 2009, and in the *Site-Specific Work Plan – Revision 3 (SSWP), Former Marinette Manufactured Gas Plant Site, Marinette, Wisconsin,* prepared by NRT, dated May 7, 2012 which contains a full bibliography

of the previously prepared reports. The *Completion Report* and *SSWP* are publically available and provide site characteristics based on physical, chemical, demographic and other available data for the site and surrounding areas. The data provides background engineering information for evaluating removal action alternatives.

For the purposes of this document, the following definitions will be used herein:

- Property – Refers to the land formally owned by WPSC purchased by the City of Marinette (Figure 2).
- Site – Refers to areas where contamination related to the former MGP has been discovered through site investigation activities completed to date and nearby areas necessary for implementation of the removal action. These areas include the Upland Portion of the Site and the River Portion of the site (Figure 2).
- Upland Portion of the Site – Refers to the former WPSC MGP structures and related areas where contamination related to the former MGP has been discovered in soil and/or groundwater.
- River Portion of the Site – Refers to near shore sediments within the Menominee River and overlaps into the Upland Portion of the Site because Boom Landing is necessary for implementation of the removal action. As previously discussed, the River Portion of the Site is the focus of this EE/CA.

1.2.1 Site Description and Background

The Property is located at T30N, R24E, Section 6, SE ¼, NE ¼, 1603 Ely Street, Marinette, Marinette County, Wisconsin. The former MGP encompassed approximately four acres and is currently owned by the City of Marinette (City). The City operates a wastewater treatment plant (WWTP) at this property. The WWTP property is bounded on the north by Mann Street and railroad tracks, on the southwest by Ludington Street and then Ely Street on the southeast (Figure 2).

The former MGP was located within 700 feet of the Menominee River. MGP residuals in the Menominee River likely migrated from the MGP via a former slough that drained into the Menominee River at approximate river mile 185+00 (United States Army Corps of Engineers [USACE]) through what is now the City of Marinette's Boom Landing boat launch facility (Figure 2). Previous site investigation data suggest that MGP residuals from the Upland Portion of the Site do not actively contribute to condition of river sediments at this time.

The River Portion of the Site is located approximately 2 miles from the river mouth draining into Lake Michigan. The River Portion of the Site includes a portion of the area between Boom Landing and

Strawberry Island (Figure 2). Strawberry Island is located approximately 400 feet north of Boom Landing. Strawberry Island is heavily vegetated and approximately 830 feet long by 150 feet wide (at its widest point) and surrounded by wood pylons, that have tipped over and many have deteriorated. This island has been mistakenly referred to as Boom Island in some previous reports.

The Menominee River is a gaining stream that receives groundwater and surface water from the Marinette area and discharges into Lake Michigan. The river separates Wisconsin from Michigan's Upper Peninsula along the northeast boundary of Wisconsin. The river is approximately 118 miles long as it flows into Lake Michigan. The drainage area for the Menominee River is 4,070 square miles according to the United States Geological Survey (USGS). Water depths in the River Portion of the Site range from 1 to 15 feet according to bathymetric survey conducted in November 2011. The river is approximately 1,075 feet wide near the River Portion of the Site.

The USGS had a stream monitoring station (USGS 04067651) in the mouth of the river until October 1995. The total flow from November 1994 until October 1995 was 36,933 cubic feet per second (cfs) with the greatest monthly flow of 5,585 cfs (May 1995) and the lowest monthly flow of 1,920 cfs (February 1995). The average daily flow during this period was 3,085 cfs.

Currently, the closest USGS stream monitoring station (USGS 04067500) to the Site is 18 miles upstream. The total flow at this station from October 1994 to September 1995 was 35,522 cfs with the greatest monthly flow of 5,391 cfs (May 1995) and the lowest monthly flow of 1,854 cfs (February 1995). The average daily flow during this period was 2,570 cfs. The total flow from September 2007 to September 2008 (most recent data) was 31,199 cfs with the greatest monthly flow of 7,786 cfs (April 2008) and the lowest monthly flow of 1,170 cfs (September 2008). The average daily flow during this period was 2,668 cfs.

The 1978 Federal Emergency Management Agency (FEMA) map (included in Appendix A of the *SSWP*) indicates the 100 year floodplain is at Elevation 585 feet above mean sea level (msl, referenced to the National Geodetic Vertical Datum of 1929).

1.2.2 Previous Removal Actions

The River Portion of the Site has had limited removal actions since the initial sediment investigation. In 2003, on behalf of the City of Marinette, Ayers Associates, Inc. drilled a boring in the excavation area for a new ramp at the boat launch and found no evidence of MGP residuals. However, subsequent near-shore upland surveys of the Boom Landing area (including three borings in the ramp excavation area and

four geotechnical borings upstream along the shore), performed on behalf of WPSC, found traces of MGP residuals in one boring in the excavation area. Because trace amounts of MGP residuals were discovered in the ramp excavation area, WPSC provided a field person to assist the contractor, Phenco Incorporated, in managing excavated soils with MGP residuals during ramp excavation and construction. A small amount of MGP residuals were encountered in an excavation for electrical lines (NRT field notes, 2003). This material was drummed and disposed of at the Waste Management Landfill in Menominee, Michigan.

1.2.3 Source, Nature, and Extent of Contamination

This section presents a summary of the documents discussing the previous investigations performed between 1995 and 2003. In addition, this section presents a summary of the nature and extent of contamination in the River Portion of the Site based on the data collected between November 2011 and May 2012 (in accordance with the USEPA-approved *SSWP*).

1.2.3.1 Previous Investigations

As summarized in the *Completion Report* and *SSWP*, multiple sediment investigations have been performed in the River Portion of the Site. Detailed information of the sediment investigation activities and results are discussed in the following documents, listed in chronological order:

- Natural Resource Technology, Inc., October 1996, Sediment Investigation Report Former Manufactured Gas Plant Located In Marinette, Wisconsin
- Natural Resource Technology, Inc., November 2002, Sampling and Analysis Plan Menominee River, Marinette, Wisconsin, Former Manufacturing Gas Plant, Marinette, Wisconsin
- November 2002 Phase I Activities
- Natural Resource Technology, Inc., March 2003, Letter to Cathy Rodda, Wisconsin Department of Natural Resources (WDNR), Phase 2 Sediment Sampling Results from Boom Landing, Marinette, Wisconsin

Additional sediment investigation was conducted November 2011 through May 2012 in accordance with the USEPA-approved *SSWP* to further define the extent of MGP residuals and evaluate potential risk associated with the River Portion of the Site. All sampling work was performed in accordance with the USEPA-approved Multi-Site Field Sampling Plan, Revision 4, dated September 8, 2008, and the Multi-Site Quality Assurance Project Plan, Revision 2, dated September 4, 2007. The investigation included the following elements relevant to this EE/CA:

Bathymetric Survey: Enviroscan, Inc. from Lancaster, Pennsylvania conducted a combined hydrographic and side scan sonar survey at the site on November 15, 2011 using standard and/or routinely accepted practices of the geophysical industry and equipment representing the best available technology.

The bathymetric survey extended a distance of approximately 1,900 lineal feet in the vicinity of the former MGP. The western-most survey boundary is approximately 500 feet upstream of the western edge of Strawberry Island, just downstream of the HWY 41 Bridge. The eastern-most survey boundary is approximately 500 feet downstream of the eastern edge of Strawberry Island. The northern-most survey boundary will be the approximate center of the river, except for the area west of Strawberry Island where the bathymetry extended across river to the Michigan shoreline. Based on a river width of approximately 1,100 feet, this equated to a survey area of about 31 acres.

The bathymetric survey results are provided on the basemap of Figures 3 through 6 and have been used to evaluate potential dredging volumes.

Sediment Poling: Sediment poling using a 2-inch diameter aluminum pole, was performed at each sediment sampling location shown on Figures 3 through 6 to measure the river water depth (i.e., depth to river bottom) and relative thickness of soft sediment. The sediment poling results were compared to the results of the bathymetric survey and used to assist with identifying sediment sampling locations. In addition, sediment poling results were used to develop human health and ecological (i.e., probing birds) exposure assumptions (i.e., how deep into sediments a person may sink while wading, what areas are available for probing birds).

River Sediment Sampling: Soft or loose non-native river sediment samples and native material (native material refers to all materials below the soft sediments) samples were collected to achieve the following:

- Evaluate “ambient” sediment conditions and potential off-site sources of contaminants
- Evaluate the vertical and horizontal contaminant distribution within river sediments through chemical analysis of sediment samples
- Evaluate the presence and characteristics of MGP residuals (NAPL) visually observed in any sample interval
- Evaluate appropriate remedial action option/alternatives (e.g., geotechnical and waste disposal characterization) to support a feasibility study

River sediment sampling was also performed to support a human health and ecological risk assessment. These data will be presented in the RI Report for the Marinette Former MGP and have not been used to support the EE/CA.

Soft sediment samples were collected using a vibrocore mounted on a pontoon boat. Sample locations were recorded using a differential global positioning system (DGPS) unit and are shown on Figures 3 through 6. The sediment cores were subdivided into the following intervals:

- 0 to 6 inches below mudline (river bottom)
- 6 to 18 inches below mudline
- 18 to 30 inches below mudline
- 30 to 42 inches below mudline
- 42 to 54 inches below mudline, etc.

The 0 to 6 inch below mudline interval was collected to assess concentrations to which the benthic community is exposed. Below this surficial 6-inch interval, the core continued to be subdivided in one-foot intervals to the bottom of the core. If the last interval was less than 4 inches in thickness, it was added to the previous interval; if the last interval was greater than 4 inches, it was analyzed as a separate interval. If additional sample volume was required to analyze the constituents of potential concern (COPCs), an additional push core sample, co-located to the original core, was collected. Each interval was homogenized in dedicated disposable plastic bags. Samples for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) were collected prior to homogenization to minimize volatilization. If an additional push core was advanced to achieve the required sediment volume, the respective intervals from the push core and vibrocore samples were homogenized.

Cores which exhibited visible evidence of non-aqueous phase liquid (NAPL, oil-coated or oil-wetted) in all intervals were not analyzed, as these cores will be considered affected by MGP residuals, and thus will be addressed as part of a removal or remedial action. Core intervals below visually affected materials or core intervals without visual evidence of NAPL throughout the entire core were analyzed for COPCs and total organic carbon.

Native material samples were collected using a mud rotary drill rig mounted on a barge. Sample locations were recorded using a DGPS unit and are shown on Figures 3 through 6. Using the DGPS unit, the barge re-occupied soft sediment locations identified for native material sampling. The native material borings were sampled continuously using a split-spoon sampler to refusal and processed and analyzed as

described for the soft sediment cores. The maximum depth of the native material borings was 12.5 feet. All native material borings were abandoned with bentonite chips to avoid creating a preferential pathway through native material to bedrock.

MGP residuals in the form of NAPL were observed in the area immediately adjacent to the mouth of the former slough as shown by the sediment cores highlighted on Figure 3. The approximate extent of the NAPL is approximately 31,600 square feet. NAPL was observed in sediment cores ranging from the mudline surface (at T05HH3, just west of the boat ramp) to the top of bedrock (approximately 6 to 10 feet below mudline just west of the former slough), as shown on the cross sections (Figures 5 and 6). A consolidated silt layer was typically observed in cores east of the boat ramp between the shore and the navigational channel limits. However, this layer was absent in cores west of the boat ramp, in the cove near the outfall of the former slough, and NAPL was observed to the top of the bedrock.

Boring logs for soft sediment and native material borings, performed in 2011 and 2012, are included in Appendix A.

1.2.3.2 Analytical Data

This section provides a summary of the sediment data that were collected in the River Portion of the Site between 2011 and 2012 in accordance with the USEPA-approved *SSWP* that have been used to support this EE/CA Report. Analytical data are summarized on Tables 1 through 3. Analytical laboratory reports are included in Appendix B.

The standard suite of constituents for both soft sediment and native material samples included; polycyclic aromatic hydrocarbons (PAHs, 16 total), BTEX, metals (aluminum, antimony, copper, iron, manganese, nickel, silver, vanadium, and zinc), and total organic carbon (TOC). PAHs, BTEX, and metals were analyzed by Pace Analytical Services in Green Bay, Wisconsin, and TOC was analyzed by Test America in Burlington, Vermont. Select samples were also submitted to Pace Analytical Services for analysis of 34 PAHs and/or Test America for analysis of black carbon. Samples analyzed for 34 PAHs were selected to clarify if impacts were MGP-related or a result of impacts from other sources (e.g. petroleum). Samples analyzed for black carbon will be used in the baseline risk assessment that will be included in the RI Report.

A limited amount of soft sediment samples did not provide sufficient material for analysis of the complete suite of constituents (i.e. PAHs, BTEX, metals, and TOC) due to the sample consisting of mostly wood debris or coarse-grained material. When the sample volume limited the constituents that could be

analyzed, sample analysis was performed in the following order of importance; PAHs, BTEX, metals, and TOC.

As part of the RI Report, a baseline risk assessment will be performed to develop a site-specific risk-based sediment level incorporating results of toxicity testing, bulk chemistry concentrations, TOC, and black carbon. For purposes of the EE/CA, the discussion of analytical results focuses on total PAH results compared to the generic sediment screening value of 22.8 mg/kg total PAH(13), which was selected as a reference screening valued because the baseline risk assessment has not been finalized. The table below summarizes sediment samples that reported a total PAH(13) concentration above 22.8 mg/kg.

Totals PAHs(13) Exceeding Screening Level

Location (Depth)	Total PAHs (mg/kg)	Location (Depth)	Total PAHs (mg/kg)
T01A (2.5-3.5)	49.8	T05HH1 (0-0.5)	743.4
T01A (3.5-4.5)	82.3	T05HH1 (0.5-1.3)	3,201.8
T01A1 (0.5-1.5)	127.6	T05HH3 (0-0.5)	188.3
T02A4 (0-0.5)	26.2	T05N (0-0.5)	24.8
T03A3 (3.5-4.5)	26.2	T05N (0.5-1.5)	61.2
T03A3 (4.5-4.9)	3,708.8	T05N (1.5-2.5)	913.8
T03E (0-0.7)	2,668.0	T05N2 (0.5-1.5)	25.6

Location (Depth)	Total PAHs (mg/kg)	Location (Depth)	Total PAHs (mg/kg)
T03HH (1.5-2.5)	38.9	T05N2 (1.5-2.2)	75.7
T03HH (2.5-3.5)	107.0	T06A (0.5-1.5)	34.3
T03HH-NATIVE (2-2.5)	232.3	T06A (2.5-3.2)	91.4
T03HH-NATIVE (2.5-4.5)	1,739.8	T06A1 (0.5-1.7)	437.6
T04A (0-0.5)	186.6	T06D (0-0.5)	31.9
T04A (0.5-1.7)	478.9	T06D (1.5-2.5)	28.7
T04HH (0-0.5)	3,587.4	T06HH1 (0-0.5)	83.7
T04HH (0.5-1.5)	6,434.7	T06HH1 (0.5-1)	64.9
T04N (0-0.5)	2,497.0	T06HH1-NATIVE (0-0.5)	66.2
T04N (0.5-1.5)	1,304.6	T06HH1-NATIVE (0.5-2.5)	1,422.3
T04N (1.5-2.5)	1,670.7	T06HH1-NATIVE1 (3.5-4.5)	263.2
T04N (2.5-3.5)	2,439.9	T07A1 (0-0.5)	334.5
T04N (3.5-4.5)	1,526.6	T07A1 (0.5-1.5)	243.0
T04N (4.5-5.2)	270.5	T07A1 (1.5-2)	80.9
T04N-NATIVE (4-5)	4,086.3	T07A2 (0-0.5)	146.4
T04N-NATIVE1 (10-10.5)	1,605.2	T07N (0-0.5)	25.9
T04NR (0-0.5)	2,017.4	T08A2 (0-0.5)	169.6
T04NR (0.5-1)	2,357.1		
Location (Depth)	**Total PAHs (mg/kg)**		
T04SW3 (0-0.5)	407.1		
T04SW3 (0.5-1.5)	474.1		
T04SW3R (0-0.5)	408.0		
T04SW3R (0.5-1.4)	297.2		
T04SW4 (0-0.5)	32.0		

Notes: 1) Only locations where Total PAHs exceed the screening level (22.8 mg/kg) are included.

2) Results have been rounded

Sediment with total PAH(13) concentrations above 22.8 mg/kg are shown on Figure 4 and summarized by area below:

Area	Location	Number of Samples Defining Area	Sample Depths (feet below mudline)	Total PAH(13) Concentration Range, mg/kg	Size, sf
1	Immediately adjacent to the mouth of the former slough and outside of the NAPL extent	48	0-10.5	25-6,435	47,800
2	Upstream of the former slough, in the channel adjacent to Nest Egg Marine	3	0.5-4.5	50-128	6,730

PAH concentrations in samples T06D (0-0.5), T06D (1.5-2.5), and T02A4 (0-0.5) may not be related to the MGP because these areas are disconnected from the former slough outfall (Area 1), exhibit low concentrations of PAHs, close to the generic screening levels, and are relatively shallow. These impacts are insignificant to the overall Menominee River benthic ecosystem. In addition, the pending baseline risk assessment, to be submitted with the RI Report, will likely indicate a site-specific risk based value higher than the generic screening level based on preliminary results. Considering these aspects, the locations of T06D and T02A4 were not considered for this removal action.

1.2.3.3 Streamlined Risk Evaluation

This section provides a streamlined risk evaluation to help identify current or potential exposures to contaminated sediment located near Boom Landing which can be prevented. Based on the USEPA-approved Conceptual Site Model presented in the *SSWP*, there are potentially complete pathways for recreational users and benthic invertebrates. These receptors and the pathways will be further evaluated in the baseline risk assessment to be included in the RI Report.

Recreational User

Under current land use conditions, recreational use by visitors to the area would be primarily focused in the area of the boat landing and Menominee River.

There are obvious entry points into the Menominee River adjacent to the boat launch docks. There is no beach and the Menominee River in the vicinity of the site is primarily used for fishing by boat. The likelihood of wading and contacting sediment is limited directly to the boat launch area because the depth of water and current in other areas of the Menominee River. The water depth along the shoreline of the river adjacent to the River Portion of the Site is generally greater than 5 feet in depth with the exception of the boat launch. Therefore, water depths would preclude wading into the river other than at the boat launch. The water depth drops quickly from the riverbank to depths greater than 10 feet deep a short distance from shore. An exception to this is a relatively small area adjacent to the boat landing, where water depth ranges from 2 to 4 feet deep within approximately 5-10 feet from the shoreline. Water depths vary greatly in this area with drop offs as deep as 10 feet, making wading treacherous. Outside this zone water depths drop quickly to greater than 5 feet in depth.

MGP residuals have been observed in the near-shore sediment in the vicinity of the former slough located adjacent to the boat landing. The potential for human exposure to these materials is expected to be minimal (see detailed discussion below). Near the boat landing, the primary recreational water activities anticipated to occur are launching of fishing and other recreational watercraft at the boat landing, and limited fishing from a boat or shore. The boat landing is well maintained with concrete ramps extending into the water, and a concrete lining extends up the banks of the river on both the upstream and downstream edges of the boat landing area. The boat landing has two well maintained docks to moor boats. Recreational boaters are not anticipated to be exposed to the sediments in the vicinity of the former slough while launching their boats due to the characteristics of the boat landing (i.e., concrete ramp) and the physical distance separating the boat launch from the former slough. Poling measurements collected in November 2011 indicate the concrete boat ramp extends into the river beyond the shallow water depth of 3.5 feet. Sediments encountered at the end of the boat ramp were in approximately 5-feet of water. As such, recreational users of the boat launch are not expected to encounter sediments while launching, retrieving, or cleaning boats.

Anglers have been observed fishing in the area where contaminated sediments have been documented within the Menominee River. Regarding the characteristics of fishing in the area where contaminated sediment are present the following is anticipated:

- Anglers potentially frequent the area a few days a week over the warmer months of the year when the river is open and contact with sediments possible; so the potential for exposure is limited to that period of time.

- The amount of time that recreational users would be fishing in the area with contaminated sediments would be limited by the small size of the area affected, and the fact that most anglers launching a boat do not fish in this area, but rather pass through the area on their way downstream to fish in Lake Michigan for salmonid species of game fish. Also, for safety sake and as a courtesy to others loading or unloading their water craft, most anglers do not fish in the area of the boat launch.

- While there would be some limited fishing from shore near the boat landing, the potential for sediment exposure would be minimized by the depth of water, which is generally over 5 feet near the shore.

- The MGP-related COPCs that are present in the river would not be expected to bioaccumulate in the fish because the fish metabolizes them.

In general, anglers and other recreational watercraft users access the river by boat and would have limited exposure to surface water and sediments for the reasons described above. In addition, a notice is posted at the boat landing advising people to wash their hands if they would happen come in contact with noticeably contaminated material containing oil or tar. The posted notice consists of a yellow sign that has been placed in a conspicuous location near the boat landing in a picnic area, adjacent to the slough area, and states:

NOTICE

SEDIMENTS CONTAIN RESUDUALS FROM THE OPERTATION OF A MANUFACTURED GAS PLANT FORMERLY LOCATED AT THIS SITE.

SHOULD OIL OR TAR SUBSTANCE OBSERVED AS A SHEEN ON THE WATER SURFACE COME INTO CONTACT WITH SKIN, IMMEDIATELY WASH OFF WITH SOAP AND WATER.

FOR INFORMATION CONTACT WISCONSIN PUBLIC SERVICE CORPORATION 800-450-7260.

Considering the characteristics of the boat landing and the notification sign, the likelihood for recreational visitors to contact contaminated sediments is quite low. If they would contact such materials, they would be advised to wash off the material and thereby minimize their exposure.

Benthic Invertebrates

MGP residuals were detected in sediment samples collected in the Menominee River above generic ecological screening levels. Benthic invertebrates form the base of many food chains and spend most or all of their life-cycle burrowed or feeding just at the interface between surface water and sediment. As part of the *SSWP* development, samples were collected to determine qualitatively the abundance of benthic invertebrates that were present. Based on these samples, a variety of benthic invertebrates exist in the river. Therefore, there are potential risks to benthic invertebrates associated with sediment exposures from the Menominee River.

No Applicable or Relevant and Appropriate Requirements (ARARs) specific to sediment exist in Wisconsin. As discussed in sections above, a site-specific risk based level will be developed as part of the baseline risk assessment included in the RI Report. The goal for managing the sediment is to address the effects of NAPL in the sediment and total PAH(13) concentrations that exceed the generic ecological screening level of 22.8 mg/kg. When the baseline risk assessment is complete it is anticipated the site-specific risk-based level will be higher than the generic value used for this removal action, making this removal action compatible with any future long-term actions and corresponding cleanup levels.

2 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

This section identifies the scope, goals, and objectives for a non-time-critical removal action. In particular, this section is used to identify applicable statutory limits, justify for the proposed action, define the applicable or relevant and appropriate requirements (ARARs), and identify ARARs for the removal action.

2.1 Statutory Limits on Removal Actions

The $2 million and 12-month statutory limits do not apply to this removal action because it is not Fund-financed.

2.2 Scope and Purpose

The purpose of this non-time-critical removal action is to address potential impacts to benthic organisms and recreational human exposure pathways associated with the River Portion of the Site. The scope of the removal action is removal of NAPL and targeted removal of PAH concentrations in sediment.

The specific objectives that define the scope of the removal action were developed to achieve the overall objective of protecting human health and the environment. The specific removal action objective for the River Portion of the Site is summarized as follows:

- Remove NAPL- and PAH-contaminated sediments that have the potential to effect human health and ecological receptors

This objective addresses human health and ecological risks, as well the reduction of mobility, and quantity of residuals remaining after treatment and/or removal.

2.3 Applicable Relevant and Appropriate Requirements (ARARs)

Removal actions conducted under CERCLA are required to meet ARARs "to the extent practicable, considering the exigencies of the situation" [Section 104(a)(2)]. ARARs are defined as:

Any cleanup standards, standard of control, environmental protection requirements, criterion, or limitation under any Federal or State environmental law that specifically addresses a hazardous substance, pollutant, contaminant, remedial action, or location.

Promulgated State Standards that are more stringent than the Federal Standards may be an ARAR. In addition to ARARs, the USEPA may identify other relevant information, criteria, or guidance to be considered (TBC). TBCs may not be legally binding or enforceable but may be useful in developing remedial alternatives. Both ARARs and TBCs may be chemical-specific, location-specific, or action-specific.

Chemical-specific ARARs are generally health or risk based standards that define concentration limits for environmental media or discharges.

Location-specific ARARs are based on the site's characteristics or location including natural site features such as wetlands, floodplains, and endangered or threatened species and habitats. Location-specific ARARs may also apply to man-made features such as cultural resource areas.

Action-specific ARARs are technology-based or activity-based limits that guide how the remedial action will be implemented or how remedial waste may be handled.

Table 4 summarizes preliminary federal and state ARARs and TBCs. The ARARs and TBCs may be modified until a Record of Decision (ROD) is issued and may be reexamined during the five-year review process.

2.4 Removal Action Schedule

The proposed schedule for the removal action is summarized below, and will be finalized after approval of the EE/CA Report for the River Portion of the Site. The removal action is tentatively scheduled to be implemented no later than October 2012.

Table 2-1. Tentative Removal Schedule

Task	Schedule Date
Submit EE/CA Report to EPA	July 25, 2012
EPA Publishes Notice in the Local Newspaper	July 31, 2012
Public Comment Period (30-day period)	July 31 - August 31, 2012
USEPA Response to Public Comments and Issues Action Memorandum	September 7, 2012
AOC for Removal Design/Action Signed by USEPA	September 12, 2012
WPSC to Initiate Removal Action	October 1, 2012

3 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The streamlined approach used in this EE/CA eliminates the technology identification and screening steps by using presumptive remedies in the remedy selection process. Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and USEPA's scientific and engineering evaluation of performance data on technology implementation (USEPA, 1993b).

3.1 General Response Options and Removal Action Alternatives

In this section, remedial action technologies and process options that are considered for the sediment are defined into general response options. The focused approach used in this EE/CA identifies three possible general response options, namely:

- Dredging and Disposal
- Dredging and Capping
- Capping

Based upon removal action objectives and site conditions identified in Section 2, these general response options were further refined into the following specific removal action alternatives (RAAs):

- RAA-01: Dredging and Disposal
  - RAA-01A: NAPL (portion of Area 1)
  - RAA-01B: NAPL and Adjacent and Near-Shore PAHs (Areas 1 and 2)
- RAA-02: Dredging and Capping
- RAA-03: Capping

These alternatives are described in further detail below and were evaluated for short- and long-term aspects of the following criteria:

- Effectiveness: the level of protection of public health and the environment achieved by the alternative expressed in the terms of:
  - Short-term effectiveness, considering:
    - Protection of the community
    - Protection of site workers
    - Environmental impacts
    - Time required to achieve removal action objectives
  - Long-term effectiveness and permanence, considering:
    - Magnitude of risk posed by waste and/or residuals remaining following completion of the removal action
    - Adequacy and reliability of alternative
  - Compliance with ARARs
  - Reduction of toxicity, mobility, or volume through treatment
- Implementability: the feasibility of the alternative expressed in the terms of:
  - Technical feasibility, considering:
    - Construction and operation requirements
    - Technology maturity and reliability
    - Suitability to site environmental conditions
    - Contribution to long-term remedial performance
    - Ability to measure and monitor effectiveness
  - Administrative feasibility, considering:
    - Permits and waivers required
    - Easements or access agreements required
    - State Agency acceptance
    - Community acceptance
  - Availability of services and materials needed, considering:
    - Personnel and technology
    - Off-site treatment, storage, and disposal
    - Other support services and materials

- Cost: expressed in the terms of:
  - Direct capital costs
  - Indirect capital costs
  - Present worth of annual operation and maintenance and/or post-removal site control costs

These evaluations were conducted consistent with the USEPA-approved Multi-Site Feasibility Study Revision 1, dated March 26, 2010, and then used to the screen the alternatives for the comparative analysis.

3.2 Dredging and Disposal RAAs

RAAs-01A and B consist of sediment dredging and disposal at an appropriately-licensed and permitted disposal facility. Due to the presence and pervasive nature of wood debris in the sediment, dredging would be accomplished by mechanical methods, in the wet is assumed, employing a temporary sheet pile cofferdam or other containment system[1] surrounding the NAPL-containing sediments and adjacent sediments containing PAHs. The temporary containment system would be designed to effectively contain suspended sediment and NAPL in the work area so that downstream impacts from these dredging residuals would be minimized or avoided altogether. Silt curtains would be employed for this purpose in any areas dredged outside of the temporary containment system.

Dredging in the dry would significantly complicate the design and construction of a temporary sheet pile cofferdam due to the relatively shallow bedrock depth beneath the Menominee River and resulting low sheet pile embedment depths. Temporary bypass of the City of Marinette WWTP and storm sewer outfalls present in the area of NAPL-containing sediments would also be necessary to facilitate dry removal, whereas bypass may not be necessary for wet removal (subject to further analysis). Further, wet dredging has been successfully accomplished at other sites where river sediments were impacted by MGP residuals, including NAPL. Consequently, dry dredging was not considered for this removal action.

Dredging would be followed by placement of a minimum 6-inch sand layer to manage dredging residuals. Dredged sediment would be stabilized on site with amendments, if required, and loaded for off-site disposal. Contact water generated during dredging/dewatering activities would be treated on site and then discharged to the Menominee River.

[1] For cost estimating purposes a sheet pile cofferdam system was assumed as the containment system.

3.2.1 RAA-01A: NAPL

RAA-01A would address only the NAPL-containing sediments located near and just upstream of the Boom Landing boat launch with a projected dredge volume of approximately 4,870 cubic yards.

Estimated costs for this RAA include post-removal monitoring until a final remedy and Record of Decision are established since PAHs in Areas 1 and 2 would not be addressed.

3.2.2 RAA-01B: NAPL and Adjacent and Near-Shore PAHs (Areas 1 and 2)

RAA-01B would address the NAPL-containing sediments and the adjacent sediments containing PAHs (all of Area 1), as well as upstream near-shore sediments containing PAHs located near Nest Egg Marine (Area 2). The projected dredge volume is approximately 6,945 cubic yards.

Estimated costs for this RAA do not include post-removal monitoring since it is anticipated that PAHs to be addressed in a final remedy would be addressed by this alternative.

3.2.3 Dredging and Disposal Effectiveness

The dredging and disposal RAAs could potentially subject the community and site workers to short-term exposure to the contaminated sediments, particularly through airborne dust and vapors. The RAAs would be designed and implemented to monitor for and mitigate these potential exposures.

The dredging and disposal RAAs could potentially also have adverse environmental impacts downstream of the removal action through suspension of NAPL and sediment containing PAHs in the water column. Specific measures to mitigate these potential impacts, including the use of a temporary sheet pile cofferdam or other containment system in the area where dredging of NAPL-containing sediments will occur (Area 1), the use of silt curtains where dredging of sediments containing only PAHs will occur (Area 2), and turbidity monitoring throughout the entire removal action area, would be incorporated into these RAAs.

The time required for the dredging and disposal RAAs to achieve the removal action objective is considered to be relatively short (within a few months). Placement of the sand layer to address residuals following dredging would expedite the time required to achieve the removal action objectives.

The dredging and disposal RAAs would achieve long-term effectiveness and permanence by removing the NAPL- containing sediments. RAA-01B is more effective at achieving the removal action objective as a result of additional mass removal. As with any environmental dredging project, it may not be practicable to achieve complete removal of these sediments due to potential suspension in the water column. Placement of the sand layer following dredging will accelerate natural deposition of the dredge residuals and mitigate any potential downstream impacts following removal of the temporary containment system.

The dredging and disposal RAAs would be designed to comply with the ARARs listed in Table 4.

The dredging and disposal RAAs would reduce the toxicity of the NAPL/PAH containing sediments through removal, but would not significantly promote treatment or volume reduction other than due to dewatering. Mobility would be reduced by placement of dredged sediments in a disposal facility engineered to contain and minimize the migration of leachate from these and other wastes to the extent required by current applicable solid waste rules and regulations.

3.2.4 Dredging and Disposal Implementability

The dredging and disposal RAAs are technically and administratively implementable. Dredging and disposal is a USEPA presumptive remedy for contaminated sediments, and has been previously approved by the WDNR for other projects addressing sediments contaminated with MGP residuals. Although CERCLA projects are exempted from State and local permitting requirements, these alternatives would still need to meet the substantive requirements of the associated permitting programs.

Disposal facilities, materials, and contractors required to implement the dredging and disposal RAAs are available. These RAAs would require adequate area, equipment, and materials to dewater sediment at the site, in preparation for transportation to the landfill. This is assumed to include a portable water treatment system, a stabilization pad, stabilization materials (e.g., cement kiln dust) and mixing equipment. Since WPSC does not own any land in the area targeted for the removal action, access agreements would be required for an upland area to support the removal action.

Dredging of the Menominee River is assumed to be moderately difficult due to the wood debris observed in the sediment. Placement of the sand layer can be implemented but would be difficult for the near-shore sediments containing PAHs (i.e., outside of the temporary containment system) due to the small area and swift current. Placement of the sand layer inside of the temporary containment system is achievable since any affects of the river current would be mitigated.

3.2.5 Dredging and Disposal Costs

The estimated 2012 net present worth cost of RAA-01A is approximately $5,993,000. Capital costs are estimated at approximately $5,732,000. Annual costs for monitoring are estimated at approximately $13,000.

The estimated capital cost of RAA-01B is approximately $6,493,000.

As described above, annual costs are assumed for RAA-01A only. Table 6 provides a summary of the overall costs to implement. Appendix C provides the unit cost and additional assumptions.

3.3 Dredging and Capping RAA

The dredging and capping RAA consists of dredging all of the NAPL-containing sediments and only the top 2.5 feet of adjacent sediments containing PAHs near the boat launch (all of Area 1), as well as upstream near-shore sediments located near Nest Egg Marine (Area 2). Dredging would be followed by placement of a minimum 6-inch sand layer to manage dredging residuals. In areas where PAHs above the generic screening value remain below the dredge line, a 2.5-ft thick sand and gravel cap (additional 12 inches of sand and 12 inches of gravel) would be placed. The projected dredge volume is approximately 6,620 cubic yards and cap area is 6,600 square feet, covering approximately 325 cubic yards of sediment.

Dredging would be accomplished in a manner similar to that described in Section 3.2 (Dredging and Disposal RAAs), including the use of a temporary sheet pile cofferdam or other containment system surrounding the NAPL-containing and adjacent sediments containing PAHs and silt curtains in areas outside of the temporary containment system. Dredged sediment would be stabilized on site with amendments, if required, and loaded for off-site disposal at an appropriately-licensed and permitted disposal facility. Contact water generated during dredging/dewatering activities would be treated on site and then discharged to the Menominee River.

Estimated costs for this RAA include post-removal monitoring of the engineered cap.

3.3.1 Dredging and Capping Effectiveness

The dredging and capping RAA could potentially subject the community and site workers to short-term exposure to the contaminated sediments, particularly through airborne dust and vapors. This RAA would be designed and implemented to monitor for and mitigate these potential exposures.

The dredging and capping RAA could potentially also have adverse environmental impacts downstream of the removal action through suspension of NAPL and sediment containing PAHs in the water column. Specific measures to mitigate these potential impacts, including the use of a temporary sheet pile cofferdam or other containment system in the area where dredging of NAPL-containing sediments will occur (Area 1), the use of silt curtains where dredging of sediments containing only PAHs will occur (Area 2), and turbidity monitoring throughout the entire removal action area, would be incorporated into this RAA.

The time required for the dredging and capping RAA to achieve the removal action objective is considered to be relatively short (within a few months). Placement of the sand layer to address residuals following dredging would expedite the time required to achieve the removal action objectives.

The dredging and capping RAA would achieve long-term effectiveness and permanence by removing the NAPL- containing sediments and the majority of sediments containing PAHs above the generic screening value. Sediments left in place containing PAHs above the generic screening value would be capped to minimize future exposure create a new sediment surface for the benthic community.

The dredging and capping RAA would be designed to comply with the ARARs listed in Table 4.

The dredging and capping RAA would reduce the toxicity and mobility of the NAPL/PAH-containing sediments through removal, and minimizing exposure of sediments left in place, but would not significantly promote treatment or volume reduction other than due to dewatering. Mobility would be reduced by placement of an engineered cap over sediments left in place and placement of dredged sediments in a disposal facility engineered to contain and minimize the migration of leachate from these and other wastes to the extent required by current applicable solid waste rules and regulations.

3.3.2 Dredging and Capping Implementability

The dredging and capping RAA is technically and administratively implementable. Dredging and capping is a USEPA presumptive remedy for contaminated sediments, and has been previously approved by the WDNR for other projects addressing sediments contaminated with MGP residuals. Although CERCLA projects are exempted from State and local permitting requirements, these alternatives would still need to meet the substantive requirements of the associated permitting programs.

Disposal facilities, cap materials, and contractors required to implement the dredging and capping RAA are available. These RAAs would require adequate area, equipment, and materials to dewater sediment at the site, in preparation for transportation to the landfill. This is assumed to include a portable water

treatment system, a stabilization pad, stabilization materials (e.g., cement kiln dust) and mixing equipment. Additional land area may be required to allow for staging / stockpiling of the cover materials before placement. Since WPSC does not own any land in the area targeted for the removal action, access agreements would be required for an upland area to support the removal action.

Dredging of the Menominee River is assumed to be moderately difficult due to the wood debris observed in the sediment. Placement of the sand layer and cap can be implemented but would be difficult for the near-shore sediments (i.e., outside of the temporary containment system) due to the small area and swift current. Placement of the sand layer and cap inside of the temporary containment system is achievable since any affects of the river current would be mitigated. Additional sediment stability evaluation would be required to design the cap.

3.3.3 Dredging and Capping Costs

The estimated 2012 net present worth cost of the dredging and capping alternative is approximately $7,984,000. Capital costs are estimated at approximately $6,448,000. Annual costs for cap monitoring and maintenance are estimated at approximately $80,000.

Table 6 provides a summary of the overall costs to implement. Appendix C provides the unit cost and additional assumptions.

3.4 Capping Alternative

The capping alternative consists of placement of an engineered cap over the NAPL-containing sediments and sediments containing PAHs above the generic screening value (Areas 1 and 2). The design of the cap would likely consist of sand and gravel (minimum 6 inches of sand and 6 inches of gravel). Also, a reactive core mat (RCM) layer would be necessary to mitigate leaching from the NAPL-containing sediments.

The resulting caps would be approximately 54,500 square feet, or 1.25 acres, in size altogether, split across the NAPL-containing and near-shore resulting in two separate caps.

It is assumed for the purposes of comparative analysis that the caps would be placed in the wet, without segregation and dewatering of the cap areas, and that a temporary sheet pile cofferdam or other containment system would not be necessary.

3.4.1 Capping Effectiveness

The capping RAA would avoid potential community and site worker exposure to the contaminated sediments since they would be capped in place and not handled as part of the removal action. For the same reason, the potential for adverse environmental impacts downstream of the removal action would also be low. Potential impacts from suspended clean sediment (associated with the cap materials) in the water column are still a possibility, but could be easily mitigated by silt curtains during placement of the cap.

The time required for the capping RAA to achieve the removal action objective is considered to be relatively short (within a few months).

A significant factor in evaluating the effectiveness of a capping only alternative is the ability to demonstrate long term protectiveness considering NAPL would be left in place at relatively shallow depths. The RCM component of the cap would be the primary mechanism to address residual NAPL and may need pilot- or bench-scale evaluation.

If no dredging is conducted prior to placement of the caps, there would be an increase in river bed elevation that would need to be evaluated for scour potential.

The capping RAA would achieve the ARARs by minimizing exposure to NAPL- and PAH-containing sediments in Areas 1 and 2.

The capping RAA would not reduce the toxicity or volume of the NAPL-and PAH-containing sediments in Areas 1 and 2. A cap will reduce mobility of the sediments, but long-term effectiveness of the cap requires monitoring and maintenance.

3.4.2 Capping Implementability

Capping could be technically feasible but would require the following evaluations to support its selection:

- Significance of flood storage and navigation impact due to an increase in the river bed elevations.
- Sediment stability evaluations considering the swift current known to occur at the site. Sufficiency of cap stability is an important evaluation since this alternative relies upon the cap for long term performance and protection to meet the removal action objectives.
- Possible bench- or pilot-scale testing to support the RCM design.

3.4.3 Capping Cost

Due to the technical evaluation requirements that affect implementabilty and effectiveness, the capping RAA was screened out for further analysis, and a corresponding cost estimate was not prepared.

4 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section provides a comparative analysis of the removal action alternatives presented in Section 3. In Section 3, each alternative was analyzed independently without consideration of other alternatives. In this section, a comparative analysis is completed to evaluate the performance of each alternative with regard to effectiveness, implementability, and cost relative to the others. The purpose of this comparative analysis is to identify the basic advantages and disadvantages of the alternatives relative to one another.

The removal action alternatives carried forward for comparative analysis are:

- RAA-01: Dredging and Disposal
  - RAA-01A: NAPL
  - RAA-01B: NAPL and Adjacent and Near-Shore PAHs (Areas 1 and 2)
- RAA-02: Dredging and Capping

4.1 Effectiveness

4.1.1 Short Term

The amount of time that the community, site workers, and downstream receptors are subject to potential exposure to the contaminated sediment would be slightly less for the dredging and capping alternative and dredging and disposal alternative that minimize dredge volume (RAA-01A), due to the lower dredge volumes. However, the relative amount of exposure reduction could be considered to be insignificant.

Also, both will require a relatively equivalent amount of time to achieve the removal action objectives.

4.1.2 Compliance with ARARs

All of the alternatives evaluated can comply with the ARARs.

4.1.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence of the dredging and disposal option that does not address residual PAH contamination (RAA-01A) would be less than the other dredging and disposal alternative evaluated due to the inherent risk that the residual PAH contamination presents.

Long-term effectiveness and permanence of the dredge and capping alternative would be less than the dredging and disposal alternatives (RAA-01A, -01B) due to the inherent risk of future exposure of the capped sediments. This can be balanced by a well-designed cap to keep these sediments below anticipated potential scour depth and not accessible to the benthic community, and institutional controls would monitor the stability of the protective cap over the remaining sediment. This reduction in long-term effectiveness and permanence is not considered significant.

4.1.4 Reduction of Toxicity, Mobility, or Volume

None of the alternatives evaluated provide a reduction in toxicity, mobility, or volume through treatment.

The dredging and disposal alternatives would reduce the in-place volume of contaminated sediments.

All of the alternatives evaluated effectively reduce the mobility of the contamination by either placement into an engineered containment facility (landfill) or covering with a cap engineered to minimize exposure and mobility.

4.2 Implementability

4.2.1 Technical Feasibility

All of the alternatives evaluated are technically feasible.

The dredging and capping alternative may be more challenging due to difficulties in placing a cap in relatively small areas with a swift river current. The alternatives that minimize dredge volumes (i.e., RAA-01A, RAA-02) may be easier to implement due to the reduced volumes/areas. These differences are considered to be insignificant.

All of the alternatives evaluated are technically feasible.

The dredging and capping alternative may be more challenging due to difficulties in placing a cap in relatively small areas with a swift river current. The alternatives that minimize dredge volumes (i.e., RAA-01A, RAA-02) may be easier to implement due to the reduced volumes/areas. These differences are considered to be insignificant.

4.2.2 Administrative Feasibility

The dredging and capping alternative is considered to be more challenging to implement from an administrative standpoint than the dredging and disposal alternatives due to the long-term monitoring and institutional controls required for the dredging and capping alternative.

Also, dredging and disposal alternative RAA-01A (NAPL only), which does not address residual PAH contamination, is considered to have a lower degree of administrative feasibility.

4.2.3 Availability of Services and Materials Required

The availability of services and materials required to implement the dredging and disposal and dredging and capping alternatives evaluated are considered to be relatively equal. More land area may be required for an upland support area for the dredging and capping alternative to allow for staging / stockpiling of the cap materials before placement, but this potential requirement is considered insignificant.

4.3 Cost

Table 6 summarizes the capital and long-term costs associated with the alternatives evaluated.

The long-term costs associated with the dredging and capping alternative cause the total present worth costs of this alternative to exceed that of the dredging and disposal alternatives.

5 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Based upon the results of the comparative analysis in Section 4, the recommended sediment removal action alternative is RAA-01B: dredging and disposal of NAPL and Adjacent and Near-Shore PAHs (Areas 1 and 2). This alternative is more effective compared to the NAPL only removal alternative evaluated (RAA-01A), and most administratively feasible compared to the dredging and capping alternative (RAA-02). Further, RAA-01B accomplishes greater removal of residual PAH contamination at lower cost than the dredging and capping alternative. The alternatives evaluated were roughly equal for other aspects of effectiveness and implementability considered.

6 REFERENCES

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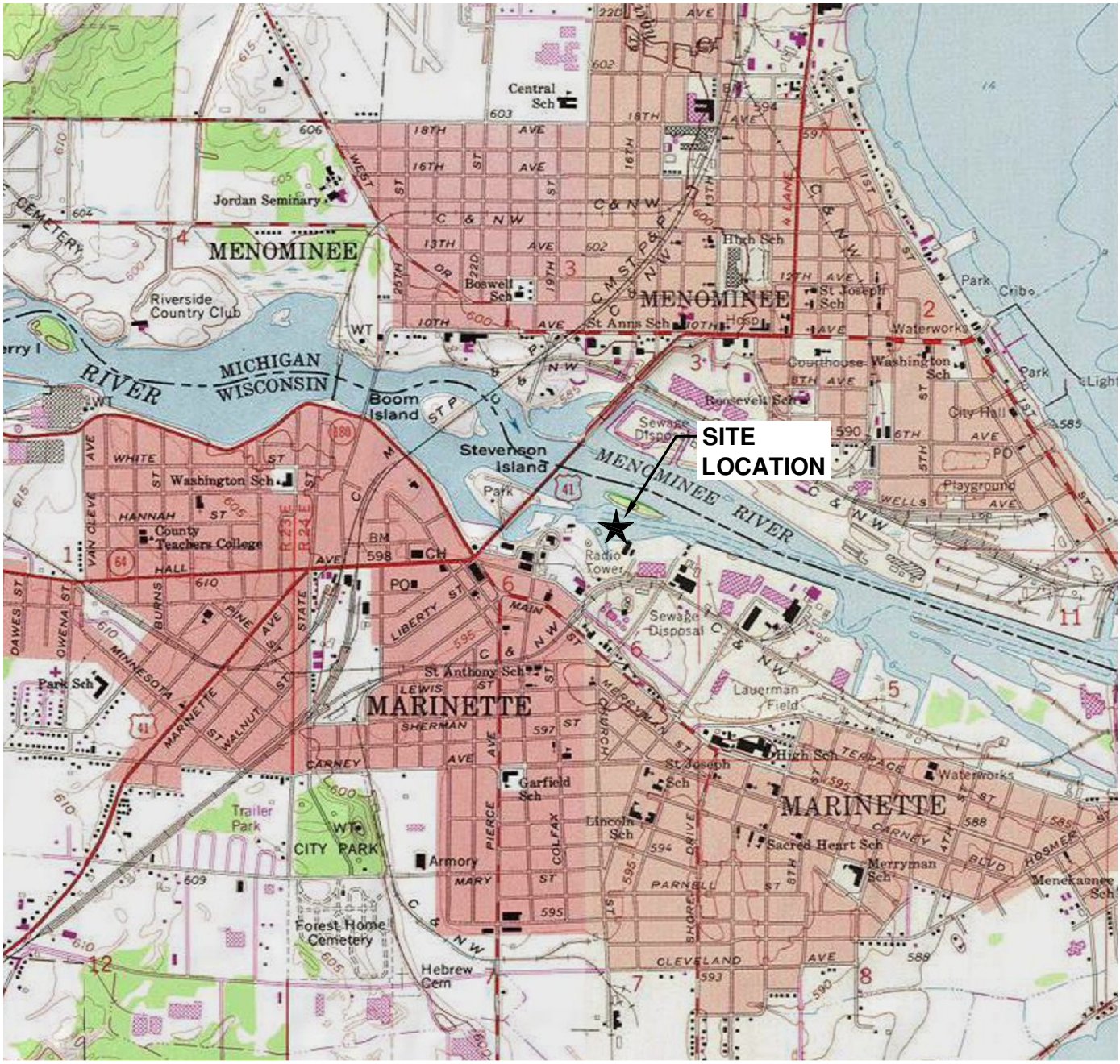
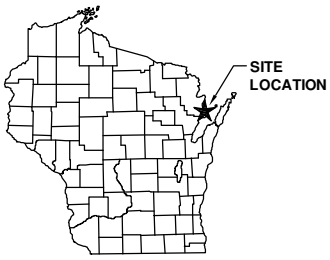
FIGURES



SOURCE NOTES:

1. NATIONAL GEOGRAPHIC TOPO. 1:24,000-SCALE MAPS FOR THE UNITED STATES. THE TOPO! MAPS ARE SEAMLESS, SCANNED IMAGES OF UNITED STATES GEOLOGICAL SURVEY (USGS) PAPER TOPOGRAPHIC MAPS. FOR MORE INFORMATION ON THIS MAP, VISIT US ONLINE AT HTTP://GOTO.ARCGISONLINE.COM/MAPS/USA_TOPO_MAPS COPYRIGHT:© 2011 NATIONAL GEOGRAPHIC SOCIETY, I-CUBED
2. COORDINATE SYSTEM IS WISCONSIN COUNTY COORDINATE SYSTEM, MARINETTE COUNTY, US FOOT.



WISCONSIN

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SCALE IN FEET

CONTOUR INTERVAL 10 FEET

SITE LOCATION MAP

NTC SEDIMENT REMOVAL ACTION EE/CA
FORMER MARINETTE MGP SITE
WISCONSIN PUBLIC SERVICE CORPORATION
MARINETTE, WISCONSIN

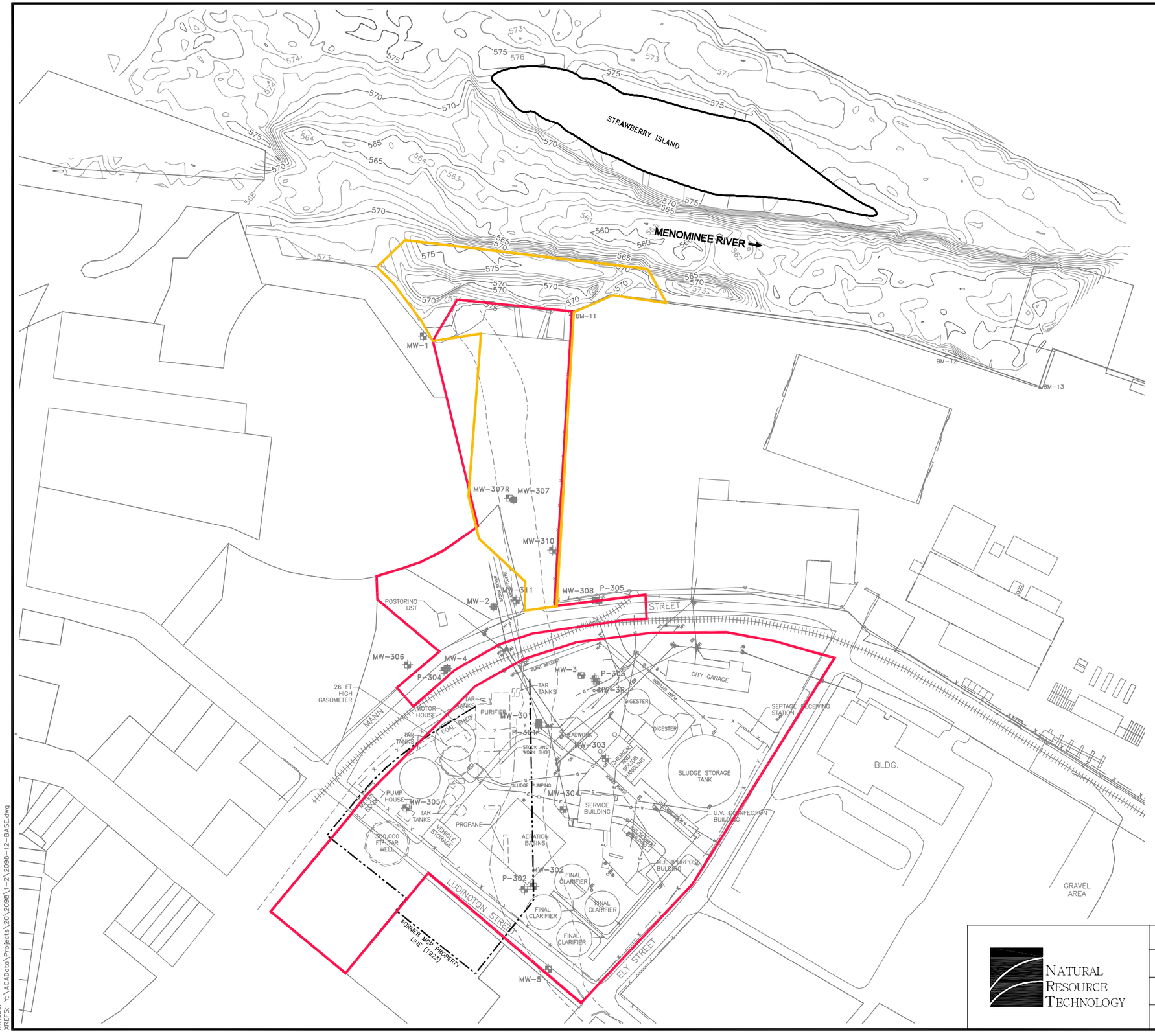
DRAWN BY: NWD 07/17/12 APP'D BY: EJT DATE: 07/23/12

NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 2098/1.2

DRAWING NO. 2098-12-A01C

FIGURE NO. 1



SOURCE NOTES:

1. THIS DRAWING WAS DEVELOPED FROM A MAP BY THE CITY OF MARINETTE.
2. PORTIONS OF THE DRAWING ARE FROM A DIGITAL FILE FROM STS CONSULTANTS, LTD. CONSULTING ENGINEERS, GREEN BAY, WISCONSIN, PROJECT NUMBER 26936, REVISED JANUARY 2001. HYDROGRAPHIC SURVEY OF RIVER WAS PERFORMED BY AYRES AND ASSOCIATES ON JULY 24–26, 2001. VERTICAL CONTROL IS U.S.G.S. DATUM. BUILDING AND STREET LOCATIONS NORTH OF RAILROAD TRACKS WERE SUPPLIED BY MARINETTE MARINE CORPORATION.
3. PORTIONS OF THIS DRAWING ARE FROM HYDRO–SEARCH DRAWING.
4. EXISTING STRUCTURES AND UTILITIES FROM FOTH & VAN DYKE ENGINEERS/ARCHITECTS, GRADING PLAN, DIGITAL FILE 7m755c06.DWG, RECORD DRAWING REVISIONS 2/22/90.
5. WELL LOCATIONS FROM A SURVEY BY WPSC DATED OCTOBER 8, 2003, REVISED OCTOBER 31, 2003.
6. BRICK INTERCEPTOR SEWER REPLACEMENT TAKEN FROM DRAWING BY AYRES ASSOCIATES, GREEN BAY, WISCONSIN, JOB NO. 16–0189.10, DRAWING NO. P101, SHEET NO. 7, DATED 3/14/03.
7. MONITORING WELLS MW–2R, MW–3R, MW–307R INSTALLED OCTOBER 2004 AND MW–308, MW–310, P–305 INSTALLED JUNE 2004. SURVEYED BY WPSC IN JANUARY 2005. (NGVD88, MARINETTE COUNTY COORDINATES).

NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 2098/1.2	**FORMER MGP PROPERTY AND SITE BOUNDARIES**
DRAWN BY: RLH 07/18/12	NTC SEDIMENT REMOVAL ACTION EE/CA FORMER MARINETTE MGP SITE WISCONSIN PUBLIC SERVICE CORPORATION MARINETTE, WISCONSIN
CHECKED BY: JMK 07/18/12	
APPROVED BY: EJT 07/23/12	DRAWING NO: 2098–12–B02C–BOUNDARIES REFERENCE: .
	FIGURE NO. 2

Jul 23, 2012 9:12am PLOTTED BY: ndraskovich SAVED BY: ndraskovich
X:\ACAData\Projects\20\2098\1-2\2098-12-B02C-BOUNDARIES.dwg FIG_2
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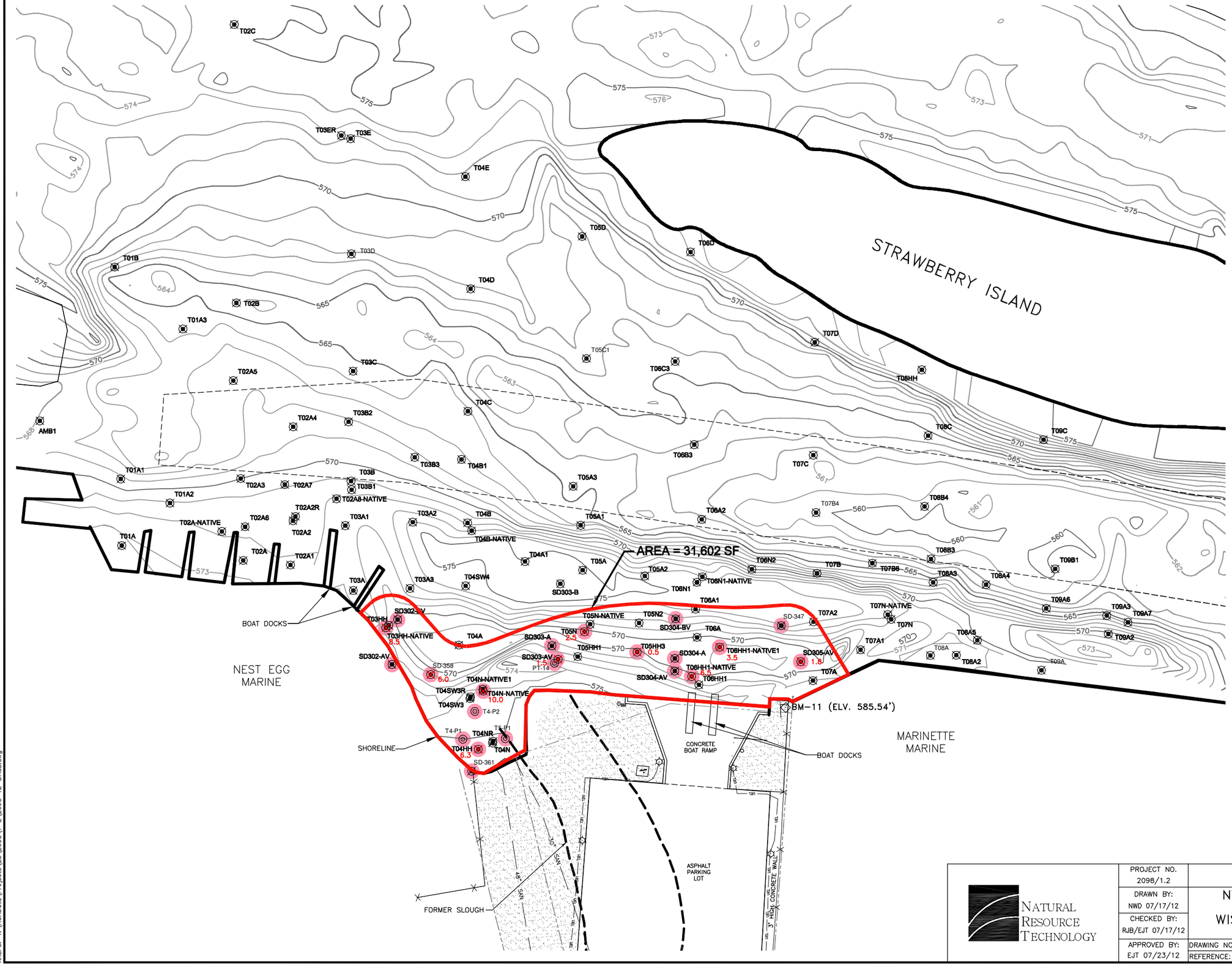

VOLUMES:

NAPL REMOVAL
BASE SURFACE: 2011_BATHY REVISED JUNE 2012 REV2
COMPARISON SURFACE: NAPL BOTTOM CUT
CUT VOLUME 4869 CU. YD.

SOURCE NOTES:

1. THIS DRAWING WAS DEVELOPED FROM A MAP BY THE CITY OF MARINETTE. A DIGITAL FILE FROM STS CONSULTANTS, LTD., GREEN BAY, WISCONSIN, PROJECT NUMBER 26936, REVISED JANUARY 2001. VERTICAL CONTROL IS U.S.G.S. DATUM. BUILDING AND STREET LOCATIONS NORTH OF RAILROAD TRACKS WERE SUPPLIED BY MARINETTE MARINE CORPORATION. PORTIONS OF THIS DRAWING ARE FROM HYDRO-SEARCH DRAWING. EXISTING STRUCTURES AND UTILITIES FROM FOTH & VAN DYKE ENGINEERS/ARCHITECTS, GRADING PLAN, DIGITAL FILE 7m755c06.DWG, RECORD DRAWING REVISIONS 2/22/90. DIGITAL FILE SITE PLAN.DWG FROM AYRES AND ASSOCIATES, EAU CLAIRE, WISCONSIN. CHANNEL LIMITS, STATIONING AND PORTIONS OF SHORELINE ARE FROM U.S. ARMY CORPS OF ENGINEERS DRAWING "CONDITION OF CHANNEL-SEP. 2008", SHEET 4 OF 4.
2. WELL LOCATIONS FROM A SURVEY BY WPSC DATED OCTOBER 8, 2003, REVISED OCTOBER 31, 2003.
3. HORIZONTAL DATUM IS MARINETTE COUNTY COORDINATE SYSTEM, UNITS = US FOOT . VERTICAL DATUM IS NAVD88.
4. BENCHMARK 11 (LOCATED ON THE NORTHEAST CORNER OF THIS SITE ON THE CONCRETE WALL) HAS AN ELEVATION OF 585.54 FEET, (NAVD88).
5. UTILITIES IN BOOM LANDING PARK SURVEYED BY WPSC MARCH 2004.
6. 2011 BATHYMETRIC SURVEY PERFORMED BY ENVIROSCAN, INC. NOVEMBER 15, 2011.

NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 2098/1.2	EXTENT OF NAPL	
DRAWN BY: NWD 07/17/12	NTC SEDIMENT REMOVAL ACTION EE/CA FORMER MARINETTE MGP SITE WISCONSIN PUBLIC SERVICE CORPORATION MARINETTE, WISCONSIN	
CHECKED BY: RJB/EJT 07/17/12		
APPROVED BY: EJT 07/23/12	DRAWING NO: 2098-12-B03C-NAPL	FIGURE 3
	REFERENCE: .	

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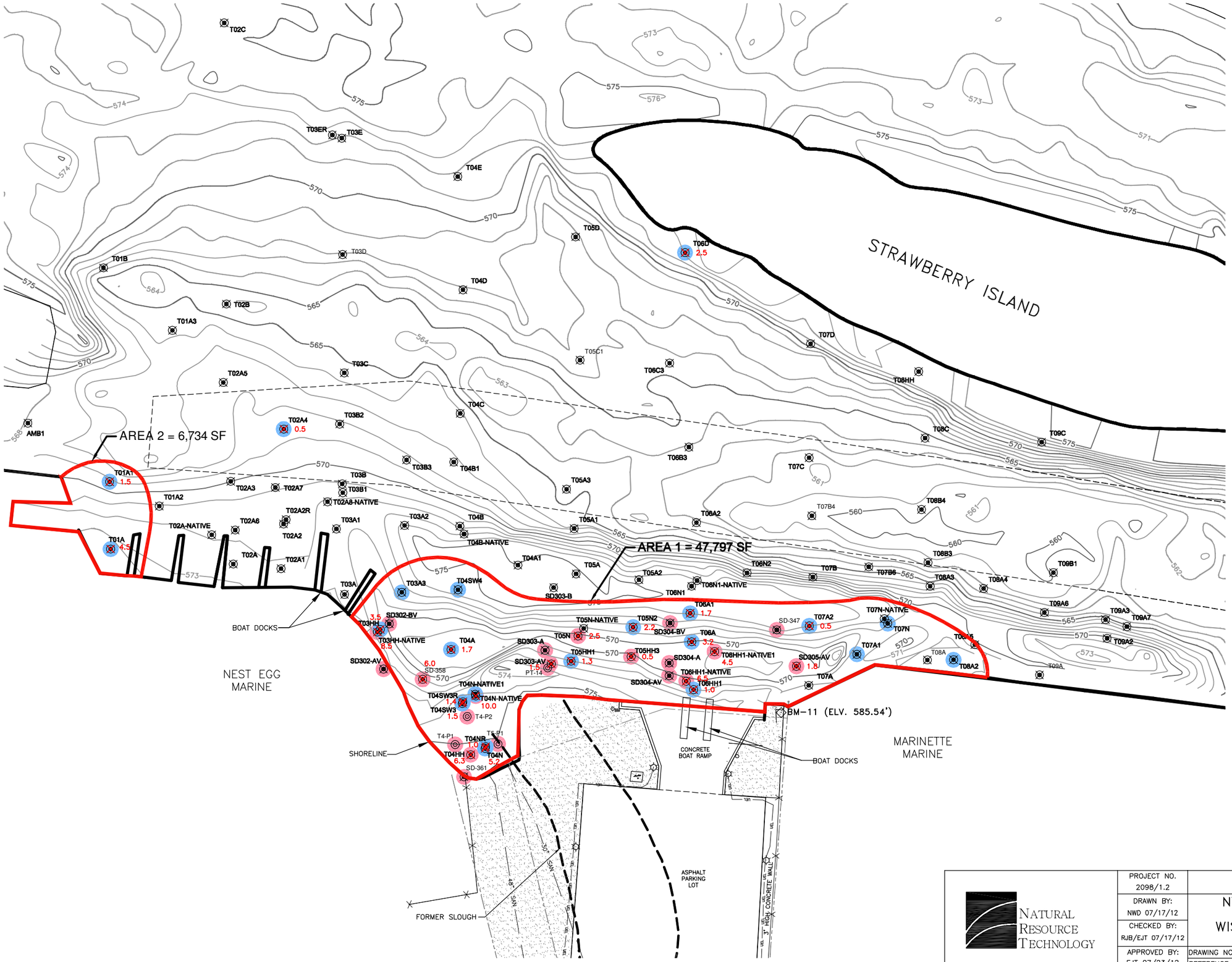

T05D 1.7 — SEDIMENT CORE SAMPLE W/ NAPL (DEPTH OF IMPACT IN FEET)

T05D 1.7 — SEDIMENT CORE SAMPLE W/ PAH > 22.8 mg/kg (DEPTH OF IMPACT IN FEET)

T05D — SEDIMENT CORE SAMPLE

BM-11 — BENCH MARK

LIGHT POLE

NAVIGATIONAL CHANNEL LIMITS

FORMER SLOUGH

PROPERTY BOUNDARY

SAN — SANITARY SEWER LINE WITH PIPE SIZE

UEL — UNDERGROUND ELECTRICAL LINE

EXISTING FENCE

VEGETATION

560 — 2011 BATHYMETRIC CONTOURS

VOLUMES:

AREA 1
BASE SURFACE: 2011_BATHY REVISED JUNE 2012 REV2
COMPARISON SURFACE: PAH 22.8 BOTTOM CUT
CUT VOLUME 6216 CU. YD.

AREA 2
BASE SURFACE: 2011_BATHY REVISED JUNE 2012 REV2
COMPARISON SURFACE: PAH 22.8 BOTTOM CUT
CUT VOLUME 729 CU. YD.

SOURCE NOTES:

1. THIS DRAWING WAS DEVELOPED FROM A MAP BY THE CITY OF MARINETTE. A DIGITAL FILE FROM STS CONSULTANTS, LTD., GREEN BAY, WISCONSIN, PROJECT NUMBER 26936, REVISED JANUARY 2001. VERTICAL CONTROL IS U.S.G.S. DATUM. BUILDING AND STREET LOCATIONS NORTH OF RAILROAD TRACKS WERE SUPPLIED BY MARINETTE MARINE CORPORATION. PORTIONS OF THIS DRAWING ARE FROM HYDRO-SEARCH DRAWING. EXISTING STRUCTURES AND UTILITIES FROM FOTH & VAN DYKE ENGINEERS/ARCHITECTS, GRADING PLAN, DIGITAL FILE 7m755c06.DWG, RECORD DRAWING REVISIONS 2/22/90. DIGITAL FILE SITE PLAN.DWG FROM AYRES AND ASSOCIATES, EAU CLAIRE, WISCONSIN. CHANNEL LIMITS, STATIONING AND PORTIONS OF SHORELINE ARE FROM U.S. ARMY CORPS OF ENGINEERS DRAWING "CONDITION OF CHANNEL-SEP. 2008", SHEET 4 OF 4.
2. WELL LOCATIONS FROM A SURVEY BY WPSC DATED OCTOBER 8, 2003, REVISED OCTOBER 31, 2003.
3. HORIZONTAL DATUM IS MARINETTE COUNTY COORDINATE SYSTEM, UNITS = US FOOT . VERTICAL DATUM IS NAVD88.
4. BENCHMARK 11 (LOCATED ON THE NORTHEAST CORNER OF THIS SITE ON THE CONCRETE WALL) HAS AN ELEVATION OF 585.54 FEET, (NAVD88).
5. UTILITIES IN BOOM LANDING PARK SURVEYED BY WPSC MARCH 2004.
6. 2011 BATHYMETRIC SURVEY PERFORMED BY ENVIROSCAN, INC. NOVEMBER 15, 2011.

NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 2098/1.2	EXTENT OF PAH > 22.8 mg/kg
DRAWN BY: NWD 07/17/12	NTC SEDIMENT REMOVAL ACTION EE/CA FORMER MARINETTE MGP SITE WISCONSIN PUBLIC SERVICE CORPORATION MARINETTE, WISCONSIN
CHECKED BY: RJB/EJT 07/17/12	
APPROVED BY: EJT 07/23/12	DRAWING NO: 2098-12-B04C-NAPL-PAH22.8
	REFERENCE: .
	FIGURE 4

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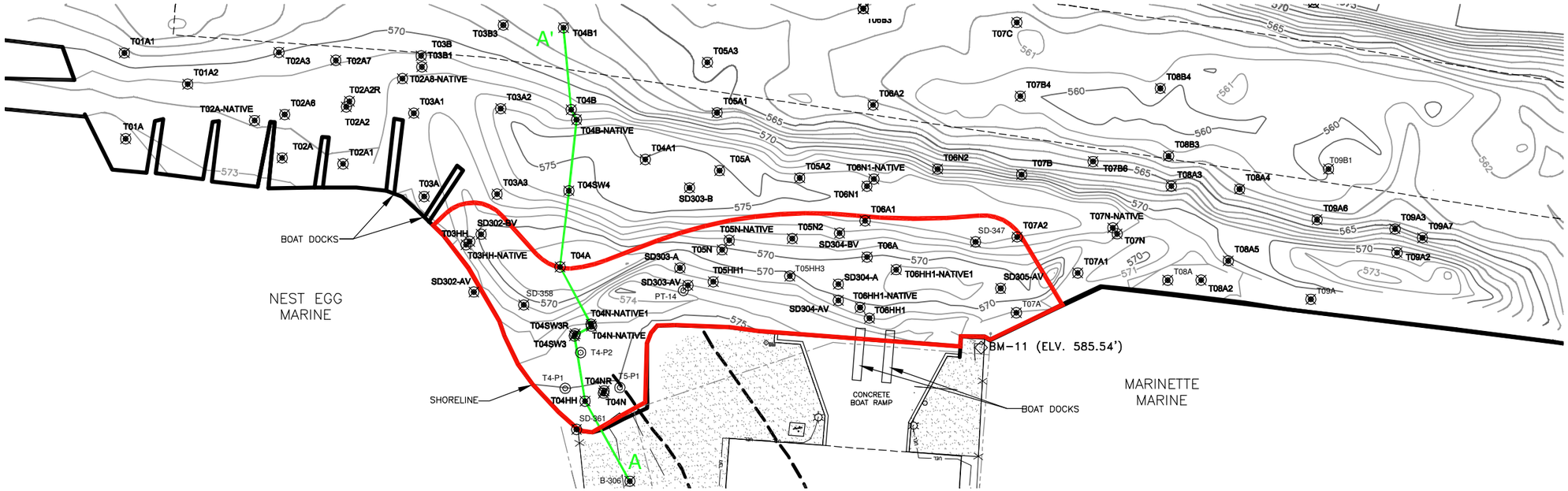

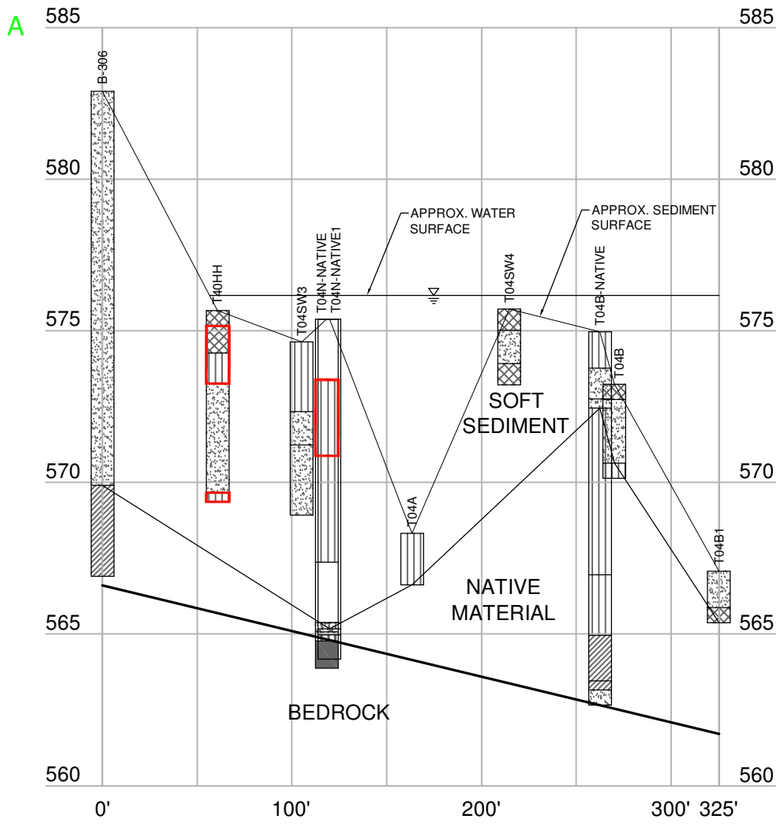

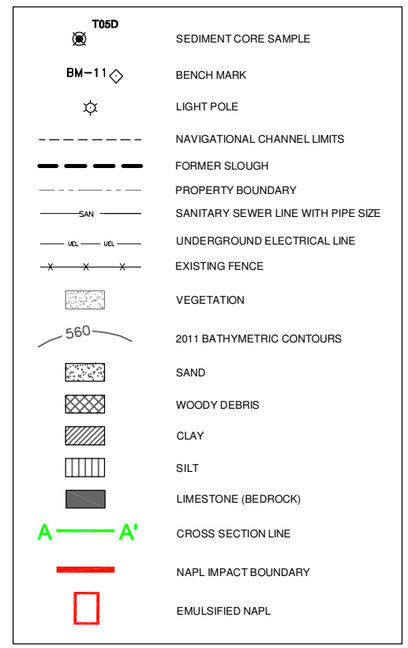

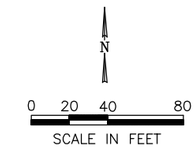

SOURCE NOTES:

1. THIS DRAWING WAS DEVELOPED FROM A MAP BY THE CITY OF MARINETTE. A DIGITAL FILE FROM STS CONSULTANTS, LTD., GREEN BAY, WISCONSIN, PROJECT NUMBER 26936, REVISED JANUARY 2001. VERTICAL CONTROL IS U.S.G.S. DATUM. BUILDING AND STREET LOCATIONS NORTH OF RAILROAD TRACKS WERE SUPPLIED BY MARINETTE MARINE CORPORATION. PORTIONS OF THIS DRAWING ARE FROM HYDRO-SEARCH DRAWING. EXISTING STRUCTURES AND UTILITIES FROM FOTH & VAN DYKE ENGINEERS/ARCHITECTS, GRADING PLAN, DIGITAL FILE 7m755c06.DWG, RECORD DRAWING REVISIONS 2/22/90. DIGITAL FILE SITE PLAN.DWG FROM AYRES AND ASSOCIATES, EAU CLAIRE, WISCONSIN. CHANNEL LIMITS, STATIONING AND PORTIONS OF SHORELINE ARE FROM U.S. ARMY CORPS OF ENGINEERS DRAWING "CONDITION OF CHANNEL-SEP. 2008", SHEET 4 OF 4.
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NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 2098/1.2	CROSS SECTION A-A'
DRAWN BY: NWD/RLH 07/18/12	NTC SEDIMENT REMOVAL ACTION EE/CA FORMER MARINETTE MGP SITE WISCONSIN PUBLIC SERVICE CORPORATION MARINETTE, WISCONSIN
CHECKED BY: JJW/EJT 07/18/12	
APPROVED BY: EJT 07/23/12	DRAWING NO: 2098-12-B05C-CROSS SECTION AA REFERENCE: .
	FIGURE 5

IMAGES:
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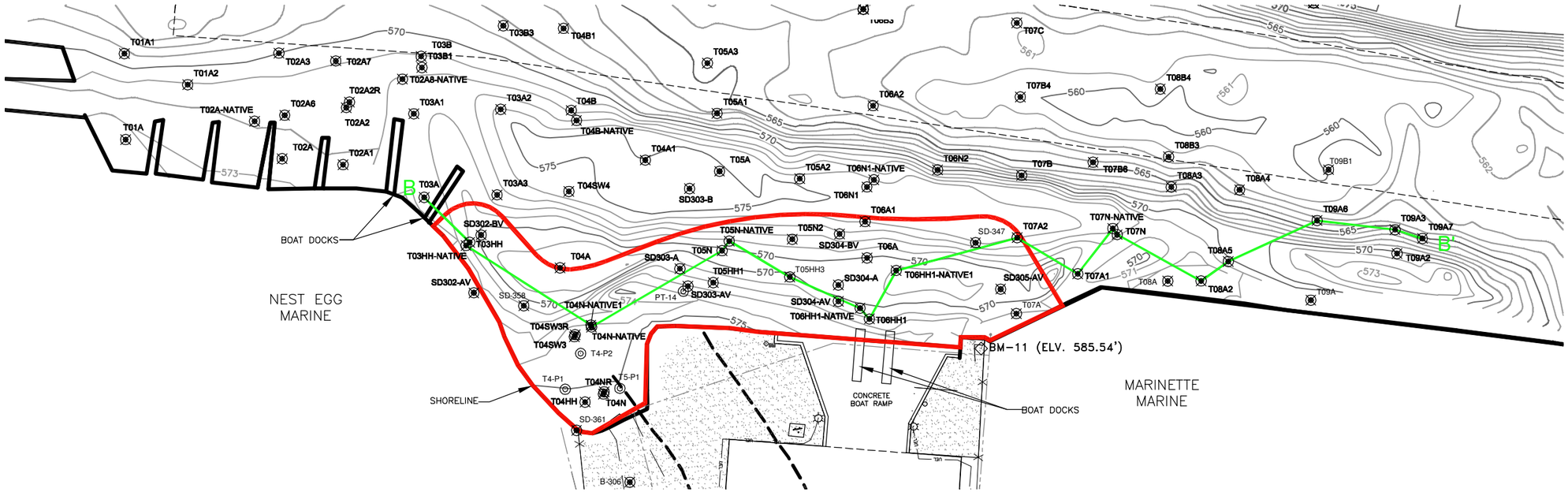

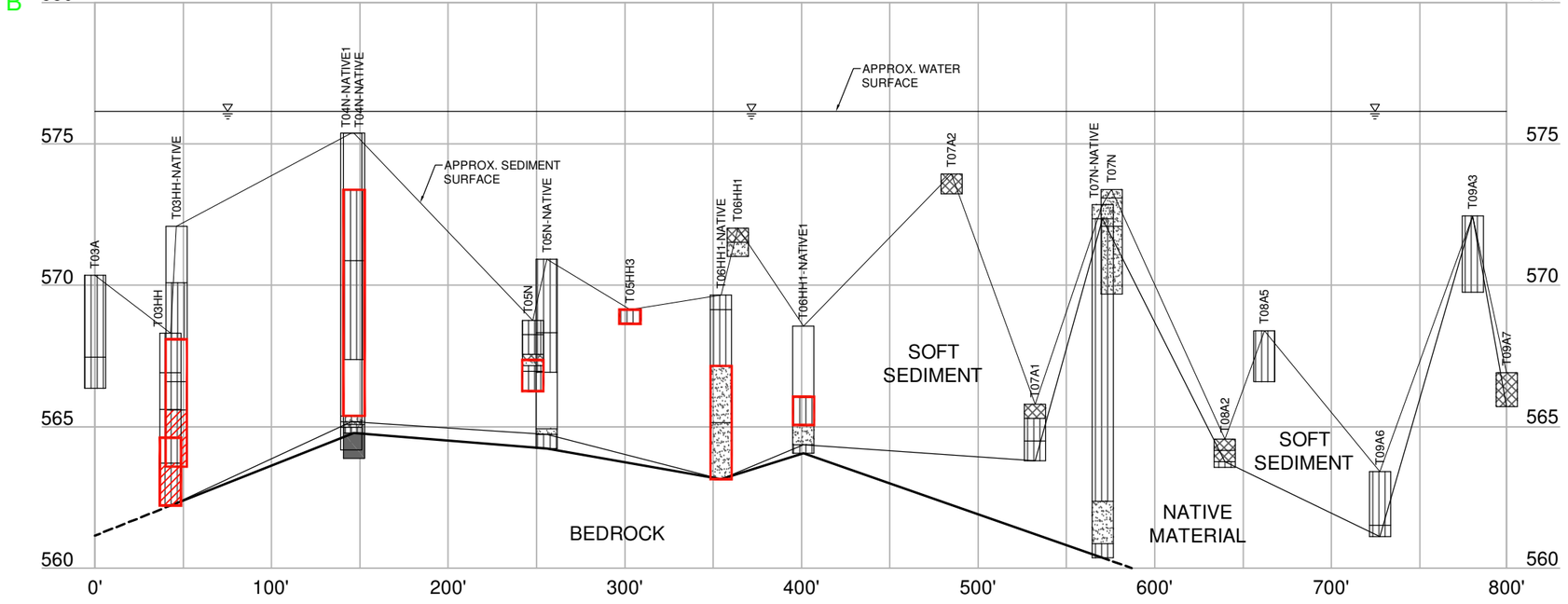

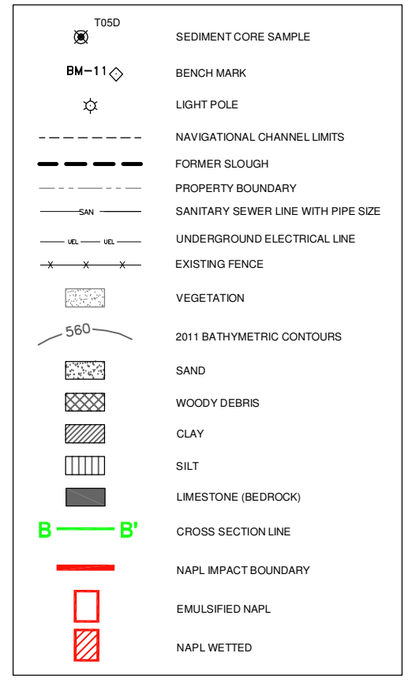

VERTICAL SCALE IN FEET
5
80
HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION = 16

N
0 20 40 80
SCALE IN FEET

SOURCE NOTES:

1. THIS DRAWING WAS DEVELOPED FROM A MAP BY THE CITY OF MARINETTE. A DIGITAL FILE FROM STS CONSULTANTS, LTD., GREEN BAY, WISCONSIN, PROJECT NUMBER 26936, REVISED JANUARY 2001. VERTICAL CONTROL IS U.S.G.S. DATUM. BUILDING AND STREET LOCATIONS NORTH OF RAILROAD TRACKS WERE SUPPLIED BY MARINETTE MARINE CORPORATION. PORTIONS OF THIS DRAWING ARE FROM HYDRO-SEARCH DRAWING. EXISTING STRUCTURES AND UTILITIES FROM FOTH & VAN DYKE ENGINEERS/ARCHITECTS, GRADING PLAN, DIGITAL FILE 7m755c06.DWG, RECORD DRAWING REVISIONS 2/22/90. DIGITAL FILE SITE PLAN.DWG FROM AYRES AND ASSOCIATES, EAU CLAIRE, WISCONSIN. CHANNEL LIMITS, STATIONING AND PORTIONS OF SHORELINE ARE FROM U.S. ARMY CORPS OF ENGINEERS DRAWING "CONDITION OF CHANNEL-SEP. 2008", SHEET 4 OF 4.
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NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 2098/1.2	CROSS SECTION B-B'
DRAWN BY: NWD/RLH 07/18/12	NTC SEDIMENT REMOVAL ACTION EE/CA FORMER MARINETTE MGP SITE WISCONSIN PUBLIC SERVICE CORPORATION MARINETTE, WISCONSIN
CHECKED BY: JJW/EJT 07/18/12	
APPROVED BY: EJT 07/23/12	DRAWING NO: 2098-12-B06C-CROSS SECTION BB REFERENCE: .
	FIGURE 6

IMAGES:
XREFS: Y:\ACAData\Projects\20\2098\1-2\2098-12-BASE.dwg