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From:

Brad Saunders, P.E.

Date:

April 27, 2018

Arcadis Project No.:

B0064607.2018

Subject:

RACER Pontiac North Campus - 2018 LNAPL IM Feasibility Confirmation
and Pre-Design Specification Testing

INTRODUCTION

Arcadis of Michigan, LLC (Arcadis) prepared this light non-aqueous phase liquid (LNAPL) Interim Measure (IM) feasibility confirmation and pre-design specification testing memorandum on behalf of Revitalizing Auto Communities Environmental Response (RACER) Trust for the Pontiac North Campus Site (the Site) located in Pontiac, Michigan (**Figure 1**). LNAPL gauging and testing activities were conducted in January and February 2018 to confirm the feasibility of removing LNAPL and further characterizing LNAPL for determining target design specifications for installing LNAPL removal systems. It is noted that the decision to implement an interim measure to address LNAPL and not first finalize a revised Corrective Measures Proposal and associated USEPA decision process was made during an October 2017 meeting with USEPA.

Previous investigation activities which occurred included an LNAPL mobility and recoverability evaluation summarized in the *General Motors Corporation Pontiac North Campus –LNAPL Mobility Evaluation* (ENCORE 2007), which along with other investigation activities served as the basis for LNAPL corrective measures alternatives evaluated and proposed in the *Draft RACER Pontiac North Campus – Corrective Measures Proposal* (Arcadis 2013). Additional Site investigation activities to further assess the extent, mobility and recoverability of LNAPL were conducted in 2013 to 2014 and summarized in the *RACER Pontiac North Campus – 2013/2014 LNAPL Investigation Technical Memorandum* (Arcadis 2015).

Following completion of the 2013 Draft Corrective Measures Proposal, Arcadis evaluated six LNAPL areas (LNAPL Areas 1/7, 2A, 2B, 5, 9/10, and 11) via a LNAPL Remedial Decision Tree process which was developed for each area to provide a consistent framework for identifying LNAPL remedial drivers and determining an appropriate remedial strategy based on a sound LNAPL conceptual site model (LCSM). The decision tree process was consistent with guidance provided in 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). The decision trees identified risks driven by the chemical composition of the LNAPL and/or issues associated with the presence of LNAPL that could move to a location where it could cause an unacceptable discharge. To the extent that composition or saturation concerns were identified, the decision tree provided a systematic approach for evaluation of applicable LNAPL management alternatives in the context of site-specific LNAPL conditions.

To further support this evaluation and further assess the extent, mobility and recoverability of LNAPL previously identified in the six Areas of Interest (AOIs), the scope of 2013/2014 Site investigation activities included transmissivity testing of LNAPL from eighteen monitoring well locations to determine which locations may be conducive to removal. The results of 2013/2014 testing activities indicated that LNAPL transmissivity values at three monitoring well locations areas exceeded the thresholds for practical recoverability (through hydraulically based remediation methods) established by MDEQ and/or the Interstate Technology and Regulatory Council (ITRC). However, transmissivity testing results indicated that LNAPL recovery efforts would not result in a beneficial reduction in overall LNAPL mass at the Site at the other fifteen monitoring well locations, several of which were nearby the three monitoring wells where testing indicated that recoverability was practical. Monitoring wells were testing indicated that recoverability was practical included monitoring wells SB-08-14 (LNAPL Area #2A within AOI W-10), SB-25-14 (LNAPL Area #2B within AOI W-10), and SB-43-14 (LNAPL Area #1/7 within AOI W-1). Refer to **Figure 2** for the location of these wells. It is noted that the LNAPL decision trees were being updated in late 2017 to incorporate information obtained from these investigations.

Based on the results of prior investigation, evaluation, including updates to the LNAPL decision trees, and testing activities, the objectives of this investigation were as follows:

- Confirm that the presence in LNAPL in monitoring wells SB-08-14, SB-25-14, and SB-43-14 is sufficient to support sampling and testing at each location.
- Obtain samples for laboratory analysis to further evaluate LNAPL properties at each location to be used in identifying design specifications for a removal system and characterize waste which would be generated from operation of a removal system.
- Re-conduct transmissivity testing at each location to confirm the results of testing previously conducted in 2014 which indicated that removal activities would be feasible.

In summary, consistent with the Draft Corrective Measures Proposal and additional evaluation and testing activities conducted since that time, including updated LNAPL decision trees, it is anticipated that the LNAPL recovery proposed in this memo in combination with deed restrictions will be the final corrective measures recommended for LNAPL.

FIELD ACTIVITIES

Field activities were completed at the Site on January 17, 2018; January 29, 2018; and February 19-20, 2018. These activities were performed in accordance with objectives, sampling methodologies, and analytical procedures set forth in the Field Sampling Plan (FSP; Encore 2001a) and Quality Assurance Project Plan (QAPP; Encore 2001b). The LNAPL mobility modeling was completed following ASTM International (ATSM), Interstate Technology and Regulatory Council (ITRC) and American Petroleum Institute (API) methods.

MONITORING WELL GAUGING

Monitoring well gauging took place at the Site on January 17, 2018, January 29, 2018, and February 19, 2018. LNAPL monitoring wells SB-08-14, SB-25-14, and SB-43-14 were gauged to confirm sufficient LNAPL was present for transmissivity testing and/or to collect samples. Consistent with recommendations in ASTM International 2013 and MDEQ RRD Resource Materials-25-2014-01 "NAPL Characterization, Remediation and Management for Petroleum Releases" (June 2014), a minimum in-well accumulation of 0.2 foot was previously established as a threshold value for determining whether transmissivity testing would provide useful data. SB-25-14 did not contain enough LNAPL to collect samples or to perform transmissivity tests and is not included in further sections of this memo. Results from these gauging events are summarized in the table below.

Well Name	Date	TOC Elevation (feet amsl)	Depth to Water (feet btoc)	Depth to Product (feet btoc)	Product Thickness (feet)	Water Elevation (feet amsl)	Water Elevation (feet amsl)
SB-08-14	1/17/2018	NS*	22.97	13.95	9.02	*	*
	1/29/2018		23.25	13.51	9.74	*	*
	2/19/2018		23.32	13.91	9.41	*	*
SB-25-14	1/17/2018	966.21	16.16	16.15	0.01	950.05	950.06
	1/29/2018		15.82	15.81	0.01	950.39	950.40
	2/19/2018		15.89	15.88	0.01	950.32	950.33
SB-43-14	1/17/2018	969.90	21.19	20.79	0.40	948.71	949.11
	1/29/2018		21.07	20.71	0.36	948.83	949.19
	2/19/2018		21.06	20.63	0.43	948.84	949.27

Notes:

btoc – below top of casing

amsl - above mean sea level

*SB-08-14 had a protective stick-up casing added on July 20, 2017 and top of casing elevation needs to be resurveyed.

LNAPL PROPERTIES TESTING

On January 17, 2018, LNAPL samples were collected from SB-08-14 and SB-43-14 for physical properties analyses. LNAPL was removed from the well using a peristaltic pump. Samples from the wells were shipped to PTS Laboratories of Houston, Texas for viscosity, density and specific gravity analyses. Results are summarized in the table below. Laboratory analytical results are included as **Attachment 1**.

Parameter	Units	Temperature (°F)	SB-08-14 (AOI W-10)	SB-43-14 (AOI W-1)
LNAPL Density	g/cm ³	70	0.8700	0.8957
LNAPL Density	g/cm ³	100	0.8589	0.8847
LNAPL Density	g/cm ³	130	0.8475	0.8734
LNAPL Viscosity *	cP	70	19.57	46.83
LNAPL Viscosity *	cP	100	10.02	20.79
LNAPL Viscosity *	cP	130	5.81	10.74
LNAPL Specific Gravity	unitless	70	0.8718	0.8975
LNAPL Specific Gravity	unitless	100	0.8649	0.8909
LNAPL Specific Gravity	unitless	130	0.8596	0.8858

Notes:

g/cm³ – grams per cubic centimeter

cP - centipoise

** Viscosity averages and ranges for common liquids (cP at appr 70 deg F): gasoline: 0.48; water: 0.8; mineral spirits: 1.6; kerosene: 2.0; #2 Diesel: 2.40; #2 Fuel Oil: 3.20; Transformer Oil: 16.2; Hydraulic Oil: 34.6; Lighter Motor Oils: 175 (range 25 – 325); Heavier Lube Oils: 550 (range 100 – 1000); #6 Fuel Oil / Bunker Oil: 3,456.

Of note, analytical results from LNAPL fingerprinting conducted by ENCORE in December 2001 indicated that LNAPL in AOI W-10 consisted of mildly weathered #2 diesel fuel or #2 fuel oil with a small amount of heavy hydrocarbons (possibly highly degraded crude oil). Results indicated that LNAPL in AOI W-1 consisted of a mixture of highly weathered #2 fuel oil or #2 diesel fuel and a highly degraded crude oil.

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.

Transmissivity tests were previously conducted at monitoring wells SB-08-14 and SB-43-14 in September 2014. The previous results from these two locations exceeded the ITRC practical lower limit of LNAPL recoverability range of 0.1 to 0.8 square feet (ft²)/day (ITRC 2009) and the Michigan Department of Environmental Quality (MDEQ) lower limit LNAPL transmissivity value of 0.5 ft²/day (MDEQ 2014) which indicated that removal activities would be feasible. Transmissivity testing was conducted again at each location to confirm these previous results.

Transmissivity tests were performed at SB-08-14 and SB-43-14 on February 19-20, 2018. A baildown test was first attempted at SB-08-14 by rapidly evacuating the LNAPL using a peristaltic pump. The maximum pumping rate of the peristaltic was inadequate for the well's recharge rate. Transmissivity was estimated by adjusting the pumping rate until a stable condition, i.e, relatively constant drawdown and discharge, was maintained. Transmissivity was estimated to be 8.2 ft²/day utilizing the Thiem solution for confined conditions (ASTM International 2013; Equation 16). Data from SB-43-14 testing could not be analyzed quantitatively due to several issues with fluid interface levels and background interference; however, previous testing results indicate LNAPL transmissivity values between 1 and 2 ft²/day at SB-43-14. A summary of the 2014 and 2018 results can be found in **Table 1**.

WASTE CHARACTERIZATION

On January 17, 2018 and February 19, 2018, LNAPL was collected from SB-08-14 and SB-43-14 and sent to Merit Laboratories of East Lansing, Michigan for analysis of total polychlorinated biphenyls (PCBs), toxicity characteristic leaching procedure (TCLP) metals, flashpoint, and pH. 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 2**.

Parameter	Units	SB-08-14	SB-43-14	TSCA limit	RCRA limit
PCBs					
Aroclor-1016	mg/kg	< 17 Y	< 83 Y	> 50	--
Aroclor-1221	mg/kg	< 17 Y	< 83 Y	> 50	--
Aroclor-1232	mg/kg	< 17 Y	< 83 Y	> 50	--
Aroclor-1242	mg/kg	< 17 Y	< 83 Y	> 50	--
Aroclor-1248	mg/kg	83 Y	750 Y	> 50	--
Aroclor-1254	mg/kg	< 17 Y	< 83 Y	> 50	--
Aroclor-1260	mg/kg	< 17 Y	< 83 Y	> 50	--
Total PCBs	mg/kg	83	750	> 50	--
Inorganics					
Arsenic	mg/L	4.18	< 0.20	--	> 5.0
Barium	mg/L	1.18	8.71	--	> 100.0
Cadmium	mg/L	< 0.20	< 0.20	--	> 1.0
Chromium	mg/L	1.60	1.32	--	> 5.0
Lead	mg/L	< 0.30	2.87	--	> 5.0
Mercury	mg/L	< 0.0005	0.045	--	> 0.2
Selenium	mg/L	< 0.40	< 0.40	--	> 1.0
Silver	mg/L	< 0.20	< 0.20	--	> 5.0
Waste Characteristics					
Flash point	°F	ND to 180°	ND to 180°	--	< 140°
pH	STD units	5.56	7.24	--	< 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.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results presented in the previous sections, LNAPL recovery is practical at location SB-08-14 and has the potential to reduce overall LNAPL mass at the Site. LNAPL recoverability at SB-43-14 remains uncertain given the relatively thin accumulation of LNAPL in the well and the inability of completing the transmissivity calculations. Arcadis recommends proceeding with preparation of an IM Work Plan for removal of LNAPL from SB-08-14 and further testing of LNAPL recoverability from SB-43-14 (see discussion of pre-design test below). The objective of LNAPL recovery efforts would be to reduce LNAPL saturation in the area of SB-08-14 until LNAPL transmissivity is at or below 0.5 ft²/day (the MDEQ threshold for practical hydraulic recovery).

Concurrent with Work Plan preparation an additional pre-design test is proposed that consists of attended (non-automated) operation of LNAPL recovery pumps for a short performance validation period (e.g., two to three days) at both SB-08-14 and SB-43-14. This pre-design step is recommended given capital investment factors related to the availability of electricity and cost of LNAPL removal alternatives at each well location. The initial phase would confirm that longer-term LNAPL recovery rates are consistent with those observed during LNAPL transmissivity testing and would confirm that pump and equipment selection is appropriate. Following the pre-design test, the Work Plan can be finalized. The Work Plan is anticipated to include installation and operation of automated LNAPL skimming equipment to support continuous or unattended operation with periodic maintenance visits, or alternatively periodic manual methods as determined based on recovery rates realized during the pre-design test. Recommendations for each of the monitoring wells associated with this memo are summarized in the table below.

In conclusion, USEPA approval of performing the pre-design test and beginning preparation of a LNAPL Recovery IM Work Plan is requested. 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 LNAPL Baildown Testing and Analysis Results

Figures

Figure 1 Site Location

Figure 2 Proposed Corrective Measure – LNAPL Locations

Attachments

- Attachment 1 PTS Analytical Reports
- Attachment 2 Merit Analytical Reports

References

ASTM. 2013. Standard Guide for Estimation of LNAPL Transmissivity. ASTM Standard E2856 -13. ASTM International, West Conshohocken, Pennsylvania.

Encore. 2001a. Field Sampling Plan, Pontiac North Campus. General Motors Corporation, Pontiac, Michigan. May, 2001.

Encore. 2001b. RFI Work Plan, Pontiac North Campus. General Motors Corporation, Pontiac, Michigan. May 15, 2001.

Encore. 2007. LNAPL Mobility Evaluation, Pontiac North Campus. General Motors Corporation, Pontiac, Michigan. February 7, 2007.

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

Interstate Technology & Regulatory Council (ITRC). 2009. Evaluating LNAPL Remedial Technologies for Achieving Project Goals. LNAPL-2. Washington, D.C.: Interstate Technology & Regulatory Council, LNAPLs Team. www.itrcweb.org

Michigan Department of Environmental Quality (MDEQ). 2014. Non-Aqueous Phase Liquid (NAPL) Characterization, Remediation, and Management for Petroleum Releases. RRD Resource Materials-25-2014-01. June 2014.

TABLES

Table 1
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_n (ft ² /day)					Notes/Comments
							Thiem	B&R	C&J	CB&P	Mean	
AOI W-10												
SB-08-14	9/17/2014	Test 1	9.96	2,760	9.53	96%	NA	2.1	1.8	2.3	2.1	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 ² to estimate with field data
	2/19/2018	Test 1	9.41	189 ¹	8.93	95%	8.2	NA	NA	NA	NA	
AOI W-1												
SB-43-14	9/18/2014	Test 1	2.58	75	2.55	99%	NA	1.7	1.6	1.1	1.4	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.
	2/19/2018	Test 1	0.43	78	0.05	12%	NA	NA	NA	NA	NA	

General Notes:

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

Bold Exceeds 0.1 to 0.8 ft²/day lower criterion range to produce sufficient LNAPL recoverability (ITRC 2009).

Shaded Exceeds 0.5 ft²/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

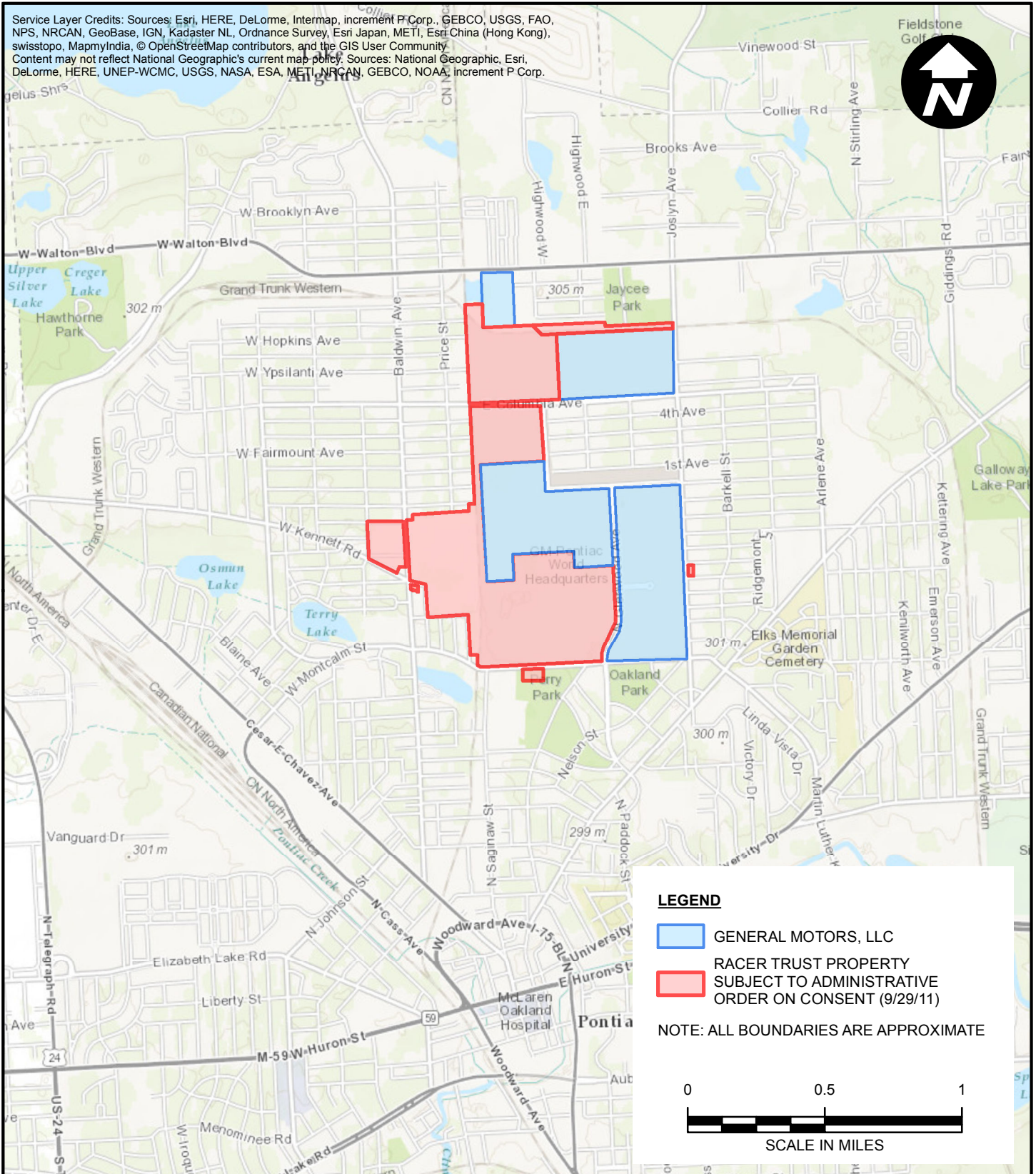
CB&P = Method based on Cooper, Bredehoeft and Papadopoulos (1967) method for analysis of groundwater slug tests in confined aquifers.

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

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

FIGURES

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PROJECT NUMBER: B0064411.0001.00145
 CITY: NOVI DIV/GROUP: ENV DB: PIC: PM: TM: TR:
 Path: D:\GIS\Project Files\Motors_Liquidation\Company\Pontiac\North Campus\Documents\SiteLocation_AOC.mxd



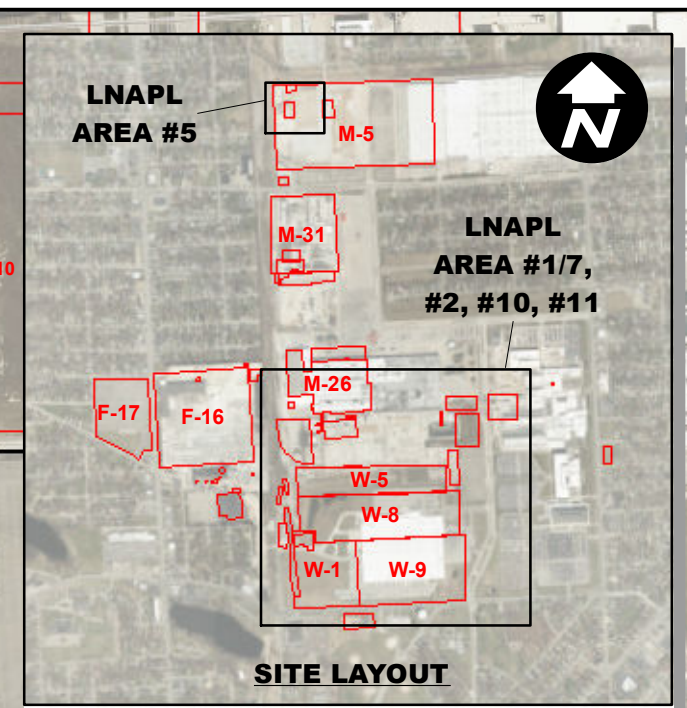
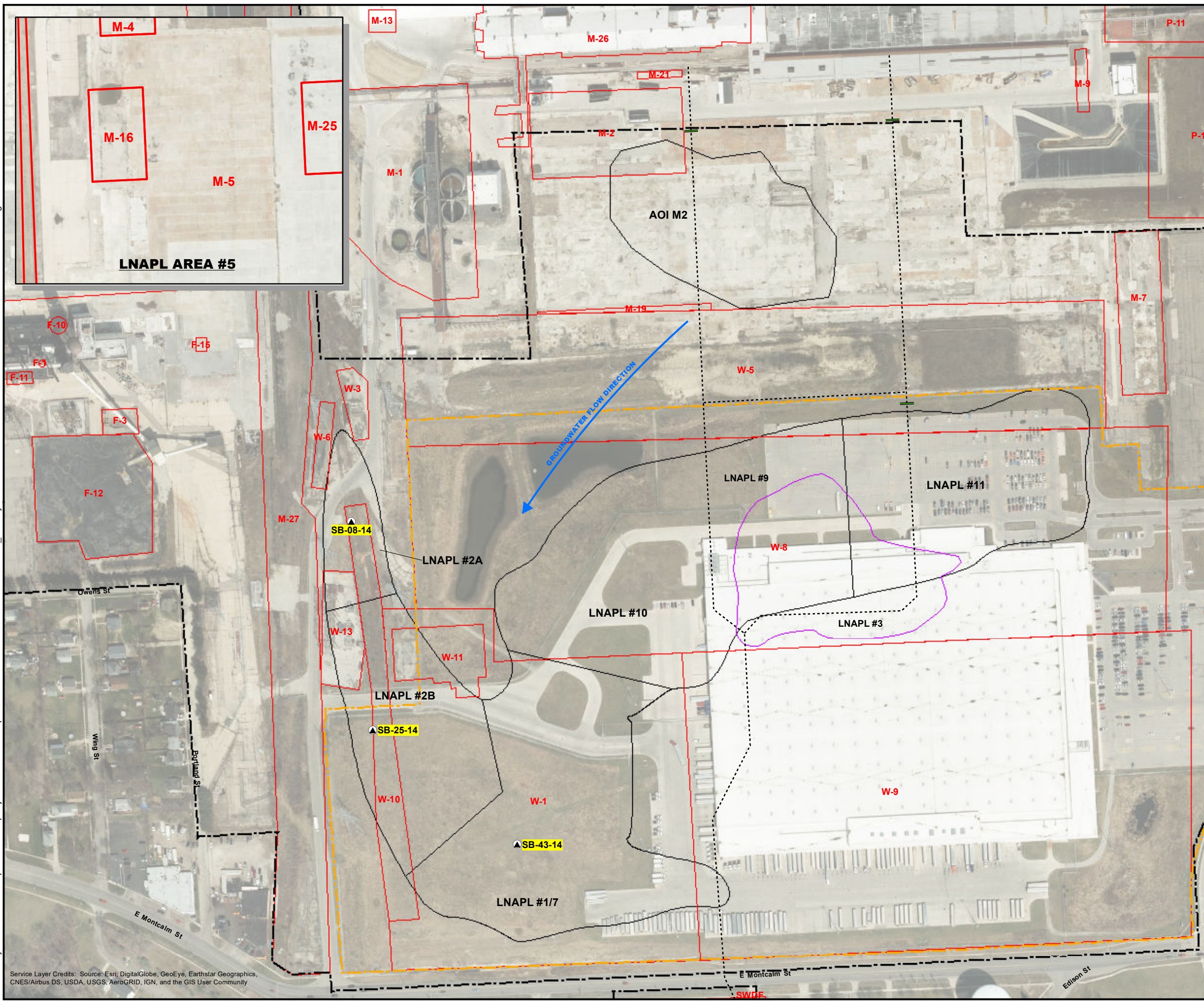
RACER TRUST
 PONTIAC NORTH CAMPUS
 PONTIAC, MICHIGAN

SITE LOCATION

ARCADIS Design & Consultancy
 for natural and
 built assets

FIGURE
1

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane Michigan South FIPS 2113 Feet
 D:\GIS\Project Files\MotorsLiquidationCompany\PontiacNorthCampus\Documents\LNAPL CorrectiveMeasure_SiteLayoutRev11x17.mxd PLOTTED: 4/22/2018 10:40:14 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 ARE WELLS WHERE T_n RESULTS WERE GREATER THAN 0.5 FT²/DAY MEASURED IN 2013/2014.

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

0 250 500
 SCALE IN FEET

RACER TRUST
 PONTIAC NORTH CAMPUS
 PONTIAC, MICHIGAN

PROPOSED CORRECTIVE MEASURE - LNAPL

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

PTS Analytical Reports



5730 Centralcrest St. • Houston, TX 77092
Telephone (713) 316-1800 • Fax (877) 225-9953

February 07, 2018

Theresa Olechiw
Project Contact
Arcadis
28550 Cabot Dr #500
Novi, MI 48377

Re: PTS File No: 48016
Project Name: Racer PNC/Pontiac MI
Project Number: B0064607.2017
ASTM D445-Viscosity and ASTM D1481-Density & Specific Gravity

Dear Ms. Olechiw:

Please find enclosed report for Fluid Properties analyses conducted upon samples received from your RACER PNC / Pontiac MI project. All analyses were performed by applicable ASTM, EPA, or API methodologies. The samples are currently in storage and will be retained for thirty days past completion of testing at no charge. Please note that the samples will be disposed of that time. You may contact me regarding storage, disposal, or return of the samples

PTS Laboratories appreciates the opportunity to be of service. If you have any questions or require additional information, please contact myself or Emeka Anazodo at (713) 316-1800.

Sincerely,
PTS Laboratories, Inc.

Rick Schweizer

Rick Schweizer
Project Manager

Encl.

Project Name: RACER PNC/Pontiac MI
Project Number: B0064607.2017

PTS File No: 48016
Client: Arcadis

TEST PROGRAM - 20180129

FLUID ID	Date Sampled	Time	Fluid Type	3-Point Viscosity, Density LNAPL	Fluid Cleaning			Comments
			Method:	ASTM D445, D1481	Proprietary			
Date Received: 20180119								
SB-08-14_LNAPL_01172018	1/17/2018	1020	NAPL/OIL	X	X			(9) 2oz vial bottles
SB-43-14_LNAPL_01172019	1/18/2018	1120	NAPL/OIL	X	X			(9) 2oz vial bottles
TOTALS:				2	2			2

Laboratory Test Program Notes
 Standard TAT for basic analysis is 10-15 business days.
 3-point viscosity includes viscosity and density at three temperatures (70, 100, 130°F).
 Temperatures dependent on fluid matrix, low temperatures may not be possible.

PTS File No: 48016
 Client: Arcadis
 Report Date: 02/07/18

VISCOSITY, DENSITY, and SPECIFIC GRAVITY DATA
 (METHODOLOGY: ASTM D445, ASTM D1481, API RP40)

Project Name: RACER PNC/Pontiac MI
 Project No: B0064607.2017

SAMPLE ID	MATRIX	TEMPERATURE, °F	SPECIFIC GRAVITY	DENSITY, g/cc	VISCOSITY	
					centistokes	centipoise
SB-08-14_LNAPL_01172018	NAPL	70	0.8718	0.8700	22.49	19.57
		100	0.8649	0.8589	11.67	10.02
		130	0.8596	0.8475	6.85	5.81
SB-43-14_LNAPL_01172018	NAPL	70	0.8975	0.8957	52.28	46.83
		100	0.8909	0.8847	23.50	20.79
		130	0.8858	0.8734	12.30	10.74

QUALITY CONTROL DATA

Date: 02/06/18
 FLUID TYPE: Cannon® CVS S3
 TEMPERATURE, °F: 70
 DENSITY, MEASURED: 0.8614
 DENSITY, PUBLISHED: 0.8615
 RPD: -0.02
 VISCOSITY, MEASURED: 4.49
 VISCOSITY, PUBLISHED: 4.47
 RPD: 0.54
 CVS Lot #: 17301

CVS = Certified Viscosity Standard

Attachment 2

Merit Analytical Reports



Analytical Laboratory Report

Report ID: S86875.01(01)
Generated on 01/30/2018

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

Additional Contacts: Colleen Barton

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 Laverty (johnlaverty@meritlabs.com)
Barbara Ball (bball@meritlabs.com)

Report Summary

Lab Sample ID(s): S86875.01
Project: RACER PNC
Collected Date: 01/17/2018
Submitted Date/Time: 01/18/2018 14:30
Sampled by: Kaityln Voet
P.O. #: B0064607.2017

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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.

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

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



Analytical Laboratory Report

Method Summary

Method	Version
ASTMD3278 - 96	ASTM Method D3278 - 96(2011)
SW1311	SW 846 Method 1311 Revision 0 July 1992
SW3015A	SW 846 Method 3015A Revision 1 February 2007
SW6020A	SW 846 Method 6020A Revision 1 February 2007
SW7471B	SW 846 Method 7471B Revision 2 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
S86875.01	WASTE01_LNAPL_01172018	Oil	01/17/18 10:20



Analytical Laboratory Report

Lab Sample ID: S86875.01

Sample Tag: WASTE01_LNAPL_01172018

Collected Date/Time: 01/17/2018 10:20

Matrix: Oil

COC Reference: 103829

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	4oz Glass	None	Yes	3.9	IR

Analysis	Results	Units	RL	Method	Run Date/Time	Tech	Limits	Flags
----------	---------	-------	----	--------	---------------	------	--------	-------

Extraction / Prep.

Mercury Digestion*	Completed			SW7471B	01/24/18 12:30	JRH		
Metal Digestion*	Completed			SW3015A	01/19/18 11:20	CCM		

TCLP Extraction

Initial Sample pH*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		
pH after 3.5 ml HCl*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		
% Solids*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		
Sample Used g*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		
Final Volume mL*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		
TCLP Extraction Fluid*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		
Final Extract pH*	<0.5%			SW1311	01/19/18 10:20-01/19	JBL		

Inorganics

Flash Point*	Not detected	oF	180	ASTMD3278 - 96	01/29/18 21:00	PL	<140	
pH/ Corrosivity*	5.56	STD Units	0.01	SW9045D	01/29/18 17:02	ASB	2-12.5	

Metals

Arsenic, TCLP*	4.18	mg/L	0.20	SW6020A	01/19/18 13:08	CCM	5.0	
Barium, TCLP*	1.18	mg/L	1.0	SW6020A	01/19/18 13:08	CCM	100.0	
Cadmium, TCLP*	Not detected	mg/L	0.20	SW6020A	01/19/18 13:08	CCM	1.0	
Chromium, TCLP*	1.60	mg/L	0.50	SW6020A	01/19/18 13:08	CCM	5.0	
Lead, TCLP*	Not detected	mg/L	0.30	SW6020A	01/19/18 13:08	CCM	5.0	
Mercury, TCLP*	Not detected	mg/L	0.0005	SW7471B	01/24/18 15:10	JRH	0.2	
Selenium, TCLP*	Not detected	mg/L	0.40	SW6020A	01/19/18 13:08	CCM	1.0	
Silver, TCLP*	Not detected	mg/L	0.20	SW6020A	01/19/18 13:08	CCM	5.0	



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C.O.C. PAGE # 1 OF 1

103829

REPORT TO

CHAIN OF CUSTODY RECORD

INVOICE TO

CONTACT NAME Theresa Olechiw
COMPANY Arcadis
ADDRESS 28550 Cabot Drive #500
CITY Novi STATE MI ZIP CODE 48377
PHONE NO. 810 225 1909 FAX NO. _____
P.O. NO. 30001607.2017
E-MAIL ADDRESS theresa.olechiw@arcadis.com
QUOTE NO. _____

CONTACT NAME Accounts Payable SAME
COMPANY Arcadis
ADDRESS 630 Plaza Drive Suite 600
CITY Highlands Ranch STATE CO ZIP CODE 80129
PHONE NO. _____ E-MAIL ADDRESS accounts.payable.administration@arcadis-us.com

ANALYSIS (ATTACH LIST IF MORE SPACE IS REQUIRED)

PROJECT NO./NAME RACER PNC SAMPLER(S) PLEASE PRINT/SIGN NAME Kathryn Velt
TURNAROUND TIME REQUIRED 1 DAY 2 DAYS 3 DAYS STANDARD OTHER _____
DELIVERABLES REQUIRED STD LEVEL II LEVEL III LEVEL IV EDD OTHER _____

MATRIX CODE: GW=GROUNDWATER WW=WASTEWATER S=SOIL L=LIQUID SD=SOLID
SL=SLUDGE DW=DRINKING WATER O=OIL WP=WIPE A=AIR W=WASTE

Containers & Preservatives

MERIT LAB NO. <small>FOR LAB USE ONLY</small>	YEAR		SAMPLE TAG IDENTIFICATION-DESCRIPTION	MATRIX	# OF BOTTLES	NONE	HCl	HNO ₃	H ₂ SO ₄	NaOH	MeOH	OTHER
	DATE	TIME										
<u>82875.01</u>	<u>1/17/18</u>	<u>1020</u>	<u>WASTE01-LNAPL-01172018</u>	<u>0</u>	<u>2</u>	<u>2</u>						

Flash point, p H, T, U, P metals

Certifications
 OHIO VAP Drinking Water
 DoD NPDES

Project Locations
 Detroit New York
 Other Pontiac MI

Special Instructions

Note: Sample contains PCB

RELINQUISHED BY: Kathryn Velt Arcadis Sampler DATE 1/17/18 TIME 1400
RECEIVED BY: Novi Cold Storage DATE 1/17/18 TIME 1400
RELINQUISHED BY: Kathryn Velt DATE 1-18-18 TIME 1220
RECEIVED BY: M DATE 1-18-18 TIME 1220

RELINQUISHED BY: [Signature] DATE 1-18-18 TIME _____
RECEIVED BY: [Signature] DATE 1/18/18 TIME 1430
SEAL NO. SEAL INTACT YES NO INITIALS _____
SEAL NO. SEAL INTACT YES NO INITIALS _____
NOTES: TEMP. ON ARRIVAL 3.9



Analytical Laboratory Report

Report ID: S87751.01(01)
Generated on 02/27/2018

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

Additional Contacts: Colleen Barton

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 Laverty (johnlaverty@meritlabs.com)
Barbara Ball (bball@meritlabs.com)

Report Summary

Lab Sample ID(s): S87751.01-S87751.02
Project: RACER PNC
Collected Date: 02/19/2018
Submitted Date/Time: 02/20/2018 14:20
Sampled by: Kaityln Voet
P.O. #: B0064607.2018.00005

Table of Contents

- Cover Page (Page 1)
- General Report Notes (Page 2)
- Report Narrative (Page 2)
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- 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

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
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SW	EPA SW 846 (Soil and Wastewater) Methods
E	EPA Methods
SM	Standard Methods



Analytical Laboratory Report

Method Summary

Method	Version
ASTMD3278 - 96	ASTM Method D3278 - 96(2011)
SW1311	SW 846 Method 1311 Revision 0 July 1992
SW3015A	SW 846 Method 3015A Revision 1 February 2007
SW3550C	SW 846 Method 3550C Revision 3 February 2007
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
SW9045D	SW 846 Method 9045D Revision 4 November 2004



Analytical Laboratory Report

Sample Summary (2 samples)

Sample ID	Sample Tag	Matrix	Collected Date/Time
S87751.01	SB-08-14_LNAPL_02192018	Oil	02/19/18 09:30
S87751.02	SB-43-14_LNAPL_02192018	Oil	02/19/18 14:30



Analytical Laboratory Report

Lab Sample ID: S87751.01

Sample Tag: SB-08-14_LNAPL_02192018

Collected Date/Time: 02/19/2018 09:30

Matrix: Oil

COC Reference: 094065

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
1	8oz Glass	None	Yes	5.4	IR

Analysis	Results	Units	RL	Method	Run Date/Time	Tech	Limits	Flags
----------	---------	-------	----	--------	---------------	------	--------	-------

Extraction / Prep.

Extraction, PCB*	Completed			SW3550C	02/26/18 10:00	PLB		
------------------	-----------	--	--	---------	----------------	-----	--	--

Organics - PCBs/Pesticides

PCB List

PCB-1016*	Not detected	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y
PCB-1242*	Not detected	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y
PCB-1221*	Not detected	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y
PCB-1232*	Not detected	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y
PCB-1248*	83,000	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y
PCB-1254*	Not detected	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y
PCB-1260*	Not detected	ug/kg	17,000	SW8082A	02/26/18 17:45	JAN		Y

Y-Elevated reporting limit due to high target concentration



Analytical Laboratory Report

Lab Sample ID: S87751.02

Sample Tag: SB-43-14_LNAPL_02192018

Collected Date/Time: 02/19/2018 14:30

Matrix: Oil

COC Reference: 094065

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
1	8oz Glass	None	Yes	5.4	IR

Analysis	Results	Units	RL	Method	Run Date/Time	Tech	Limits	Flags
----------	---------	-------	----	--------	---------------	------	--------	-------

Extraction / Prep.

Extraction, PCB*	Completed			SW3550C	02/26/18 10:00	PLB		
Mercury Digestion*	Completed			SW7471B	02/21/18 12:00	JRH		
Metal Digestion*	Completed			SW3015A	02/21/18 10:00	CCM		

TCLP Extraction

Initial Sample pH*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		
pH after 3.5 ml HCl*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		
% Solids*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		
Sample Used g*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		
Final Volume mL*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		
TCLP Extraction Fluid*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		
Final Extract pH*	<0.5%			SW1311	02/21/18 10:30-02/21	JBL		

Inorganics

Flash Point*	Not detected	oF	180	ASTMD3278 - 96	02/25/18 21:00	DMK	<140	
pH/ Corrosivity*	7.24	STD Units	0.01	SW9045D	02/20/18 17:45	ASB	2-12.5	

Metals

Arsenic, TCLP*	Not detected	mg/L	0.20	SW6020A	02/21/18 11:45	CCM	5.0	
Barium, TCLP*	8.71	mg/L	1.0	SW6020A	02/21/18 11:45	CCM	100.0	
Cadmium, TCLP*	Not detected	mg/L	0.20	SW6020A	02/21/18 11:45	CCM	1.0	
Chromium, TCLP*	1.32	mg/L	0.50	SW6020A	02/21/18 11:45	CCM	5.0	
Lead, TCLP*	2.87	mg/L	0.30	SW6020A	02/21/18 11:45	CCM	5.0	
Mercury, TCLP*	0.045	mg/L	0.0050	SW7471B	02/21/18 15:19	JRH	0.2	
Selenium, TCLP*	Not detected	mg/L	0.40	SW6020A	02/21/18 11:45	CCM	1.0	
Silver, TCLP*	Not detected	mg/L	0.20	SW6020A	02/21/18 11:45	CCM	5.0	

Organics - PCBs/Pesticides

PCB List

PCB-1016*	Not detected	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y
PCB-1242*	Not detected	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y
PCB-1221*	Not detected	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y
PCB-1232*	Not detected	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y
PCB-1248*	750,000	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y
PCB-1254*	Not detected	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y
PCB-1260*	Not detected	ug/kg	83,000	SW8082A	02/26/18 18:33	JAN		Y

Y-Elevated reporting limit due to high target concentration



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C.O.C. PAGE # 1 OF 1

094065

REPORT TO

CHAIN OF CUSTODY RECORD

INVOICE TO

CONTACT NAME Theresa Olechiv
 COMPANY Arcadis
 ADDRESS 28550 Cabot Drive, Ste 500
 CITY Novi STATE MI ZIP CODE 48377
 PHONE NO. 810 225 1909 FAX NO. _____ P.O. NO. B0064607.2018.00005
 E-MAIL ADDRESS colleen.barton@arcadis.com QUOTE NO. _____
theresa.olechiv@arcadis.com

CONTACT NAME Accounts Payable SAME
 COMPANY Arcadis
 ADDRESS 630 Plaza Drive Ste 600
 CITY Highlands Ranch STATE CO ZIP CODE 80129
 PHONE NO. _____ E-MAIL ADDRESS accounts.payable.administration@arcadis.com

PROJECT NO./NAME RACER PNC SAMPLER(S) - PLEASE PRINT/SIGN NAME Kaitlyn Voet / Kaitlyn Voet
 TURNAROUND TIME REQUIRED 1 DAY 2 DAYS 3 DAYS STANDARD OTHER _____
 DELIVERABLES REQUIRED STD LEVEL II LEVEL III LEVEL IV EDD OTHER _____

MATRIX CODE: GW=GROUNDWATER WW=WASTEWATER* S=SOIL L=LIQUID SD=SOLID
 SL=SLUDGE DW=DRINKING WATER O=OIL WP=WIPE A=AIR W=WASTE

MERIT LAB NO. <small>FOR LAB USE ONLY</small>	YEAR		SAMPLE TAG IDENTIFICATION-DESCRIPTION	MATRIX	# OF BOTTLES	NONE	HCl	HNO ₃	H ₂ SO ₄	NaOH	MeOH	OTHER	# Containers & Preservatives
	DATE	TIME											
<u>STTS 1.01</u>	<u>2/19/18</u>	<u>0930</u>	<u>SB-08-14-LNAPL-02192018</u>		<u>0</u>	<u>1</u>	<u>X</u>						
<u>AL</u>	<u>2/19/18</u>	<u>1430</u>	<u>SB-43-14-LNAPL-02192018</u>		<u>0</u>	<u>1</u>	<u>X</u>						

Total PCBs
Flashpoint, PH, TUP
metals #Hg

ANALYSIS (ATTACH LIST IF MORE SPACE IS REQUIRED)

Certifications
 OHIO VAP Drinking Water
 DoD NPDES

Project Locations
 Detroit New York
 Other Pontiac

Special Instructions

Note: Samples contain PCB
 Note: Limited volume, Run PCB analysis first

RELINQUISHED BY: Kaitlyn Voet / Arcadis ^{Sampler} DATE 2/19/18 TIME 1800
 RECEIVED BY: Novi Cold Storage DATE 2/19/18 TIME 1800
 RELINQUISHED BY: [Signature] DATE 2/20/18 TIME _____
 RECEIVED BY: [Signature] DATE 2/20/18 TIME 1120

RELINQUISHED BY: Christine Gregg / Arcadis DATE 2/20/18 TIME 1120
 RECEIVED BY: [Signature] DATE 2/20/18 TIME 1420
 SEAL NO. _____ SEAL INTACT YES NO INITIALS _____
 SEAL NO. _____ SEAL INTACT YES NO INITIALS _____

NOTES: TEMP. ON ARRIVAL 5.4