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April 22, 2019

Mr. Matt Thompson
Wisconsin Department of Natural Resources
1300 W. Clairemont Avenue
Eau Claire, WI 54701

Subject: Residual Phase LNAPL Soil Site Investigation Work Plan
BRRTS #02-37-000006
Wauleco, Inc.
Wausau, Wisconsin

Dear Mr. Thompson:

On behalf of Wauleco, Inc., enclosed is the above referenced report. If you have any questions or comments, please call me at (608) 826-3644.

Sincerely,

TRC Environmental Corporation

Bruce Iverson
Project Manager

Enclosure: Residual Phase LNAPL Soil Site Investigation Work Plan

cc: Evan Schreiner – Wauleco
Dave Crass – Michael Best & Friedrich
Tom Dushek – TRC
Ken Quinn – TRC



Residual Phase LNAPL – Soil Investigation Work Plan

**Wauleco
Residual Phase LNAPL Soil Investigation
Wausau, Wisconsin**

BRRTS #02-37-000006

**April 2019
Revision 0**

*Prepared For
Wauleco, Inc.*

*Prepared By
TRC Environmental Corporation
708 Heartland Trail, Suite 3000
Madison, WI 53717*

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Section 1

Professional Certification

"I, Kenneth J. Quinn, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs.NR 700 to 726, Wis. Adm. Code."



Senior Project Hydrogeologist / G-016

P.G. Stamp

Section 2

Project Management Plan

Consistent with NR 716.09(2)(a), (b), and (c) Wis. Adm. Code, the following information is provided:

1. **Site Address and Location:**

Wauleco, Inc.
125 Rosecrans Street
Wausau, WI 54402
Marathon County
N½ of SE¼ of Section 35, Township 29 North, Range 7 East

2. **Responsible Party:**

Wauleco, Inc.
1800 North Point Drive
Stevens Point, WI 54481

Contact: Mr. Evan Schreiner
(715) 346-8530

3. **Name of the consultant involved with the project:**

TRC Environmental Corporation
708 Heartland Trail, Suite 3000
Madison, WI 53717

Attention: Mr. Bruce Iverson
Senior Project Manager
(608) 826-3644
e-mail: biverson@trcsolutions.com

4. **Site Location Map:** See Figure 1

Section 3

Introduction

Consistent with NR 716.09(2)(d) Wis. Adm. Code, the following applicable information per NR 716.07 (Site Investigation Scoping) Wis. Adm. Code is provided:

3.1 Site History and Background

The Wauleco, Inc. (Wauleco) facility is located at 125 Rosecrans Street, Wausau, Wisconsin (Figure 1). The property is located in an area of mixed industrial and residential land use. The property is the location of a former window and patio door manufacturer.

As was common in the wood window manufacturing industry, surface coating on the exterior portions of wood windows manufactured at the site was performed using a wood preservative solution of pentachlorophenol (PCP) and mineral spirits. Over time, releases of the solution occurred, and residual-phase light non-aqueous phase liquid (LNAPL) is present in the smear zone (i.e., the interface of the unsaturated zone and the water table).

The horizontal and vertical distribution of residual phase LNAPL was investigated with laser induced fluorescence surveys (LIF) and reported in the Extent of Residual Phase Product/2015 LIF Survey Memo (TRC, 2015). Figure 2 illustrates the results of the LIF survey as a thickness map of residual phase LNAPL¹.

Additional information on site history and background is presented in documents on the Wisconsin Department of Natural Resources (WDNRs) Bureau of Remediation and Redevelopment Tracking System (BRRTS) site.

3.2 Purpose and Approach

The purpose of this Residual Phase LNAPL - Soil Investigation Work Plan (Work Plan) is to gather additional data concerning the physical and chemical characteristics of the residual phase LNAPL. This data will be used to evaluate the applicability of other or potential additional remedial technologies and alternatives beyond the current groundwater pump and treatment system.

The proposed approach to collecting samples in the residual phase LNAPL zone is to use advanced drilling techniques to core through the smear zone, freeze the soil and associated

¹ Figure 2 is modified from the original 2015 memo due to a correction in the LNAPL thickness at point L06.

fluids upon sample collection, allowing collection of all the fluids within the sample interval and retaining the soil structure in the sample. Frozen samples will be shipped to the laboratory on dry ice to retain the fluids and soil structure through transportation, sample preparation and analysis. Analyses of the frozen soil cores will include LNAPL saturation properties, LNAPL content, PCP concentration, and total oxidant demand, for use in the evaluation of potential remedial alternatives.

Methods for this approach were developed by Colorado State University (CSU) and are described in detail in Sale (2016) and Kiaalhosseini, et. al. (2016). Dr. Sale's team from CSU and the drilling firm, Drilling Engineers, Inc., have been implementing these methods at LNAPL sites across the country and are proposed to perform this scope of work at Wauleco.

3.3 Previous Investigations and Reports

Several soil investigations have been conducted at the site. Documents associated with these investigations are on the WDNR's BRRTS site.

Characterization of the LNAPL residual phase has been completed and reported in TRC's 2015 report titled Extent of Residual Phase Product/2015 LIF Survey Memo. This report summarizes the distribution of residual phase LNAPL both vertically and horizontally. From this report, the areal extent and thickness of residual phase LNAPL is presented in Figure 2.

3.4 Off-Site Location Access

Figure 2 also shows the proposed boring locations, with 4 locations located off the Wauleco property. These borings will be located in the City rights-of-way. Therefore, access permission/agreements will be obtained from the City, modifying the locations as needed to accommodate City requirements for the boring location. Utility locations will be cleared for all borings prior to mobilization, modifying locations as needed to avoid utilities.

Section 4

Site Description

Consistent with NR 716.09((2)(e) Wis. Adm. Code, this section provides information on the site setting.

4.1 Site Location and Features

According to the U.S. Geological Survey 7.5-Minute Quadrangle (USGS, see Figure 1), Wauleco is located in the N½ of SE¼ of Section 35, Township 29 North, Range 7 East, at an approximate elevation of 820 feet above mean sea level (amsl). The Site is located within the limits of the City of Wausau, in a mixed industrial, commercial and residential area, approximately 500 feet to 1,000 feet west of the Wisconsin River.

Marathon County has a temperate climate with cold winters and warm summers. Total annual precipitation is approximately 32 inches.

4.2 Geology and Hydrogeology

The Wauleco site is located within the Wisconsin River bedrock valley and south of the southern extent of glacial advance. In general, the geology consists of a valley in the PreCambrian bedrock created by pre-glacial erosion with subsequent deposition in the valley of glacial aged outwash and lake deposits. The depth to the top of bedrock at the Wauleco site ranges from 58 feet on the west side of the site at well W-1B to greater than 60 feet near the Wisconsin River at well W-10B. The bedrock valley fill consists of sand, and sand and gravel glacial outwash from the surface to the top of bedrock on the western portion of the Site (i.e., at 58 feet at well W-1B). A continuous silty clay to clayey silt deposit is present on top of bedrock, below the sand and gravel outwash, extending from the center of the site, near well PW-12, to the east, past well W-10B and under the Wisconsin River.

The groundwater in the vicinity of Wauleco occurs within the sand and gravel outwash within the Wisconsin River bedrock valley. Depth to groundwater ranges from approximately 33 feet (at well W-8) upgradient, west of Wauleco, to approximately 19 feet (at well W-10A) near the Wisconsin River shoreline.

Section 5

Sampling and Analysis Strategy

Consistent with NR 716.09(2)(f) and (g) Wis. Adm. Code, this section provides information on the proposed sampling and analysis strategy.

5.1 Scope of Work

To achieve the purpose discussed in Section 3.2, the proposed Scope of Work includes the drilling and cryogenic coring methods, sample preservation and shipping, and analytical methods. Results will be provided in a Site Investigation Technical Memorandum.

5.2 Coring Locations

Figure 2 shows the locations of the proposed coring locations. These locations were selected to provide sample locations within the following areas of the residual phase LNAPL:

- **M01** – on-site, upgradient location.
- **M02 and M03** – on-site, within the thickest zone of residual phase LNAPL and where mobile phase LNAPL was collected until 2010.
- **M04** – off-site, in the lobe of LNAPL to the southeast.
- **M05, M06, and M07** – off-site, in the main lobe of LNAPL.

Soil sampling at each of these locations will be conducted through the smear zone, as described by a nearby LIF probe. Specific depths are included in Table 1. The coring and cryogenic preservation sampling methods are described in Section 6.1 of this Work Plan.

5.3 Analytical Strategy

The analytical strategy is to gather data on the physical and chemical characteristics of the residual phase LNAPL. Analyses include porosity, fluid saturation for water, LNAPL, and gas, dissolved methane, TPH, and PCP. In addition, three samples will be analyzed for total oxidant demand (TOD). Analyses for TOD will include TPH and PCP both before and after the oxidizing the sample in the TOD analysis.

As described in Sale (2016) (see his Appendix C), a High-Throughput Core Analysis approach will be used. This consists generally of:

- Opening the clear PVC liner

- Visual logging in visible light to record the soil characteristics, taking visible light photos of the core and visual inspection and photos under ultraviolet light to detect LNAPL occurrence.
- Subsampling the core into 1 inch thick cylinder and then into 3 subsamples of the 1" cylinder.
- Analysis by CSU of:
 - Fluid saturations (i.e., the content of water, LNAPL, and gas in the soils)
 - Porosity
 - Dissolved gases (methane)
 - Total petroleum hydrocarbons (TPH)
 - Pentachlorophenol
- Shipping sufficient sample volume to Redox Tech, Inc. for analysis of total oxidant demand.

Visual logging (e.g., photos under ultraviolet light) and analyses of the core will be obtained in real time, so that decisions on subsequent analyses can be based on prior analyses. The core remains in CSU's -80° C freezer except for short periods of time for processing. This allows retaining undisturbed, preserved core for later analyses. Therefore, the actual number of samples will be determined based on observations during processing the core and progressive results from analyses of the core.

The initial visual inspection in ultraviolet light will indicate where residual phase LNAPL may occur (as with the LIF, LNAPL will fluorescence in ultraviolet light). Observations of visible LNAPL will be used in selecting intervals for testing. If visible LNAPL is not observed in some locations, saturation testing will be skipped, with analysis of only TPH and PCP. Subsequent analysis of fluid saturations, particularly LNAPL saturation will be used to select subsamples for analysis of dissolved gases, TPH, and PCP. Representative intervals will be tested for porosity.

5.4 Sample Preservation and Shipping

Sample cores in the PVC liners will be labeled and stored on dry ice immediately after visual inspection through the clear PVC liner. The cores will be stored on-site on dry ice and then shipped on dry ice to the laboratory for processing and analysis.

5.5 Analytical Methods

Analyses being conducted by CSU, listed in Section 5.3, are described in Sale (2016) and Kiaalhosseini (2016), with the exception of PCP, which will be analyzed by GC/MS. Detection limits for these analyses are dependent on several factors, such as the soil types, core quality, LNAPL content in the samples, etc. Therefore, detection limits will be presented with the analytical results.

TOD being conducted by Redox Tech will include analysis of TPH and PCP on soil aliquots before and after oxidation of the sample. Analytical methods and detection limits for these analyses are presented in Appendix A.

5.6 Residual Phase LNAPL Soil Investigation Technical Memorandum

A Residual Phase LNAPL Soil Investigation Technical Memorandum will be prepared and submitted to summarize the activities discussed in this Work Plan. It will be provided to the WDNR within 60 days of receipt of all laboratory data described in this Work Plan.

Section 6

Soil Coring Methods

This section describes the specific sampling equipment and methodology for the collection of soil samples for chemical analysis from the soil sample locations to be determined, as described above.

6.1 Coring Methods

Drilling for this soil sampling program will be completed using hollow stem auger drilling. Soil sampling will consist of 2.5' long dual wall core barrels with liquid nitrogen freezing the soil and associated fluids inside a PVC liner. A detailed protocol for cryogenic core collection is provided by Sale (2016, Appendix B). In general, the methods include:

- Drilling to the depth immediately above the coring target depth with hollow stem augers.
- Inserting the cryogenic core barrel and advancing it with the augers, filling the PVC sample liner with 2.5 feet of soil solids and associated fluids.
- Liquid nitrogen is circulated around the sample barrel to freeze the sample, which takes approximately 5 to 7 minutes. Note, the use of liquid nitrogen will likely create a “white cloud” appearance due to the cold temperature of the liquid nitrogen, this is expected and does not create a hazard (unless touched due to the extreme cold). Recall, the air we breathe contains approximately 78% nitrogen.
- The core barrel is then retrieved, and the PVC core barrel extracted from the dual-wall cylinder.

The thickness of the smear zone off-site, at proposed borings M04 to M07, ranges from 0.8 ft. to 1.5 ft. thick. In these areas, 5 ft. of coring through the interval will be conducted, to obtain soils above, within, and below the LIF measured smear zone. At on-site locations M01 through M03, where the smear zone is 2.1 ft. to 6.5 ft. thick, 7.5 ft. to 10 ft. of core will be collected. The coring target depth will be based on the depth to the residual phase LNAPL zone determined from the LIF survey and the depth to the water table, as shown in Table 1.

Visual inspection of the soil core through the clear PVC core barrel will be recorded and the frozen sample core immediately placed on dry ice to keep the core frozen for storage during the drilling program and shipment to the laboratory. Upon receipt by CSU, the core will be stored in the laboratory in a -80° C freezer.

6.1.1 Sample Identification

Each sample of soil collected from the soil borings will be assigned a unique alphanumeric sample descriptor identifying the sample location. The sample ID and depth of collection will be recorded in the field notes.

6.1.2 Sample Shipment and Laboratory Analysis

Soil cores will be placed on dry ice immediately after collection for storage during the drilling program and then replenished with dry ice for transport to CSU for processing and analysis.

6.1.3 Sample Locations

The final locations of the borings will be documented using differential global positioning system (GPS) techniques. A Trimble Geoexplorer handheld GPS unit, with H-Star technology enabled (or equivalent), will be used to collect these locations. Where field conditions permit, carrier-phase signal data will be used for GPS data collection. When collecting GPS location data, field staff will continuously log a sample position until the predicted post-processed accuracy is better than 1 foot, or 30 position readings have been collected. All data collected with the Trimble GPS unit will be post-processed through the software program Trimble Pathfinder Office using nearby reference station Global Navigation Satellite System (GNSS) reference data, as available. GPS and survey data will be projected into the State Plane Wisconsin Central coordinate system (NAD83, US Feet).

6.1.4 Sample Location Abandonment

Soil borings will be backfilled with bentonite chips as the hollow stem augers are extracted in accordance with NR 141 Wis. Adm. Code.

6.2 Sample Quality Assurance/Quality Control (QA/QC) Samples

The condition of each cooler will be evaluated upon receipt at the laboratory, checking for remaining dry ice and checking the temperature of the frozen cores. Temperature blanks will be measured to assess whether the sample temperature was maintained during sample transport. Temperature blanks consist of a sample container, generally polyethylene, filled with tap water. As specified in NR 716.13(6)(b) Wis. Adm. Code, one temperature blank will be included for every shipping container.

6.3 Decontamination of Equipment

Equipment decontamination will include pressure washing the augers and core barrels. Each PVC core barrel liner will be new.

6.4 Investigation Derived Waste (IDW)

Hollow stem auger drill cuttings will be contained in labeled 55-gallon drums. The drums of soil cuttings will be sealed, labeled with the date and contents, and staged at the Wauleco project. After receipt and evaluation of the analytical results discussed in this Work Plan, additional waste characterization laboratory analysis will be performed, as required, to facilitate the off-site disposal of soil cuttings. Liquid IDW, from decontamination procedures, will be contained and liquids disposed to the Wauleco treatment system. Personal protection equipment waste will be contained and disposed as solid waste.

Section 7 Schedule

Consistent with NR 716.09(2)(h) Wis. Adm. Code, based on the approach described in this Work Plan, the targeted schedule is dictated by the availability of the specialized drilling contractor availability. The driller is currently scheduled to begin work on June 3. Drilling is expected to take 1 week. Following the drilling:

- Laboratory analysis will require approximately 60 days.
- Within 60 days of receipt of analytical data, a Residual Phase LNAPL Investigation Technical Memorandum will be prepared and submitted to the WDNR.

Section 8 References

Kiaalhosseini, S., R.L. Johnson, R. Rogers, M.I. Renno, M. Lyverse, and T. Sale. 2016. Cryogenic Core Collection (C 3) from Unconsolidated Subsurface Media. *Groundwater Monitoring and Remediation*. Vol. 36. No. 4. Fall 2016. Pages 41-69.

Sale, T., R. Johnson, R. Rogers. 2016 Third-Generation (3G) Site Characterization: Cryogenic Core Collection and High-Throughput Core Analysis - An Addendum to Basic Research Addressing Contaminants in Low Permeability Zones - A State of the Science Review. SERDP Project ER-1740.

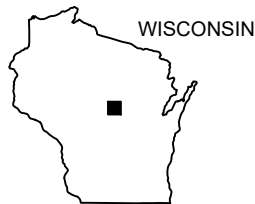
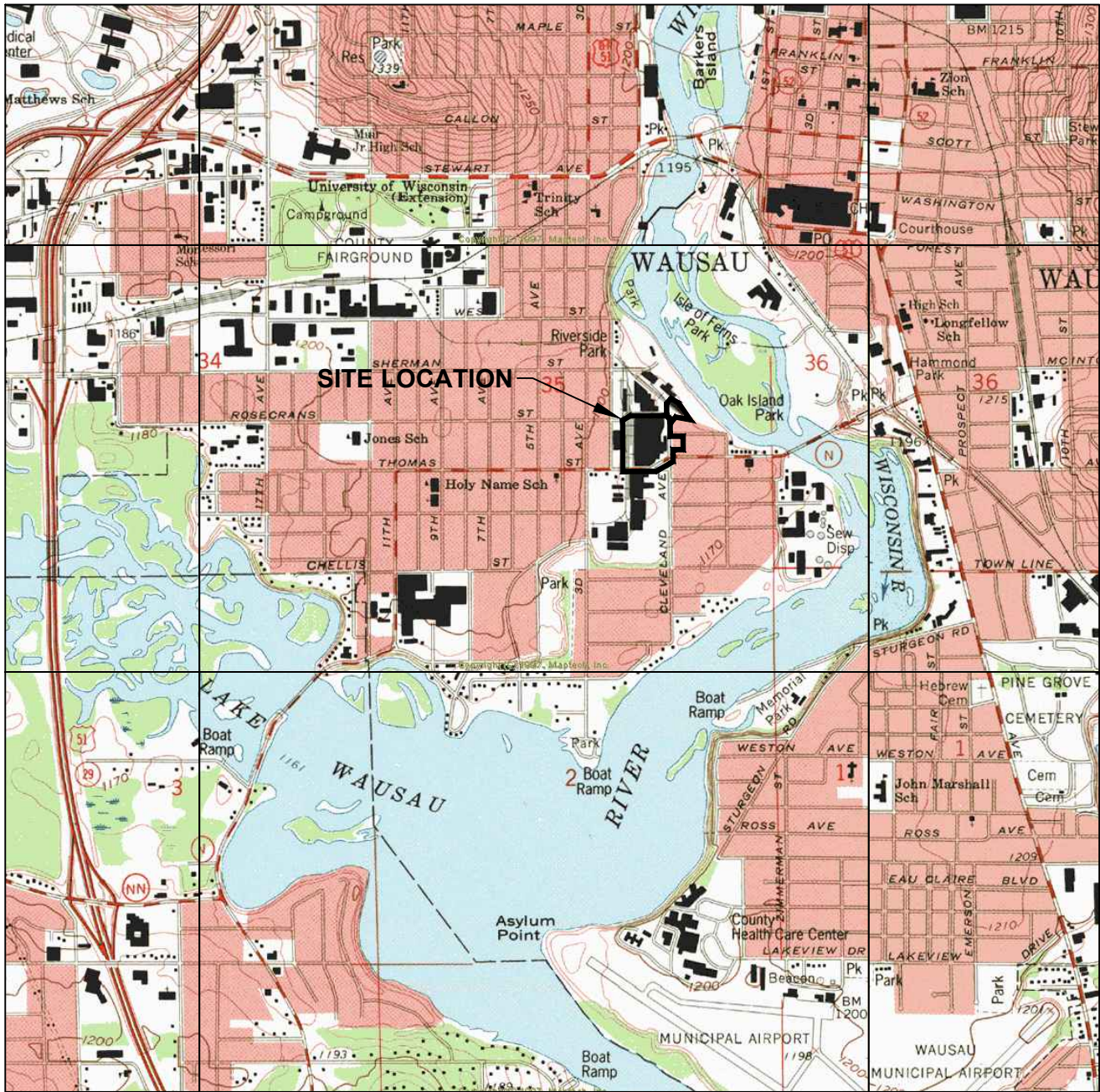
TRC. 2015. Extent of Residual Phase Product/2015 LIF Survey. August 28, 2015 Letter.

Table 1
 Boring Locations and LNAPL Depths
 Wauleco Project Site
 Wausau, Wisconsin

| PROPOSED LNAPL SOIL BORING ID | ADJACENT LIF PROBE ID | SURFACE ELEVATION (ft) | RELATIVE LOCATION | | DEPTH TO TOP OF RESIDUAL PHASE LNAPL (ft below ground) | THICKNESS OF RESIDUAL PHASE LNAPL (ft) |
|-------------------------------|-----------------------|------------------------|---------------------|----------------------|--|--|
| | | | ON WAULECO PROPERTY | OFF WAULECO PROPERTY | | |
| M01 | L03 | 1192.15 | X | | 28.9 | 2.1 |
| M02 | L06 | 1188.09 | X | | 24.9 | 6.0 |
| M03 | L07 | 1189.41 | X | | 25.6 | 4.0 |
| M04 | L08 | 1187.03 | | X | 26.2 | 0.9 |
| M05 | L36 | 1185.499 | | X | 25.4 | 1.0 |
| M06 | L34 | 1181.728 | | X | 21.8 | 0.8 |
| M07 | L39 | 1179.676 | | X | 18.6 | 1.4 |

Created by: K. Quinn April 5, 2019

Checked by: S. Sellwood April 5, 2019



NOTE

BASE MAP DEVELOPED FROM THE WAUSAU WEST AND WAUSAU EAST, WISCONSIN 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAPS, DATED 1993. PART OF SECTION 35, T29N, R8E

QUADRANGLE LOCATION



708 Heartland Trail
Suite 3000
Madison, WI 53717
Phone: 608.826.3600

PROJECT: **WAULECO, INC.**
RESIDUAL PHASE LNAPL SOIL
INVESTIGATION WORK PLAN
WAUSAU, WISCONSIN

TITLE:
SITE LOCATION MAP

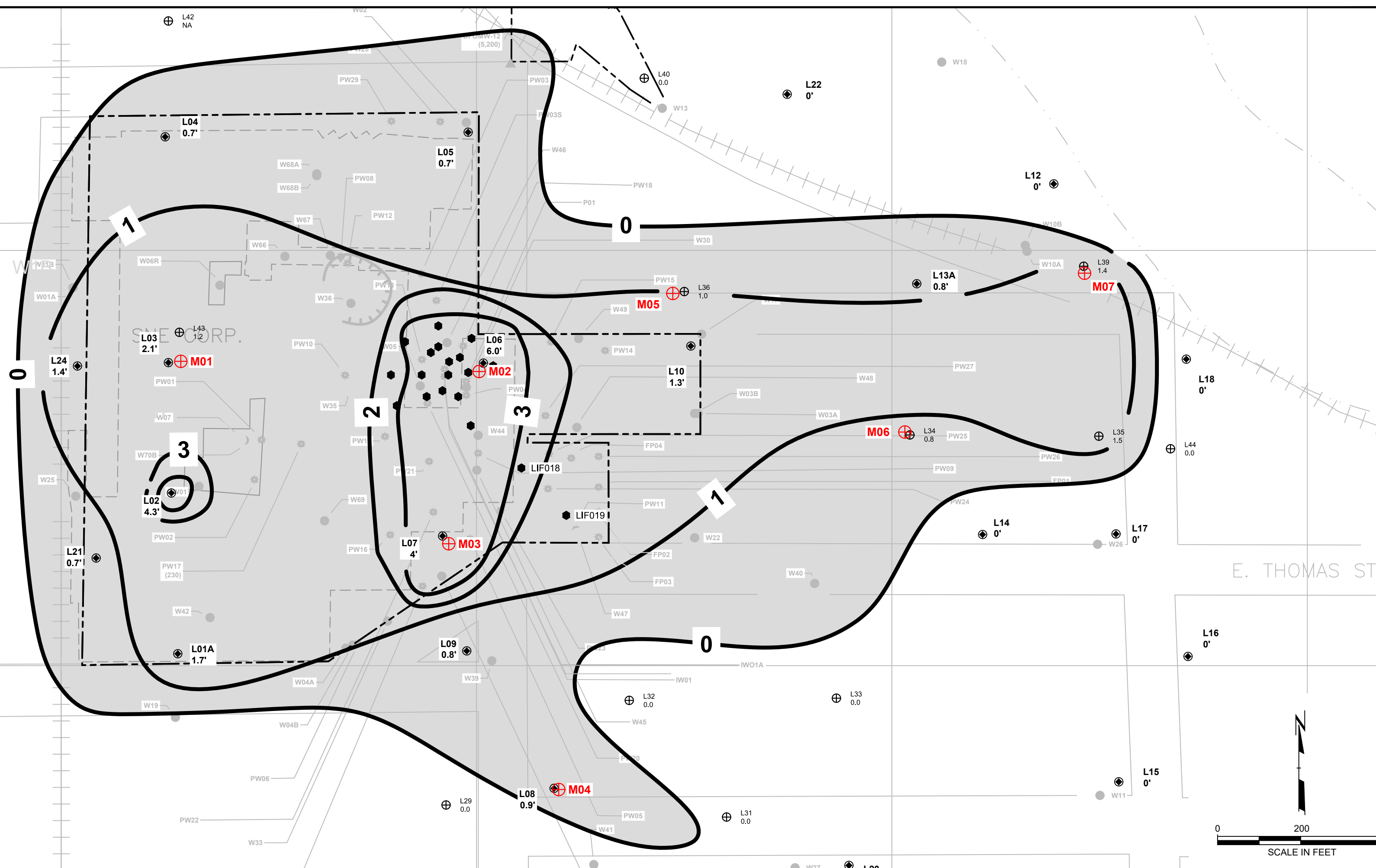
DRAWN BY: A. BLEECKER
CHECKED BY: K. QUINN
APPROVED BY: B. IVERSON
DATE: APRIL 2019
PROJ. NO.: 189597.0008.0000
FILE: SITE LOCATION MAP.dwg

FIGURE 1

1104 - ATTACHED XREFS: Baume & Mercier, JULY 2014 F03 BASE MAP, LIF Probe and Well, Point, LIF Probe, Potential Boring Locations - ATTACHED IMAGES
 DRAWING NAME: J:\Wauleco\189597\0006\0003-PR Investigation.dwg -- PLOT DATE: April 18, 2019 - 10:18 AM -- LAYOUT: 21MAPL PROPOSED FIELD INVESTIGATION LOCATIONS

FIRST AVE.

E. THOMAS ST.

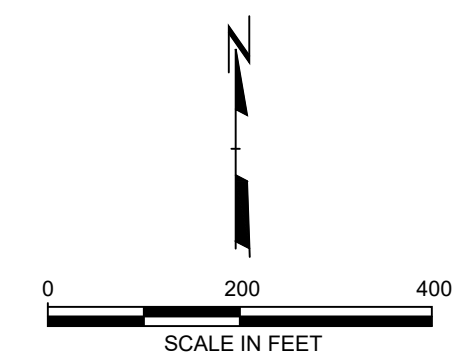


LEGEND

- W17 ● MONITORING WELL LOCATION AND NUMBER
- PW12 ⚙️ EXTRACTION WELL LOCATION AND NUMBER
- DFOMW-5 ▲ 3M GROUNDWATER MONITORING WELL
- - - APPROXIMATE PROPERTY LINE
- - - FORMER BUILDING OUTLINE
- 50 — PCP ISOCONCENTRATION CONTOUR INTERVAL VARIES (DASHED WHERE INFERRED)
- -2003 & 2005 LIF LOCATIONS (LIF001-LIF017 SHOWN BUT NOT LABELED)
- L22 0' - 2013 LIF LOCATION - THICKNESS OF LIF RESPONSE
- ⊕ L24 1.4' - 2015 LIF PROBE LOCATION - THICKNESS OF LIF RESPONSE
- ⊕ M06 PROPOSED BORING LOCATIONS
- 0 — ESTIMATED THICKNESS OF RESIDUAL PHASE PRODUCT (DASHED WHERE INFERRED)

NOTES

1. BASE MAP DEVELOPED FROM DRAWING A107250-1 OF THE SEPTEMBER 1992 SEMI-ANNUAL GROUNDWATER MONITORING REPORT BY KEYSTONE ENVIRONMENTAL, MWH DRAWING 2082658.302160101-B1, AND 3M WELLS LOCATION BASED ON 3M MAPS.
2. LASER INDUCED FLUORESCENCE (LIF) SURVEY COMPLETED JUNE 2-13, 2015 AND JUNE 11-13, 2013 BY TRC AND COLUMBIA TECHNOLOGIES, INC.
3. LIF RESULTS FROM 2003 AND 2005 WERE ALSO USED TO ESTIMATE THE THICKNESS OF RESIDUAL PHASE PRODUCT.
4. THICKNESS OF LIF RESPONSE AT L06 WAS CORRECTED FROM AUGUST 25, 2015 MEMORANDUM, WAULECO: EXTENT OF RESIDUAL PHASE PRODUCT/2015 LIF SURVEY, FIGURE 1, LIF SURVEY RESULTS.



| | | |
|--|----------------------------|---|
| PROJECT: WAULECO, INC. | | |
| RESIDUAL PHASE LNAPL SOIL INVESTIGATION WORK PLAN | | |
| WAUSAU, WISCONSIN | | |
| TITLE: LNAPL PROPOSED FIELD INVESTIGATION LOCATIONS | | |
| DRAWN BY: A. BLEECKER | PROJ NO.: 189597.0008.0000 | FIGURE 2 |
| CHECKED BY: K. QUINN | | |
| APPROVED BY: B. IVERSON | | |
| DATE: APRIL 2019 | | |
| | | 708 Heartland Trail Suite 3000 Madison, WI 53717 Phone: 608.826.3600 |
| FILE NO.: 189597.0006.0003-PR Investigation.dwg | | |

Appendix A

Analytical Methods Detection Limits

Appendix A
Analytical Methods Detection Limits

| TEST GROUP | METHOD | MATRIX | ANALYTE | CAS # | DETECTION LIMIT | REPORTING LIMIT | UNITS |
|------------------------------|--------|--------|--------------------------|---------|-----------------|-----------------|-------|
| SVOC | 8270D | Soil | Pentachlorophenol | 87-86-5 | 0.05 | 0.05 | mg/kg |
| Total Petroleum Hydrocarbons | 8015M | Soil | TPH - as Mineral Spirits | -- | 8 | 26 | mg/kg |

Note:

TPH as Mineral Spirits detection limit and reporting limits presented here are for TPH-DRO. TPH-as Mineral Spirits will be similar but determined during analysis.