RACER Trust

PLANT 2 LNAPL CONCEPTUAL SITE MODEL

RACER Lansing Industrial Land

Lansing, Michigan

February 20, 2020

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RACER Lansing Industrial Land,
Lansing, Michigan

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February 20, 2020

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1 INTRODUCTION

The following report provides a conceptual site model (CSM) for the light non-aqueous phase liquid (LNAPL) located in the central portion of Plant 2 (aka Area 5-2) at the RACER Trust Site located in Lansing, Michigan. The Plant 2 LNAPL was initially identified in 2011 during Phase 1 of the Resource Conservation and Recovery Act (RCRA) Facilities Investigation (RFI) (Arcadis 2012). Follow-up activities to characterize the nature and extent of the LNAPL were completed from 2012 through 2019.

Details regarding the various investigations used to characterize the Plant 2 LNAPL are provided in the 2012 RFI, the RFI Phase 2 Activities Summary Report (Arcadis 2013) and several subsequent reports cited throughout this report and summarized in the reference list included as Section 6. The purpose of this CSM is to provide an overview of the Plant 2 LNAPL characterization, identified risk and potential remedy considerations. The LNAPL Remedial Decision Tree, included as **Appendix A**, provides the overall framework for this CSM. This LNAPL Remedial Decision Tree was developed in 2012-2013 in collaboration with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Technical Assistance Program Support (TAPS) team and was originally provided to the EGLE for this LNAPL as part of the Draft 2014 Corrective Measures Study (Arcadis 2014a). The LNAPL risk and remedy evaluation is based on two primary lines of evidence: LNAPL composition and LNAPL mobility.

Work Completed

The Plant 2 LNAPL covers an area of approximately 1.2 acres with LNAPL present in shallow, saturated soils typically 6 to 12 feet below grade within the perched zone. In addition, based on the laser-induced fluorescence (LIF) data and subsequent monitoring well installation, the presence of LNAPL under confined conditions has been identified in a deeper zone below the shallower LNAPL at approximately 18 to 25 feet below grade (**Figures 1 and 2**). Investigations of these LNAPL impacts have focused on composition, delineation, mobility and recoverability, and an evaluation of natural source zone depletion (NSZD):

- 2011 - LNAPL was initially observed during the 2011 Phase I RFI (Arcadis 2012). A monitoring well was installed at soil boring P2-SB-37 to assess LNAPL observed in the soil. A sample from LNAPL monitoring well P2-SB-37 was analyzed via gas chromatography (GC/FID), and also fractionated to gasoline range/purgeable (GRO, C5-C10) and diesel-range/extractable (DRO) fractions (C10-C28 and C28-C34). Review of chromatograms from this phase of investigation suggests that the Plant 2 LNAPL is most likely a mixture of relatively light lubrication and/or cutting oils with a small amount of diesel fuel. Analytical results also indicate that the LNAPL contains polychlorinated biphenyls (PCBs) and chlorinated volatile organic compounds (VOCs).
- 2012 - The RFI Phase 2 Summary Report (Arcadis 2013) includes a summary of the LNAPL delineation using laser induced fluorescence (LIF) and follow-up monitoring well installation. LNAPL was identified in the shallow fill and sand seams, as well in a deeper portion of the perched zone (approximately 18 to 25 feet below grade, present as confined LNAPL). Associated soil and groundwater impacts were also defined as part of the RFI Phase 2 work. The horizontal extent of LNAPL is included on **Figure 1** and vertical distribution is shown in cross-section on **Figure 2**.

- 2012 - Evaluation of LNAPL mobility and recoverability was completed as part of the ongoing Phase 2 RFI activities and summarized in the LNAPL Mobility and Recoverability Evaluation included as an attachment to the report (Arcadis 2013, Appendix J). The LNAPL was confirmed to not be migrating and recoverability was characterized as low.
- 2013 through 2015 - Further investigation, including the installation of additional deeper monitoring wells, LNAPL sampling, and transmissivity testing, were completed to further define and characterize the deeper, confined LNAPL. Results of the investigations for the confined LNAPL are summarized in the 2015 LNAPL Removal Workplan (Arcadis 2015a) as well as the Summary of LNAPL Transmissivity Results (Arcadis 2015b). Elevated PCBs and chlorinated volatile organic compounds were detected in samples of the confined LNAPL.
- 2016 through 2017 - Sampling of the LNAPL showed elevated concentrations of chloroethanes and suggested a potential for LNAPL as an ongoing source of 1,4-dioxane to the surrounding perched and underlying weathered bedrock aquifer. Additional sampling was completed to evaluate the distribution of 1,4-dioxane within and around the Plant 2 LNAPL. The results show the LNAPL is depleted of 1,4-dioxane and the majority of the 1,4-dioxane mass is present in the dissolved phase in surrounding groundwater (Arcadis 2017a).
- 2017 – Additional work was completed around the LNAPL to evaluate leakage of 1,4-dioxane from the perched zone to the weathered bedrock zone. As described in the lower 1,4-dioxane toe reports (Arcadis 2016b, 2016c and 2017b), 1,4-dioxane dissolved in perched water appears to leak through the glacial till lower confining unit in discrete areas and reach the weathered bedrock zone. The vertical leakage may be aided by groundwater recharge via an opening through the concrete slab located in a portion of the LNAPL area (**Figure 1**).
- 2017 - Further evaluation of the potential exposure pathways associated with VOCs and 1,4-dioxane that are co-incident with the LNAPL was provided to the EGLE as part of the Plant 2 LNAPL Area 1,4-Dioxane Investigation (Arcadis 2017a). Target Compound List (TCL) VOCs represent a small fraction (approximately 2 percent or less) of the LNAPL, and groundwater data collected to date show dissolved-phase VOC extents are limited to the immediate vicinity of the LNAPL within the perched zone.
- 2017 - Additional sampling of the LNAPL was completed in December 2017 to verify composition of the LNAPL and evaluate potential risk to the underlying bedrock aquifer that may be associated with other heavier petroleum compounds. Results of the sampling are summarized in the Plant 2 LNAPL Composition Report (Arcadis 2018a). The TPH fractionation results were consistent with the previous TPH GRO/DRO analytical data and indicate that the LNAPL consists primarily of weathered oils composed of heavier (longer-chain) aliphatic hydrocarbons that are characterized by low mobility and low toxicity.
- 2019 - Due to the proximity of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) impacted groundwater to the LNAPL, and lack of definitive historical per- and polyfluorinatedalkyl substance (PFAS) sources in the immediate vicinity, an investigation was completed to evaluate the LNAPL as a potential source of PFAS to perched groundwater. The LNAPL PFAS investigation is summarized in the 2019 Plant 2 LNAPL PFAS Investigation Memo (Arcadis 2019a). The investigation of LNAPL consisted of groundwater sampling from wells impacted with

LNAPL to evaluate the equilibrium concentrations of PFAS in groundwater as well as collection of LNAPL samples to evaluate concentrations of PFAS currently present in LNAPL. Results of the sampling suggest that PFAS concentrations in LNAPL and the surrounding groundwater are low and LNAPL does not represent a significant ongoing source of dissolved-phase PFAS. It is also possible that concentrations observed in LNAPL have partitioned from groundwater to LNAPL and are related to a non-LNAPL source. PFAS does not appear to migrate vertically at significant concentrations. PFAS has been detected in weathered bedrock at two locations at estimated concentrations (<3 ng/L) that are below current and proposed criteria.

- 2019 - Arcadis conducted an evaluation of NSZD (Arcadis 2019b) which examined three lines of evidence (soil gas screening, subsurface temperature profiling, and soil gas flux measurement) to determine LNAPL depletion rates. Using the average rate calculated from these measurements, the LNAPL area NSZD is estimated at 570 gallons of LNAPL depleted per year over an approximate LNAPL footprint of 1.2 acres.

The results of these evaluations are detailed further below and were used to complete the LNAPL Remedial Decision Tree (**Appendix A)**. Based on the LNAPL composition and saturation concerns, institutional and engineered controls are currently considered appropriate to address the risk associated with the Plant 2 LNAPL Area.

2 LNAPL COMPOSITION

The analytical results for TPH, VOCs, SVOCs and PCBs are included in **Table 1**. Analytical results for PFAS are included in **Table 2**. As discussed in the 2018 LNAPL Composition Report (Arcadis 2018), based on the 2017 Michigan Part 201 Non-Residential Soil Direct Contact (DC) Criteria, the compounds listed below do not pose a DC risk, with the potential exception of PCBs, particularly in the deeper LNAPL saturated soils. The concentrations of VOCs and SVOCs within LNAPL impacted soils are typically one or more orders of magnitude below DC criteria. Potential DC exceedances for PCBs will be addressed by institutional controls (deed restrictions) including limiting future land use to nonresidential, prohibiting installing wells for extraction of groundwater, requiring proper precautions and safety measures for any excavation or other intrusive activity and management of impacted soil, and providing notification of the presence of PCB remediation waste. Exceedances of site-specific vapor inhalation (VI) criteria associated with elevated VOCs in LNAPL will be addressed by a deed restriction that requires a VI evaluation and/or engineered controls prior to construction of any building for human occupation.

LNAPL composition and potential risks with respect to specific groups or classes of compounds (TPH, VOCs, SVOCs, PCBs, and PFAS) are discussed in the following sections.

TPH Fractions

Refined petroleum products are complex mixtures of hydrocarbon compounds that consist of a wide range of compounds (extending from those with 2 carbon atoms, or C2, to compounds C40 and higher). The TPH fractionation results from samples collected in 2017 confirm that the LNAPL is predominantly longer-chain aliphatic compounds; aliphatic compounds in the C19-C36 range make up between 57 and 75 percent of the hydrocarbon compounds reported for the samples analyzed (Arcadis 2018).

Additionally, the data indicate that the reported TPH fractions (extending up to carbon numbers C36 for aliphatics and C22 for aromatics) encompass roughly 360,000 to 550,000 mg/kg of the TPH mixture. While laboratory precision and analytical uncertainty contributes somewhat to this observation (e.g., reported fractions would not be expected to add up exactly to 1,000,000 mg/kg for any sample), the size of the remaining, unquantified fractions of the mixture suggested that a significant part of the LNAPL is heavier compounds that are likely to have very low water solubility and pose low health risk overall.

The U.S. EPA Regional Screening Level (RSL) tables provide risk-based screening-levels for specific fractions of complex hydrocarbon mixtures, covering different carbon ranges for both aliphatic and aromatic hydrocarbon fractions. These levels, presented below, account for ingestion, inhalation, and dermal/direct-contact pathways. In general, aromatic compounds are more toxic than aliphatic compounds. Aliphatic compounds are typically saturated with hydrogen atoms and are less reactive due to their molecular configuration.

TPH Fractions	Carbon Range	Industrial Soil Screening Level (mg/kg)
Low aliphatic	C5-C8	2,200
Medium aliphatic	C9-C18	440
High aliphatic	C19-C32	3,500,000
Low aromatic	C6-C8	420
Medium aromatic	C9-C16	600
High aromatic	C17-C32	33,000

TPH fractions are not carcinogenic, and their toxicity is associated with non-cancer adverse health effects. The TPH fraction RSLs for industrial soil, corresponding to a target hazard quotient (THQ) of 1 are summarized in the table above. Note that these soil screening levels should not be compared directly to the LNAPL analytical results presented earlier, because the analytical results represent the composition of the pure-phase LNAPL rather than a concentration of TPH constituents in LNAPL-impacted soil, which would be significantly lower.

Nonetheless, the RSLs are useful for assessing the relative risk associated with each hydrocarbon fraction. Most hydrocarbon compounds detected in the LNAPL mixture are heavy, or high-carbon-range, aliphatic hydrocarbons, which are the lowest-toxicity fraction for which RSLs are developed. Due to the low toxicity of these compounds, the RSL for this fraction is over 1,000,000 mg/kg, indicating that no possible concentration of heavy aliphatic hydrocarbons in soil poses an unacceptable human health risk for nonresidential soil exposure scenarios.

1,4-Dioxane

Sampling of LNAPL and LNAPL-impacted soils in the Plant 2 LNAPL area have shown high concentrations of chlorinated ethanes, including 1,1,1-trichloroethane, suggesting the LNAPL could be an ongoing source of 1,4-dioxane. Additional sampling completed during the 2017 Plant 2 LNAPL Area 1,4-dioxane investigation have shown that 1,4-dioxane associated with the LNAPL is depleted and the majority of the 1,4-dioxane mass in the Plant 2 LNAPL area is present as dissolved phase in surrounding perched groundwater (Arcadis 2017a, 2018). This data, coupled with the partitioning characteristics of 1,4-dioxane, indicate the majority of all 1,4-dioxane available for leaching from LNAPL to groundwater has already moved to the dissolved phase.

A cross section of the LNAPL Area, included as part of **Appendix B (**Figure B-1)**,** illustrates the relative concentrations of 1,4-dioxane in LNAPL and the surrounding soils. Soil samples collected during the toe investigations (Arcadis 2016b, 2016c and 2017b) indicate concentrations of 1,4-dioxane around the perimeter of the Plant 2 LNAPL, within the underlying glacial till, are up to several orders of magnitude higher concentrations those observed in the LNAPL impacted soils.

The 1,4-dioxane mass present in weathered bedrock beneath the Plant 2 LNAPL area appears to be primarily related to perched groundwater leakage from the zone beneath and immediately surrounding the LNAPL plume. As described in the lower 1,4-dioxane toe reports (Arcadis 2016b, 2016c and 2017b),1,4-dioxane leakage from the Plant 2 LNAPL area to weathered bedrock appears to occur in discrete areas. The potential value of a cap installed as a corrective measure component, or as a result of redevelopment, is being evaluated for the Plant 2 LNAPL area to reduce infiltration and subsequent leakage to the weathered bedrock. In the interim, a propane biosparge system being implemented will treat 1,4-dioxane mass within the weathered bedrock around the Plant 2 LNAPL area.

VOCs

Analytical results from soil and groundwater sampling in the vicinity of the LNAPL indicate dissolved-phase VOC impacts are limited to the perched zone and attenuate rapidly. The VOCs historically detected in LNAPL above a concentration of 1.0 part per million include:

- 1,1,1-Trichloroethane,
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichlorobenzene
- 2-Methylnaphthalene
- Chloroethane
- m&p-Xylene
- o-Xylene
- Methyl cyclohexane
- Naphthalene

- N-Butylbenzene
- Tetrachloroethene
- Toluene

Target Compound List (TCL) VOCs represent a small fraction (approximately 2 percent or less) of the LNAPL composition (Arcadis 2014). The chlorinated ethenes/ethanes and other VOCs detected in groundwater around the LNAPL attenuate rapidly due to the geochemical conditions created by the presence of LNAPL and do not migrate downgradient or vertically at significant concentrations. The reducing geochemical environment is generated by an abundance of organic material (including petroleum hydrocarbons) and the resulting depletion of oxygen and other electron acceptors providing a suitable environment to support microbial reductive dechlorination (Wiedemeier et al. 1998). VOCs are primarily limited to the perched zone in the LNAPL area and only sporadic low-level detections of VOCs have been detected in weathered bedrock groundwater (Arcadis 2017b).

Exceedances of vapor inhalation (VI) criteria associated with the elevated VOCs in LNAPL will be addressed by a deed restriction that requires a VI evaluation and/or engineered controls prior to construction of any building for human occupation.

SVOCs

The SVOCs detected in the LNAPL, such as phenanthrene and fluorene, are common components of middle petroleum distillates. Surrounding soil and groundwater samples have indicated only limited SVOC impacts. The extent of dissolved-phase SVOC impacts is limited by the lower solubility of these compounds. SVOCs detected in LNAPL include the following:

- 2-Methylnaphthalene
- Anthracene
- Fluoranthene
- Fluorene
- Phenanthrene
- Pyrene

The LNAPL does not contain detectable concentrations of carcinogenic PAHs (such as benzo(a)pyrene) or other SVOC compounds associated with significant health risk. Sampling of weathered bedrock groundwater has not yielded any detections of SVOCs with the exception of bis(2-ethylhexyl)phthalate (DEHP). The DEHP detections are associated with sample sets where the compound was also detected in the laboratory method blank. As indicated in previous correspondence to EGLE, the persistent low-level phthalates detected in groundwater at the Site appear to be associated with laboratory cross-contamination.

PCBs

PCBs in LNAPL, although elevated, particularly within the deeper LNAPL zone, do not dissolve readily and do not present a dissolved-phase risk to the perched zone or bedrock aquifer. PCB detections in soil and groundwater are limited and appear to be related to residual LNAPL impacts in soil, or suspended material entrained within groundwater samples. The PCB evaluation for the Site was summarized as part of the USEPA work plan for PCB removal (PM Environmental 2012). The PCB detections in soil and saturated soil samples are summarized in **Appendix B** (Figure B-2). PCBs detected in LNAPL include the following:

- Aroclor-1242
- Aroclor-1254

The Toxic Substances Control Act (TSCA), 40 CFR 761.61(a)(4)(i)(A), specifies the following cleanup levels for low-occupancy areas:

- For concentrations ≤ 25 mg/kg in soils: institutional controls
- For concentrations >25 but ≤ 50 mg/kg in soils: site secured by fence, marked with low occupancy warning sign, and institutional controls
- For concentrations >50 but ≤ 100 mg/kg in soils: cap and institutional controls

Sampling of LNAPL-impacted soils has indicated two locations where PCBs in soil exceed 10 ppm. These locations include VAP-A5.2-NV119 at a depth of 6-7 feet (39 mg/kg) and SB-A5.2-NW124 at a depth of 4-5 feet (22 mg/kg). The near surface sample result at both locations was relatively low (0.6 mg/kg and non-detect, respectively). Based on these results, PCBs can be addressed through institutional controls.

PFAS

Due to the proximity of PFOS and PFOA impacted groundwater to the LNAPL and lack of known historical sources in the immediate vicinity, an investigation was completed to determine if the LNAPL represents a historical, or perhaps continuing, source of PFAS to perched groundwater. The LNAPL PFAS investigation is summarized in the 2019 Plant 2 LNAPL PFAS Investigation Memo (Arcadis 2019a). The investigation of LNAPL consisted of two components:

- Groundwater sampling from wells impacted with LNAPL to evaluate the concentrations of PFAS in groundwater in close proximity to the LNAPL.
- Collection of LNAPL samples to evaluate concentrations of PFAS currently present in LNAPL.

As there is no established method for quantifying PFAS in petroleum LNAPL, Arcadis contracted SGS Axys Laboratories of Sidney, British Columbia to develop a custom extraction procedure and analysis for LNAPL**.**

Laboratory analytical results for LNAPL samples analyzed for PFAS are included as **Table 2**. A figure illustrating PFAS concentrations in groundwater and LNAPL is included in **Appendix B** (Figure B-3).Comparison of the analytical results for both groundwater and LNAPL does not show a tendency toward a higher concentration in either media. The highest concentrations of individual PFAS compounds within LNAPL are on the order of hundreds of nanograms per liter (ng/L) and typically less than 100 ng/L for PFOA and PFOS. These concentrations are similar to those observed in the surrounding perched groundwater.

Based on these results, LNAPL is unlikely to represent a substantial ongoing source of PFAS impacts to groundwater, and it is possible that concentrations observed in LNAPL have partitioned from groundwater into LNAPL and are therefore related to a separate source. Further, the detected concentrations in both groundwater and LNAPL are low enough that differences in various PFAS concentrations could be attributed to sampling variability in addition to partitioning characteristics.

Groundwater samples collected from the weathered bedrock in the vicinity of the Plant 2 LNAPL area have shown only estimated concentrations of PFAS (i.e. PFOS) at two locations, MW-16-81 and TW-14-02 (2.96 and 2.47 ng/L, respectively) (Arcadis 2018b).

3 MOBILITY

Evaluation of LNAPL mobility and recoverability was completed as part of the ongoing RFI and summarized in the LNAPL Mobility and Recoverability Evaluation, submitted as an attachment to the Phase 2 RFI Summary Report (Arcadis 2013, Appendix J) as well as the Plant 2 LNAPL Recovery Workplan (Arcadis 2015a) and LNAPL Transmissivity Result Summary (Arcadis 2015b).

An LNAPL baildown test within perched well PMW-01 yielded an estimated LNAPL transmissivity of 0.01 square feet per day (ft^2/d)(Arcadis 2013, Appendix J), while LNAPL transmissivity estimates for all three of the wells installed in the deeper, confined LNAPL ranged from 0.004 ft^2/d at LMW-14-15D to 0.035 ft^2/d at LMW-14-12D (Arcadis 2015a). These values are two to three orders of magnitude below the 0.5 ft^2/d criterion established by the EGLE to define LNAPL that can be recovered in a cost effective and efficient manner (MDEQ 2014b). Results of the mobility analysis indicated the LNAPL plume is not migrating, and hydraulic LNAPL recovery is not expected to provide significant mass reduction.

4 NSZD

An NSZD assessment was conducted in 2018 and 2019 at the LNAPL area. The methods and results of the NSZD investigation are summarized in the 2019 Plant 2 LNAPL Area – Natural Source Zone Depletion Memo (Arcadis 2019b).

NSZD is a combination of processes, including dissolution, volatilization, and biodegradation, that reduce the mass of LNAPL in subsurface systems. NSZD occurs when processes act to physically redistribute LNAPL components to the aqueous phase via dissolution or to the gaseous phase via volatilization. In turn, dissolved or volatilized LNAPL constituents can be biologically degraded by microbial and/or enzymatic activity. Biodegradation can also occur directly on the LNAPL phase, without a need for dissolution or volatilization. These biodegradation reactions result in the production of carbon dioxide (CO_2) and methane (CH_4). Due to the limited solubility of carbon dioxide and methane, these byproducts partition into the gas phase and migrate toward the ground surface by diffusive and advective gas transport.

The evaluation completed at the LNAPL area used three types of data collection (soil gas screening, subsurface temperature profiling, and soil gas flux measurement) to evaluate NSZD activity; each of the data sets collected provides a line of evidence that NSZD is active and ongoing at the LNAPL area. Using the average NSZD rate calculated from these measurements, the LNAPL area NSZD rate is estimated at 570 gallons of LNAPL depleted per year over an approximate LNAPL footprint of 1.2 acres. This equivalent loss rate would be expected to vary based on seasonal and environmental factors, and to decrease over time as LNAPL mass is depleted. The estimated loss rate is substantially larger than LNAPL removal rates achieved via manual LNAPL bailing and would surpass recovery from an automated hydraulic recovery system that could be installed at the LNAPL area. NSZD is therefore the dominant contributor to current LNAPL mass reductions. The three lines of evidence evaluated to determine NSZD rates are summarized in the following subsections.

Soil Gas Composition Screening Results

The results of the soil vapor screening results indicated that NSZD is actively occurring at the LNAPL area; elevated CO_2 concentrations and depleted O_2 concentrations relative to background values were observed at several locations. These soil gas results are used in a qualitative manner to support the quantitative findings of other lines of evidence.

Temperature Profiling Results

Temperature profiling data were collected using dataloggers in five wells for a period from October 2018 through June 2019. Multiple measurement dates were used at each well to construct profiles using the same model as discussed above to account for seasonal changes. The estimated NSZD rate based on this data ranges from 200 gallons per acre per year (gal/acre/yr) to 2,000 gal/acre/yr and the average was approximately 500 gal/acre/yr.

Soil Gas Flux Results

CO_2 and CH_4 Flux measurements collected at ground surface indicate that most of the CH_4 being produced is being converted to CO_2 prior to reaching the ground surface. Short-term CO_2 flux measurements using a portable flux chamber were used to identify viable, representative areas for longer-term sorbent CO_2 trap deployment and to identify locations of anomalously high or low CO_2 flux which should be avoided during trap deployment. Traps were deployed for approximately two weeks to collect time-averaged data, and a carbon isotope (^{14}C) analysis was used to identify the portion of CO_2 flux representative of petroleum degradation at each trap location. The CO_2 trap results indicated average petroleum-related CO_2 fluxes ranging from near-zero to 1.45 µmol/m^2/sec, corresponding to equivalent LNAPL loss rates up to 900 gal/acre/yr.

5 CONCLUSIONS

Based on the CSM outlined above and the LNAPL Decision Tree, the LNAPL remaining in place is not expected to pose a significant human health risk through direct contact, drinking water, or groundwater surface water interface exposure pathways. Exceedances of vapor inhalation (VI) criteria associated with the elevated VOCs in LNAPL will be addressed by deed restriction that requires a VI evaluation and/or engineered controls prior to construction of any building for human occupation. Impacts to the underlying bedrock drinking water aquifer will be addressed with a biosparge system to reduce the concentrations of 1,4-dioxane.

The results of this evaluation and previous LNAPL investigation results support the following conclusions:

- TPH fractionation results indicate that the LNAPL consists primarily of heavier (longer-chain) aliphatic hydrocarbons characterized by low mobility and low toxicity. The overall low volatility and solubility of heavier petroleum compounds that make up the majority of the LNAPL mixture suggest that migration of these compounds in dissolved phase or vapor phase is minimal. Target compound list VOCs make up only a small fraction of the LNAPL (<2%).
- Previous evaluations have demonstrated that the LNAPL has been depleted of 1,4-dioxane mass and the majority of the 1,4-dioxane present is dissolved in groundwater
- The 1,4-dioxane mass present in weathered bedrock beneath the Plant 2 LNAPL area appears to be primarily related to perched groundwater leakage from the zone beneath and immediately surrounding the LNAPL. The proposed remedy for the lower 1,4-dioxane includes a propane biosparge system to treat 1,4-dioxane mass within the weathered bedrock around the LNAPL area.
- The potential value of a cap installed as a corrective measure component, or as a result of redevelopment, is being evaluated for the Plant 2 LNAPL area to reduce infiltration leakage to the weathered bedrock.
- Dissolved phase VOC impacts are limited to the immediate vicinity of the LNAPL. The chlorinated ethenes/ethanes and other VOCs detected in groundwater around the LNAPL attenuate rapidly due to the geochemical conditions created by the presence of the LNAPL and do not migrate downgradient or vertically at significant concentrations. VOCs are primarily limited to the perched zone in the LNAPL area and only sporadic low-level detections of VOCs have been detected in weathered bedrock groundwater (Arcadis 2017b).
- Exceedances of vapor inhalation (VI) criteria associated with the elevated VOCs in LNAPL will be addressed by deed restriction that requires a VI evaluation and/or engineered controls prior to construction of any building for human occupation.
- SVOC analytical results for the LNAPL identified relatively low-toxicity PAHs as the only detectable compounds. Surrounding soil and groundwater samples have indicated limited SVOC impacts. The extent of dissolved-phase SVOC impacts is limited by the lower solubility of these compounds. The LNAPL does not contain detectable concentrations of carcinogenic PAHs or other SVOC compounds associated with significant health risk. Sampling of the weathered bedrock groundwater has not yielded any detections of SVOCs with the exception of bis(2-ethylhexyl)phthalate, which is believed to be a laboratory contaminant.

- The PCBs in LNAPL, although elevated, particularly within the confined LNAPL, do not dissolve readily and do not present a dissolved phase risk to the perched zone or bedrock aquifer. Sampling of LNAPL impacted soils has indicated two locations where PCBs in soil exceed 10 ppm. The near surface sample at both locations indicated relatively low concentrations. Based on these results, the PCBs can be addressed through institutional controls.
- Overall the LNAPL plume is stable and not migrating, as shown by LNAPL delineation and long-term monitoring.
- Testing that shows LNAPL transmissivity is two to three orders of magnitude below the 0.5 ft^2/d criterion established by the EGLE to define LNAPL that can be recovered in a cost effective and efficient manner.
- NSZD is the dominant contributor to current LNAPL mass reductions, as indicated by the results of the 2019 NSZD investigation (Arcadis 2019b). Each line of evidence evaluated (soil gas screening, subsurface temperature profiling, and soil gas flux measurement) indicates that NSZD is active and ongoing. Using the average NSZD rate calculated from these measurements, the LNAPL area NSZD rate is estimated at 570 gallons of LNAPL depleted per year over an approximate LNAPL footprint of 1.2 acres. The estimated loss rate is substantially larger than LNAPL removal rates achievable via manual LNAPL bailing or via potential automated hydraulic recovery systems.

Based on the data summarized above, in the referenced reports and the CSM outlined herein, the LNAPL Decision Tree (**Appendix A**) supports the use of institutional controls, engineered controls and NSZD as the most appropriate and cost-effective approach to address and mitigate risk associated with the Plant 2 LNAPL.

6 REFERENCES

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TABLES

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID: Date Collected:	Units	LMW-12-03D 9/10/2014	LMW-12-03D 10/31/2014	LMW-12-08 11/25/2014	LMW-12-08 4/6/2017	LMW-12-08 12/7/2017	LMW-12-08 12/7/2017	LMW-14-12D 12/2/2014	LMW-14-12D 12/7/2017	LMW-14-12D 12/7/2017	LMW-14-15D 12/2/2014	LMW-14-15D 4/7/2017
Volatile Organics												
1,1,1,2-Tetrachloroethane	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
1,1,1-Trichloroethane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,1,2,2-Tetrachloroethane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,1,2-Trichloroethane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,1-Dichloroethane	µg/kg	800 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,1-Dichloroethene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,2,3-Trichlorobenzene	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
1,2,3-Trichloropropane	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
1,2,3-Trimethylbenzene	µg/kg	NA	NA	NA	NA	600 X	NA	NA	1,100 X	NA	NA	NA
1,2,4-Trichlorobenzene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,2,4-Trimethylbenzene	µg/kg	NA	NA	NA	NA	**700 X**	NA	NA	2,800 X	NA	NA	NA
1,2-Dibromo-3-chloropropane (DBCP)	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,2-Dibromoethane (Ethylene dibromide)	µg/kg	<500 X	NA	<200 MX	NA	<500 X	NA	<2,000 MX	<500 X	NA	<2,000 MX	NA
1,2-Dichlorobenzene	µg/kg	<500 X	NA	**1,300 X**	NA	<1,000 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,2-Dichloroethane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,2-Dichloropropane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,3,5-Trimethylbenzene	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
1,3-Dichlorobenzene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,4-Dichlorobenzene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
1,4-Dioxane	µg/kg	<3,000 X	NA	<3,000	<500	NA	NA	<30,000 X	NA	NA	<30,000 X	<500
2-Butanone (Methyl Ethyl Ketone)	µg/kg	<5,000 X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (Methyl ethyl ketone) (MEK)	µg/kg	NA	NA	<5,000 X	NA	<5,000 X	NA	<50,000 X	<5,000 X	NA	<50,000 X	NA
2-Hexanone	µg/kg	<5,000 X	NA	<5,000 X	NA	<5,000 X	NA	<50,000 X	<5,000 X	NA	<50,000 X	NA
2-Methylnaphthalene	µg/kg	NA	NA	NA	NA	**2,000 X**	NA	NA	9,000 X	NA	NA	NA
2-Phenylbutane (sec-Butylbenzene)	µg/kg	NA	NA	NA	NA	**800 X**	NA	NA	600 X	NA	NA	NA
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	µg/kg	<5,000 X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/kg	NA	NA	<5,000 X	NA	<5,000 X	NA	<50,000 X	<5,000 X	NA	<50,000 X	NA
Acetone	µg/kg	<5,000 X	NA	<5,000 X	NA	<5,000 X	NA	<50,000 X	<5,000 X	NA	<50,000 X	NA
Acrylonitrile	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Benzene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Bromobenzene	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Bromodichloromethane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Bromoform	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Bromomethane (Methyl bromide)	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Carbon disulfide	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Carbon tetrachloride	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Chlorobenzene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Chlorobromomethane	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Chloroethane	µg/kg	**8,000 X**	NA	**9,800 X**	NA	**3,900 X**	NA	**321,000 X**	71,300 X	NA	**282,000 X**	NA
Chloroform (Trichloromethane)	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Chloromethane (Methyl chloride)	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
cis-1,2-Dichloroethene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA

See notes on last page.

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID:		LMW-12-03D	LMW-12-03D	LMW-12-08	LMW-12-08	LMW-12-08	LMW-12-08	LMW-14-12D	LMW-14-12D	LMW-14-12D	LMW-14-15D	LMW-14-15D
Date Collected:	Units	9/10/2014	10/31/2014	11/25/2014	4/6/2017	12/7/2017	12/7/2017	12/2/2014	12/7/2017	12/7/2017	12/2/2014	4/7/2017
cis-1,3-Dichloropropene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Cyclohexane	µg/kg	<5,000 X	NA	<500 X	NA	NA	NA	<5,000 X	NA	NA	<5,000 X	NA
Cymene (p-Isopropyltoluene)	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	**1,300 X**	NA	NA	NA
Dibromochloromethane	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Dibromomethane	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Dichlorodifluoromethane (CFC-12)	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Ethyl ether	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Ethylbenzene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Hexachloroethane	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Iodomethane	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Isopropyl benzene	µg/kg	NA	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Isopropylbenzene	µg/kg	<500 X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m&p-Xylene	µg/kg	**1,400 X**	NA	<1,000 X	NA	<1,000 X	NA	<10,000 X	**1,000 X**	NA	<10,000 X	NA
Methyl acetate	µg/kg	<5,000 X	NA	<5,000 X	NA	NA	NA	<50,000 X	NA	NA	<50,000 X	NA
Methyl cyclohexane	µg/kg	<5,000 X	NA	<500 X	NA	NA	NA	<5,000 X	NA	NA	<5,000 X	NA
Methyl Tert Butyl Ether	µg/kg	<500 X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl tert butyl ether (MTBE)	µg/kg	NA	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Methylene chloride	µg/kg	<500 X	NA	<500 X	NA	<1,000 X	NA	<5,000 X	<1,000 X	NA	<5,000 X	NA
Naphthalene	µg/kg	NA	NA	NA	NA	<1,000 X	NA	NA	**4,000 X**	NA	NA	NA
N-Butylbenzene	µg/kg	NA	NA	NA	NA	**1,200 X**	NA	NA	**1,200 X**	NA	NA	NA
N-Propylbenzene	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	**600 X**	NA	NA	NA
o-Xylene	µg/kg	**1,100 X**	NA	<500 X	NA	<500 X	NA	<5,000 X	**600 X**	NA	<5,000 X	NA
Styrene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
tert-Butylbenzene	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Tetrachloroethene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Tetrahydrofuran	µg/kg	NA	NA	NA	NA	<10,000 X	NA	NA	<10,000 X	NA	NA	NA
Toluene	µg/kg	**2,200 X**	NA	<500 X	NA	<500 X	NA	<5,000 X	**500 X**	NA	<5,000 X	NA
trans-1,2-Dichloroethene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
trans-1,3-Dichloropropene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
trans-1,4-Dichloro-2-butene	µg/kg	NA	NA	NA	NA	<500 X	NA	NA	<500 X	NA	NA	NA
Trichloroethene	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Trichlorofluoromethane (CFC-11)	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Trifluorotrichloroethane (Freon 113)	µg/kg	<500 X	NA	<500 X	NA	NA	NA	<5,000 X	NA	NA	<5,000 X	NA
Vinyl chloride	µg/kg	<500 X	NA	<500 X	NA	<500 X	NA	<5,000 X	<500 X	NA	<5,000 X	NA
Semivolatile Organics												
1,2,4-Trichlorobenzene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
1,2-Dichlorobenzene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
1,2-Diphenylhydrazine	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
1,3-Dichlorobenzene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
1,4-Dichlorobenzene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,4,5-Trichlorophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,4,6-Trichlorophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA

See notes on last page.

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID:		LMW-12-03D	LMW-12-03D	LMW-12-08	LMW-12-08	LMW-12-08	LMW-12-08	LMW-14-12D	LMW-14-12D	LMW-14-12D	LMW-14-15D	LMW-14-15D
Date Collected:	Units	9/10/2014	10/31/2014	11/25/2014	4/6/2017	12/7/2017	12/7/2017	12/2/2014	12/7/2017	12/7/2017	12/2/2014	4/7/2017
2,4-Dichlorophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,4-Dimethylphenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,4-Dinitrophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,4-Dinitrotoluene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2,6-Dinitrotoluene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2-Chloronaphthalene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2-Chlorophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2-Methylnaphthalene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	**19,000 J**	NA	NA
2-Methylphenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2-Nitroaniline	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
2-Nitrophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
3&4-Methylphenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
3,3'-Dichlorobenzidine	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
3-Nitroaniline	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4,6-Dinitro-2-methylphenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4-Bromophenyl phenyl ether	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4-Chloro-3-methylphenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4-Chloroaniline	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4-Chlorophenyl phenyl ether	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4-Nitroaniline	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
4-Nitrophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Acenaphthene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Acenaphthylene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Anthracene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	**36,000**	NA	NA
Benzo(a)anthracene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Benzo(a)pyrene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Benzo(b)fluoranthene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Benzo(g,h,i)perylene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Benzo(k)fluoranthene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
bis(2-Chloroethoxy)methane	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
bis(2-Chloroethyl)ether	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
bis(2-Ethylhexyl)phthalate (DEHP)	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Butyl benzylphthalate (BBP)	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Chrysene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Dibenz(a,h)anthracene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Dibenzofuran	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Diethyl phthalate	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Dimethyl phthalate	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Di-n-butylphthalate (DBP)	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Di-n-octyl phthalate (DnOP)	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Fluoranthene	µg/kg	NA	NA	NA	NA	<80,000 X	**14,000 J**	NA	<79,000 X	**18,000 J**	NA	NA
Fluorene	µg/kg	NA	NA	NA	NA	<80,000 X	**13,000 J**	NA	<79,000 X	**87,000**	NA	NA
Hexachlorobenzene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA

See notes on last page.

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID:		LMW-12-03D	LMW-12-03D	LMW-12-08	LMW-12-08	LMW-12-08	LMW-12-08	LMW-14-12D	LMW-14-12D	LMW-14-12D	LMW-14-15D	LMW-14-15D
Date Collected:	Units	9/10/2014	10/31/2014	11/25/2014	4/6/2017	12/7/2017	12/7/2017	12/2/2014	12/7/2017	12/7/2017	12/2/2014	4/7/2017
Hexachlorobutadiene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Hexachlorocyclopentadiene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Hexachloroethane	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Indeno(1,2,3-cd)pyrene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Isophorone	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Naphthalene	µg/kg	NA	NA	NA	NA	<80,000 X	<19,000	NA	<79,000 X	<20,000	NA	NA
Nitrobenzene	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
N-Nitrosodi-n-propylamine	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
N-Nitrosodiphenylamine	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Pentachlorophenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Phenanthrene	µg/kg	NA	NA	NA	NA	<80,000 X	**29,000**	NA	<79,000 X	**110,000**	NA	NA
Phenol	µg/kg	NA	NA	NA	NA	<80,000 X	NA	NA	<79,000 X	NA	NA	NA
Pyrene	µg/kg	NA	NA	NA	NA	<80,000 X	**26,000**	NA	<79,000 X	**33,000**	NA	NA
Polychlorinated Biphenyls												
Aroclor-1016 (PCB-1016)	µg/kg	<100,000 Y	<67,000 Y	<2,000 Y	NA	<3,000 Y	NA	<33,000 Y	<33,000 Y	NA	<100,000 Y	NA
Aroclor-1221 (PCB-1221)	µg/kg	<100,000 Y	<67,000 Y	<2,000 Y	NA	<3,000 Y	NA	<33,000 Y	<33,000 Y	NA	<100,000 Y	NA
Aroclor-1232 (PCB-1232)	µg/kg	<100,000 Y	<67,000 Y	<2,000 Y	NA	<3,000 Y	NA	<33,000 Y	<33,000 Y	NA	<100,000 Y	NA
Aroclor-1242 (PCB-1242)	µg/kg	**500,000 Y**	**546,000 Y**	**17,000 Y**	NA	**15,000 Y**	NA	<33,000 Y	<33,000 Y	NA	**532,000 Y**	NA
Aroclor-1248 (PCB-1248)	µg/kg	<100,000 Y	<67,000 Y	<2,000 Y	NA	<3,000 Y	NA	<33,000 Y	<33,000 Y	NA	<100,000 Y	NA
Aroclor-1254 (PCB-1254)	µg/kg	<100,000 Y	<67,000 Y	<2,000 Y	NA	<3,000 Y	NA	**227,000 Y**	**223,000 Y**	NA	<100,000 Y	NA
Aroclor-1260 (PCB-1260)	µg/kg	<100,000 Y	<67,000 Y	<2,000 Y	NA	<3,000 Y	NA	<33,000 Y	<33,000 Y	NA	<100,000 Y	NA
Total PCBs	µg/kg	**500,000 Y**	**546,000 Y**	**17,000 Y**	NA	**15,000 Y**	NA	**227,000 Y**	**223,000 Y**	NA	**532,000 Y**	NA
Total Petroleum Hydrocarbons												
Total Petroleum Hydrocarbons (C10-C28) DRO	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (C28-C34) DRO	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (C5-C10) GRO	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Volatile Petroleum Hydrocarbons												
Volatile Petroleum Hydrocarbons (C5-C8 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	**28 J**	NA	NA	**120**	NA	NA
Volatile Petroleum Hydrocarbons (C9-C12 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	**660**	NA	NA	**240**	NA	NA
Extractable Petroleum Hydrocarbons												
Volatile Petroleum Hydrocarbons (C9-C18 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	**20,000**	NA	NA	**14,000**	NA	NA
Volatile Petroleum Hydrocarbons (C19-C36 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	**210,000**	NA	NA	**410,000**	NA	NA
Volatile Petroleum Hydrocarbons (C11-C22 Aromatics)	mg/kg	NA	NA	NA	NA	NA	**120,000**	NA	NA	**110,000**	NA	NA

Notes:
< indicates result is less than the indicated reporting limit
Bold = Compound detected above laboratory reporting limit
J = Result is an estimated value
M = Result reported to method detection limit not reporting detection limit
NA = not analyzed
X = Elevated reporting limit due to matrix interference.
Y = Elevated reporting limits due to high target concentrations

mg/kg = milligrams per kilogram
µg/L = microgram per liter
µg/kg = microgram per kilogram

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID:		P2-SB-37	P2-SB-37	P2-SB-37	PMW-01	PMW-01	PMW-01	PMW-01	PMW-02
Date Collected:	**Units**	**9/6/2011**	**10/6/2011**	**5/31/2012**	**11/24/2014**	**4/7/2017**	**12/7/2017**	**12/7/2017**	**10/19/2012**
Volatile Organics									
1,1,1,2-Tetrachloroethane	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
1,1,1-Trichloroethane	µg/kg	**476,000**	NA	NA	700,000 Y	NA	**345,000 Y**	NA	NA
1,1,2,2-Tetrachloroethane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,1,2-Trichloroethane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,1-Dichloroethane	µg/kg	**277,000**	NA	NA	230,000 Y	NA	**162,000 Y**	NA	NA
1,1-Dichloroethene	µg/kg	**7,000**	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,2,3-Trichlorobenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
1,2,3-Trichloropropane	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
1,2,3-Trimethylbenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
1,2,4-Trichlorobenzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,2,4-Trimethylbenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
1,2-Dibromo-3-chloropropane (DBCP)	µg/kg	<5,000	NA	NA	<50,000 X	NA	<5,000 Y	NA	NA
1,2-Dibromoethane (Ethylene dibromide)	µg/kg	<5,000	NA	NA	<20,000 MX	NA	<5,000 Y	NA	NA
1,2-Dichlorobenzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,2-Dichloroethane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,2-Dichloropropane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,3,5-Trimethylbenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
1,3-Dichlorobenzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,4-Dichlorobenzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
1,4-Dioxane	µg/kg	<3,000	NA	NA	<30,000 X	<500	NA	NA	NA
2-Butanone (Methyl Ethyl Ketone)	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (Methyl ethyl ketone) (MEK)	µg/kg	<50,000	NA	NA	<500,000 Y	NA	<50,000 Y	NA	NA
2-Hexanone	µg/kg	<50,000	NA	NA	<500,000 Y	NA	<50,000 Y	NA	NA
2-Methylnaphthalene	µg/kg	NA	NA	NA	NA	NA	**20,000 Y**	NA	NA
2-Phenylbutane (sec-Butylbenzene)	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/kg	<50,000	NA	NA	<500,000 Y	NA	<50,000 Y	NA	NA
Acetone	µg/kg	<50,000	NA	NA	<500,000 Y	NA	<50,000 Y	NA	NA
Acrylonitrile	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Benzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Bromobenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Bromodichloromethane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Bromoform	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Bromomethane (Methyl bromide)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Carbon disulfide	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Carbon tetrachloride	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Chlorobenzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Chlorobromomethane	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Chloroethane	µg/kg	**181,000**	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Chloroform (Trichloromethane)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Chloromethane (Methyl chloride)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
cis-1,2-Dichloroethene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA

See notes on last page.

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID:		P2-SB-37	P2-SB-37	P2-SB-37	PMW-01	PMW-01	PMW-01	PMW-01	PMW-02
Date Collected:	Units	9/6/2011	10/6/2011	5/31/2012	11/24/2014	4/7/2017	12/7/2017	12/7/2017	10/19/2012
cis-1,3-Dichloropropene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Cyclohexane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	NA	NA	NA
Cymene (p-Isopropyltoluene)	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Dibromochloromethane	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Dibromomethane	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Dichlorodifluoromethane (CFC-12)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Ethyl ether	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Ethylbenzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Hexachloroethane	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Iodomethane	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Isopropyl benzene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Isopropylbenzene	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA
m&p-Xylene	µg/kg	<10,000	NA	NA	<100,000 Y	NA	<10,000 Y	NA	NA
Methyl acetate	µg/kg	<50,000	NA	NA	<500,000 Y	NA	NA	NA	NA
Methyl cyclohexane	µg/kg	**6,000**	NA	NA	<50,000 Y	NA	NA	NA	NA
Methyl Tert Butyl Ether	µg/kg	NA	NA	NA	NA	NA	NA	NA	NA
Methyl tert butyl ether (MTBE)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Methylene chloride	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<10,000 Y	NA	NA
Naphthalene	µg/kg	NA	NA	NA	NA	NA	<10,000 Y	NA	NA
N-Butylbenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
N-Propylbenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
o-Xylene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Styrene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
tert-Butylbenzene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Tetrachloroethene	µg/kg	**8,000**	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Tetrahydrofuran	µg/kg	NA	NA	NA	NA	NA	<100,000 Y	NA	NA
Toluene	µg/kg	**11,000**	NA	NA	<50,000 Y	NA	**7,000 Y**	NA	NA
trans-1,2-Dichloroethene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
trans-1,3-Dichloropropene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
trans-1,4-Dichloro-2-butene	µg/kg	NA	NA	NA	NA	NA	<5,000 Y	NA	NA
Trichloroethene	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Trichlorofluoromethane (CFC-11)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Trifluorotrichloroethane (Freon 113)	µg/kg	<5,000	NA	NA	<50,000 Y	NA	NA	NA	NA
Vinyl chloride	µg/kg	<5,000	NA	NA	<50,000 Y	NA	<5,000 Y	NA	NA
Semivolatile Organics									
1,2,4-Trichlorobenzene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
1,2-Dichlorobenzene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
1,2-Diphenylhydrazine	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
1,3-Dichlorobenzene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
1,4-Dichlorobenzene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,4,5-Trichlorophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,4,6-Trichlorophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA

See notes on last page.

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID: Date Collected:	Units	P2-SB-37 9/6/2011	P2-SB-37 10/6/2011	P2-SB-37 5/31/2012	PMW-01 11/24/2014	PMW-01 4/7/2017	PMW-01 12/7/2017	PMW-01 12/7/2017	PMW-02 10/19/2012
2,4-Dichlorophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,4-Dimethylphenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,4-Dinitrophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,4-Dinitrotoluene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2,6-Dinitrotoluene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2-Chloronaphthalene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2-Chlorophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2-Methylnaphthalene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	**24,000**	NA
2-Methylphenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2-Nitroaniline	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
2-Nitrophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
3&4-Methylphenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
3,3'-Dichlorobenzidine	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
3-Nitroaniline	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4,6-Dinitro-2-methylphenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4-Bromophenyl phenyl ether	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4-Chloro-3-methylphenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4-Chloroaniline	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4-Chlorophenyl phenyl ether	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4-Nitroaniline	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
4-Nitrophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Acenaphthene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Acenaphthylene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Anthracene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Benzo(a)anthracene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Benzo(a)pyrene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Benzo(b)fluoranthene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Benzo(g,h,i)perylene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Benzo(k)fluoranthene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
bis(2-Chloroethoxy)methane	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
bis(2-Chloroethyl)ether	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
bis(2-Ethylhexyl)phthalate (DEHP)	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Butyl benzylphthalate (BBP)	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Chrysene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Dibenz(a,h)anthracene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Dibenzofuran	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Diethyl phthalate	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Dimethyl phthalate	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Di-n-butylphthalate (DBP)	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Di-n-octyl phthalate (DnOP)	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Fluoranthene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	**35,000**	NA
Fluorene	µg/kg	NA	NA	NA	NA	NA	**165,000 X**	**270,000**	NA
Hexachlorobenzene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA

See notes on last page.

Table 1
Summary of LNAPL Results
RACER Trust Plant 2
Lansing, Michigan

Location ID:		P2-SB-37	P2-SB-37	P2-SB-37	PMW-01	PMW-01	PMW-01	PMW-01	PMW-02
Date Collected:	Units	9/6/2011	10/6/2011	5/31/2012	11/24/2014	4/7/2017	12/7/2017	12/7/2017	10/19/2012
Hexachlorobutadiene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Hexachlorocyclopentadiene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Hexachloroethane	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Indeno(1,2,3-cd)pyrene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Isophorone	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Naphthalene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	<20,000	NA
Nitrobenzene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
N-Nitrosodi-n-propylamine	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
N-Nitrosodiphenylamine	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Pentachlorophenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Phenanthrene	µg/kg	NA	NA	NA	NA	NA	**174,000 X**	**260,000**	NA
Phenol	µg/kg	NA	NA	NA	NA	NA	<78,000 X	NA	NA
Pyrene	µg/kg	NA	NA	NA	NA	NA	<78,000 X	**41,000**	NA
Polychlorinated Biphenyls									
Aroclor-1016 (PCB-1016)	µg/kg	<7,000 J	NA	<7,000 J	<3,000 Y	NA	<3,000 Y	NA	<33,000 Y
Aroclor-1221 (PCB-1221)	µg/kg	<7,000 J	NA	<7,000 J	<3,000 Y	NA	<3,000 Y	NA	<33,000 Y
Aroclor-1232 (PCB-1232)	µg/kg	<7,000 J	NA	<7,000 J	<3,000 Y	NA	<3,000 Y	NA	<33,000 Y
Aroclor-1242 (PCB-1242)	µg/kg	**52,000 J**	NA	**33,000 J**	**22,000 Y**	NA	**30,000 Y**	NA	**133,000 Y**
Aroclor-1248 (PCB-1248)	µg/kg	<7,000 J	NA	<7,000 J	<3,000 Y	NA	<3,000 Y	NA	<33,000 Y
Aroclor-1254 (PCB-1254)	µg/kg	<7,000 J	NA	<7,000 J	<3,000 Y	NA	<3,000 Y	NA	<33,000 Y
Aroclor-1260 (PCB-1260)	µg/kg	<7,000 J	NA	<7,000 J	<3,000 Y	NA	<3,000 Y	NA	<33,000 Y
Total PCBs	µg/kg	**52,000 J**	NA	**33,000 J**	**22,000 Y**	NA	**30,000 Y**	NA	**133,000 Y**
Total Petroleum Hydrocarbons									
Total Petroleum Hydrocarbons (C10-C28) DRO	µg/L	NA	**270,000,000 J**	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (C28-C34) DRO	µg/L	NA	**190,000,000 J**	NA	NA	NA	NA	NA	NA
Total Petroleum Hydrocarbons (C5-C10) GRO	µg/L	NA	**1,100,000**	NA	NA	NA	NA	NA	NA
Volatile Petroleum Hydrocarbons									
Volatile Petroleum Hydrocarbons (C5-C8 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	NA	**480**	NA
Volatile Petroleum Hydrocarbons (C9-C12 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	NA	**200**	NA
Extractable Petroleum Hydrocarbons									
Volatile Petroleum Hydrocarbons (C9-C18 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	NA	**22,000**	NA
Volatile Petroleum Hydrocarbons (C19-C36 Aliphatics)	mg/kg	NA	NA	NA	NA	NA	NA	**290,000**	NA
Volatile Petroleum Hydrocarbons (C11-C22 Aromatics)	mg/kg	NA	NA	NA	NA	NA	NA	**100,000**	NA

Notes:
< indicates result is less than the indicated reporting limit
Bold = Compound detected above laboratory reporting limit
J = Result is an estimated value
M = Result reported to method detection limit not reporting detection limit
NA = not analyzed
X = Elevated reporting limit due to matrix interference.
Y = Elevated reporting limits due to high target concentrations

mg/kg = milligrams per kilogram
µg/L = microgram per liter
µg/kg = microgram per kilogram

Table 2
Plant 2 LNAPL Analytical Results - PFAS
RACER Trust Plant 2 - Lansing, Michigan

Location ID: Plant: Date Collected: Sample Name:	**Units**	**PZ-SB-37 Plant 2 2/4/2019 PZ-SB-37-020419**	**LMW-12-03D Plant 2 2/5/2019 LMW-12-03-020519**	**PMW-01 Plant 2 2/4/2019 PMW-01-020419**	**LMW-15-16D Plant 2 2/4/2019 LMW-15-160-020419**	**LMW-14-12D Plant 2 2/5/2019 LMW-14-120-020519**	**LMW-14-15D Plant 2 2/5/2019 LMW-14-150-020519**	**LMW-12-08 Plant 2 2/5/2019 LMW-12-08-020519**
Poly- and Perfluorinated Alkyl Substances								
4:2 Flourotelemer Sulfonate (4:2 FTS)	ng/L	<32	<16	<16 [<16]	<16	<16	<16	<16
6:2 Flourotelemer Sulfonate (6:2 FTS)	ng/L	<28.8	**18.1 B**	<14. 4[<14.4]	**37.4 B**	<14.4	<14.4	<14.4
8:2 Flourotelemer Sulfonate (8:2 FTS)	ng/L	<32	<16	NQ [NQ]	<16	<16	<16	<16
N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	ng/L	<8	**6.9**	**254 [263]**	<4	<4	**7.43**	<4
N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	ng/L	<8	<4	**5.63 [7.48]**	<4	<4	<4	<4
Perfluorobutanesulfonic acid (PFBS)	ng/L	<8.2	`	<4.1 [<4.1]	<4.1	<4.1	<4.1	<4.1
Perfluorobutanoic acid (PFBA)	ng/L	<32.8	**61.2**	<16.4[<16.4]	**220**	**18.9**	**76.4**	<16.4
Perfluorodecanesulfonic acid (PFDS)	ng/L	<8.2	<4.1	<4.1 [<4.1]	<4.1	<4.1	<4.1	<4.1
Perfluorodecanoic acid (PFDA)	ng/L	<8	**12.2**	<4 [<4]	<4	<4	<4	**4.33**
Perfluorododecanoic acid (PFDoA)	ng/L	<8	<4	<4 [<4]	<4	<4	<4	**10.1**
Perfluoroheptanesulfonic Acid (PFHpS)	ng/L	<7.6	<3.8	<4.44[<4.53]	<3.8	<3.8	<3.8	<4.19
Perfluoroheptanoic acid (PFHpA)	ng/L	**18.2**	**47.1**	<4.1[<4.1]	<20.1	<4.1	<4.1	<4.1
Perfluorohexanesulfonic acid (PFHxS)	ng/L	<8.2	<8.29	**37.4 [45.2]**	<4.1	<4.1	<4.1	**30.1**
Perfluorohexanoic acid (PFHxA)	ng/L	<19.1	**30.2**	<4.1 [<5.49]	<4.1	<4.1	<4.1	<4.1
Perfluorononanesulfonic acid (PFNS)	ng/L	<7.6	<3.8	<3.8 [<3.8]	<3.8	<3.8	<3.8	<3.8
Perfluorononanoic acid (PFNA)	ng/L	**8.23**	**14.7**	<4 [<4]	<4	<4	<4	**4.83**
Perfluorooctane Sulfonamide (FOSA)	ng/L	<8.2	**10.6**	<4.1 [<4.1]	<4.1	<4.1	**4.58**	**5.58**
Perfluorooctanesulfonic acid (PFOS)	ng/L	**51.6**	**35.2**	**13.4 [12.1]**	<4.1	**4.37**	**10.4**	**19.1**
Perfluorooctanoic acid (PFOA)	ng/L	**10.8**	**18.4**	<4.1 [<4.1]	<5.07	<4.1	**4.19**	<4.1
Perfluoropentanesulfonic acid (PFPeS)	ng/L	<7.6	<4.14	<3.8 [<3.8]	<3.8	<3.8	<3.8	<8.34
Perfluoropentanoic acid (PFPeA)	ng/L	**46.7**	**87.9**	<8.2 [<8.2]	<10.6	<8.2	<8.2	<8.2
Perfluorotetradecanoic acid (PFTeA)	ng/L	<8	<7.06	NQ [NQ]	<4	<76.4	<105	<237
Perfluorotridecanoic Acid (PFTriA)	ng/L	<27.1	**17.3**	NQ [NQ]	<136	<111	<102	<236
Perfluoroundecanoic acid (PFUnA)	ng/L	<8	**4.94**	4 [<5.05]	<4	<4	<4	**9.22**

Table 2
Plant 2 LNAPL Analytical Results - PFAS
RACER Trust Plant 2 - Lansing, Michigan

Notes:

Bold result denotes detection is above the laboratory reporting limit

Data shown in brackets [ ] represent duplicate sample analytical results.

< = Data below listed reference level

All analyis completed using SGS AXYS METHOD MLA-110 Rev 01

Acronyms and Abbreviations:

ng/L - nanograms per liter

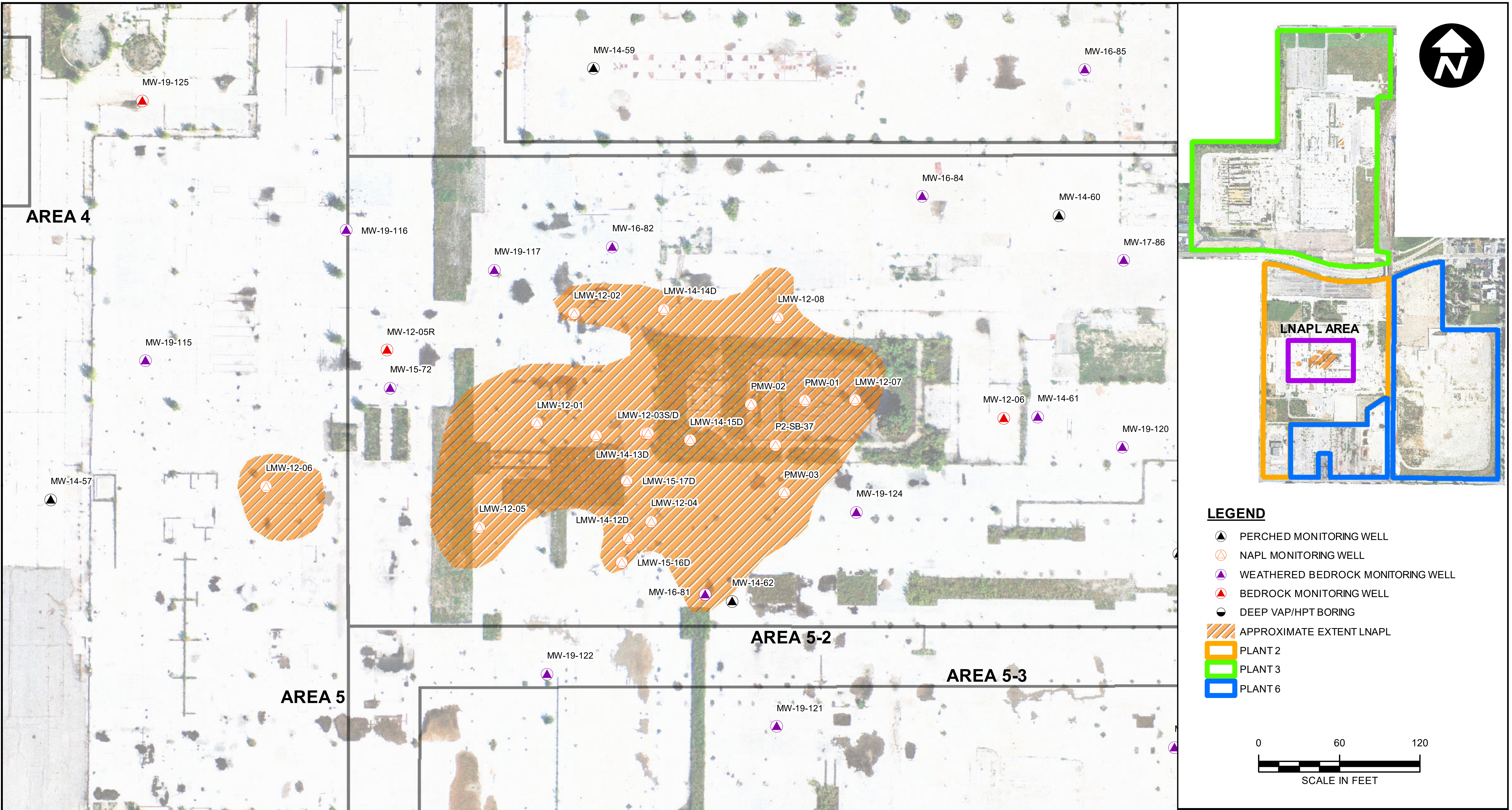
Qualifiers:

J = Compound positively detected above laboratory method detection limit below the quantitative reporting limit. The value reported is an estimated concentration.

NQ = Data not quantifiable

B = Compound detected in laboratory method blank

FIGURES



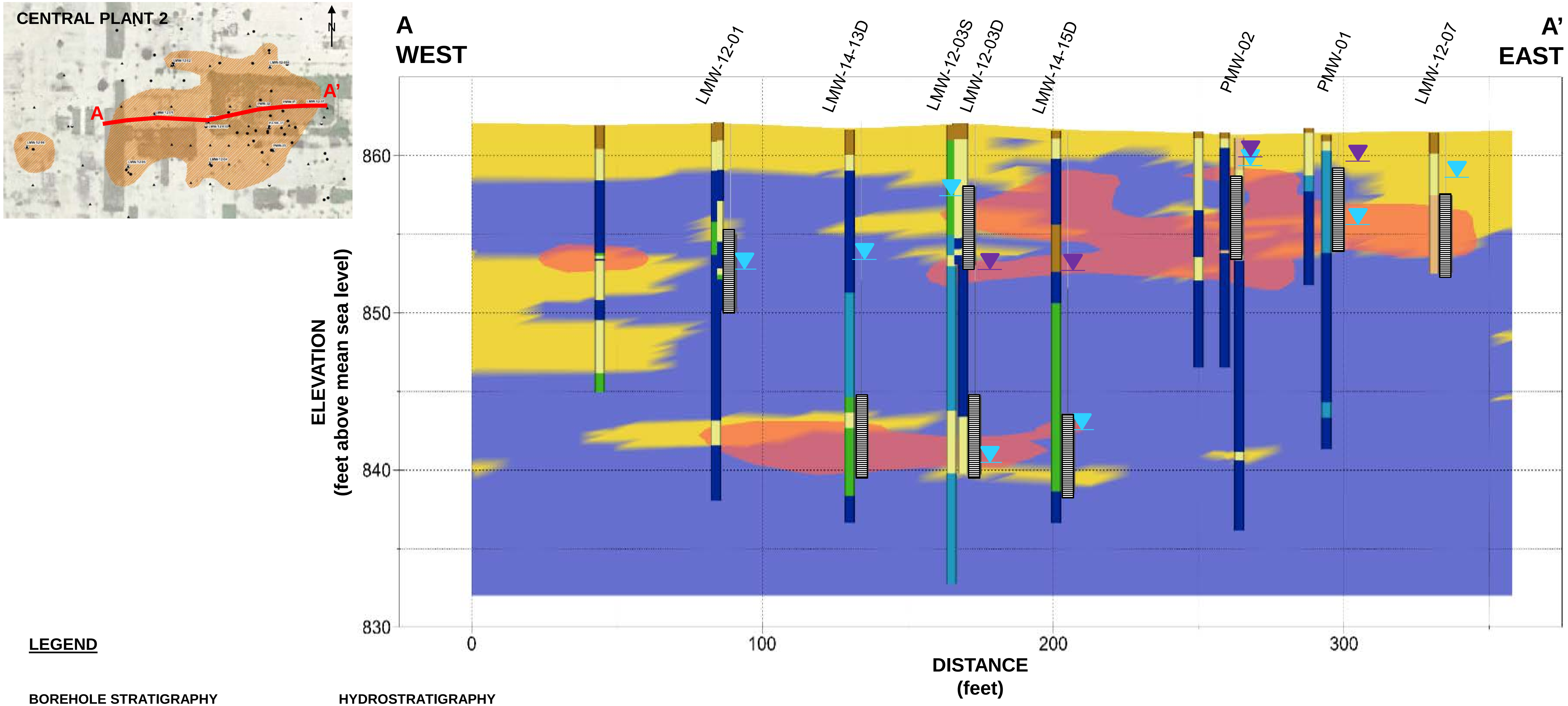
RACER TRUST
PLANTS 2, 3 & 6
LANSING, MICHIGAN

PLANT 2 LNAPL EXTENT AND MONITORING WELL LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1

CITY: Novi DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl
G:\GIS\Project Files\RACER\Lansing\Docs\2017 Workplan Figures\Perched MW Locations.mxd PLOTTED: 6/29/2018 10:44:48 AM BY: dolexa



LEGEND

BOREHOLE STRATIGRAPHY

- 🟫 Topsoil/Concrete/Asphalt
- ⬜ Fill
- 🟧 Gravelly Sand
- 🟨 Sand
- 🟩 Sandy Silt/Silt
- 🟦 Silty/Sandy/Gravelly Clay
- 🟦 Clay

HYDROSTRATIGRAPHY

- 🟦 More Permeable (Silty Sand, Sand, Gravel)
- 🟨 Less Permeable (Sandy Silt, Silt, Clay)
- ▥ Monitoring Well Screen
- 🟥 Approximate Extent Residual LNAPL based on Laser Induced Fluorescence and Observed Impacts (LIF %RE > 15%)
- ▽ Groundwater Elevation, June 2015 (prior to LNAPL removal activities)
- ▼ LNAPL Elevation, June 2015 (prior to LNAPL removal activities)

Vertical Exaggeration: 5.0X

RACER TRUST
PLANTS 2, 3 & 6
LANSING, MICHIGAN

PLANT 2 LNAPL AREA CROSS-SECTION

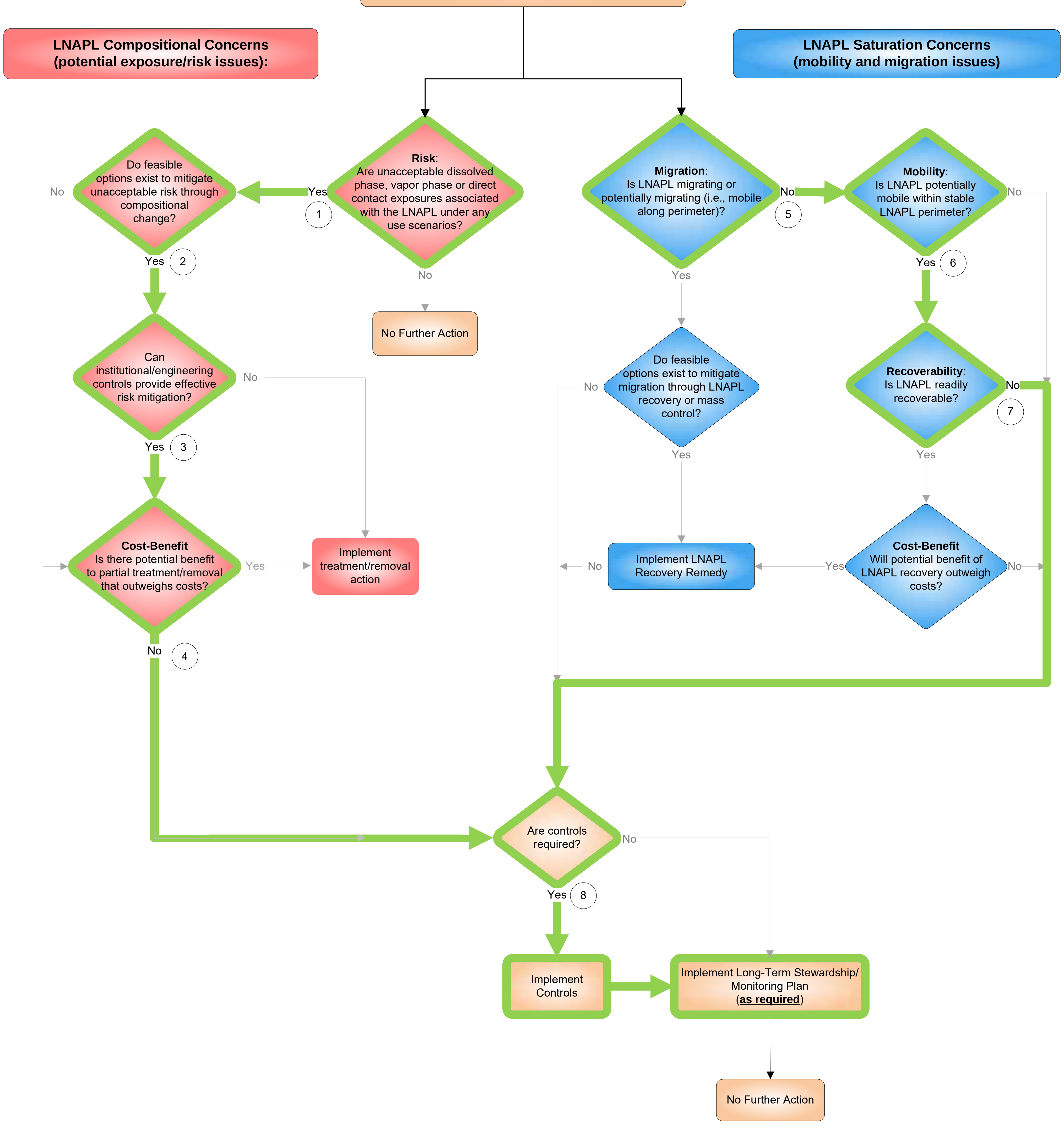
ARCADIS Design & Consultancy for natural and built assets

FIGURE
2

APPENDIX A

LNAPL Decision Tree

Attachment 1
LNAPL Remedial Decision Tree
Plant 2: Area 5-2



NOTES: See Page 2

APPENDIX A

LNAPL REMEDIATION DECISION TREE

RACER Trust Lansing Industrial Land, Plant 2, Area 5-2, Lansing, Michigan

LNAPL in Area 5-2, located in the central portion of Plant 2, is present within the shallow fill and interbedded zone (perched zone). The LNAPL consists primarily of cutting oil and/or lubricating oil composed primarily of heavier (longer-chain) aliphatic hydrocarbons characterized by low mobility and low toxicity. Details regarding the Plant 2 LNAPL composition, mobility, recoverability, natural attenuation and overall risk are summarized in the *Plant 2 LNAPL Conceptual Site Model* (Arcadis 2020). Rational for decision points within the LNAPL Remedial Decision Tree are provided below.

1) YES - The following potential risk/exposure concerns are acknowledged for LNAPL in Area 5-2:
   - Groundwater Concerns: Constituents associated with LNAPL have been detected in groundwater at concentrations exceeding relevant generic groundwater cleanup criteria. VOCs exceed residential drinking water and vapor intrusion criteria; 1,4-dioxane exceeds residential drinking water criteria; SVOCs and PCBs exceed residential drinking water and groundwater contact criteria. Additionally, there are aesthetic concerns associated with groundwater use from LNAPL in Area 5-2. Groundwater quality results to date indicate that constituents associated with the LNAPL in Area 5-2 have not migrated off Site, and that VOCs and 1,4-dioxane plumes are stable to decreasing in the perched groundwater. Groundwater monitoring will continue to confirm the stability of the perched 1,4-dioxane and spatially limited VOC impacts. A deed restriction is in place to prohibit installation of wells or use of groundwater and there are due care requirements to protect workers.
   - Vapor Intrusion Concerns: VOCs have been detected in soil and groundwater at concentrations exceeding volatilization to indoor air inhalation criteria. Additionally, it is recognized that anaerobic biodegradation of hydrocarbons will generate methane. While there are currently no structures in the area, it is possible Plant 2 will be redeveloped in the future, and the presence of VOCs and potential for methane generation could result in indoor air quality concerns for future structures. A deed restriction is in place that provides for assessment and/or mitigation of vapors intruding indoors and there are due care requirements that also address this potential exposure pathway.
   - Direct Contact Concerns: Concrete or asphalt cover at ground surface and the depth to LNAPL and associated PCBs limits current exposure potential. Total petroleum hydrocarbon (TPH) fractionation analysis indicates that LNAPL constituents other than the identified VOCs, SVOCs, and PCBs are predominantly middle- and heavy-end aliphatic hydrocarbons, which pose little risk from direct contact. Short-term exposures to LNAPL are possible for future construction or

utility workers; however, institutional controls and due care will be put in place to protect workers.

2) YES – A general discussion regarding feasibility of various compositional change remediation approaches considered for Area 5-2 is provided below:
   - Natural source zone depletion (NSZD) is proposed as a corrective measure for Area 5-2 LNAPL. NSZD relies on volatilization, dissolution, and biodegradation to naturally attenuate LNAPL. NSZD processes help stabilize the LNAPL body and limit the duration of any potential risks. Based on publications (Lundegard and Johnson [2006], Sihota et al [2011]) and the site-specific NSZD evaluation completed for Area 5-2, the petroleum hydrocarbon-based LNAPL loss is estimated at 570 gallons per acre per year, significantly higher than manual LNAPL recovery rates achieved from this area to date.
   - Due to the depth to LNAPL, capping was not proposed as a corrective measure for LNAPL. However, a cap over a portion of Area 5-2 is being evaluated, as a corrective measure or as part of site redevelopment, to reduce infiltration and limit 1,4-dioxane horizontal and vertical migration.
   - Multi-phase extraction was considered as a potential corrective measure for Area 5-2. MPE was not proposed as a corrective measure for Area 5-2 because there is limited potential for LNAPL recoverability in Area 5-2 (see note 6, below), and anticipated implementation challenges associated with limited soil permeability and geologic heterogeneity.
   - A highly variable suite of constituents of concern (COCs) are present in LNAPL in Area 5-2, including VOCs, 1,4-dioxane, SVOCs, PFAS and PCBs. Not all COCs in the LNAPL are highly soluble, volatile or biodegradable, rendering remedial technologies which rely primarily on vapor-phase partitioning or enhanced biodegradation, such as soil vapor extraction (SVE), ineffective for addressing all primary target COCs.
   - Total excavation of the LNAPL was considered as a potential corrective measure for Area 5-2. Total excavation was not proposed as a corrective measure because it would be cost-prohibitive, difficult to implement based on the estimated depth, would not provide meaningful 1,4-dioxane mass removal, and would not affect the viability or longevity of the lower 1,4-dioxane propane biosparge remedy. Additionally, because dissolved-phase VOC impacts are stable and localized, excavation of LNAPL would not serve to meaningfully reduce the already-low risk associated with VOCs in groundwater. Further, excavation or targeted excavation poses a risk of breaching the confining layer and exacerbating current conditions and not serving to meaningfully reduce the already-low risk associated with the LNAPL
   - LNAPL recovery with skimmers was considered as a potential corrective measure. LNAPL recovery was not proposed as a corrective measure because recoverability and mobility testing indicated that the LNAPL is not migrating and exhibits low LNAPL transmissivity (i.e., is not readily or cost-effectively recoverable); therefore, an LNAPL skimming system would not recover

significant quantities of LNAPL. Further, LNAPL recovery would not provide meaningful 1,4-dioxane mass removal or VOC risk reduction for the reasons described above.

- In situ chemical oxidation (ISCO) was not evaluated for Area 5-2 because the desired chemical reactions occur within the aqueous phase only, and thus would be rate-limited by dissolution of contaminants from the non-aqueous to aqueous phase. ISCO is also infeasible from a cost perspective, given the relatively large quantities of reagent that would be required to address the mass of LNAPL in the subsurface.

3) YES – Based on the current understanding of Site conditions, institutional controls can provide effective risk mitigation for the Area 5-2 LNAPL. The following conclusions for the primary COCs are provided consistent with the *Plant 2 LNAPL Conceptual Site Model* (Arcadis 2020).
    - TPH fractionation results indicate that the LNAPL consists primarily of heavier (longer-chain) aliphatic hydrocarbons characterized by low mobility and low toxicity. The overall low volatility and solubility of heavier petroleum compounds that make up the majority of the LNAPL mixture suggest that migration of these compounds in dissolved phase or vapor phase is minimal. Target compound list VOCs make up only a small fraction of the LNAPL (<2%).
    - Previous evaluations have demonstrated that the LNAPL has been depleted of 1,4-dioxane mass and the majority of the 1,4-dioxane present is already dissolved in groundwater. The 1,4-dioxane mass present in weathered bedrock beneath the Plant 2 LNAPL area appears to be primarily related to perched groundwater leakage from the zone beneath and immediately surrounding the LNAPL. A propane biosparge system is being implemented to treat 1,4-dioxane mass within the weathered bedrock around the LNAPL area.
    - Dissolved phase VOC impacts are limited to the immediate vicinity of the LNAPL. The chlorinated ethenes/ethanes and other VOCs detected in groundwater around the LNAPL attenuate rapidly due to the geochemical conditions created by the presence of the LNAPL and do not migrate downgradient or vertically at significant concentrations. VOCs are primarily limited to the perched zone in the LNAPL area and only sporadic low-level detections of VOCs have been detected in weathered bedrock groundwater.
    - Exceedances of vapor inhalation (VI) criteria associated with the elevated VOCs in LNAPL will be addressed by a deed restriction that requires a VI assessment and/or engineered controls prior to construction of any building for human occupation.
    - SVOC analytical results for the LNAPL identified relatively low-toxicity PAHs as the only detectable compounds. Surrounding soil and groundwater samples have detected limited SVOC impacts. The extent of dissolved-phase SVOC impacts is limited by the lower solubility of these compounds. The LNAPL does not contain detectable concentrations of carcinogenic PAHs or other SVOC compounds associated with significant health risk. Sampling of weathered bedrock groundwater has not yielded any detections of SVOCs apart from bis(2-ethylhexyl)phthalate, which is believed to be a laboratory contaminant.

- PCBs in LNAPL, although elevated, particularly within the confined LNAPL, do not dissolve readily and do not present a dissolved phase risk to the perched zone or bedrock aquifer. Sampling of LNAPL impacted soils has indicated two locations where PCBs in soil exceed 10 ppm. The near surface sample at both locations had relatively low concentrations. Based on these results, the PCBs can be addressed through institutional controls.
- The results of the PFAS evaluation indicate that LNAPL does not represent a significant ongoing source of PFAS.
- Groundwater monitoring and statistical trend analysis will be used to continue to assess the long-term stability of the dissolved-phase plume(s) and to determine the potential for future off-Site migration of COCs at concentrations exceeding applicable criteria.

4) NO - LNAPL mass reduction will be achieved through natural source zone depletion. As outlined above, other than the continued vertical migration of dissolved phase 1,4-dioxane, the compositional risk associated with the Area 5-2 LNAPL can be managed via institutional controls. A propane biosparge system is being implemented to treat 1,4-dioxane mass that migrates to the weathered bedrock. Additional remediation or excavation is not necessary and does not constitute an effective or beneficial use of financial or natural resources. Excavation or targeted excavation poses a risk of breaching the confining layer and exacerbating current conditions at the site. However, groundwater monitoring and propane biosparge performance monitoring will continue to evaluate the stability of the perched and lower 1,4-dioxane and spatially limited VOC impacts.

5) NO - a comprehensive LNAPL mobility evaluation was completed for Area 5-2 in 2013. The evaluation indicated that LNAPL is stable and not migrating, based on the following lines of evidence:
    - Pore velocity potentials were calculated based on API methodology at four soil core locations where field saturation exceeded residual saturation. All calculated LNAPL velocity potentials were less than 1.0 x 10^{-6} centimeters per second (cm/s) (the velocity criterion suggested by ASTM [2006]), indicating that LNAPL is functionally immobile in Area 5-2.
    - LNAPL pore-entry pressure analysis indicated that LNAPL thicknesses observed at the perimeter of the LNAPL body in Area 5-2 are below the threshold values required for LNAPL to migrate into soils not previously affected by LNAPL.
    - Operations at the Site were halted in 2006 and thus all LNAPL releases to the subsurface occurred at a minimum, eleven years ago. LNAPL bodies typically stabilize 2 to 5 years after the release has stopped (ITRC 2012).Fluid level gauging data collected through February 2014 indicate LNAPL accumulation in some of the monitoring wells in Area 5-2 (PMW-01, LMW-12-08, LMW-12-03D, LMW-14-12D, LMW-14-15D and LMW-14-16D). Four of these wells (‘D’ series) were located within the confined LNAPL zone. The observed LNAPL accumulation likely reflects gradual equilibration between LNAPL in the formation and the LNAPL accumulated in the wells,

rather than evidence of LNAPL migration. Fluid level gauging will be completed semi-annually to continue evaluating LNAPL stability.

6) YES - a comprehensive LNAPL mobility evaluation was completed in Area 5-2. The evaluation demonstrated that mobile LNAPL is present within the stable LNAPL perimeter, based on the following lines of evidence:
   - LNAPL accumulates in monitoring wells.
   - Laboratory petrophysical testing of undisturbed soil cores indicated that field LNAPL saturations exceeded residual at some sampling locations.

7) NO - An LNAPL baildown test within perched well PMW-01 yielded an estimated LNAPL transmissivity of 0.01 square feet per day (ft2/d), while LNAPL transmissivity estimates for all three of the wells installed in the deeper, confined LNAPL ranged from 0.004 ft^2/d at LMW-14-15D to 0.035 ft^2/d at LMW-14-12D. These values are two to three orders of magnitude below the 0.5 ft^2/d criterion established by the EGLE to define LNAPL that can be recovered in a cost effective and efficient manner (MDEQ 2014b). Results of the mobility analysis indicated the LNAPL plume is not migrating, and hydraulic LNAPL recovery is not expected to provide significant mass reduction. Given that LNAPL at Area 5-2 appears stable, the risks associated with the LNAPL will not change appreciably as a result of active recovery efforts. A quantitative assessment of NSZD rates has been completed for Area 5-2 and has shown natural depletion of LNAPL is occurring at an estimated 570 gallons per year over the 1.2 acre footprint.

8) YES - the following controls are either in place or are proposed for LNAPL Area 5-2 to limit potential for future exposure:
   - Land Use Restrictions:
     - Land use at the entire Site is limited to nonresidential.
     - All Site soils, media, and/or debris will be managed in accordance with applicable requirements of RCRA and all other relevant state and federal laws.
     - Construction of new structures will not be permitted unless construction incorporates engineering controls designed to eliminate the potential for vapor intrusion into the new structure at concentrations greater than applicable criteria, or unless prior to construction of any structure, an assessment of the potential for any hazardous substances to volatilize into indoor air assures the protection of persons who may be present in the buildings and is in compliance with all relevant federal, state, and local laws.
     - Intrusive excavation activities will be conducted in accordance with a Due Care Plan.
   - Groundwater Use Restrictions: Installation of wells and groundwater use is prohibited at the Site except as provided below:
     - Wells and other devices constructed as part of a response activity for the purpose of evaluating groundwater quality or to remediate subsurface contamination associated

  - with a release of hazardous substances into the environment are permitted provided the construction of the wells or devices complies with all applicable local, state, and federal laws and regulations and does not cause or result in a new release, exacerbation of existing contamination, or any other violation of local, state, or federal laws or regulations.
  - Short-term dewatering for construction purposes is permitted provided the dewatering, including management and disposal of the groundwater, is conducted in accordance with all applicable local, state, and federal laws and regulations and does not cause or result in a new release, exacerbation of existing contamination, or any other violation of local, state, and federal environmental laws and regulations.
- Monitored Plume Stability: A groundwater monitoring program is being implemented that provides data to verify dissolved phase plume stability.
- Caps: While capping is not proposed as an LNAPL corrective measure, cover over Area 5-2 could be implemented during redevelopment of the Site and is being evaluated as a groundwater corrective measure for 1,4-dioxane. This would have the additional benefit of reducing the potential for direct contact risks associated with the LNAPL. There is a current approved interim measure to maintain the existing concrete slab (or equivalent) that covers part of Area 5-2.

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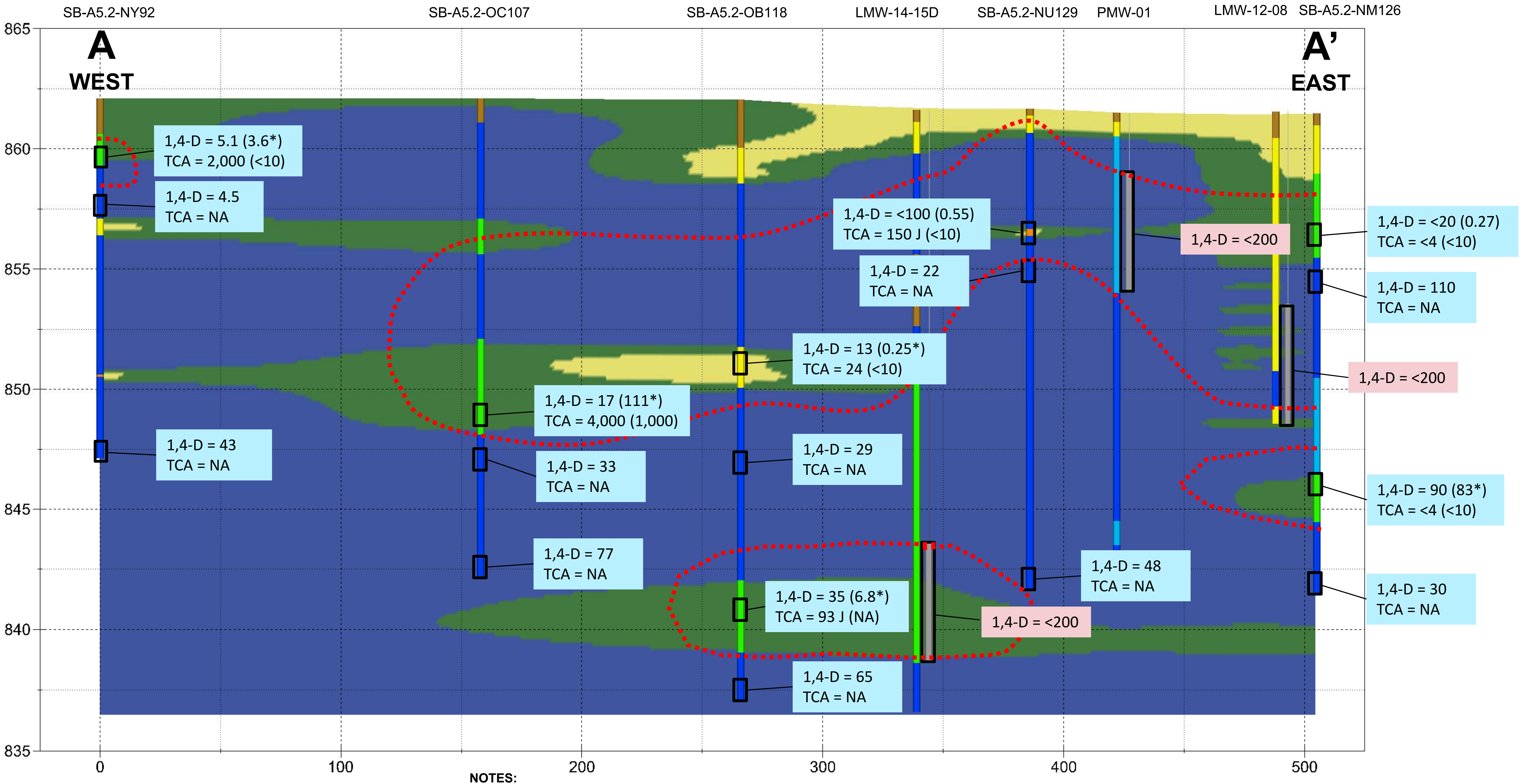
Swiger, N., 2013. Nonaqueous Phase Liquids (NAPL) Management. Presentation at the American Institute of Professional Geologists (AIPG), Michigan Section, March 2013 Meeting.

United States Environmental Protection Agency (USEPA). 2006. Treatment Technologies for 1,4-Dioxane: Fundamentals and Field Applications. Office of Solid Waste and Emergency Response. December 2006. Document number: EPA 542-R-06-009.

APPENDIX B

Plant 2 LNAPL Key Figures



STRATIGRAPHY

- 🟫 Topsoil/Asphalt/Concrete
- ⬜ Fill
- 🟧 Gravelly Sand
- 🟨 Sand
- 🟩 Sandy Silt/Silt
- 🟦 Silty/Sandy/Gravelly Clay
- 🟦 Clay

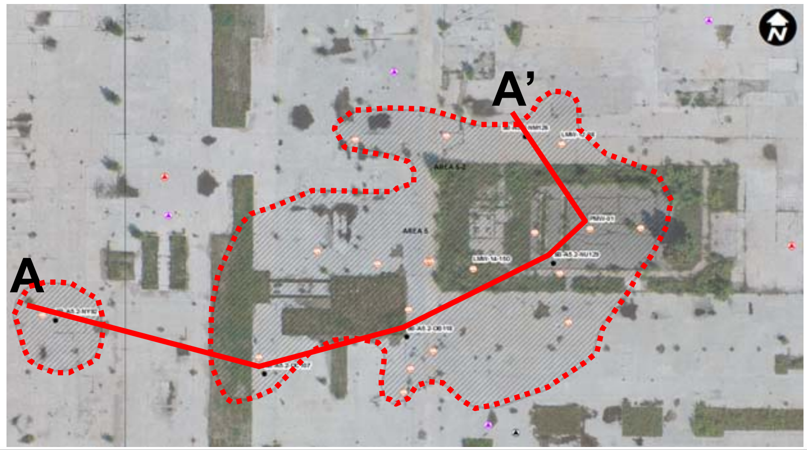
HYDROSTRATIGRAPHY

- 🟨 Transport zone
- 🟩 Slow advection zone
- 🟦 Storage zone
- Soil Results (SPLP Results)
- LNAPL Results

NOTES:

1. ALL SOIL AND LNAPL SAMPLE RESULTS IN MICROGRAMS PER KILOGRAM (µg/kg).
2. ALL SPLP SAMPLE RESULTS IN MICROGRAMS PER LITER (µg/L). CORRECTED FIELD LEACHATE CONCENTRATIONS CALCULATED WHERE POSSIBLE AND DENOTED BY '*'.

TCA – 1,1,1-Trichloroethane
1,4-D – 1,4-Dioxane
NA – Not Analyzed
J – Estimated Value
▯ - Sample Interval
○ - Approximate extent of LNAPL

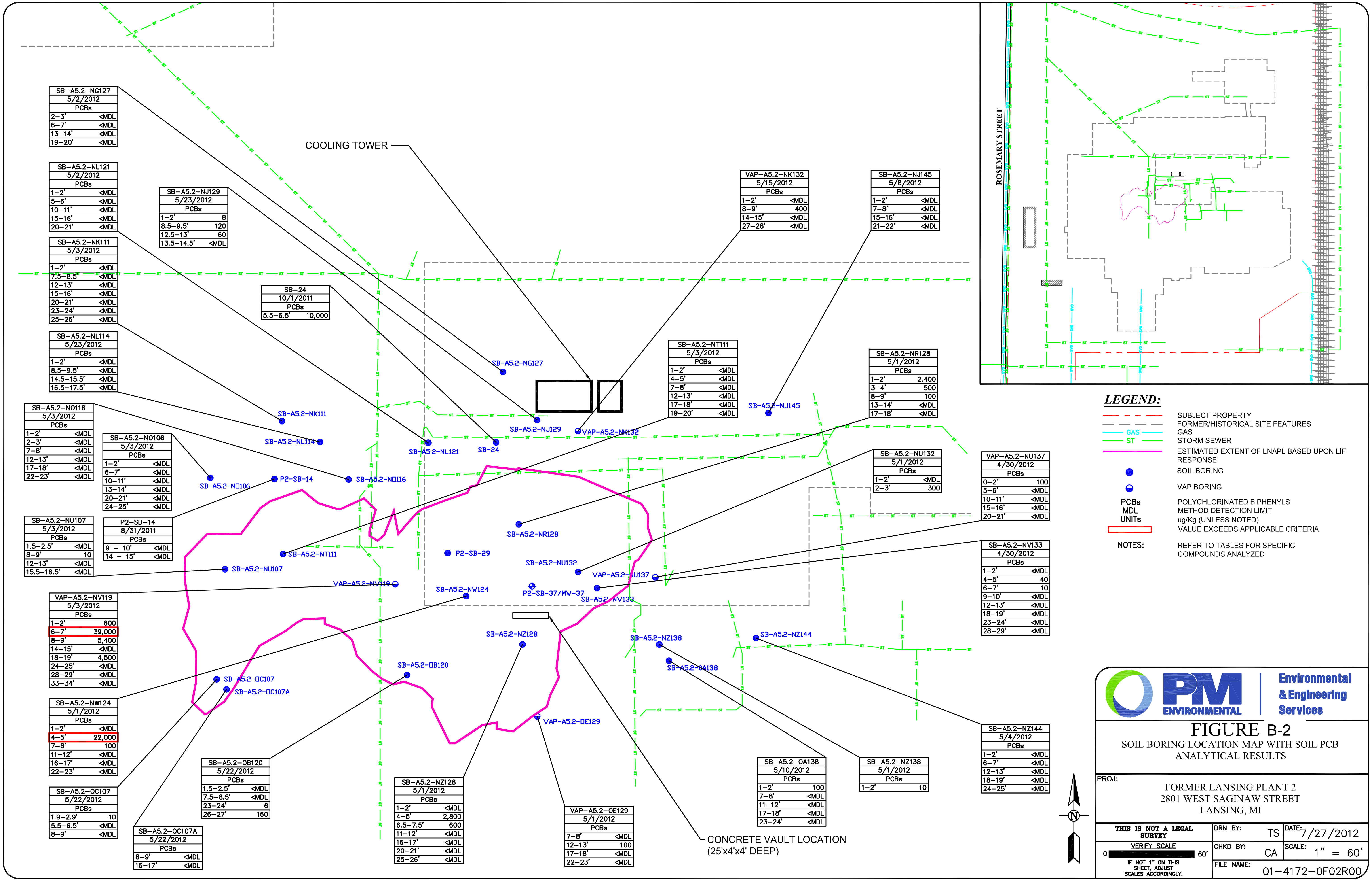


RACER TRUST
PLANTS 2,3, & 6
LANSING, MICHIGAN

LNAPL AREA 1,4-DIOXANE INVESTIGATION CROSS-SECTION

ARCADIS Design & Consultancy for natural and built assets

FIGURE
B-1



SB-A5.2-NG127	
5/2/2012	
PCBs	
2-3'	<MDL
6-7'	<MDL
13-14'	<MDL
19-20'	<MDL

SB-A5.2-NL121	
5/2/2012	
PCBs	
1-2'	<MDL
5-6'	<MDL
10-11'	<MDL
15-16'	<MDL
20-21'	<MDL

SB-A5.2-NK111	
5/3/2012	
PCBs	
1-2'	<MDL
7.5-8.5'	<MDL
12-13'	<MDL
15-16'	<MDL
20-21'	<MDL
23-24'	<MDL
25-26'	<MDL

SB-A5.2-NL114	
5/23/2012	
PCBs	
1-2'	<MDL
8.5-9.5'	<MDL
14.5-15.5'	<MDL
16.5-17.5'	<MDL

SB-A5.2-NO116	
5/3/2012	
PCBs	
1-2'	<MDL
2-3'	<MDL
7-8'	<MDL
12-13'	<MDL
17-18'	<MDL
22-23'	<MDL

SB-A5.2-NU107	
5/3/2012	
PCBs	
1.5-2.5'	<MDL
8-9'	10
12-13'	<MDL
15.5-16.5'	<MDL

VAP-A5.2-NV119	
5/3/2012	
PCBs	
1-2'	600
6-7'	39,000
8-9'	5,400
14-15'	<MDL
18-19'	4,500
24-25'	<MDL
28-29'	<MDL
33-34'	<MDL

SB-A5.2-NW124	
5/1/2012	
PCBs	
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4-5'	22,000
7-8'	100
11-12'	<MDL
16-17'	<MDL
22-23'	<MDL

SB-A5.2-OC107	
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PCBs	
1.9-2.9'	10
5.5-6.5'	<MDL
8-9'	<MDL

SB-A5.2-OC107A	
5/22/2012	
PCBs	
8-9'	<MDL
16-17'	<MDL

SB-A5.2-OB120	
5/22/2012	
PCBs	
1.5-2.5'	<MDL
7.5-8.5'	<MDL
23-24'	6
26-27'	160

SB-A5.2-NJ129	
5/23/2012	
PCBs	
1-2'	8
8.5-9.5'	120
12.5-13'	60
13.5-14.5'	<MDL

SB-24	
10/1/2011	
PCBs	
5.5-6.5'	10,000

SB-A5.2-NO106	
5/3/2012	
PCBs	
1-2'	<MDL
6-7'	<MDL
10-11'	<MDL
13-14'	<MDL
20-21'	<MDL
24-25'	<MDL

P2-SB-14	
8/31/2011	
PCBs	
9 - 10'	<MDL
14 - 15'	<MDL

SB-A5.2-NZ128	
5/1/2012	
PCBs	
1-2'	<MDL
4-5'	2,800
6.5-7.5'	600
11-12'	<MDL
16-17'	<MDL
20-21'	<MDL
25-26'	<MDL

VAP-A5.2-OE129	
5/1/2012	
PCBs	
7-8'	<MDL
12-13'	100
17-18'	<MDL
22-23'	<MDL

VAP-A5.2-NK132	
5/15/2012	
PCBs	
1-2'	<MDL
8-9'	400
14-15'	<MDL
27-28'	<MDL

SB-A5.2-NJ145	
5/8/2012	
PCBs	
1-2'	<MDL
7-8'	<MDL
15-16'	<MDL
21-22'	<MDL

SB-A5.2-NT111	
5/3/2012	
PCBs	
1-2'	<MDL
4-5'	<MDL
7-8'	<MDL
12-13'	<MDL
17-18'	<MDL
19-20'	<MDL

SB-A5.2-NR128	
5/1/2012	
PCBs	
1-2'	2,400
3-4'	500
8-9'	100
13-14'	<MDL
17-18'	<MDL

SB-A5.2-NU132	
5/1/2012	
PCBs	
1-2'	<MDL
2-3'	300

VAP-A5.2-NU137	
4/30/2012	
PCBs	
0-2'	100
5-6'	<MDL
10-11'	<MDL
15-16'	<MDL
20-21'	<MDL

SB-A5.2-NV133	
4/30/2012	
PCBs	
1-2'	<MDL
4-5'	40
6-7'	10
9-10'	<MDL
12-13'	<MDL
18-19'	<MDL
23-24'	<MDL
28-29'	<MDL

SB-A5.2-OA138	
5/10/2012	
PCBs	
1-2'	100
7-8'	<MDL
11-12'	<MDL
17-18'	<MDL
23-24'	<MDL

SB-A5.2-NZ138	
5/1/2012	
PCBs	
1-2'	10

SB-A5.2-NZ144	
5/4/2012	
PCBs	
1-2'	<MDL
6-7'	<MDL
12-13'	<MDL
18-19'	<MDL
24-25'	<MDL

LEGEND:

— - —	SUBJECT PROPERTY
— — —	FORMER/HISTORICAL SITE FEATURES
— GAS —	GAS
— ST —	STORM SEWER
———	ESTIMATED EXTENT OF LNAPL BASED UPON LIF RESPONSE
●	SOIL BORING
◒	VAP BORING
PCBs	POLYCHLORINATED BIPHENYLS
MDL	METHOD DETECTION LIMIT
UNITs	ug/Kg (UNLESS NOTED)
▭	VALUE EXCEEDS APPLICABLE CRITERIA
NOTES:	REFER TO TABLES FOR SPECIFIC COMPOUNDS ANALYZED

PM ENVIRONMENTAL | Environmental & Engineering Services

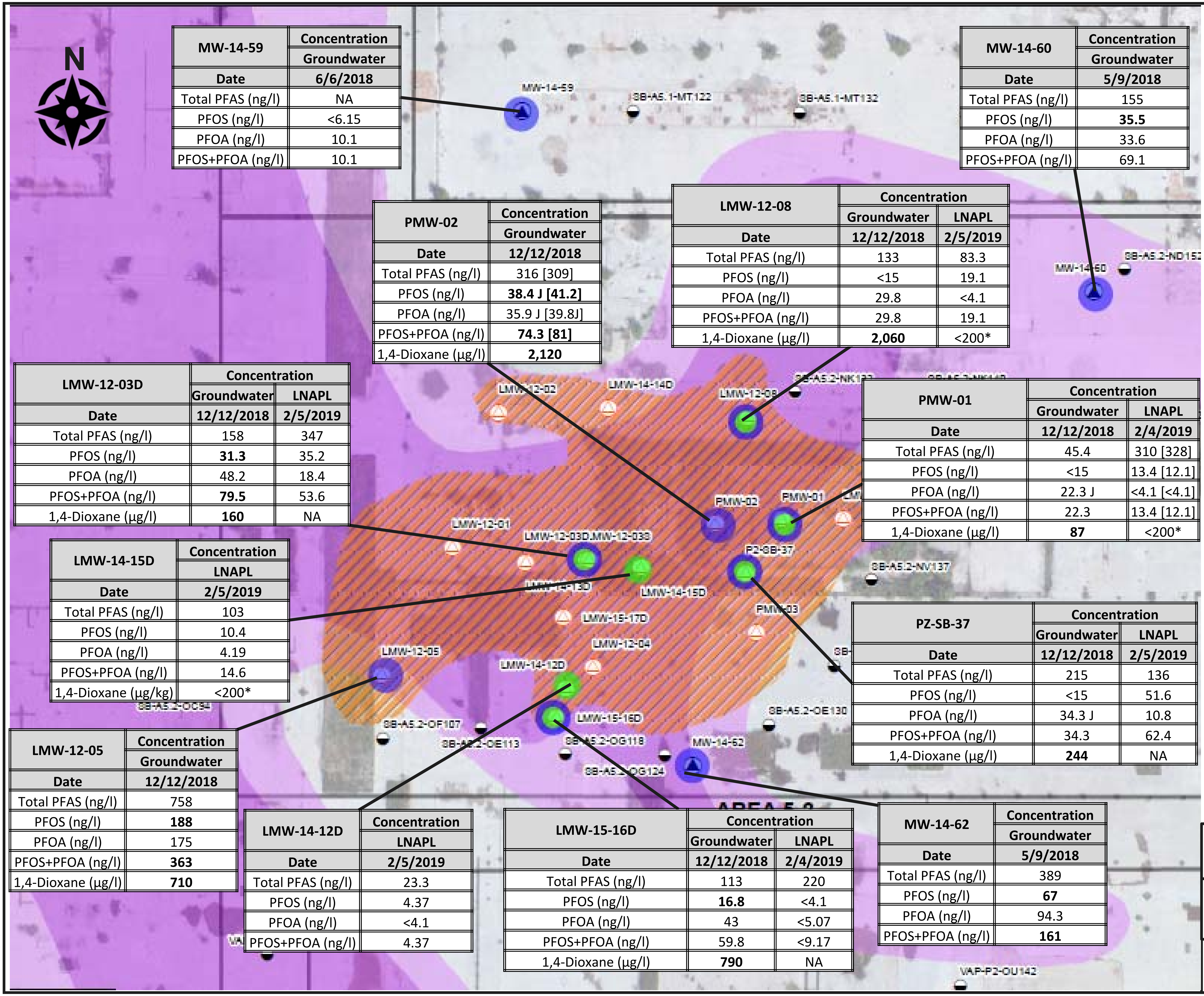
FIGURE B-2

SOIL BORING LOCATION MAP WITH SOIL PCB ANALYTICAL RESULTS

PROJ:
FORMER LANSING PLANT 2
2801 WEST SAGINAW STREET
LANSING, MI

THIS IS NOT A LEGAL SURVEY
VERIFY SCALE
0 60'
IF NOT 1" ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DRN BY: TS
DATE: 7/27/2012
CHKD BY: CA
SCALE: 1" = 60'
FILE NAME: 01-4172-0F02R00



MW-14-59	Concentration
	Groundwater
Date	6/6/2018
Total PFAS (ng/l)	NA
PFOS (ng/l)	<6.15
PFOA (ng/l)	10.1
PFOS+PFOA (ng/l)	10.1

MW-14-60	Concentration
	Groundwater
Date	5/9/2018
Total PFAS (ng/l)	155
PFOS (ng/l)	**35.5**
PFOA (ng/l)	33.6
PFOS+PFOA (ng/l)	69.1

PMW-02	Concentration
	Groundwater
Date	12/12/2018
Total PFAS (ng/l)	316 [309]
PFOS (ng/l)	**38.4 J [41.2]**
PFOA (ng/l)	35.9 J [39.8J]
PFOS+PFOA (ng/l)	**74.3 [81]**
1,4-Dioxane (µg/l)	**2,120**

LMW-12-08	Concentration	
	Groundwater	LNAPL
Date	12/12/2018	2/5/2019
Total PFAS (ng/l)	133	83.3
PFOS (ng/l)	<15	19.1
PFOA (ng/l)	29.8	<4.1
PFOS+PFOA (ng/l)	29.8	19.1
1,4-Dioxane (µg/l)	**2,060**	<200*

LMW-12-03D	Concentration	
	Groundwater	LNAPL
Date	12/12/2018	2/5/2019
Total PFAS (ng/l)	158	347
PFOS (ng/l)	**31.3**	35.2
PFOA (ng/l)	48.2	18.4
PFOS+PFOA (ng/l)	**79.5**	53.6
1,4-Dioxane (µg/l)	**160**	NA

PMW-01	Concentration	
	Groundwater	LNAPL
Date	12/12/2018	2/4/2019
Total PFAS (ng/l)	45.4	310 [328]
PFOS (ng/l)	<15	13.4 [12.1]
PFOA (ng/l)	22.3 J	<4.1 [<4.1]
PFOS+PFOA (ng/l)	22.3	13.4 [12.1]
1,4-Dioxane (µg/l)	**87**	<200*

LMW-14-15D	Concentration
	LNAPL
Date	2/5/2019
Total PFAS (ng/l)	103
PFOS (ng/l)	10.4
PFOA (ng/l)	4.19
PFOS+PFOA (ng/l)	14.6
1,4-Dioxane (µg/kg)	<200*

PZ-SB-37	Concentration	
	Groundwater	LNAPL
Date	12/12/2018	2/5/2019
Total PFAS (ng/l)	215	136
PFOS (ng/l)	<15	51.6
PFOA (ng/l)	34.3 J	10.8
PFOS+PFOA (ng/l)	34.3	62.4
1,4-Dioxane (µg/l)	**244**	NA

LMW-12-05	Concentration
	Groundwater
Date	12/12/2018
Total PFAS (ng/l)	758
PFOS (ng/l)	**188**
PFOA (ng/l)	175
PFOS+PFOA (ng/l)	**363**
1,4-Dioxane (µg/l)	**710**

LMW-14-12D	Concentration
	LNAPL
Date	2/5/2019
Total PFAS (ng/l)	23.3
PFOS (ng/l)	4.37
PFOA (ng/l)	<4.1
PFOS+PFOA (ng/l)	4.37

LMW-15-16D	Concentration	
	Groundwater	LNAPL
Date	12/12/2018	2/4/2019
Total PFAS (ng/l)	113	220
PFOS (ng/l)	**16.8**	<4.1
PFOA (ng/l)	43	<5.07
PFOS+PFOA (ng/l)	59.8	<9.17
1,4-Dioxane (µg/l)	**790**	NA

MW-14-62	Concentration
	Groundwater
Date	5/9/2018
Total PFAS (ng/l)	389
PFOS (ng/l)	**67**
PFOA (ng/l)	94.3
PFOS+PFOA (ng/l)	**161**

LEGEND

- ▲ PERCHED MONITORING WELL
- △ NAPL MONITORING WELL
- ◒ DEEP VAP/HPT BORING

LOWER 1,4-DIOXANE PLUME

- 🟪 72
- ▢ 7.2
- ▨ APPROXIMATE EXTENT LNAPL
- ● - Groundwater Sample
- ● - LNAPL Sample
- ● - Groundwater and LNAPL samples

NOTES

BOLDED RESULTS EXCEED ONE OR MORE EGLE PART 201 CRITERIA

< = NOT DETECTED ABOVE REPORTING LIMIT

ng/l = NANOGRAMS PER LITER

µg/l = MICROGRAMS PER LITER

µg/kg = MICROGRAMS PER KILOGRAM

* LNAPL 1,4-DIOXANE RESULTS IN µg/kg FROM 2017 PLANT 2 LNAPL AREA 1,4-DIOXANE INVESTIGATION SUMMARY (ARCADIS 2017)

TOTAL PFAS = SUM OF DETECTED CONCENTRATIONS OF THE 24 COMPOUNDS LISTED IN THE EGLE RECOMMENDED PFAS ANALYTE LIST

0 60 120
SCALE IN FEET

RACER TRUST
PLANT 2
LANSING, MICHIGAN

GROUNDWATER AND LNAPL PFAS ANALYTICAL RESULTS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
B-3

CITYY: Novi DIV: ENV DB:AV PIC:JB PM: RC TM:AV PROJECT #: B0064479.2019
\\arcadis-us.com\OfficeData\Novi-MI\COMMON\Racer Lansing\64479\11 Draft Reports and Presentations\2019 Plant 3 PFAS Well Install
6/21/2019 1:51:02 PM

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