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## From:

Brad Saunders, P.E.

## Date:

August 27, 2018

## Arcadis Project No.:

B0064607.2018

## Subject:

RACER Pontiac North Campus - 2018 Additional LNAPL Pre-Design /  
Transmissivity Testing and Interim Measure Removal Work Plan

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## INTRODUCTION

Arcadis of Michigan, LLC (Arcadis) prepared this memorandum to summarize the results of additional light non-aqueous phase liquid (LNAPL) pre-design / transmissivity testing activities and provide an Interim Measure (IM) removal work plan on behalf of Revitalizing Auto Communities Environmental Response (RACER) Trust for the Pontiac North Campus Site (Site) located in Pontiac, Michigan (**Figure 1**). LNAPL gauging and testing activities were conducted in July 2018 to develop removal system specifications at one location and further determine the feasibility for LNAPL removal at four other locations. The scope of July 2018 LNAPL gauging and testing activities was developed based on the following:

- The results of LNAPL gauging and testing activities conducted in January-February 2018 which were summarized and reported in the *RACER Pontiac North Campus – 2018 LNAPL IM Feasibility Confirmation and Pre-Design Specification Testing Memorandum* (Arcadis 2018), subsequent USEPA correspondence, and more recent LNAPL gauging activities.
- A combination of previous investigation activities, LNAPL Decision Tree analysis, and previous USEPA correspondence as summarized in the Introduction of 2018 LNAPL IM Feasibility Confirmation and Pre-Design Specification Testing Memorandum. Relevant references include the *General Motors Corporation Pontiac North Campus –LNAPL Mobility Evaluation* (ENCORE 2007), *Draft RACER Pontiac North Campus – Corrective Measures Proposal* (Arcadis 2013), the

*Michigan Department of Environmental Quality (MDEQ) Non-Aqueous Phase Liquid (NAPL) Characterization, Remediation, and Management for Petroleum Releases (RRD Resource Materials-25-2014-01, June 2014), and the RACER Pontiac North Campus – 2013/2014 LNAPL Investigation Technical Memorandum (Arcadis 2015).*

Following up on the results of January-February 2018 investigation activities, the scope of July 2018 activities included developing LNAPL removal system specifications as necessary to complete a work plan at monitoring well SB-08-14 (LNAPL Area #2A within AOI W-10), and further evaluating the feasibility of removing LNAPL at monitoring well locations SB-25-14 (LNAPL Area #2B within AOI W-10) and SB-43-14 (LNAPL Area #1/7 within AOI W-1). In addition, based on the results of recent gauging activities, the scope of July 2018 activities also included re-evaluating the feasibility of removing LNAPL at monitoring well locations MWW8-65 and TWW8-01 (LNAPL Area #11 with AOI W-5). Refer to **Figure 2** for the location of these wells.

LNAPL mobility modeling was completed following ASTM International (ATSM), Interstate Technology and Regulatory Council (ITRC) and American Petroleum Institute (API) methods.

## PRE-MOBILIZATION GAUGING AND TEST PLANNING ACTIVITIES

Prior to mobilizing to the Site to conduct testing activities, Arcadis conducted additional LNAPL gauging activities at select monitoring wells to determine if the locations would be conducive to LNAPL transmissivity and/or pre-design removal testing.

### **Monitoring Well SB-25-14**

Following up on the results of three gauging events conducted in January-February 2018 LNAPL when only 0.01-foot of LNAPL was present, monitoring well SB-25-14 was gauged again on June 22, 2018 to determine if LNAPL might be present in the well at a thickness which would warrant transmissivity testing and further consideration for the feasibility of removal. The thickness of LNAPL measured in the well during the June 22, 2018 event was only 0.08-foot, which was insufficient to support transmissivity or removal testing. A summary of historical gauging data at SB-25-14 is included as **Table 1**.

### **Monitoring Well MWW8-65**

The results of a gauging event conducted in October 2017 revealed that 9.46 feet of LNAPL was present in monitoring well MWW8-65, which was significantly more product measured in the well than in prior events over the past ten years (refer to **Table 2**). Monitoring well MWW8-65 was gauged again on June 22, 2018, during which 8.29 feet of product was measured in the well. The thickness of LNAPL present in monitoring well MWW8-65 was 2.88 feet when transmissivity testing was last conducted on the well on April 10, 2014. Based on the increase in measured LNAPL thickness, additional transmissivity testing was planned at monitoring well MWW8-65 for the July 2018 field event. A summary of historical gauging data at MWM8-65 is included as **Table 2**.

### **Monitoring Well TWW8-01**

The results of a gauging event conducted in October 2017 revealed that 6.94 feet of LNAPL was present in monitoring well TWW8-01, which was consistent with the 5.75 feet thickness in the well when transmissivity testing was conducted on April 10, 2014. However, the well was dry during other gauging events conducted before and after the last transmissivity test (refer to **Table 3**). Based on the sufficient thickness of LNAPL measured in this well, additional transmissivity testing was planned at monitoring well

TWW8-01 for the July 2018 field event. A summary of historical gauging data at TWW8-01 is included as **Table 3**.

## LNAPL REMOVAL PRE-DESIGN RECOVERY TESTING

Based on the results of January-February 2018 LNAPL transmissivity and feasibility tests, LNAPL recovery testing was performed on monitoring wells SB-08-14 from July 16-19, 2018 and SB-43-14 on July 16, 2018. Field staff pumped LNAPL out of each well with a top loading pneumatic pump to quantify the volume that can be removed from each over an extended period. The depth to product was monitored as the tests were conducted.

### Monitoring Well SB-08-14

Upon mobilizing to the Site on July 16, 2018, the depth to LNAPL at monitoring well SB-08-14 was measured at 13.15 feet (from the top of the stick-up) and the depth to water was measured at 23.47 feet for a total LNAPL thickness of 10.32 feet. LNAPL sample SB-08-14\_LNAPL\_07162018 was collected during recovery testing for waste characterization analysis. Laboratory analytical reports are included as **Attachment 1**.

LNAPL from SB-08-14 was pumped into six total 55-gallon drums for storage and disposal. The volume of LNAPL recovered in each drum and an overall total is displayed below:

### Recovery Totals from SB-08-14

Drum	DTP (ft)	DTW (ft)	Product Volume (gal)	Water volume (gal)
1	0.72	2.05	27.5	15.7
2	0.52	1.73	25.0	22.3
3	1.90	2.25	7.2*	11.6
4	0.21	1.96	36.1	17.6
5	0.65	2.27	33.5	11.2
6	2.34	2.68	7.0	0.4
<b>TOTAL</b>			<b>136.3*</b>	<b>78.7</b>

\*Includes about three gallons pumped out of SB-43-14

It was demonstrated that the monitoring well could maintain a flow rate of about 0.25 GPM for up to 8 hours of continuous operation each day. SB-08-14 yielded a total of over 135 gallons of LNAPL over the course of five days consistent with transmissivity testing conducted in February that produced an estimated transmissivity of 8.2 ft<sup>2</sup>/day. The yield of LNAPL recovered from SB-08-14 allowed continuous operation throughout the testing period. Due to the size of the well, a total fluids recovery pump had to be used during testing so that a portion of the recovered volume was also water. Over 78 gallons of water was recovered which gradually separated out from recovered fluid in drums throughout recovery testing.

### Monitoring Well SB-43-14

Field staff also conducted recovery testing at SB-43-14. Prior to the test, the depth to LNAPL was measured at 20.11 feet and the depth to water was measured at 20.61 feet, for a total LNAPL thickness of 0.50 feet. The yield of LNAPL at this well was noted to be significantly less than that at SB-08-14; a total of only about 3.1 gallons was recovered on 7/16/18. Very little recovery of LNAPL occurred from 7/17-7/18/18, preventing further recovery testing.

## LNAPL TRANSMISSIVITY TESTING

LNAPL transmissivity represents the volumetric rate of LNAPL flow through a unit width of porous media per unit time under a unit hydraulic gradient. LNAPL transmissivity is an ideal parameter for assessing LNAPL recoverability, inherently accounting for the combined effects of aquifer matrix permeability, LNAPL physical properties, and the relative proportion of pore space occupied by LNAPL within a specified vertical interval of aquifer material.

As previously described, transmissivity tests were previously conducted at monitoring wells MWW8-65 and TWW8-01 in April 2014. The previous results from these two locations were below the ITRC practical lower limit of LNAPL recoverability range of 0.1 to 0.8 square feet  $\text{ft}^2/\text{day}$  (ITRC 2009) and the Michigan Department of Environmental Quality (MDEQ) lower limit LNAPL transmissivity value of 0.5  $\text{ft}^2/\text{day}$  (MDEQ 2014) which indicated that removal activities would not be feasible. Based on recent LNAPL thickness gauging results and to confirm the continued validity of previous results, transmissivity testing was conducted again at each location.

### Monitoring Well MWW8-65

A baildown transmissivity test was performed at monitoring well MWW8-65 on July 17-19, 2018. The well had an initial depth to LNAPL of 25.57 feet and a depth to water of 34.54 feet, for a total LNAPL thickness of 8.97 feet. Field staff initially attempted to remove the LNAPL with a peristaltic pump, but switched to use of a bailer to remove in-well NAPL faster, and subsequent LNAPL depths were recorded at varying time intervals for three days. Recovery was noted as being limited, as the LNAPL depth had recovered to only 4.73 feet after three days.

Transmissivity was estimated in the range of 0.003-0.01  $\text{ft}^2/\text{day}$  depending on the analytical drawdown solution (see **Attachment 2**). This transmissivity value is well under the MDEQ lower limit LNAPL transmissivity value of 0.5  $\text{ft}^2/\text{day}$  and indicates that removal activities are not feasible at this location. A summary of the July 2018 data is presented in **Table 2**.

### Monitoring Well TWW8-01

A baildown transmissivity test was performed at monitoring well TWW8-01 on July 17-19, 2018. The well had an initial depth to LNAPL of 23.72 feet and a depth to water of 31.38 feet, for a total LNAPL thickness of 7.66 feet. Using a bailer, field staff evacuated LNAPL from the well and monitored LNAPL and water depths periodically over the next three days. LNAPL thickness recovered to 5.71 feet by the end of the monitoring period.

Transmissivity was estimated to be in the range of 0.01-0.02  $\text{ft}^2/\text{day}$  depending on the analytical drawdown solution (see **Attachment 2**). This transmissivity is well under the MDEQ lower limit LNAPL transmissivity value of 0.5  $\text{ft}^2/\text{day}$  and indicates that removal activities are not feasible at this location. A summary of the July 2018 data is presented in **Table 3**.

## WASTE CHARACTERIZATION

On July 16, 2018, LNAPL was collected from SB-08-14 and sent to Merit Laboratories (Merit) of East Lansing, Michigan for analysis of toxicity characteristic leaching procedure (TCLP) volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). These analyses supplemented previously reported characterization data from samples obtained in January-February 2018 and analyzed for total polychlorinated biphenyls (PCBs), TCLP metals, flashpoint, and pH. In addition, on July 19, 2018,

LNAPL was collected from MWW8-65 and sent to Merit for analysis of these same parameters. Results are compared to Resource Conservation and Recovery Act (RCRA) hazardous waste limits specified in 40 CFR Part 261.21-24 and Toxic Substances Control Act (TSCA) regulatory limits specified in 40 CFR 761.61 (a)(5)(i)(B)(2) and are summarized in the table below. Laboratory analytical results are included as **Attachment 1**.

Parameter	Units	SB-08-14	MWW8-65	TSCA limit	RCRA limit
PCBs		02/19/2018	07/19/2018		
Aroclor-1016	mg/kg	< 17 Y	< 1	> 50	--
Aroclor-1221	mg/kg	< 17 Y	< 1	> 50	--
Aroclor-1232	mg/kg	< 17 Y	< 1	> 50	--
Aroclor-1242	mg/kg	< 17 Y	< 1	> 50	--
Aroclor-1248	mg/kg	83 Y	1.2	> 50	--
Aroclor-1254	mg/kg	< 17 Y	< 1	> 50	--
Aroclor-1260	mg/kg	< 17 Y	< 1	> 50	--
Total PCBs	mg/kg	<b>83</b>	<b>&lt; 1</b>	> 50	--
Volatile Organics		07/16/2018	07/19/2018		
Benzene	mg/L	< 5	< 5	--	> 0.5
Carbon Tetrachloride	mg/L	< 5	< 5	--	> 0.5
Chlorobenzene	mg/L	< 5	< 5	--	> 100
Chloroform	mg/L	< 5	< 5	--	> 6
1,4-Dichlorobenzene	mg/L	< 5	< 5	--	> 7.5
1,2-Dichloroethane	mg/L	< 5	< 5	--	> 0.5
1,1-Dichloroethane	mg/L	< 5	< 5	--	> 0.7
2-Butanone (MEK)	mg/L	< 50	< 50	--	> 200
Tetrachloroethene	mg/L	< 5	< 5	--	> 0.7
Trichloroethene	mg/L	< 5	< 5	--	> 0.5
Semi-Volatile Organics		07/16/2018	07/19/2018		
o-Cresol	mg/L	< 100	< 100	--	> 200
p,m-Cresol	mg/L	< 200	< 200	--	> 200
Pentachlorophenol	mg/L	< 100	< 100	--	> 100
2,4,5-Trichlorophenol	mg/L	< 100	< 100	--	> 400
2,4,6-Trichlorophenol	mg/L	< 100	< 100	--	> 2
2,4-Dinitrotoluene	mg/L	< 100	< 100	--	> 0.13
Hexachlorobenzene	mg/L	< 100	< 100	--	> 0.13
Hexachlorobutadiene	mg/L	< 100	< 100	--	> 0.50
Hexachloroethane	mg/L	< 100	< 100	--	> 3
Nitrobenzene	mg/L	< 100	< 100	--	> 2
Pyridine	mg/L	< 100	< 100	--	> 5
Inorganics		01/17/2018	07/19/2018		
Arsenic	mg/L	4.18	0.31	--	> 5.0

Barium	mg/L	1.18	< 1.0	--	> 100.0
Cadmium	mg/L	< 0.20	< 0.20	--	> 1.0
Chromium	mg/L	1.60	< 0.50	--	> 5.0
Lead	mg/L	< 0.30	< 0.30	--	> 5.0
Mercury	mg/L	< 0.0005	< 0.001	--	> 0.2
Selenium	mg/L	< 0.40	< 0.40	--	> 1.0
Silver	mg/L	< 0.20	< 0.20	--	> 5.0
<b>Waste Characteristics</b>		<b>01/17/2018</b>	<b>07/19/2018</b>		
Flash point	°F	ND up to 180°	ND up to 180°	--	< 140°
pH	STD units	5.56	6.31	--	< 2.0, > 12.5

## Notes:

°F - degrees Fahrenheit

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

ND - nondetect

STD - standard

Y - Elevated reporting limit due to high target concentration

**Bold** - exceeds one or more listed limits.

Flash Point Interpretation: Samples did not ignite at temperatures up to 180 °F

## CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations based on the results of gauging and testing including the following:

- Based on recent LNAPL thickness measurement results at monitoring well location SB-25-14, no future transmissivity testing or removal is recommended for this location. Gauging of this well is proposed to be included in the annual groundwater monitoring program.
- Based on the results of pre-design testing conducted at SB-08-14, implementation of a LNAPL Removal IM Work Plan is recommended as proposed below. Based on additional waste characterization testing performed at SB-08-14, waste generated during removal activities will remain a liquid TSCA regulated waste. Laboratory reporting limits were elevated for certain VOCs and SVOCs which exceeded RCRA hazardous waste thresholds due to required dilution for analysis, but no detections of such contaminants occurred and there is no indication that such contaminants exist. Therefore, based on recent characterization data and prior LNAPL physical characterization data and disposal facility approvals, the waste will remain characterized as RCRA non-hazardous.
- Based on the results of pre-design testing and gauging conducted at SB-43-14, no future transmissivity testing or removal is recommended for this location. Gauging of this well is proposed to be included in the annual groundwater monitoring program.
- Based on the results of transmissivity testing at MWW8-65 and TWW8-01, no future transmissivity testing or removal is recommended for these two locations. Gauging of these wells is proposed to be included in the annual groundwater monitoring program. Based on waste characterization testing performed at MWW8-65, waste generated during removal activities did not exceed TSCA or RCRA thresholds. Similar to the test results at SB-08-14, due to required dilution laboratory reporting limits for certain VOCs and SVOCs exceeded RCRA hazardous waste thresholds.

Similar to the characterization at SB-08-14, no detections of such contaminants occurred and there is no indication that such contaminants exist.

## SB-08-14 LNAPL REMOVAL IM WORK PLAN

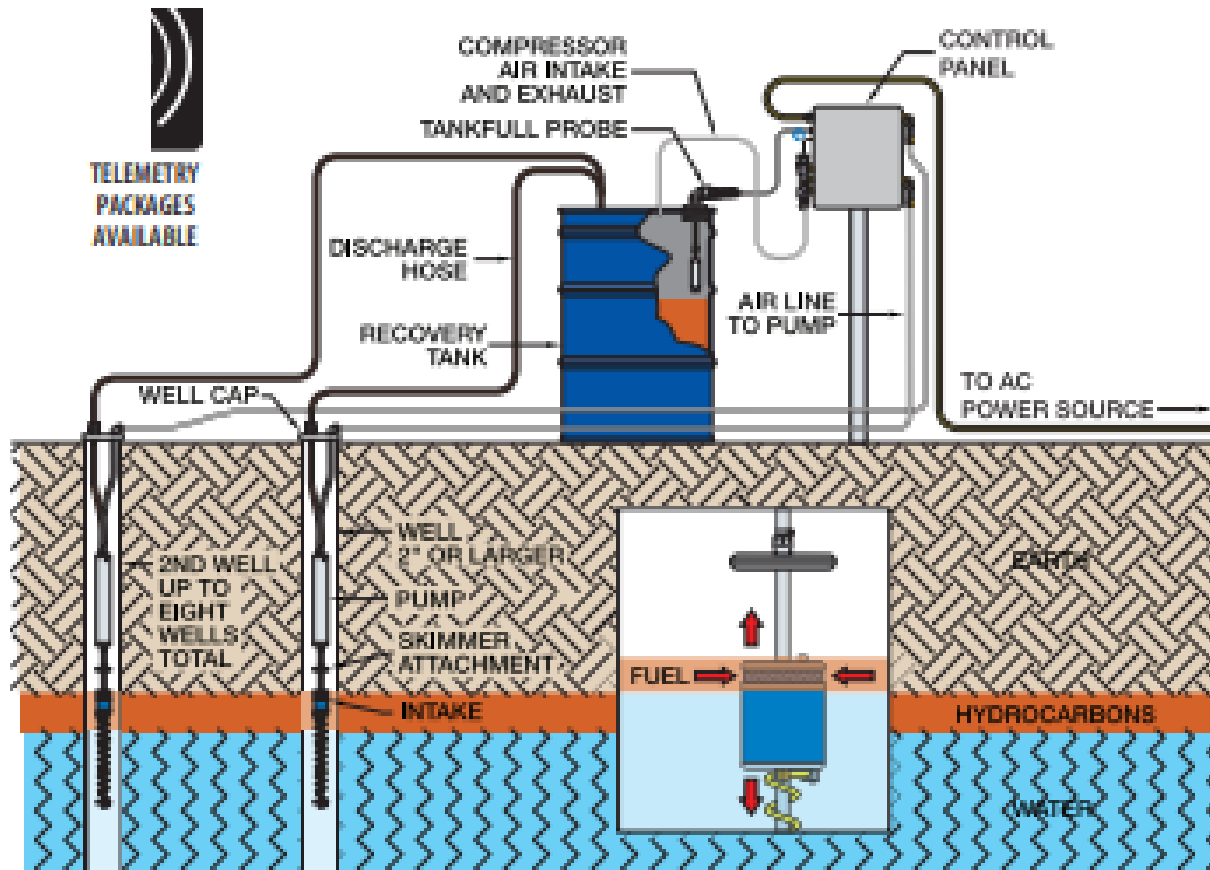
Consistent with the conclusions and recommendations, the following proposes an IM work plan for LNAPL recovery at location SB-08-14:

### Recovery Well Installation

To allow room for LNAPL skimming equipment and well gauging, it is proposed that a 6-inch recovery well be installed within 5 feet of SB-08-14. The well screen will be installed from 10.0-20.0 feet below ground surface. The proposed depth is identical to that of SB-08-14, but the screen length may be adjusted based on lithological interpretation in the field.

### Equipment Specifications and Purchase

A Geotech Single-Well AC Sipper is the proposed hydrocarbon recovery system to be implemented at this well. A schematic of this system is displayed below:



Geotech Single-Well AC Sipper Process Schematic ([www.geotechenv.com](http://www.geotechenv.com))

A 4" skimmer will automatically adjust to keep the pump intake in line with the LNAPL level in the well using a floating specific gravity intake to minimize water from being drawn up with the LNAPL. This skimmer is attached to a down well pneumatic pump. This pump is attached to both a 0.17" inner diameter (ID) airline that runs to the control panel and a 0.375" ID hose that will discharge into 275-gallon intermediate bulk containers (IBCs). It is estimated that up to 35 feet of airline tubing and about 75 feet of discharge tubing will be necessary to reach the control panel and recovery IBCs.

The control panel is enclosed in a weather-proof NEMA 3R enclosure that will be mounted on a pole adjacent to the well. The well control panel includes an automatic shutoff switch for when the tank is full, a pressure/vacuum pump, and a pressure-vacuum gauge. Electrical service will be installed so the control panel will have 120-volt power supply.

The discharge line will run into a TSCA-compliant storage IBC that is stored within secondary containment in a shed like the one displayed below:



Potential IBC storage configuration ([www.absorbentsonline.com](http://www.absorbentsonline.com))

The hard-top spill protection modules are available in units of two to five. It is proposed that two units be utilized to begin operations (for a total fluid capacity of 550 gallons), and more units can be added if more capacity is needed. The tote pallets include extra secondary containment storage attached behind the main unit allowing the IBC to be stored closer to the ground than other alternatives. This will make it easier to move the IBCs when a waste pickup is necessary.

### **System Installation and Startup**

It is anticipated that the recovery well will be installed first followed by installation of electrical service, skimming pump, and associated LNAPL recovery equipment. Installation of an electrical power drop and meter will be coordinated with DTE and a licensed electrician will connect the control panel to the electrical supply.

Once the recovery system is installed, field staff will assemble the hard-top spill protection and containment modules adjacent to the recovery well. Storage IBCs will be delivered to the Site. Access holes will be drilled into the containment units so that a discharge hose can be run into each IBC. Tank full shutoff probes will be installed to prevent overfilling of IBCs.

### **Operations Monitoring and Maintenance**

The system will initially be optimized to maximize the amount of LNAPL that is collected from the recovery well. It was demonstrated during recovery testing that a flow rate of 0.25 GPM could be sustained for eight hours, and that was limited by a field staff member needing to be present during the testing. Recovery

rates will be monitored each business day for the first week of operation, and inspection frequencies will be reduced following the initial week as LNAPL recovery rates drop over time to accommodate storage and waste removal contractor availability. Any required maintenance and well gauging will be completed during site inspections.

**LNAPL System Shutdown Criteria**

The system will be shut down when data from the field indicates that transmissivity values drop below the MDEQ lower limit LNAPL transmissivity value of 0.5 ft<sup>2</sup>/day. The recovery well will be gauged over the course of weeks for a month following this observation. If enough LNAPL accumulates to conduct transmissivity testing, then testing will occur to determine if transmissivity remains below the MDEQ threshold. If it does not, system operation will resume. If it does, the system will remain shut down. If after a year transmissivity values remain below the MDEQ threshold in the recovery well, the system will be dismantled and removed from the Site.

**Schedule**

Equipment can be purchased and subcontractor procurement for the well installation and equipment installation can occur after USEPA approval of this plan and the system installed as soon as practical thereafter, weather permitting. Equipment and contractor procurement is anticipated to be conducted in the fall of 2018. Field implementation (system installation) will also be initiated in the fall of 2018, weather permitting. A draft schedule for implementation is included below:

Weeks from USEPA approval	Item
3 weeks	Coordination with utility company
	Equipment procurement
7 weeks	Utility locate
	Well installation
	Contractor coordination
10 weeks	Skimmer pump and storage equipment installation
	Electrical service installation and electrical infrastructure installation
12 weeks	System startup and begin operations and maintenance inspections

Please contact us if you have any questions regarding this memo or its attachments.

Sincerely,

Arcadis of Michigan, LLC



Brad Saunders, P.E.  
Principal Engineer/ Certified Project Manager

### Table

Table 1	SB-25-14 Gauging Data
Table 2	MWW8-65 Gauging Data
Table 3	TWW8-01 Gauging Data
Table 4	LNAPL Baildown Testing and Analysis Results

### Figures

Figure 1	Site Location
Figure 2	Proposed Corrective Measure - LNAPL

### Attachments

Attachment 1	Merit Analytical Reports
Attachment 2	Transmissivity Test Output Graphs

### References

Arcadis. 2015. RACER Pontiac North Campus – 2013/2014 LNAPL Investigation Technical Memorandum. January 29, 2015.

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# TABLES

**Table 1  
SB-25-14 Gauging Data  
RACER - Pontiac North Campus  
Pontiac, MI**

Date	Well Screen (ft bgs)	Well Screen (ft bTOC)	TOC (ft AMSL)	Depth to LNAPL (ft bTOC)	Depth to Water (ft bTOC)	Air/LNAPL Interface (ft AMSL)	LNAPL/Water Interface (ft AMSL)	Potentiometric Surface (ft AMSL)	LNAPL thickness (ft)	Notes
6/17/2014	9-19	10.62-20.62	966.21	NA	15.21	NA	NA	951.00	0	
6/30/2014			966.21	NA	15.64	NA	NA	950.57	0	
7/28/2014			966.21	NA	16.13	NA	NA	950.08	0	
9/10/2014			966.21	16.62	17.95	949.59	948.26	949.39	1.33	Transmissivity testing 9/18/14; Removed 0.1 gallons of LNAPL and 0.3 gallons of water
10/24/2014			966.21	16.08	16.73	950.13	949.48	950.03	0.65	
10/30/2014			966.21	16.05	16.36	950.16	949.85	950.11	0.31	LNAPL sampled; Collected approximately 8 oz of LNAPL and water
6/24/2015			966.21	16.27	17.14	949.94	949.07	949.80	0.87	
9/21/2015			966.21	17.41	18.72	948.80	947.49	948.60	1.31	
10/23/2015			966.21	16.08	16.73	950.13	949.48	950.03	0.65	
1/18/2016			966.21	16.12	18.61	950.09	947.60	949.71	2.49	
8/15/2016			966.21	16.53	16.76	949.68	949.45	949.64	0.23	
1/17/2018			966.21	16.15	16.16	950.06	950.05	950.05	0.01	
1/29/2018			966.21	15.81	15.82	950.40	950.39	950.39	0.01	
2/19/2018			966.21	15.88	15.89	950.33	950.32	950.32	0.01	
6/22/2018			966.21	15.22	15.30	950.99	950.91	950.97	0.08	

ft = feet  
 AMSL = above mean sea level  
 TOC = top of casing  
 bTOC = below top of casing  
 bgs = below ground surface  
 NA = not applicable due to lack of LNAPL  
 oz = ounces  
 LNAPL = light non-aqueous phase liquid

**Table 2**  
**MWW8-65 Gauging Data**  
**RACER - Pontiac North Campus**  
**Pontiac, MI**

Date	Well Screen (ft bgs)	Well Screen (ft bTOC)	TOC (ft AMSL)	Depth to LNAPL (ft bTOC)	Depth to Water (ft bTOC)	Air/LNAPL Interface (ft AMSL)	LNAPL/Water Interface (ft AMSL)	Potentiometric Surface (ft AMSL)	LNAPL thickness (ft)	Notes
November 4, 2008	25-35	24.47-34.47	969.71	34.15	NA	935.56	NA	NA	0.03	
November 2, 2010			969.71	31.21	NA	938.50	NA	NA	3.34	
September 20, 2011			969.71	31.07	NA	938.64	NA	NA	3.48	
February 18, 2013			969.71	32.10	NA	937.61	NA	NA	2.36	
February 22, 2013			969.71	33.90	34.16	935.81	935.55	935.77	0.26	
March 1, 2013			969.71	32.96	34.01	936.75	935.70	936.60	1.05	
March 15, 2013			969.71	33.45	34.30	936.26	935.41	936.14	0.85	
April 6, 2013			969.71	33.61	34.13	936.10	935.58	936.03	0.52	
April 22, 2013			969.71	33.71	35.10	936.00	934.61	935.81	1.39	
April 23, 2013			969.71	33.81	35.11	935.90	934.60	935.72	1.30	
May 3, 2013			969.71	34.62	35.01	935.09	934.70	935.04	0.39	
June 24, 2013			969.71	34.66	35.08	935.05	934.63	934.99	0.42	
August 2, 2013			969.71	34.79	35.05	934.92	934.66	934.88	0.26	
October 17, 2013			969.71	34.40	35.03	935.31	934.68	935.22	0.63	
November 22, 2013			969.71	34.56	35.01	935.15	934.70	935.09	0.45	
December 1, 2013			969.71	NA	35.15	NA	NA	934.56	0.00	
April 7, 2014			969.71	31.73	34.61	937.98	935.10	937.58	2.88	Transmissivity testing 4/10/14; Removed 0.15 gallons and LNAPL and 0.05 gallons of water
October 15, 2017			969.71	25.11	34.57	944.60	935.14	943.29	9.46	
June 22, 2018	969.71	26.09	34.38	943.62	935.33	942.47	8.29			
July 17, 2018	969.71	25.57	34.54	944.14	935.17	942.90	8.97	Transmissivity testing 7/17/18; removed ~ 2 gallons of LNAPL		

ft = feet  
 AMSL = above mean sea level  
 TOC = top of casing  
 bTOC = below top of casing  
 bgs = below ground surface  
 NA = not applicable due to either lack of LNAPL or water  
 LNAPL = light non-aqueous phase liquid

Note: Well screen information based on boring log from Encore Environmental Consortium (EEC) in 2008. Several depth to LNAPL and/or depth to water measurements appear to exceed the total depth of the well screen. Variation in logged screen depth vs. actual total depth may have had inaccuracies or the well may have settled over time.

**Table 3**  
**TWW8-01 Gauging Data**  
**RACER - Pontiac North Campus**  
**Pontiac, MI**

Date	Well Screen (ft bgs)	Well Screen (ft bTOC)	TOC (ft AMSL)	Depth to LNAPL (ft bTOC)	Depth to Water (ft bTOC)	Air/LNAPL Interface (ft AMSL)	LNAPL/Water Interface (ft AMSL)	Potentiometric Surface (ft AMSL)	LNAPL thickness (ft)	Notes	
December 2, 2013	20-30	22.47-32.47	969.37	NA	NA	NA	NA	NA	NA	Dry	
April 7, 2014			969.37	26.75	32.50	942.62	936.87	941.64	5.75	Transmissivity testing 4/10/14; Removed 3 gallons of LNAPL	
September 18, 2014			969.37	NA	NA	NA	NA	NA	NA	NA	Dry
September 21, 2015			969.37	NA	NA	NA	NA	NA	NA	NA	Dry
October 15, 2017			969.37	24.15	31.09	945.22	938.28	944.04	6.94		
June 22, 2018			969.37	23.60	29.82	945.77	939.55	944.71	6.22		
July 17, 2018			969.37	23.72	31.38	945.65	937.99	944.59	7.66	Transmissivity testing 7/17/18; Removed 2 gallons of LNAPL and < 0.1 gallons of water	

ft = feet  
 AMSL = above mean sea level TOC = top of casing  
 bTOC = below top of casing  
 bgs = below ground surface  
 NA = not applicable due to lack of LNAPL or water  
 LNAPL = light non-aqueous phase liquid

**Table 4  
LNAPL Baildown Testing and Analysis Results  
RACER - Pontiac North Campus  
Pontiac, Michigan**

Well ID	Date	Test	Initial LNAPL Thickness (ft)	Test Duration (min)	Final LNAPL Thickness (ft)	LNAPL Recovery (%)	LNAPL Transmissivity, T <sub>n</sub> (ft <sup>2</sup> /day)					Notes/Comments
							Thiem	B&R	C&J	CB&P	Mean	
<b>AOI W-10</b>												
SB-08-14	9/17/2014	Test 1	9.96	2,760	9.53	96%	NA	<b>2.1</b>	<b>1.8</b>	<b>2.3</b>	<b>2.1</b>	
	2/19/2018	Test 1	9.41	189 <sup>1</sup>	8.93	95%	<b>8.2</b>	NA	NA	NA	NA	Tn estimate based on attaining stable conditions, i.e., drawdown and discharge were relatively constant due to LNAPL infiltrating well faster than could be removed. Used Thiem equation <sup>2</sup> to estimate with field data
<b>AOI W-1</b>												
SB-43-14	9/18/2014	Test 1	2.58	75	2.55	99%	NA	<b>1.7</b>	<b>1.6</b>	<b>1.1</b>	<b>1.4</b>	
	2/19/2018	Test 1	0.43	78	0.05	12%	NA	NA	NA	NA	NA	Data could not be analyzed quantitatively. LNAPL column in the well was hydraulically isolated from the formation after initial 8 minutes of testing. No change in LNAPL drawdown after first 18 minutes of test. Interference from background water table fluctuations in late testing data.
<b>AOI W-8</b>												
TWW8-01	4/10/2014	Test 1	5.74	11,422	4.59	80%	NA	0.003	0.004	NA	0.004	Little to no groundwater recharge observed over the course of nearly 8 days.
	7/17/2018	Test 1	7.66	2,766	5.71	75%	NA	0.020	0.010	0.020	0.017	
MWW8-65	4/10/2014	Test 1	2.85	11,510	1.6	56%	NA	0.001	0.001	NA	0.001	Little to no groundwater recharge observed over the course of nearly 8 days.
	7/17/2018	Test 1	8.97	2,864	4.75	53%	NA	0.010	0.004	0.003	0.006	Little to no groundwater recharge observed over the course of the test (2 days)

**General Notes:**

All analyses completed using American Petroleum Institute (API) LNAPL Transmissivity Workbook (API 2012).

**Bold** Exceeds 0.1 to 0.8 ft<sup>2</sup>/day lower criterion range to produce sufficient LNAPL recoverability (ITRC 2009).

**Shaded** Exceeds 0.5 ft<sup>2</sup>/day lower limit LNAPL transmissivity value defining recovery to the maximum extent practicable (MDEQ 2014).

**Acronyms and Abbreviations:**

AOI = Area of interest

ft = feet

LNAPL = light non-aqueous phase liquid

min = minute

NA = not analyzed

B&R = Method based on Bouwer & Rice (1976) method for analysis of groundwater slug tests in unconfined aquifers.

C&J = Method based on Cooper & Jacob (1946)/Jacob & Lohman (1952) methods for groundwater flow to a well under constant drawdown or constant discharge conditions

CB&P = Method based on Cooper, Bredehoeft and Papadopoulos (1967) method for analysis of groundwater slug tests in confined aquifers.

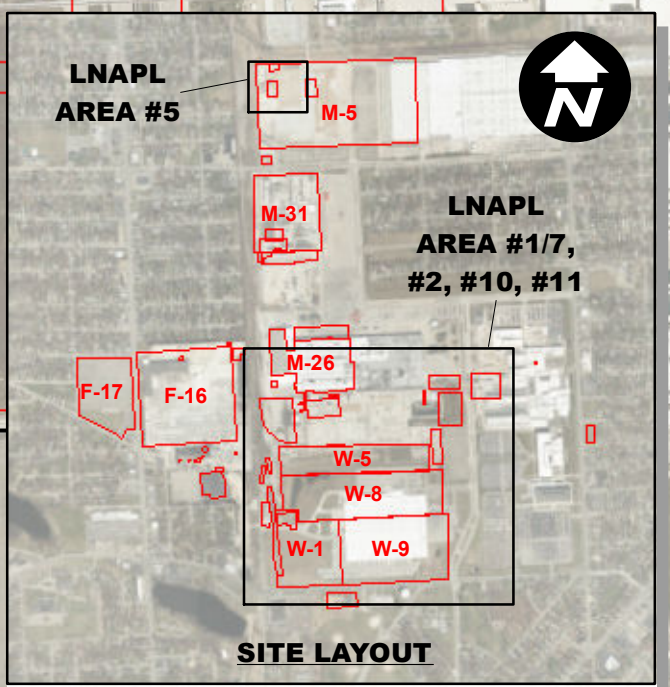
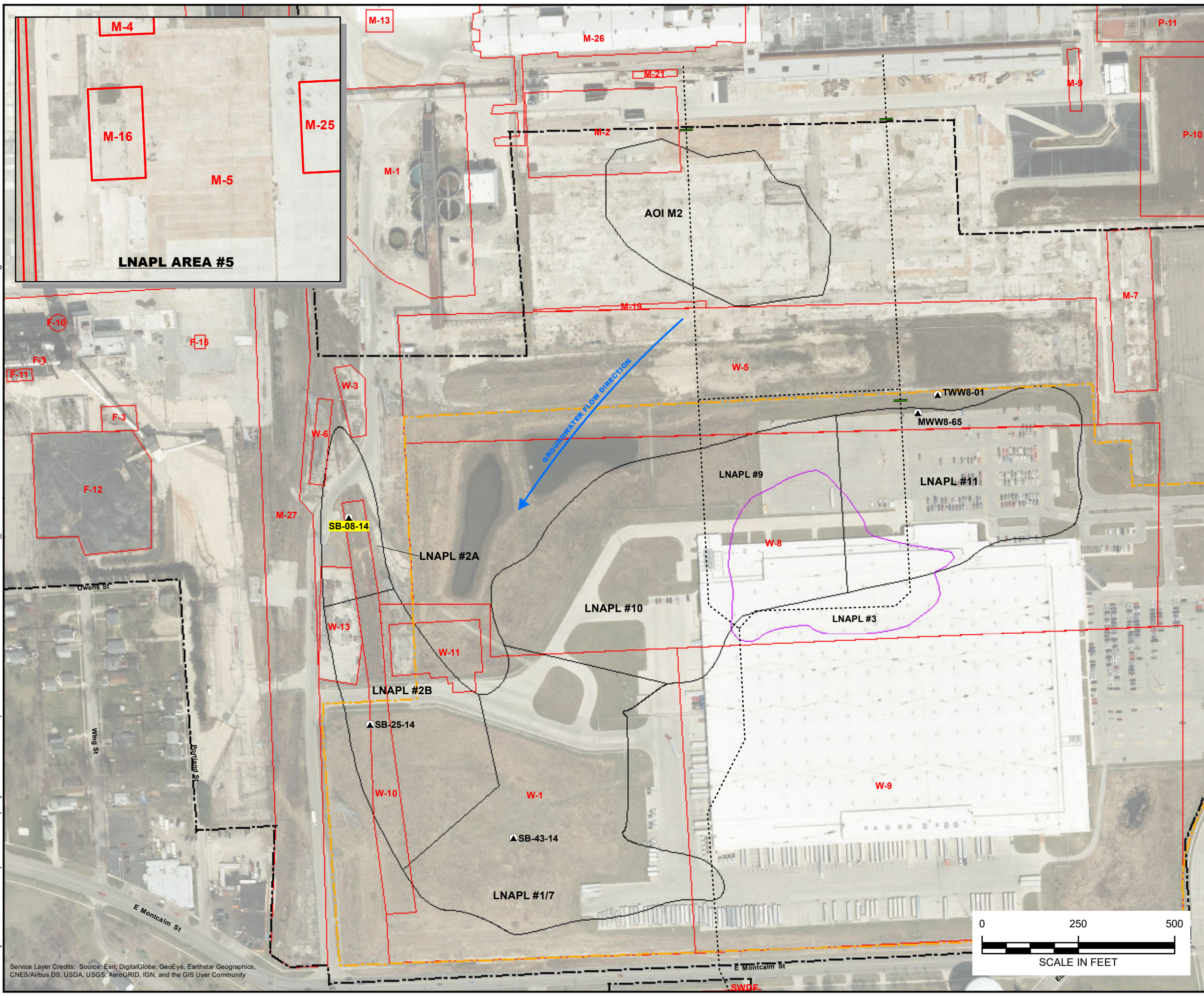
<sup>1</sup> Note that test was completed once a stable condition was achieved and pumping had stopped. Total LNAPL recovery includes recharge time following LNAPL pumping.

<sup>2</sup> LNAPL transmissivity estimated based on Thiem solution for confined conditions (ASTM International 2013; Equation 16).

# FIGURES



CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane Michigan South FIPS 2113 Feet  
 D:\GIS\Project Files\MotorsLiquidationCompany\PontiacNorthCampus\Documents\LNAPL CorrectiveMeasure\_201808.mxd PLOTTED: 8/8/2018 11:14:09 AM BY: TYarborough



**LEGEND**

- ABANDONED SEWER BULKHEAD LOCATION
- ABANDONED SEWER
- BOUNDARY OF CURRENT AND FORMERLY OWNED RACER TRUST PROPERTY (NOWAK & FRAUS, JUNE 2012)
- USPS (UNITED STATES POSTAL SERVICE) DISTRIBUTION CENTER PROPERTY BOUNDARY
- AREAS OF INTEREST
- EXTENT OF LIF RESPONSE > 25% BASED ON 2007 AND 2013/2014 MOBILITY STUDY
- LNAPL AREA 3 EXTENT BASED ON 2007 ENCORE INTERIM MEASURES REPORT
- HIGHLIGHTED LOCATIONS HAVE BEEN SELECTED FOR LNAPL RECOVERY

AOI - AREA OF INTEREST  
 LIF - LASER-INDUCED FLUORESCENCE  
 LNAPL - LIGHT NON-AQUEOUS PHASE LIQUID

NOTE: WELLS NOT SELECTED FOR LNAPL RECOVERY WILL BE ADDED TO THE ANNUAL GROUNDWATER MONITORING PROGRAM.

RACER TRUST  
 PONTIAC NORTH CAMPUS  
 PONTIAC, MICHIGAN

**PROPOSED CORRECTIVE MEASURE - LNAPL**

0 250 500  
 SCALE IN FEET

**ARCADIS** Design & Consultancy for natural and built assets

FIGURE  
**2**

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# Attachment 1

Merit Analytical Reports



# Analytical Laboratory Report

Report ID: S91734.01(01)  
Generated on 07/24/2018

## Report to

---

Attention: Theresa Olechiw  
Arcadis  
28550 Cabot Drive  
Suite 500  
Novi, MI 48377

Phone: NA FAX: 248-994-2241  
Email: [theresa.olechiw@arcadis-us.com](mailto:theresa.olechiw@arcadis-us.com)

Additional Contacts: Colleen Barton, Brad Saunders

## Report produced by

---

Merit Laboratories, Inc.  
2680 East Lansing Drive  
East Lansing, MI 48823

Phone: (517) 332-0167 FAX: (517) 332-6333

Contacts for report questions:  
John Lavery ([johnlavery@meritlabs.com](mailto:johnlavery@meritlabs.com))  
Barbara Ball ([bball@meritlabs.com](mailto:bball@meritlabs.com))

## Report Summary

---

Lab Sample ID(s): S91734.01  
Project: PNC Racer  
Collected Date: 07/16/2018  
Submitted Date/Time: 07/17/2018 14:55  
Sampled by: Kaitlyn Voet  
P.O. #: B0064607.2018

## Table of Contents

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Glossary of Abbreviations (Page 3)  
Method Summary (Page 4)  
Sample Summary (Page 5)

Maya Murshak  
Technical Director



# Analytical Laboratory Report

## General Report Notes

---

Analytical results relate only to the samples tested, in the condition received by the laboratory.

Methods may be modified for improved performance.

Results reported on a dry weight basis where applicable.

'Not detected' indicates that parameter was not found at a level equal to or greater than the reporting limit (RL).

40 CFR Part 136 Table II Required Containers, Preservation Techniques and Holding Times for the Clean Water Act specify that samples for acrolein and acrylonitrile need to be preserved at a pH in the range of 4 to 5 or if not preserved, analyzed within 3 days of sampling.

QA/QC corresponding to this analytical report is a separate document with the same Merit ID reference and is available upon request.

Full accreditation certificates are available upon request. Starred (\*) analytes are not NELAP accredited.

Samples are held by the lab for 30 days from the final report date unless a written request to hold longer is provided by the client.

Report shall not be reproduced except in full, without the written approval of Merit Laboratories, Inc.

Limits for drinking water samples, are listed as the MCL Limits (Maximum Contaminant Level Concentrations)

## Report Narrative

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There is no additional narrative for this analytical report



# Analytical Laboratory Report

## Laboratory Certifications

Authority	Certification ID
Michigan DEQ	#9956
DOD ELAP/ISO 17025	#69699
WBENC	#2005110032
Ohio VAP	#CL0002
Indiana DOH	#C-MI-07
New York NELAC	#11814
North Carolina DENR	#680
North Carolina DOH	#26702
Alaska CSLAP	#17-001

## Qualifier Descriptions

Qualifier	Description
!	Result is outside of stated limit criteria
B	Compound also found in associated method blank
E	Concentration exceeds calibration range
F	Analysis run outside of holding time
G	Estimated result due to extraction run outside of holding time
H	Sample submitted and run outside of holding time
I	Matrix interference with internal standard
J	Estimated value less than reporting limit, but greater than MDL
L	Elevated reporting limit due to low sample amount
M	Result reported to MDL not RDL
O	Analysis performed by outside laboratory. See attached report.
R	Preliminary result
S	Surrogate recovery outside of control limits
T	No correction for total solids
X	Elevated reporting limit due to matrix interference
Y	Elevated reporting limit due to high target concentration
b	Value detected less than reporting limit, but greater than MDL
e	Reported value estimated due to interference
j	Analyte also found in associated method blank
p	Benzo(b)Fluoranthene and Benzo(k)Fluoranthene integrated as one peak.
x	Preserved from bulk sample

## Glossary of Abbreviations

Abbreviation	Description
RL/RDL	Reporting Limit
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
SW	EPA SW 846 (Soil and Wastewater) Methods
E	EPA Methods
SM	Standard Methods
LN	Linear
BR	Branched



# Analytical Laboratory Report

## Method Summary

Method	Version
SW1311	SW 846 Method 1311 Revision 0 July 1992
SW3510C	SW 846 Method 3510C Revision 3 December 1996
SW5030C/8260C	SW 846 Method 8260C Revision 3 August 2006 / 5030C Revision 3 May 2003
SW8270D	SW 846 Method 8270D Revision 4 February 2007



# Analytical Laboratory Report

## Sample Summary (1 samples)

Sample ID	Sample Tag	Matrix	Collected Date/Time
S91734.01	SB-08-14_LNAPL_07162018	Oil	07/16/18 11:45



# Analytical Laboratory Report

Lab Sample ID: S91734.01

Sample Tag: SB-08-14\_LNAPL\_07162018

Collected Date/Time: 07/16/2018 11:45

Matrix: Oil

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
1	4oz Glass	None	Yes	3.9	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
TCLP Zero Headspace Ext.*	<0.5%	SW1311	07/18/18 10:00	JBL	
TCLP/SPLP BNA Extraction*	Completed	SW3510C	07/18/18 10:00	PLB	

TCLP Extraction

Parameter	Result	Method	Run Date	Analyst	Flags
Initial Sample pH*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	
pH after 3.5 ml HCl*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	
% Solids*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	
Sample Used g*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	
Final Volume mL*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	
TCLP Extraction Fluid*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	
Final Extract pH*	<0.5%	SW1311	07/18/18 10:00 - 07/18/18	JBL	

Organics - Semi-Volatiles

TCLP Semi Volatiles, Method: SW8270D, Run Date: 07/18/18 21:59, Analyst: PL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
o-Cresol*	Not detected	100,000		ug/L	50	95-48-7	X	200,000
p,m-Cresol*	Not detected	200,000		ug/L	50	3/4-CRESOL	X	200,000
Pentachlorophenol*	Not detected	100,000		ug/L	50	87-86-5	X	100,000
2,4,5-Trichlorophenol*	Not detected	100,000		ug/L	50	95-95-4	X	400,000
2,4,6-Trichlorophenol*	Not detected	100,000		ug/L	50	88-06-2	X	2,000
2,4-Dinitrotoluene*	Not detected	100,000		ug/L	50	121-14-2	X	130
Hexachlorobenzene*	Not detected	100,000		ug/L	50	118-74-1	X	130
Hexachlorobutadiene*	Not detected	100,000		ug/L	50	87-68-3	X	500
Hexachloroethane*	Not detected	100,000		ug/L	50	67-72-1	X	3,000
Nitrobenzene*	Not detected	100,000		ug/L	50	98-95-3	X	2,000
Pyridine*	Not detected	100,000		ug/L	50	110-86-1	X	5,000

Organics - Volatiles

TCLP Volatiles, Method: SW5030C/8260C, Run Date: 07/19/18 15:40, Analyst: JML

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Benzene*	Not detected	5,000		ug/L	5000	71-43-2	X	500
Carbon tetrachloride*	Not detected	5,000		ug/L	5000	56-23-5	X	500
Chlorobenzene*	Not detected	5,000		ug/L	5000	108-90-7	X	100,000
Chloroform*	Not detected	5,000		ug/L	5000	67-66-3	X	6,000
1,4-Dichlorobenzene*	Not detected	5,000		ug/L	5000	106-46-7	X	7,500
1,2-Dichloroethane*	Not detected	5,000		ug/L	5000	107-06-2	X	500
1,1-Dichloroethene*	Not detected	5,000		ug/L	5000	75-35-4	X	700
2-Butanone (MEK)*	Not detected	50,000		ug/L	5000	78-93-3	X	200,000
Tetrachloroethene*	Not detected	5,000		ug/L	5000	127-18-4	X	700
Trichloroethene*	Not detected	5,000		ug/L	5000	79-01-6	X	500

X-Elevated reporting limit due to matrix interference



# Analytical Laboratory Report

Lab Sample ID: S91734.01 (continued)

Sample Tag: SB-08-14\_LNAPL\_07162018

**TCLP Volatiles, Method: SW5030C/8260C, Run Date: 07/19/18 15:40, Analyst: JML (continued)**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Vinyl chloride*	Not detected	5,000		ug/L	5000	75-01-4	X	200

X-Elevated reporting limit due to matrix interference

# Merit Laboratories Login Checklist

Lab Set ID: S91734

Client: ARCADIS\_NOVI (ARCADIS U.S., Inc.)

Project: PNC Racer

Submitted: 07/17/2018 14:55 Login User: SRS

Attention: Theresa Olechiv

Address: Arcadis  
28550 Cabot Drive  
Suite 500  
Novi, MI 48377

Phone: NA

FAX: 248-994-2241

Email: [theresa.olechiv@arcadis-us.com](mailto:theresa.olechiv@arcadis-us.com)

Selection	Description	Note
<b>Sample Receiving</b>		
01.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Samples are received at 4C +/- 2C Thermometer # IR 3.9
02.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Received on ice/ cooling process begun
03.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples shipped
04.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples left in 24 hr. drop box
05.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Are there custody seals/tape or is the drop box locked
<b>Chain of Custody</b>		
06.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	COC adequately filled out
07.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	COC signed and relinquished to the lab
08.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sample tag on bottles match COC
09.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Subcontracting needed? Subcontracted to:
<b>Preservation</b>		
10.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Do sample have correct chemical preservation
11.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Completed pH checks on preserved samples? (no VOAs)
12.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Did any samples need to be preserved in the lab?
<b>Bottle Conditions</b>		
13.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	All bottles intact
14.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Appropriate analytical bottles are used
15.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Merit bottles used
16.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sufficient sample volume received
17.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples require laboratory filtration
18.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Samples submitted within holding time
19.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Do water VOC or TOX bottles contain headspace

Corrective action for all exceptions is to call the client and to notify the project manager.

Client Review By: \_\_\_\_\_ Date: \_\_\_\_\_





# Analytical Laboratory Report

Report ID: S92028.01(01)  
Generated on 08/06/2018

## Report to

---

Attention: Theresa Olechiw  
Arcadis  
28550 Cabot Drive  
Suite 500  
Novi, MI 48377

Phone: NA FAX: 248-994-2241  
Email: [theresa.olechiw@arcadis-us.com](mailto:theresa.olechiw@arcadis-us.com)

Additional Contacts: Colleen Barton, Brad Saunders

## Report produced by

---

Merit Laboratories, Inc.  
2680 East Lansing Drive  
East Lansing, MI 48823

Phone: (517) 332-0167 FAX: (517) 332-6333

Contacts for report questions:  
John Lavery ([johnlavery@meritlabs.com](mailto:johnlavery@meritlabs.com))  
Barbara Ball ([bball@meritlabs.com](mailto:bball@meritlabs.com))

## Report Summary

---

Lab Sample ID(s): S92028.01  
Project: PNC Racer  
Collected Date: 07/19/2018  
Submitted Date/Time: 07/23/2018 15:10  
Sampled by: Kaitlyn Voet  
P.O. #: B0064607.2018

## Table of Contents

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Sample Summary (Page 5)

Maya Murshak  
Technical Director



# Analytical Laboratory Report

## General Report Notes

---

Analytical results relate only to the samples tested, in the condition received by the laboratory.

Methods may be modified for improved performance.

Results reported on a dry weight basis where applicable.

'Not detected' indicates that parameter was not found at a level equal to or greater than the reporting limit (RL).

40 CFR Part 136 Table II Required Containers, Preservation Techniques and Holding Times for the Clean Water Act specify that samples for acrolein and acrylonitrile need to be preserved at a pH in the range of 4 to 5 or if not preserved, analyzed within 3 days of sampling.

QA/QC corresponding to this analytical report is a separate document with the same Merit ID reference and is available upon request.

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Limits for drinking water samples, are listed as the MCL Limits (Maximum Contaminant Level Concentrations)

## Report Narrative

---

There is no additional narrative for this analytical report



# Analytical Laboratory Report

## Laboratory Certifications

Authority	Certification ID
Michigan DEQ	#9956
DOD ELAP/ISO 17025	#69699
WBENC	#2005110032
Ohio VAP	#CL0002
Indiana DOH	#C-MI-07
New York NELAC	#11814
North Carolina DENR	#680
North Carolina DOH	#26702
Alaska CSLAP	#17-001

## Qualifier Descriptions

Qualifier	Description
!	Result is outside of stated limit criteria
B	Compound also found in associated method blank
E	Concentration exceeds calibration range
F	Analysis run outside of holding time
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H	Sample submitted and run outside of holding time
I	Matrix interference with internal standard
J	Estimated value less than reporting limit, but greater than MDL
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R	Preliminary result
S	Surrogate recovery outside of control limits
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Y	Elevated reporting limit due to high target concentration
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SW	EPA SW 846 (Soil and Wastewater) Methods
E	EPA Methods
SM	Standard Methods
LN	Linear
BR	Branched



# Analytical Laboratory Report

## Method Summary

Method	Version
ASTMD3278 - 96	ASTM Method D3278 - 96(2011)
ASTMD891 - 09	ASTM Method D891 - 09
SW1311	SW 846 Method 1311 Revision 0 July 1992
SW3015A	SW 846 Method 3015A Revision 1 February 2007
SW3510C	SW 846 Method 3510C Revision 3 December 1996
SW3546	SW 846 Method 3546 Revision 0 February 2007
SW5030C/8260C	SW 846 Method 8260C Revision 3 August 2006 / 5030C Revision 3 May 2003
SW6020A	SW 846 Method 6020A Revision 1 February 2007
SW7471B	SW 846 Method 7471B Revision 2 February 2007
SW8082A	SW 846 Method 8082A Revision 1 February 2007
SW8270D	SW 846 Method 8270D Revision 4 February 2007
SW9045D	SW 846 Method 9045D Revision 4 November 2004



# Analytical Laboratory Report

## Sample Summary (1 samples)

Sample ID	Sample Tag	Matrix	Collected Date/Time
S92028.01	MWW8-65_LNAPL_07192018	Oil	07/19/18 13:20



# Analytical Laboratory Report

Lab Sample ID: S92028.01

Sample Tag: MWW8-65\_LNAPL\_07192018

Collected Date/Time: 07/19/2018 13:20

Matrix: Oil

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
1	8oz Glass	None	Yes	4.1	IR

**Extraction / Prep.**

Parameter	Result	Method	Run Date	Analyst	Flags
TCLP Zero Headspace Ext.*	<0.5%	SW1311	07/24/18 11:00	JBL	
Metal Digestion*	Completed	SW3015A	07/24/18 11:00	CCM	
TCLP/SPLP BNA Extraction*	Completed	SW3510C	07/24/18 11:00	ANW	
Extraction, PCB*	Completed	SW3546	07/24/18 11:00	PLB	
Mercury Digestion*	Completed	SW7471B	07/24/18 11:00	JRH	

**TCLP Extraction**

Parameter	Result	Method	Run Date	Analyst	Flags
Initial Sample pH*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	
pH after 3.5 ml HCl*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	
% Solids*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	
Sample Used g*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	
Final Volume mL*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	
TCLP Extraction Fluid*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	
Final Extract pH*	<0.5%	SW1311	07/24/18 11:00 - 07/24/18	JBL	

**Inorganics**

Method: ASTM D3278 - 96, Run Date: 07/27/18 15:00, Analyst: DMK

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Flash Point*	Not detected	180		oF	1			<140

Method: ASTM D891 - 09, Run Date: 07/26/18 10:13, Analyst: JBL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Specific Gravity*	0.856				1			

Method: SW9045D, Run Date: 07/25/18 18:39, Analyst: ASB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
pH/ Corrosivity*	6.31	0.01		STD Units	1			2-12.5

**Metals**

Method: SW6020A, Run Date: 07/30/18 11:36, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Arsenic, TCLP*	0.31	0.20		mg/L	200	7440-38-2		5.0
Barium, TCLP*	Not detected	1.0		mg/L	200	7440-39-3		100.0
Cadmium, TCLP*	Not detected	0.20		mg/L	200	7440-43-9		1.0
Chromium, TCLP*	Not detected	0.50		mg/L	200	7440-47-3		5.0
Lead, TCLP*	Not detected	0.30		mg/L	200	7439-92-1		5.0
Selenium, TCLP*	Not detected	0.40		mg/L	200	7782-49-2		1.0
Silver, TCLP*	Not detected	0.20		mg/L	200	7440-22-4		5.0



# Analytical Laboratory Report

Lab Sample ID: S92028.01 (continued)  
Sample Tag: MWW8-65\_LNAPL\_07192018

Method: SW7471B, Run Date: 07/27/18 13:30, Analyst: JRH

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Mercury, TCLP*	Not detected	0.001		mg/L	100	7439-97-6		0.2

### Organics - PCBs/Pesticides

PCB List, Method: SW8082A, Run Date: 07/30/18 14:13, Analyst: JANB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
PCB-1016*	Not detected	1,000		ug/kg	1	12674-11-2		
PCB-1242*	Not detected	1,000		ug/kg	1	53469-21-9		
PCB-1221*	Not detected	1,000		ug/kg	1	11104-28-2		
PCB-1232*	Not detected	1,000		ug/kg	1	11141-16-5		
PCB-1248*	1,200	1,000		ug/kg	1	12672-29-6		
PCB-1254*	Not detected	1,000		ug/kg	1	11097-69-1		
PCB-1260*	Not detected	1,000		ug/kg	1	11096-82-5		

### Organics - Semi-Volatiles

TCLP Semi Volatiles, Method: SW8270D, Run Date: 07/24/18 19:44, Analyst: PL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
o-Cresol*	Not detected	100,000		ug/L	50	95-48-7	X	200,000
p,m-Cresol*	Not detected	200,000		ug/L	50	3/4-CRESOL	X	200,000
Pentachlorophenol*	Not detected	100,000		ug/L	50	87-86-5	X	100,000
2,4,5-Trichlorophenol*	Not detected	100,000		ug/L	50	95-95-4	X	400,000
2,4,6-Trichlorophenol*	Not detected	100,000		ug/L	50	88-06-2	X	2,000
2,4-Dinitrotoluene*	Not detected	100,000		ug/L	50	121-14-2	X	130
Hexachlorobenzene*	Not detected	100,000		ug/L	50	118-74-1	X	130
Hexachlorobutadiene*	Not detected	100,000		ug/L	50	87-68-3	X	500
Hexachloroethane*	Not detected	100,000		ug/L	50	67-72-1	X	3,000
Nitrobenzene*	Not detected	100,000		ug/L	50	98-95-3	X	2,000
Pyridine*	Not detected	100,000		ug/L	50	110-86-1	X	5,000

### Organics - Volatiles

TCLP Volatiles, Method: SW5030C/8260C, Run Date: 08/01/18 11:25, Analyst: JML

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags	Limits
Benzene*	Not detected	500		ug/L	500	71-43-2	X	500
Carbon tetrachloride*	Not detected	500		ug/L	500	56-23-5	X	500
Chlorobenzene*	Not detected	500		ug/L	500	108-90-7	X	100,000
Chloroform*	Not detected	500		ug/L	500	67-66-3	X	6,000
1,4-Dichlorobenzene*	Not detected	500		ug/L	500	106-46-7	X	7,500
1,2-Dichloroethane*	Not detected	500		ug/L	500	107-06-2	X	500
1,1-Dichloroethene*	Not detected	500		ug/L	500	75-35-4	X	700
2-Butanone (MEK)*	Not detected	5,000		ug/L	500	78-93-3	X	200,000
Tetrachloroethene*	Not detected	500		ug/L	500	127-18-4	X	700
Trichloroethene*	Not detected	500		ug/L	500	79-01-6	X	500
Vinyl chloride*	Not detected	500		ug/L	500	75-01-4	X	200

X-Elevated reporting limit due to matrix interference

# Merit Laboratories Login Checklist

Lab Set ID: S92028

Client: ARCADIS\_NOVI (ARCADIS U.S., Inc.)

Project: PNC Racer

Submitted: 07/23/2018 15:10 Login User: MMC

Attention: Theresa Olechiv

Address: Arcadis  
28550 Cabot Drive  
Suite 500  
Novi, MI 48377

Phone: NA

FAX: 248-994-2241

Email: [theresa.olechiv@arcadis-us.com](mailto:theresa.olechiv@arcadis-us.com)

Selection	Description	Note
<b>Sample Receiving</b>		
01.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Samples are received at 4C +/- 2C Thermometer # IR 4.1
02.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Received on ice/ cooling process begun
03.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples shipped
04.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples left in 24 hr. drop box
05.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Are there custody seals/tape or is the drop box locked
<b>Chain of Custody</b>		
06.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	COC adequately filled out
07.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	COC signed and relinquished to the lab
08.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sample tag on bottles match COC
09.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Subcontracting needed? Subcontracted to:
<b>Preservation</b>		
10.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Do sample have correct chemical preservation
11.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Completed pH checks on preserved samples? (no VOAs)
12.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Did any samples need to be preserved in the lab?
<b>Bottle Conditions</b>		
13.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	All bottles intact
14.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Appropriate analytical bottles are used
15.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Merit bottles used
16.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sufficient sample volume received
17.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples require laboratory filtration
18.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Samples submitted within holding time
19.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Do water VOC or TOX bottles contain headspace

Corrective action for all exceptions is to call the client and to notify the project manager.

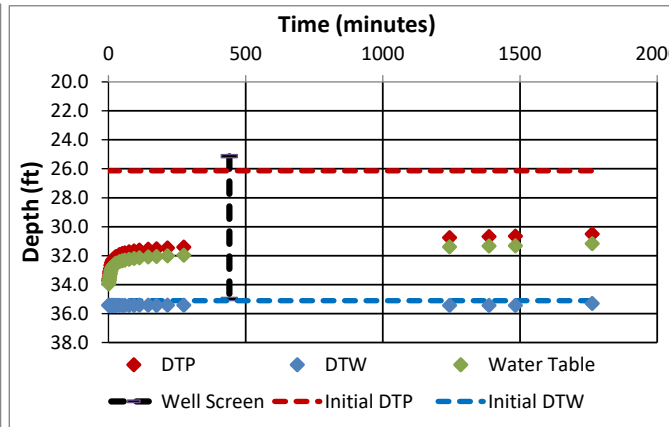
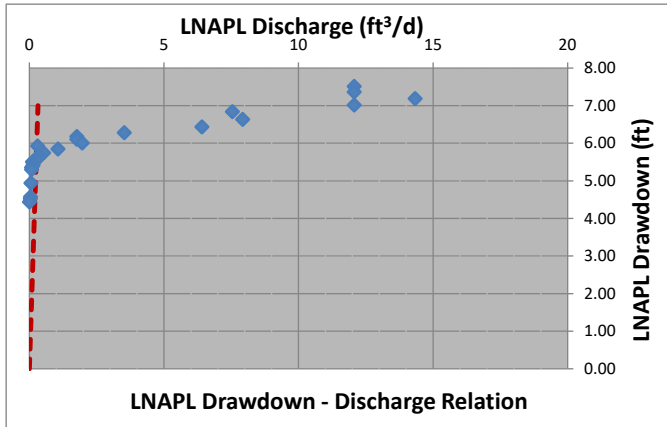
Client Review By: \_\_\_\_\_ Date: \_\_\_\_\_



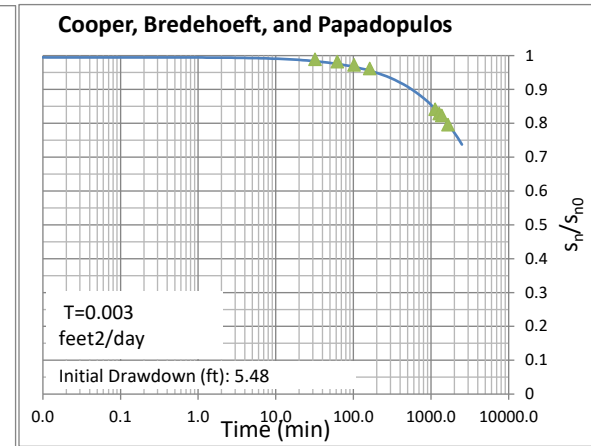
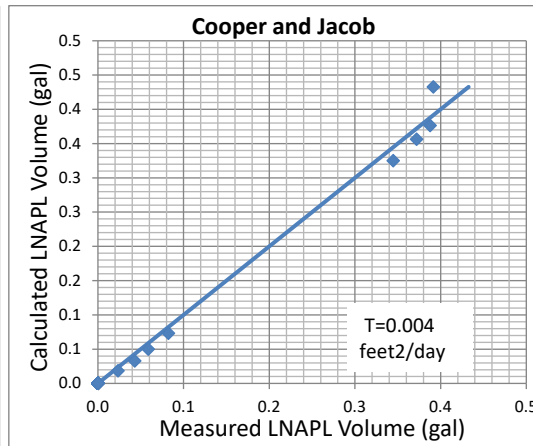
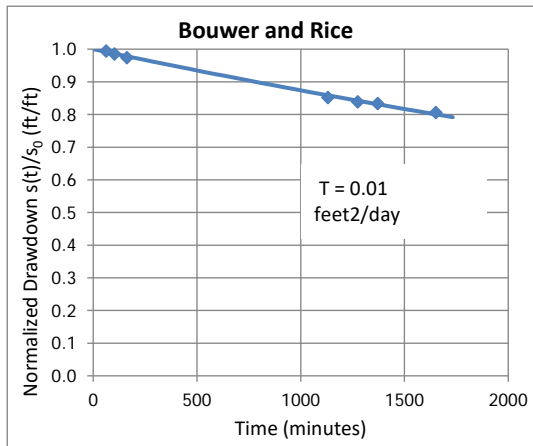
# Attachment 2

Transmissivity Test Output Graphs

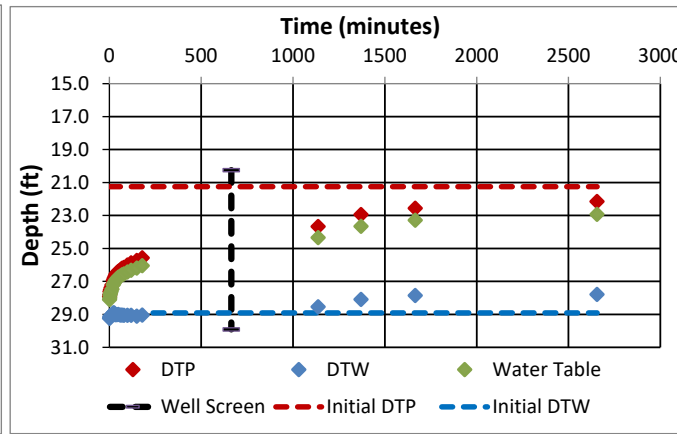
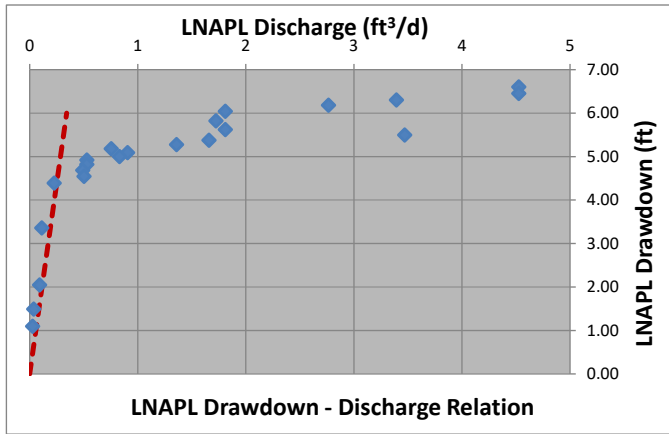
MWW8-65 07/17/2018



**Abbreviations:**  
 d = day  
 DTP = depth to product  
 DTW = depth to water  
 ft = feet  
 LNAPL = light non-aqueous phase liquid  
 s = drawdown  
 T = LNAPL transmissivity



TWW8-01 07/17/2018



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