Resource Conservation and Recovery Act Corrective Action

Corrective Measures Study
Lansing Plants 2, 3, and 6
Lansing, Michigan

January 2022

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Acronyms and Abbreviations

Area	area of interest
Arcadis	Arcadis of Michigan, LLC
CAO	corrective action objective
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
COC	constituent of concern
DC	Direct Contact
DRC	Declaration of Restrictive Covenant
EGLE	Michigan Department of Environment, Great Lakes, and Energy
GSI	Groundwater-Surface Water Interface
GSIP	Groundwater-Surface Water Interface Protection
ISS	in-situ stabilization
LNAPL	light non-aqueous phase liquid
µg/L	micrograms per liter
MPE	multi-phase extraction
NPDES	National Pollutant Discharge Elimination System
NREPA	Natural Resources and Environmental Protection Act
NSZD	Natural Source Zone Depletion
PCB	polychlorinated biphenyl
PFAS	per and poly-fluoroalkyl substances
PFOS	perfluorooctanesulfonic acid
POTW	publicly owned treatment works
PRB	permeable reactive barrier
PSIC	Particulate Soil Inhalation Criteria
RACER	Revitalizing Auto Communities Environmental Response
RCRA	Resource Conservation and Recovery Act
Relevant Criteria	Part 201 Generic Cleanup Criteria implemented in 2013 with updates in 2016, 2018, and 2020
RFI	RCRA Facility Investigation
Site	RACER Trust Lansing Plants 2, 3, and 6 located in Lansing, Michigan

SSVIAC	Site-specific Soil Volatilization to Indoor Air Criteria
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1 Introduction

This Resource Conservation and Recovery Act (RCRA) Corrective Action Corrective Measures Study Report (CMS Report) has been prepared on behalf of the Revitalizing Auto Communities Environmental Response (RACER) Trust for Lansing Plants 2 and 3 (United States Environmental Protection Agency [USEPA] ID MID 980 700 827) and Plant 6 (USEPA ID MID 005 356 928) located in Lansing, Michigan (Site). RACER Trust was established and assumed the rights, title, and interest of Motors Liquidation Company in and to the Site pursuant to an Environmental Response Trust Consent Decree and Settlement Agreement entered by the U.S. Bankruptcy Court for the Southern District of New York on March 29, 2011, in the case of *In re Motors Liquidation Company*, etc. et al, Debtors, Case No. 09-50026 (REG), among the Debtors; the United States of America; certain states, including the State of Michigan; the Saint Regis Mohawk Tribe; and EPLET, LLC (not individually but solely in its capacity as Administrative Trustee of RACER Trust).

This CMS Report has been developed in general accordance with USEPA guidance (USEPA 2005) and Parts 111 and 201 of the Michigan Natural Resources and Environmental Protection Act (NREPA Act 451, 1994, as amended). The purpose of this CMS Report is to develop and evaluate corrective measures and recommend a corrective measures alternative for the Site that meets the corrective action objectives (CAOs), RCRA evaluation criteria, and overall Site strategy to protect public health, welfare, and the environment. Figure 1 shows the location of the Site.

1.1 Corrective Action Background

The Site is subject to the RACER Corrective Action requirements. In an effort to fulfill RCRA Corrective Action requirements, Arcadis of Michigan, LLC (Arcadis) prepared this CMS Report on behalf of RACER Trust to present the identification and evaluation of corrective measure alternatives for the Site for Michigan Department of Environment, Great Lakes, and Energy's (EGLE's) consideration.

1.2 Corrective Action Objectives and Goals

The CAOs for the Site is to protect human health and the environment as reflected by achieving a RCRA Corrective Action Complete with Controls determination (i.e., restricted, nonresidential closure per EGLE standards). Relevant criteria, as well as current and future Site use, were used to establish relevant pathways and CAOs. CAOs for the Site are summarized in Table 1.

2 Site Background

The Site (Plants 2, 3, and 6) is located in Lansing and occupies an area of approximately 250 acres. Plants 2 and 3 are located in Lansing Township, and Plant 6 is located within the City of Lansing. Figure 1 shows the locations of Plants 2, 3, and 6 relative to the greater Lansing area. A detailed description of the Site's history and operations is included in the Current Conditions Report (Arcadis 2008).

2.1 Land Use

Currently, the Site is generally vacant and fenced, and the buildings have been demolished. The Site is zoned as heavy industrial and is likely to be redeveloped for industrial and commercial uses in the future. The Site is surrounded by residential and commercial properties, parks, and school properties. During the RCRA Facility Investigation (RFI), the Site was evaluated based on a current and future nonresidential use. Offsite properties were evaluated based on a residential exposure scenario.

2.2 Summary of the Resource Conservation and Recovery Act Facility Investigation

The RFI was completed in multiple phases over several years to characterize impacts on the Site and the associated risk. The RFI Summary Report (Arcadis 2022) summarizes the results of the investigations completed to characterize and assess risk at the Site. The RFI Summary report provides an overview of investigation activities completed at the Site and a summary of the key findings used to develop this CMS Report. Based on the conclusions of the RFI, the following are addressed as part of this CMS Report:

- Exceedances of relevant criteria in the perched zone, including:
  - Soil exceedances of Nonresidential Drinking Water Protection Criteria, Groundwater-Surface Water Interface Pathway (GSIP) Criteria, Site-specific Soil Volatilization to Indoor Air Criteria (SSVIAC), Volatile Soil Inhalation Criteria, Direct Contact (DC) Criteria, and/or Particulate Soil Inhalation Criteria (PSIC) for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and/or metals at Plants 2, 3, and 6.
  - Groundwater exceedances of Nonresidential Drinking Water Criteria, Groundwater-Surface Water Interface (GSI) Criteria, and SSVIAC for VOCs, SVOCs, PCBs, and/or metals at Plants 2, 3 and 6.
  - Light non-aqueous phase liquid (LNAPL) present within shallow fill material at:
    - Central portion of Plant 2 (Area 5-2). LNAPL consists of cutting oil that contains elevated concentrations of VOCs and PCBs in some areas.
    - North-central portion of Plant 3 (Area 17). LNAPL is gasoline and is associated with a former underground storage tank farm.
  - Per and poly-fluoroalkyl substances (PFAS) present in perched groundwater:
    - Plant 2. PFAS is generally associated with Areas of Interest (Areas) 2-15, 6-19, and 2-4 in the southeastern portion of Plant 2. The main risk driver for PFAS at Plant 2 is impacted groundwater entering Site sewers that discharge to the County drain at the northwest corner

of Plant 2. Perfluorooctanesulfonic acid (PFOS) has been identified above GSI criteria in Site sewers.

  - Plant 3. PFAS is largely associated with the former plating area located in the northeastern portion of Plant 3. PFAS associated with this source has been identified in Site sewers above GSI criteria and has been detected in groundwater offsite above DW criteria.
  - Plant 6. PFAS have been detected in groundwater at the Plant 6 property boundary above GSI and DW criteria. PFOS has been detected above GSI criteria in offsite sewers.
- Lower 1,4-dioxane plume at Plants 2 and 3. The primary source area for the lower 1,4-dioxane plume is near the "coliseum" on the southwestern portion of Plant 3 (Area 11). In addition, 1,4-dioxane from the perched zone in the vicinity of the Plant 2 LNAPL (Area 5-2) is contributing 1,4-dioxane to the lower 1,4-dioxane plume below and downgradient of the LNAPL area (Arcadis 2021b).

2.3 Summary of Corrective Measures Testing

Since 2014, various corrective measures bench-scale and field pilot tests have been completed to assess and refine the corrective measures alternatives for the lower 1,4-dioxane plume. The following summarizes the corrective measures testing completed at the Site:

- An advanced oxidation process bench test showed that the advanced oxidation process could treat 1,4-dioxane in Site groundwater to concentrations less than 1 microgram per liter (µg/L) with low risk of byproduct generation and relatively low energy requirements (ULTURA, Inc. 2014).
- Hydraulic field testing indicated that groundwater extraction from the weathered bedrock was limited by the saturated thickness of the weathered bedrock zone, and that limited available drawdown and injection are relatively easier based on the large positive displacement available for injection (65 to 75 feet) (Arcadis 2015).
- Chemical oxidation bench testing showed that chemical oxidation using sodium persulfate without engineered activation can oxidize 1,4-dioxane in Site groundwater to concentrations of 4 µg/L or less (Arcadis 2016).
- An in-situ chemical oxidation and tracer field study showed that in-situ chemical oxidation was limited by distribution of the oxidant, rebound of the groundwater concentration associated with mass in storage, and lack of drift of working strength oxidant (Arcadis 2016).
- A biosparge proof of concept field study demonstrated a reduction of 1,4-dioxane concentrations to less than 10 µg/L where the distribution of propane and oxygen was achieved (Arcadis 2017a).
- A bioreactor proof of concept field study established that ex-situ treatment using a bioreactor was not able to reduce 1,4-dioxane concentrations to less than 70 µg/L, was sensitive to upset conditions, and had relatively high energy requirements (Arcadis 2017b and 2018).
- A biosparge pre-design field study demonstrated that installation of in-situ horizontal sand lenses improved gas distribution and treatment of 1,4-dioxane, and that a 15-foot radius of influence could be consistently achieved (Arcadis 2019c).

2.4 Summary of Interim Measures

Since 2011, several interim measures have been completed or are in progress at the Site. Interim measures include the following:

- Selected portions of the existing concrete slabs at Plants 2, 3, and 6 were retained for plume stability, per the EGLE approved-map in 2014 (Fitzgerald Henne & Associates Inc, 2014).
- Targeted excavations were completed at Plant 6, Areas 5-7, 7, and 9, to remove VOCs in soil and groundwater that represented a direct contact and potential vapor intrusion risk near the property boundary (PME 2016; Arcadis 2017c).
- Plant 2, 3, and 6 soil corrective measures have been implemented or are in the process of being implemented (Arcadis 2017c and 2021e) including the establishment of appropriate exposure barriers and implementation of targeted excavations.
- Plant 2 Area 5-2: Soil samples collected in Area 5-2 at Plant 2 contained PCBs at concentrations exceeding Toxic Substances Control Act (TSCA) remediation objectives. This area is proposed to be managed using a low-occupancy restriction with an exposure barrier/cap, as defined in the TSCA Plan (Arcadis 2021i). These low-occupancy areas will be identified in the Amended Declaration of Restrictive Covenant (DRC) for Plant 2.
- The Plant 2 Area 5-2 concrete vault had the liquids contained within characterized, pumped out, and filled with flowable fill material to close the concrete vault structure, in accordance with the EGLE approved scope of work dated April 13, 2021 (Arcadis 2021h).
- Plant 2, 3, and 6 sewer modifications have been implemented since 2018 and are ongoing to eliminate discharge of PFAS offsite through Site sewers (Arcadis 2019a, 2020c, 2021d, and 2021f).
- Manual LNAPL recovery was completed at Plant 2 in Area 5-2 from 2015 to 2019. Approximately 165 gallons of LNAPL were recovered during that time. Because of low recovery and recharge rates, EGLE approved discontinuation of LNAPL recovery efforts in 2019.
- A full-scale biosparge system was installed and operation is ongoing for the lower 1,4-dioxane plume at Plants 2 and 3 (Arcadis 2021a and 2021c).

These interim measures are incorporated into the proposed corrective measures alternatives discussed in Section 5, as appropriate.

3 Summary of Corrective Measures Alternatives

Potential corrective measures to address applicable exceedances of Relevant Criteria at the Site are identified and described in the subsections below and summarized in Table 2. The corrective measures have been screened against RCRA's threshold criteria (USEPA 2005), which are as follows:

- Protection of human health and the environment;
- Attainment of media cleanup objectives; and
- Controlling the sources or demonstrating plume stability.

Screening results are also summarized in Table 2. The various corrective measures can be combined, as needed, to meet all RCRA threshold criteria and to meet the CAOs.

3.1 Site-wide Measures

3.1.1 Land Use/Activity Restriction

The exposure pathway analysis included as Appendix F of the RFI Phase 2 Activities Summary Report (Arcadis 2013) assumes that future land use at the Site would be industrial and/or commercial under a nonresidential closure scenario. To prevent a change in land use and to address other potential exposures, a DRC would be recorded on the deeds and would cover the following:

- Site-wide Land Use Restriction: Uses at the entire Site would be prohibited if they are not compatible with or are inconsistent with the exposure assumptions for the nonresidential cleanup criteria established pursuant to Section 324.20120a(1)(b) of NREPA.
- Site-wide Contaminated Soil Management: All Site soils, media, and/or debris would be managed in accordance with the applicable requirements of NREPA Parts 111 and 201, RCRA, and all other relevant state and federal laws.
- Site-wide Health and Safety Requirement for Intrusive Activities: Intrusive excavation activities Site-wide would be conducted following a Site-specific Health and Safety Plan prepared by qualified professionals and intrusive activities would be conducted by appropriately trained personnel. All known exceedances of DC criteria and particulate soil inhalation criteria would be identified in the DRC.
- Site-wide Hazardous Substances Management: Hazardous substances would not be treated, stored, disposed of, or released on, at, or below the Site in a manner that would require a RCRA permit or equivalent permit required by state law, except pursuant to a plan or permit approved in writing by EGLE.
- Site-wide Subsurface Features Restrictions: Construction, installation, or maintenance of subsurface utilities, structures, or other features (collectively, Subsurface Features), would be restricted, unless the construction incorporates engineering controls designed to eliminate the potential for perched water to enter and/or migrate along the utility corridor or for the utility to release fluids that could infiltrate through the subsurface and exacerbate impacts to groundwater.
- Site-wide Soil Vapor Management: The construction and/or occupancy of any building or structures on the Site would be prohibited, unless such construction and/or occupancy incorporates engineering controls designed to eliminate the potential for subsurface vapor phase contaminants or hazardous substances to migrate into the structure at concentrations greater than the appropriate concentrations protective of public health; or unless prior to construction and/or occupancy of any structure, an evaluation of the potential for any contaminants or hazardous substances to volatilize into indoor air confirms the protection of persons who may be present in the buildings. Prior to the potential for any human exposures, documentation of compliance with the above requirements would need to be submitted to EGLE for approval.

3.1.2 Groundwater Use Restriction

The Restrictive Covenant would also include Site-wide groundwater use prohibition for perched, deep overburden, and bedrock groundwater. Construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose would be prohibited, 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 would be 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 would be 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.
- Removing, disturbing, or damaging any monitoring wells on the Site without prior EGLE or RACER Trust written approval would be prohibited. The number and location of monitoring wells may change over time in accordance with approvals and requirements of EGLE.

3.1.3 Monitored Plume Stability

Monitored plume stability has been identified as a potential Site-wide corrective measure to meet the CAOs. As described in the following subsections, monitored plume stability includes 1) groundwater monitoring, 2) retaining selected existing surface cover for infiltration management (e.g., building slabs, asphalt, concrete), and 3) land use restrictions to document requirements associated with any intrusive activity that could affect the integrity of the existing surface cover.

3.1.3.1 Monitoring

Groundwater monitoring would be completed to collect the necessary data for evaluating trends and verifying the stability and extent of concentrations of groundwater constituents of concern (COCs). Monitoring would be focused on evaluation of the primary COCs at the Site. Specifically, data collected during groundwater monitoring would be used to:

- Monitor the stability of the perched 1,4-dioxane.
- Monitor metals in areas near Site boundaries and in areas where metals are known to be Site related.
- Monitor perched groundwater for PFAS at Plants 2, 3, and 6.
- Monitor the stability of 1,4-dioxane in the deep overburden and weathered bedrock.
- Monitor sentinel wells to verify there is no vertical or horizontal migration of COCs.
- Monitor dry weather storm sewer discharge from Plants 2, 3, and 6 to verify that PFAS are not leaving the Site via the storm sewer system at unacceptable levels.

Following each sampling event, the analytical results would be reviewed to determine if adjustments to the monitoring plan are needed. Any mid-year adjustments would be provided to EGLE for approval. A summary of field activities, water level information, and analytical results would be provided to EGLE in an annual groundwater monitoring report. After five years of monitoring, a comprehensive plume stability analysis would be completed to verify plume stability and optimize the monitoring plan.

3.1.3.2 Infiltration Management

Removal of certain existing land surface covers at the Site has the potential to negatively impact plume stability, as it will result in an immediate increase in recharge to groundwater. Therefore, monitored plume stability includes retaining certain existing surface cover (e.g., building slabs, concrete, asphalt) near groundwater impacts to limit infiltration in conjunction with ongoing groundwater monitoring.

Certain existing surface cover near groundwater impacts and over source areas would be retained (i.e., not removed) but not maintained as part of corrective measures. Slow degradation of this surface cover would result in small changes in infiltration over time and be less likely to negatively impact plume stability. The ongoing groundwater monitoring program would be used to evaluate potential negative impacts on plume stability that could be related to the degradation of the surface cover. Any future redevelopment at the Site that affects the integrity of the existing surface cover in designated areas will need to provide for repair or replacement with cover that provides at least an equivalent degree of protection as the original. Repair and/or replacement of the surface cover would be required unless it is determined that surface cover in the area is no longer necessary to limit infiltration.

3.1.3.3 Restrictions

In addition to the land use/activity restrictions described in Section 3.1.1, the DRC would prohibit any excavation or other intrusive activity that could affect the integrity of the existing surface cover for designated portions of the Site, except during short-term construction or repair projects or for purposes of further treating or remediating the subject contamination. Any excavation or other intrusive activity, including removing, altering, or disturbing the surface cover in designated portions of the Site, would need prior EGLE and RACER Trust written approval. Any excavation or other intrusive activity would need to include the use of engineering controls to minimize infiltration of water into the contaminated soil underlying the barrier until the existing surface cover is repaired or replaced. The surface cover would need to be repaired or replaced with a cover that provides at least an equivalent degree of protection as the original. Repair and/or replacement of the surface cover would be required unless it is determined that surface cover in the area is no longer necessary to limit infiltration.

3.2 Soil

As discussed in Section 3.1.1, land use/activity restrictions would be a potential corrective measure to prevent unacceptable exposure to soil exceedances, most applicable for those exposures associated with intrusive activities. In addition to the Site-wide land use/activity restrictions, the DRC would restrict use of a portion of Area 5-2 to low occupancy as defined in Title 40 of the Code of Federal Regulations (CFR) Section 761.61.

Targeted excavations and exposure barriers have also been evaluated as corrective measures to address soil exceedances and are most applicable for shallow soil exceedances.

3.2.1 Exposure Barriers

Exposure barriers have been identified as a corrective measure to prevent unacceptable exposure to exceedances for surface soils. Existing building slabs or the existing soil/gravel, concrete, or asphalt would be used as an exposure barrier. In areas of the Site with soil exceedances where existing building slabs or cover are not present, a clean surface cover (e.g., soil, gravel) would be placed to prevent exposure.

If cover were the (or part of the) selected corrective measures alternative, a DRC would include prohibiting the removal, excavation, or other intrusive activity that could affect the integrity of the cover, except during short-term construction or repair projects, or for purposes of further treating or remediating the subject contamination. In any excavation area or area where other intrusive activities (i.e., removing, altering, or disturbing the cover) that could affect the integrity of the cover has occurred, the cover would need to be replaced with a cover that provides at least an equivalent degree of protection as the original cover. Repair and/or replacement of cover would be required unless additional assessment is conducted that demonstrates that a cover in the area is no longer necessary.

Similarly, for a portion of the TCSA restricted low occupancy areas that require a cap (same as an exposure barrier, defined as a cap in Title 40 CFR Section 761.61), a DRC would include prohibiting any excavation or other intrusive activity that could affect the integrity of the cap without prior USEPA, EGLE, and RACER Trust written approval. Any excavation or other intrusive activity that could remove, alter, or disturb the cap would have to be restored with a cap that provides at least an equivalent degree of protection as the original cap.

3.2.2 Targeted Excavation

Targeted excavation with offsite disposal at a licensed disposal facility is a potentially feasible corrective measure to address soil exceedances. Additional characterization to refine the proposed excavation area may be completed prior to the excavation, if deemed necessary.

3.3 Groundwater (not related to PFAS or 1,4-dioxane)

This section discusses corrective measures for perched groundwater containing VOCs, SVOCs, PCBs, and/or metals at concentrations exceeding relevant criteria. As discussed in Sections 3.1.2 and 3.1.3, groundwater use restrictions and monitored plume stability are potential corrective measures to prevent unacceptable exposure to groundwater containing Site-caused and Site-related COCs at concentrations exceeding Relevant Criteria. Hydraulic control has also been identified as a possible corrective measure to address groundwater.

3.3.1 Hydraulic Control

Hydraulic control has been identified as a potential corrective measure for perched groundwater containing VOCs, SVOCs, PCBs, and/or metals. A groundwater extraction system would physically remove groundwater and control impacts migrating toward the Site boundary. The extracted groundwater would be treated in an above-grade treatment system.

Based on the range of contaminants at the Site, all hydraulic control options would require an above-grade treatment system that may include equalization, aeration, pH adjustment, filtration, air stripping, advanced oxidation, ion exchange resin, and/or granular-activated carbon. The treatment system effluent would be discharged in accordance with a National Pollutant Discharge Elimination System (NPDES) permit or publicly owned treatment works [POTW] permit.

Prior to full-scale implementation, a laboratory treatability test would be completed to evaluate the most efficient unit operations for treatment of COCs present in groundwater to support the design and long-term operations and maintenance cost evaluation. A field pilot test would also be conducted to verify hydraulics and that water can be treated to the required levels for NPDES or POTW permit discharge.

3.4 Light Non-Aqueous Phase Liquid

A Plant 2 LNAPL conceptual site model was prepared and submitted to EGLE to provide an overview of the Plant 2 LNAPL (Area 5-2) characterization, risk, and potential remedy considerations (Arcadis 2020a). An overview of the LNAPL conceptual site model for Area 17 is provided in the RFI Phase 1 Activities Summary Report (Arcadis 2012) and the RFI Phase 2 Activities Summary Report (Arcadis 2013). As described in the Plant 2 LNAPL conceptual site model, corrective measures to address LNAPL at Area 5-2 have been evaluated as part of an LNAPL Decision Tree. Appendix A to this CMS Report the evaluation utilizing the LNAPL Decision Tree for Area 5-2. Appendix B includes the LNAPL Decision Tree evaluation for Area 17. The following sections detail the corrective measures evaluated for LNAPL, consistent with the corrective measures for Area 5-2 presented to the EGLE NAPL Technical and Program Support Team (Arcadis 2020b). Based on Site conditions, LNAPL properties, and depth of impacts, there is no corrective measure that can feasibly remove all or most of the LNAPL. Therefore, as documented in the LNAPL Decision Trees, the evaluation of options is to determine if there is potential benefit to partial treatment/removal that outweighs the cost.

3.4.1 Natural Source Zone Depletion

Natural source zone depletion (NSZD) relies on natural processes to reduce LNAPL mass. NSZD processes include volatilization, dissolution, and biodegradation. NSZD is an appropriate remedy option because the LNAPL at the Site is not mobile and is not migrating, and the LNAPL composition does not present an ongoing or unacceptable risk to the underlying bedrock aquifer or offsite vapor intrusion receptors (Arcadis 2020a).

NSZD processes and rates were measured using temperature profiles and carbon dioxane and methane flux in 2018 and 2019. The results indicate that LNAPL is degrading at a rate of approximately 600 gallons depleted per year (Arcadis 2019b). For reference, the total LNAPL recovery efforts removed 165

gallons of LNAPL between 2015 and 2019. NSZD is expected to continue providing LNAPL mass reduction.

NSZD would be combined with deed restrictions. The restrictions discussed in Section 3.1 include restrictions to prevent onsite risks (vapor exposure, construction worker direct contact, soil management, etc.).

3.4.2 Cap

Low-permeability caps have been identified as potential corrective measures for the areas with LNAPL to limit infiltration and minimize recharge to the LNAPL area, reducing the potential for LNAPL-related constituents to leach into perched groundwater and to limit the migration of perched groundwater horizontally and/or vertically. For Area 5-2, capping would include preserving the current condition of the existing surface cover (e.g., building slabs, concrete, asphalt) with an extension to cover the LNAPL footprint. LNAPL in Area 17 is currently covered by concrete and asphalt. Capping could be implemented in conjunction with other corrective measures, as appropriate.

If capping were the (or part of the) selected corrective measures alternative, a restriction would be included in the DRC and include prohibiting the removal, excavation, or other intrusive activity that could affect the integrity of the caps, except during short-term construction or repair projects or for purposes of further treating or remediating the subject contamination. In any excavation area or area where other intrusive activities (e.g., removing, altering, or disturbing the caps) that could affect the integrity of the cap have occurred, the cap would have to be replaced with a cover that provides at least an equivalent degree of infiltration reduction as the original cap. Maintenance, repair, and/or replacement of the caps would be required unless additional evaluation is conducted that demonstrates that a cap in the area is no longer necessary.

3.4.3 Excavation

Excavation and offsite disposal at a licensed disposal facility to remove LNAPL were identified as part of a potentially feasible corrective measures alternative for Areas 5-2 and 17. The excavation would extend until all LNAPL was removed. Excavation would be complicated by subsurface debris, concrete slabs, sub-floors, utilities, shoring, and water management.

If excavation were the (or part of the) selected corrective measures alternative, additional characterization to refine the proposed excavation area would likely be necessary.

3.4.4 Light Non-Aqueous Phase Liquid Recovery via Active Skimming

LNAPL skimming has been identified as a potential corrective measure to remove LNAPL to the extent practicable. LNAPL skimming would involve installation of skimmers (i.e., belt skimmers or skimmer pumps) in recovery wells to remove free-phase LNAPL that collects in wells. LNAPL would be transferred to an above-grade storage tank or drum and removed and disposed of in accordance with applicable requirements of RCRA, TSCA for some portions of the LNAPL, and all other relevant state and federal laws.

3.4.5 In-Situ Stabilization

In-situ stabilization (ISS) has been identified to immobilize LNAPL to the extent practicable. This option involves excavating surface soil, mixing the underlying soil with a cementing agent to immobilize the LNAPL, and then backfilling. The extents of ISS would be the same as the potential excavation areas. Based on the depth of the LNAPL and presence of debris, concrete slabs, sub-floors, and subgrade utilities, pre-excavation to approximately 10 feet below ground surface would be required prior to soil mixing.

3.4.6 Soil Vapor Extraction

Soil vapor extraction (SVE) has been identified as an appropriate technology to volatilize and enhance aerobic degradation of LNAPL in Area 17 (gasoline) to mitigate compositional concerns of LNAPL. LNAPL present in Area 5-2 consists of cutting oil; therefore, SVE has not been evaluated for Area 5-2.

In Area 17, SVE would consist of installation of SVE wells across the perched water table to draw air across the surface of LNAPL, thereby volatizing and enhancing aerobic degradation of the LNAPL. Pilot testing would be completed to determine the appropriate well spacing, extraction flow rates, wellhead vacuum, extraction equipment requirements, and air treatment requirements (if any). An air permit would be obtained, if required.

3.4.7 Multi-Phase Extraction

Multi-phase extraction (MPE) has been identified as a potential corrective measure to remove LNAPL from Areas 5-2 and 17 to the extent practicable. MPE would involve installation of extraction wells to recover LNAPL and perched groundwater by pumping or high-vacuum extraction. Soil vapor would also be removed to enhance recovery of the LNAPL and promote volatilization and aerobic biodegradation, when applicable. Groundwater and LNAPL would be separated above grade, and groundwater would be treated and discharged in accordance with an NPDES permit or POTW permit.

Based on the range of contaminants at the Site, the above-grade treatment system may include equalization, aeration, pH adjustment, filtration, air stripping, advanced oxidation, ion exchange, and/or granular-activated carbon. Treatability testing would be required to determine the appropriate treatment technologies to meet the standards.

If groundwater treatment is required to address 1,4-dioxane in recovered groundwater, it is recommended that an extended field-scale pilot test of a unit treatment system be implemented prior to full-scale application to verify long-term performance and costs. Operating requirements and costs can be significant for advanced oxidation process treatment units.

Recovered LNAPL would be removed and disposed of in accordance with applicable requirements of RCRA and all other relevant federal, state, and local laws. Pilot testing would be completed to determine the appropriate well spacing, extraction flow rates, wellhead vacuum, extraction equipment requirements, and air treatment requirements (if any). An air permit would be obtained, if deemed necessary.

3.5 Per and Poly-fluoroalkyl Substances

Due to the unique challenges associated with PFAS, corrective measures associated with PFAS in perched groundwater have been evaluated separately. However, several corrective measures already discussed would be appropriate for PFAS in perched groundwater including:

- Implementation of groundwater use restrictions, as discussed in Section 3.1.2 is a potential corrective measure to prevent unacceptable exposure to PFAS in groundwater onsite.
- Monitoring of plume stability, as discussed in Section 3.1.3, is a potential corrective measure to verify the stability of PFAS in groundwater.
- Hydraulic control, as discussed in Section 3.3.1, is a potential corrective measure to physically remove and treat impacted groundwater and will also mitigate potential additional migration of perched groundwater offsite.

Several additional corrective measures have also been identified and screened for PFAS in perched groundwater including use of a groundwater ordinance, sewer modifications, capping, implementation of a permeable reactive barrier, and ISS.

3.5.1 Groundwater Ordinance

Current monitoring data indicate that PFAS in perched groundwater at concentrations above drinking water criteria has migrated offsite. A groundwater ordinance is a viable institutional control to prevent unacceptable exposure to PFAS in perched groundwater offsite. A Groundwater Use Restriction Ordinance already exists in the vicinity of the Site that, with the approval of the City of Lansing, may be updated to include current EGLE required language to cover PFAS impacts associated with the Site. A groundwater ordinance would likely be implemented in conjunction with monitored plume stability to ensure the ordinance boundaries are appropriate to mitigate unacceptable risk. It is noted that the Lansing Board of Water and Light provides potable water to the proposed area to be included in a groundwater ordinance.

3.5.2 Sewer Modifications

PFAS, specifically PFOS, has been detected in Site sewer outfalls above GSI criteria. Potential corrective measures to mitigate discharge of PFOS offsite are sewer modifications, including:

- Sewer abandonment via bulkheading, pipe filling, and/or manhole filling to prevent impacted water in the sewer from discharging.
- Rehabilitation or replacement of manhole structures to minimize infiltration of groundwater into the sewer network.
- Sewer lining to minimize the potential for impacted groundwater to enter the sewers.

If sewer modifications were selected, outfalls would be left in place to the extent practical to allow for future Site redevelopment to connect new sewers to the existing outfalls to facilitate redevelopment.

If sewer modifications were the (or part of the) selected corrective measures alternative, the DRC would include prohibiting use of or disturbing the modified sewers, and requiring any redevelopment to install water-tight sewers.

3.5.3 Cap

Use of low-permeability caps has been identified as a potential corrective measure for areas with PFAS to limit infiltration and minimize recharge to the PFAS area, reducing the potential for perched groundwater to migrate horizontally and/or vertically. Cap implementation would involve installation of a low-permeability barrier such as pavement over the area of the former press pits to prevent infiltration that has resulted in the current distribution of the groundwater containing PFAS at Plant 3.

If capping were the (or part of the) selected corrective measures alternative, the DRC would need to include prohibiting the removal, excavation, or other intrusive activity that could affect the integrity of the caps, except during short-term construction or repair projects or for purposes of further treating or remediating the subject contamination. In any excavation area or area where other intrusive activities (e.g., removing, altering, or disturbing the caps) that could affect the integrity of the cap occurred, the cap would need to be replaced with a cover that provides at least an equivalent degree of infiltration reduction as the original cap. Maintenance, repair, and/or replacement of the caps would be required unless additional evaluation is conducted that demonstrates that a cap in the area is no longer necessary.

3.5.4 Permeable Reactive Barrier

Use of permeable reactive barriers (PRBs) has been identified as a potential corrective measure to address offsite migration of PFAS-impacted groundwater from Plants 3 and 6. A PRB is a passive technology that removes PFAS from groundwater in-situ without the need to pump groundwater. PRBs can be implemented in various configurations. Two options were considered to treat the Plant 3 and 6 PFAS:

- Installation of a continuous barrier of activated carbon (i.e., PlumeStop or equivalent) along the property boundary where offsite migration of PFAS may be occurring. Activated carbon could be installed via pressurized injections or continuous trenching methods.
- Installation of low-permeability funnels (e.g., slurry wall or sheet pile) that direct groundwater through engineered treatment gates. Treatment gates would be filled with treatment media (e.g., activated carbon or resin) that could be removed from the gates and replaced if/when it is spent.

At Plant 3, the PRB would be placed along the eastern property boundary. At Plant 6, the PRB would be located along the Osborn Street and Verlinden Street boundaries.

A bench test to determine the quantity and type of media most efficient at PFAS removal for the application would be completed to verify design, implementation, and long-term operation and maintenance costs.

3.5.5 In-Situ Stabilization

ISS is a potential corrective measure for the PFAS source area identified at Plant 3. This option involves excavating surface soil, mixing the underlying soil with a cementing agent to immobilize the PFAS impacts, and then backfilling, as needed. The objective is to immobilize the PFAS source area and reduce permeability to minimize the potential for further lateral and vertical migration of groundwater containing PFAS. Two ISS options are considered:

- Solidify and stabilize the former plating line area.
- Solidify and stabilize the area with the currently highest concentration of PFAS in groundwater to the east, north, and west of the former plating pits, and cap the plating pits to minimize infiltration and flushing of the PFAS source area.

ISS would involve bench testing to determine the appropriate reactive admixture, ensure PFAS are immobilized to the extent needed to meet objectives, and verify costs associated with implementation.

Based on the depth of PFAS and presence of debris, concrete slabs, sub-floors, and subgrade utilities, pre-excavation to approximately 10 feet below ground surface would be required prior to soil mixing.

3.6 Lower 1,4-Dioxane

As discussed in Sections 3.1.2 and 3.1.3, groundwater use restrictions and monitored plume stability would be potential corrective measures to prevent unacceptable exposure to groundwater with Site-caused and Site-related COCs at concentrations exceeding Relevant Criteria. Biosparge and hydraulic control have also been identified as corrective measures to address the lower 1,4-dioxane plume to meet CAOs.

3.6.1 Biosparge

Biosparge has been identified as a potential corrective measure for the lower 1,4-dioxane groundwater plume. Biosparge is an in-situ remedy that has been proven to reduce concentrations of 1,4-dioxane in groundwater by providing propane and oxygen to the groundwater to facilitate the co-metabolic biodegradation of 1,4-dioxane. Biosparge equipment includes an air compressor, propane tank, distribution manifold, and injection wells.

3.6.2 Hydraulic Control

Hydraulic control has been identified as a potential corrective measure for the lower 1,4-dioxane plume groundwater. A groundwater extraction system would physically remove groundwater and would control impacts migrating toward the Site boundary. The extracted groundwater would be treated in an above-grade treatment system.

Based on the range of contaminants at the Site, hydraulic control would require an above-grade treatment system that may include equalization, aeration, pH adjustment, filtration, air stripping, advanced oxidation, ion exchange resin, and/or granular-activated carbon. The treatment system effluent would be discharged in accordance with an NPDES permit or POTW permit.

Prior to full-scale implementation, a laboratory treatability test would be completed to evaluate the most efficient unit operations for treatment of the COCs present in groundwater and to support the design and long-term operation and maintenance cost evaluation. A field pilot test would also be conducted to verify hydraulics and that water can be treated to the required levels for NPDES or POTW permit discharge.

4 Evaluation of Corrective Measures Alternatives

Based on the corrective measures screening results summarized in Table 2, corrective measures meeting the screening criteria for soil, groundwater, LNAPL, and PFAS were further evaluated. Table 3 includes a description of the corrective measures alternative and a summary of the evaluation of corrective measures against the RCRA evaluation criteria. The RCRA corrective measures alternative evaluation criteria are summarized below:

- Long-Term Reliability and Effectiveness: This criterion considers the level of threat posed by hazardous constituents remaining in place, the adequacy of the remedial alternative, and the risk associated with any treatment residuals compared to untreated waste.
- Reduction of Toxicity, Mobility, or Volumes of Waste: This criterion considers the ability of the remedial alternatives to reduce the toxicity, mobility, or volume of waste significantly and permanently.
- Short-Term Effectiveness: This criterion evaluates the effects of the remedial alternatives on human health and the environment during their implementation period. It considers factors such as impacts from remedy construction, transportation, and air quality.
- Implementation: This criterion considers the technical and administrative feasibility of implementing the selected remedial alternative.
- Community Acceptance: This criterion evaluates the issues and concerns the local community may have regarding the alternatives.
- State Acceptance: This criterion evaluates the technical and administrative issues and concerns the state may have regarding the alternatives.
- Cost: This criterion considers the cost-effectiveness of each alternative. Cost-effectiveness is evaluated by comparing the costs proportional to the effectiveness achieved by the remedial alternative.
- Sustainability: This criterion considers the sustainability of each alternative with regard to energy requirements; air emissions; water requirements, including impacts on water resources; land and ecosystem impacts; and material consumption and waste generation. The sustainability evaluation is used in conjunction with the core elements of the RCRA corrective measures alternatives evaluation to identify corrective measures alternatives that balance effectiveness and sustainability.

The sections below summarize the key considerations for each corrective measure evaluated.

4.1 Site-wide

The corrective measures alternatives to prevent unacceptable exposures on a Site-wide basis were land/activity and groundwater use restrictions as well as monitored plume stability. These corrective

measures are meant to ensure proper restrictions are established to prevent unacceptable exposure onsite and implementation of monitored plume stability to ensure no unacceptable offsite exposures. These Site-wide corrective measure would be implemented in combination with additional corrective measures for soil, groundwater, and LNAPL, if needed, to meet CAOs. Land/activity and groundwater use restrictions and monitored plume stability are appropriate corrective measures to mitigate risk, can be readily implemented, and are relatively cost-effective.

4.2 Soil

For surface soil, exposure barriers and excavations were considered for areas with exceedances of DC criteria and PSIC. Exposure barriers are equally protective when compared to excavation, but easier to implement and relatively cost-effective compared to excavation.

Land/activity use restrictions and targeted excavation were the corrective measures evaluated for potential vapor intrusion risk. For areas internal to the Site, land use restrictions would be effective in the short- and long-term to mitigate risk, are easy to implement, and are relatively cost-effective. In areas near the property boundary where the potential for offsite impact is higher when compared to areas internal to the Site, excavations are more effective to mitigate short- and long-term risk.

4.3 Groundwater

For perched groundwater containing VOCs, SVOCs, PCBs, and/or metals, the corrective measures alternatives considered were land/activity and groundwater use restrictions as well as monitored plume stability and hydraulic control. These corrective measures are meant to ensure proper restrictions are established to prevent unacceptable exposure onsite and implementation of monitored plume stability and/or hydraulic control to address possible unacceptable offsite exposures.

Due to the variable nature of the perched zone, range of COCs, and geochemical conditions, hydraulic control would be difficult to reliably implement and would be costly. Current data indicate perched groundwater COC concentrations are stable or decreasing and remain onsite (with the exception of PFAS as discussed in Section 4.5 below). Therefore, land/activity and groundwater use restrictions with monitored plume stability are appropriate corrective measures to sustainably mitigate risk, can be readily implemented, and are relatively cost-effective.

Corrective measures evaluations for PFAS in perched groundwater and the lower 1,4-dioxane plume are discussed in Sections 4.5 and 4.6, respectively.

4.4 Light Non-Aqueous Phase Liquid

Land/activity use restrictions, NSZD, capping, skimming, MPE, ISS, and excavation were evaluated as corrective measures for Area 5-2 and 17 LNAPL. SVE was also evaluated for Area 17. The LNAPL conceptual site model and LNAPL Decision Trees were used to identify LNAPL remedial drivers and to determine the most appropriate remedy. LNAPL investigations, mobility assessments, and monitoring completed since 2011 have shown that the LNAPL in Areas 5-2 and 17 is not migrating, the LNAPL has

low recoverability, no significant 1,4-dioxane mass remains in the LNAPL in Area 5-2, and VOCs present in the LNAPL are not resulting in unacceptable concentrations in the perched zone or weathered bedrock.

Land/activity use restrictions were evaluated for potential risk associated with perched LNAPL (vapor intrusion, direct contact, etc.). Based on the location of the LNAPL at the Site (interior to the Site), land/activity use restrictions would be effective in the short- and long-term to mitigate risk, are easy to implement, and are relatively cost-effective.

The depth of the LNAPL and presence of subsurface debris, concrete slabs, sub-floors, and utilities limit the feasibility of accessing LNAPL for excavation and ISS. In Area 5-2, excavation presents a risk of breaching the confining unit and exacerbating leakage to the deeper zone. Excavation and ISS are high-cost options that would likely not be able to address all LNAPL due to Site conditions and LNAPL depth.

Site transmissivity testing indicates low LNAPL recoverability, which was confirmed based on historical manual recovery efforts recovering low volumes of LNAPL (165 gallons over four years). Because of this low recovery, EGLE approved discontinuation of LNAPL recovery efforts in 2019. LNAPL recovery with skimming would have similar challenges as manual recovery; skimming only recovers LNAPL that collects in wells, has a limited radius of influence, and typically recovers more water than LNAPL.

The interbedded and low-permeability geology of the Site and low LNAPL transmissivity would limit the effectiveness of an MPE system. MPE would not recover residual LNAPL, and would recover large quantities of perched groundwater that would require complex treatment. The high cost, difficult implementation, and minimal effect on LNAPL result in MPE not being a cost-effective measure.

Installation of a low-permeability cap can be easily implemented to limit infiltration and minimize recharge to the LNAPL area and is relatively cost-effective. A low-permeability cap (i.e., concrete slab) already exists in Area 17 and ongoing monitoring does not show unacceptable groundwater impacts associated with the LNAPL.

For Area 5-2, monitoring data suggest that the perched groundwater COC concentrations in contact with or dissolving from LNAPL are stable, and any vertical leakage of 1,4-dioxane is actively being treated with the biosparge system. During active biosparge treatment, allowing infiltration that drives leakage in Area 5-2 results in active treatment of 1,4-dioxane mass that would otherwise not be easily accessible to treat. Capping, if completed as part of Site redevelopment (i.e., parking lot pavement), would likely enhance stability of the perched COC concentrations and lower 1,4-dioxane plume. However, based on current data, capping is not needed as a separate component of the remedy as long as the biosparge system at Plant 2 is in operation or if conditions are otherwise achieved for discontinuing operation of the Plant 2 biosparge system.

Based on Site data, NSZD is already providing LNAPL mass reduction at a rate higher than any active remedy can feasibly maintain at no additional cost. NSZD combined with land/activity and groundwater use restrictions is an effective and sustainable corrective measure to mitigate risk, can be readily implemented, and is cost-effective.

4.5 Per and Poly-fluoroalkyl Substances

Due to the unique challenges associated with PFAS, corrective measures associated with PFAS in perched groundwater were evaluated separately and included land/activity and groundwater use

restrictions, monitored plume stability, hydraulic control, use of a groundwater ordinance, sewer modifications, capping, implementation of a PRB, and ISS. Due to the variable nature of the perched zone, range of COCs, and geochemical conditions, hydraulic control would be difficult to reliably implement and would be costly. While a passive PRB may be estimated to be less costly to install and operate than an active hydraulic control system, PRBs have not been proven to be effective in the long term for PFAS in groundwater. Media can be fouled by non-target COCs (i.e., total organic carbon), resulting in earlier-than-estimated PFAS breakthrough. This raises the uncertainty for the remedy to effectively meet the PFAS criteria and potentially increases the lifecycle cost to operate if frequent media change-outs and/or ongoing barrier reinstallations are required.

The depth of the PFAS and presence of subsurface debris, concrete slabs, sub-floors, and utilities limit the feasibility of accessing PFAS for ISS. ISS is a high-cost option that would likely not address all PFAS due to site conditions and depth of PFAS.

While there have been some detections of PFAS in groundwater offsite at concentrations exceeding DW criteria at Plants 3 and 6, current groundwater data for Plants 2 and 3 indicate that PFAS concentrations in the perched zone are stable. Data are still being collected to evaluate the stability of PFAS at Plant 6, but early trends suggest Plant 6 PFAS concentrations are also stable. Plume stability under current conditions suggests that there is no need for capping or any other active remedy to address groundwater. Capping completed as part of Site redevelopment (i.e., parking lot pavement) would likely enhance plume stability, but based on current data, is not needed as a separate component of the remedy. A groundwater ordinance implemented in conjunction with monitored plume stability to verify the ordinance boundaries is appropriate, may be able to be implemented with approval from the City of Lansing, and is a cost-effective corrective measure to sustainably mitigate unacceptable risk associated with PFAS in perched groundwater.

Even if groundwater is actively addressed, sewer modifications would likely be needed and are the most cost-effective, implementable, and effective in the short and long term to address PFOS detected above GSI criteria in Site sewer outfalls. Sewer modifications can be and have been addressed in a stepwise process, addressing the highest levels of PFAS in the system with abandonment, rehabilitation, and/or lining, while maintaining drainage in areas of the sewer system that are not impacted with PFAS to the extent practicable.

4.6 Lower 1,4-Dioxane Plume

Hydraulic control and biosparging have been evaluated as potential corrective measures for the lower 1,4-dioxane plume. As summarized in Section 2.4, several bench-scale and field pilot tests have been completed to assess implementability and effectiveness of these technologies. Pumping tests indicated that groundwater extraction from the weathered bedrock is limited by the saturated thickness of the weathered bedrock zone that limits available drawdown. Low extraction flow rates (1 gallon per minute or less) were difficult to balance and maintain consistently. Based on these results, it would be difficult to implement a hydraulic control system that would be effective in the short or long term. While bench testing showed that above-grade treatment with an advanced oxidation process is feasible, it is energy intensive, complicated, costly, and overall not a sustainable approach.

Biosparging was evaluated in a laboratory and in several phases of field pilot studies. Results from the laboratory and field pilot studies showed that propane biosparge is a successful technology to effectively reduce 1,4-dioxane concentrations in groundwater where distribution of propane, oxygen, and nutrients could be consistent and controlled. Sand lens enhancements installed at biosparge wells were successful, achieving consistent and controlled distribution of gases and nutrients. Biosparge systems are simple to operate, low energy, and sustainable compared to hydraulic control. Biosparge has been shown to reduce concentrations of 1,4-dioxane to non-detectable levels within weeks of operation and continue to reduce concentrations after years of operation. Biosparge is an effective, implementable, and sustainable remedy to mitigate potential risk associated with the lower 1,4-dioxane plume.

5 Proposed Corrective Measures

Table 4 presents the proposed corrective measures for Plants 2, 3, and 6 based on the evaluation of potential corrective measures with respect to the RCRA evaluation criteria. The proposed corrective measures are protective of Relevant Criteria and meet CAOs. The proposed and implemented final corrective measures for the Site include:

- Site-Wide
  - Land/Activity Use Restrictions
  - Groundwater Use Restrictions
  - Monitored Plume Stability
- Soil
  - Site-wide Corrective Measures
  - Area-specific Exposure Barriers
  - Targeted Excavations
- Groundwater (not related to PFAS or the Lower 1,4-Dioxane Plume)
  - Site-wide Corrective Measures
- LNAPL
  - Site-wide Corrective Measures
  - NSZD
- PFAS
  - Site-wide Corrective Measures
  - Groundwater Ordinance
  - Sewer Modifications
- Lower 1,4-Dioxane Plume
  - Site-wide Corrective Measures
  - Biosparge

Figure 2 illustrates interim measures and proposed corrective measures including exposure barriers, targeted excavations, infiltrations management areas, and the biosparge system.

5.1 Land Use/Activity Restrictions

To meet the CAOs, land/activity use restrictions would be implemented as part of the corrective measures. A DRC would be recorded and will cover the following:

- Site-wide Land Use Restriction: Uses at the entire Site would be prohibited if they are not compatible with or are inconsistent with the exposure assumptions for the nonresidential cleanup criteria established pursuant to Section 324.20120a(1)(b) of NREPA.
- Site-wide Contaminated Soil Management: All Site soils, media, and/or debris would be managed in accordance with the applicable requirements of RCRA and all other relevant state and federal laws.
- Site-wide Health and Safety Requirement for Intrusive Activities: Intrusive excavation activities Site-wide would be conducted following a Site-specific Health and Safety Plan prepared by qualified professionals, and intrusive activities will be conducted by appropriately trained personnel. All known exceedances of DC criteria and particulate soil inhalation criteria would be identified in the DRC.
- Site-wide Hazardous Substances Management: Hazardous substances would not be treated, stored, disposed of, or released on, at, or below the Site in a manner that would require a RCRA permit or equivalent permit required by state law, except pursuant to a plan or permit approved in writing by EGLE.
- Site-wide Subsurface Features Restrictions: Construction, installation, or maintenance of subsurface utilities, structures, or other features (collectively, Subsurface Features) would be restricted, unless the construction incorporates engineering controls designed to eliminate the potential for perched water to enter and/or migrate along the utility corridor or for the utility to release fluids that could infiltrate through the subsurface and exacerbate impacts to groundwater.
- Site-wide Soil Vapor Management: The construction and/or occupancy of any building or structures on the Site would be prohibited, unless such construction and/or occupancy incorporates engineering controls designed to eliminate the potential for subsurface vapor phase contaminants or hazardous substances to migrate into the structure at concentrations greater than the appropriate concentrations protective of public health; or unless prior to construction and/or occupancy of any structure, an evaluation of the potential for any contaminants or hazardous substances to volatilize into indoor air confirms the protection of persons who may be present in the buildings. Prior to the potential for any human exposures, documentation of compliance with the above requirements would need to be submitted to EGLE for approval.
- Infiltration Management Prohibits any excavation or other intrusive activity that could affect the integrity of the existing surface cover for designated portions of the Site, except during short-term construction or repair projects or for purposes of further treating or remediating the subject contamination. Any excavation or other intrusive activity, including removing, altering, or disturbing the surface cover in designated portions of the Site would need prior EGLE and RACER Trust written approval. Any excavation or other intrusive activity would need to include the use of engineering controls to minimize infiltration of water into the contaminated soil underlying the barrier until the existing surface cover is repaired or replaced. The surface cover would need to be repaired or replaced with a cover that provides at least an equivalent degree of protection as the original. Repair and/or replacement of the surface cover would be required unless it is determined that surface cover in the area is no longer necessary to limit infiltration.

- TSCA-Restricted Areas: For one area designated as low occupancy, the use would be restricted to low occupancy as defined in TSCA regulations included in Title 40 CFR Section 761.61. For the portion of the area designated as low occupancy with a cap, any excavation or other intrusive activity that could affect the integrity of the cap would be prohibited without prior USEPA, EGLE, and RACER Trust written approval. Any excavation or other intrusive activity that could remove, alter, or disturb the cap would need to be restored with a cap that provides at least an equivalent degree of protection as the original cap.

5.2 Groundwater Use Restrictions

To meet the CAOs, the DRC would include groundwater use restrictions prohibiting the construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose, 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 would be 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. Any activity that would interfere with the function of or obstruct access to any monitoring wells and devices located on the Site would be prohibited or replacement would be allowed.
- Short-term dewatering for construction purposes would be 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.
- Removing, disturbing, or damaging any monitoring wells on Site would be prohibited. The number and location of monitoring wells may change over time in accordance with approvals and requirements of EGLE.

5.3 Monitored Plume Stability

Site-wide monitored plume stability (including COC concentrations) is an integral part of the corrective measure as it provides data to confirm ongoing plume stability and the effectiveness of the selected corrective measures. Currently, monitoring is conducted in accordance with the Revised Interim Groundwater Monitoring Work Plan (Arcadis 2019d), submitted on October 28, 2019, or as otherwise agreed to with EGLE. The groundwater monitoring plan would be updated to ensure the appropriate data are being collected at suitable frequencies. In general, the monitoring plan is used to:

- Monitor stability of perched groundwater, including 1,4-dioxane, PFAS, and metals in areas near Site boundaries and in areas where metals are known to be Site related.
- Monitor stability of 1,4-dioxane in the deep overburden and weathered bedrock.
- Monitor sentinel wells to confirm no vertical or horizontal migration of COCs.

- Monitor dry weather storm sewer discharge from Plants 2, 3, and 6 to verify that PFAS are not leaving the Site via the storm sewer system at levels above Relevant Criteria. Note that sewer monitoring is currently being conducted in accordance with ongoing sewer modification interim measures (discussed further in Section 5.6), but would be included in the monitoring plan after the completion of the sewer modifications to facilitate long-term monitoring.

Following each sampling event, analytical results would be reviewed to determine if adjustments need to be made to the sampling plan or if other action is appropriate. After five years of monitoring, a comprehensive plume stability analysis would be completed to optimize the monitoring plan and any other aspects of the corrective measure.

Monitored plume stability also includes retaining the existing surface cover (e.g., building slabs, concrete, asphalt) near areas of groundwater impacts to limit infiltration in conjunction with ongoing groundwater monitoring. As discussed in Sections 5.1 and 5.2, Site-wide land/activity use and groundwater use restrictions will include requirements to ensure surface cover is retained and to prohibit activities that interfere with or obstruct access to monitoring wells.

5.4 Exposure Barriers and Targeted Excavations

Exposure barriers have been selected as part of the proposed corrective measures to prevent potential unacceptable risk associated with surface soils. Existing building slabs, pavement, and/or soil below applicable criteria would be used to the extent possible for exposure barriers. Clean soil or gravel would be placed, where needed, to cover surface soils above Relevant Criteria. Execution of an exposure barrier has been completed at Area 5-6 at Plant 6 (Arcadis 2017d) and is in progress at Plants 2 and 3. A Plants 2 and 3 Soil Corrective Measures Summary report (Arcadis 2021h) has been submitted to EGLE. A TSCA plan to address PCB impacts at Plant 2, Area 5-2, and detailing the soil delineation work completed at Plants 2 and 3 and the proposed exposure barriers, is expected to be submitted to EGLE. The following exposure barriers have been implemented or will be implemented as part of the ongoing interim measures work:

- Plant 2, Area 5-2 TSCA exposure barrier for low occupancy (also referred to as a cap per TSCA regulation in Title 40 CFR Section 761.61);
- Plant 2, Area 2 Arsenic exposure barrier;
- Plant 3, Area 14 Cyanide exposure barrier;
- Plant 3, Area 18 Benzo(a)pyrene exposure barrier;
- Plant 3, Area 19 Arsenic exposure barrier; and
- Plant 6, Area 5-6, Lead exposure barrier.

Exposure barriers would be inspected on a routine basis to verify they remain in place and are protective. A DRC would be recorded to include prohibiting the removal, excavation, or other intrusive activity that could disturb or affect the integrity of the exposure barriers, except during short-term construction or repair projects or for purposes of further treating or remediating the subject contamination. Any excavation or other intrusive activity, including removing, altering, or disturbing the exposure barriers, that could affect the integrity of the barrier would need to provide for replacement with a cover that provides at least an equivalent degree of protection as the original barrier. Repair and/or replacement of the exposure

barrier would be required unless additional assessment is conducted that demonstrates an exposure barrier in the area is no longer necessary.

Targeted excavations have been completed at Plant 6 as interim measures to address soils near the property boundary that represented a vapor intrusion and direct contact risk (PME 2016). The Plants 2 and 3 Soil Corrective Measures Summary report (Arcadis 2021h) submitted to EGLE details the soil delineation work completed at Plants 2 and 3 and a proposed targeted excavation. Excavations were completed, or will be completed in the case of Plant 2, Area 2, in the locations listed below:

- Plant 2, Area 2 arsenic in surface soil;
- Plant 6, Area 5-7, completed to address vapor intrusion risk;
- Plant 6, Area 7, completed to address vapor intrusion risk; and
- Plant 6, Area 9, vapor intrusion.

Upon completion of the execution of the remaining exposure barriers and targeted excavation interim measures, all soils with unacceptable risk will have been addressed or will be managed by Site-wide land/activity use restrictions.

Exposure barriers or targeted excavation for soil exceedances of DC criteria and/or Site-specific PSIC at depths greater than 2 feet are not proposed. Notifications of all DC criteria and Site-specific PSIC exceedances in soils deeper than 2 feet will be included in the DRC for the Site. Appendix C includes a summary of each area at Plants 2, 3, and 6 that contains exceedances of DC criteria and/or Site-specific PSIC and therefore requires corrective measures with the proposed corrective measure identified (i.e., exposure barrier or DRC notification).

5.5 Natural Source Zone Depletion

In combination with deed restrictions (including notification of the presence of LNAPL), NSZD has been selected as the proposed corrective measure for LNAPL. NSZD is an appropriate remedy option because the LNAPL is not mobile and is not migrating, and the LNAPL composition does not present an ongoing or unacceptable risk to the underlying bedrock aquifer or offsite vapor intrusion receptors (Arcadis 2020a). NSZD is currently reducing LNAPL volume by an estimated 600 gallons per year (Arcadis 2019b) and is expected to continue providing LNAPL mass reduction. NSZD would be combined with land use restrictions to prevent onsite risks (vapor exposure, construction worker direct contact, soil management, etc.). A cap or cover could potentially be added in Area 5-2 in the future as part of Site redevelopment, but is not required at this time based on the stability of the perched COC concentrations and the biosparge system for the lower 1,4-dioxane plume in the vicinity of the LNAPL.

5.6 Per and Poly-fluoroalkyl Substances

The selected corrective measures for PFAS in groundwater are land/activity and groundwater use restrictions, monitored plume stability, use of a groundwater ordinance, and sewer modifications. Exposure risk associated with PFAS in groundwater can be managed onsite with land and groundwater use restrictions and offsite with a groundwater ordinance. Monitored plume stability will confirm that the controls are protective.

Sewer modifications at Plants 2, 3, and 6 are being implemented as interim measures to address offsite PFAS discharges in the sewers. Bulkheading, catch basin capping, plugging, manhole filling, and structure rehabilitation have been completed to mitigate the offsite discharge of PFOS at concentrations exceeding Relevant Criteria. Details for the completion of these activities are included in the Plants 2, 3, and 6 Sewer Modification Report and the Plants 2 and 6 Sewer Modification Completion Update Report (Arcadis 2021d and 2021g). Sewer monitoring is currently being conducted in accordance with ongoing sewer modification interim measures but would be included in the plume stability monitoring plan after the completion of the sewer modifications to facilitate long-term monitoring.

5.7 Lower 1,4-Dioxane Biosparge

Biosparge is the selected corrective measure for the lower 1,4-dioxane plume. Biosparge systems were installed at Plant 2 and Plant 3 in summer 2020 and fall 2019, respectively, as an interim measure (Arcadis 2021a). Biosparge, in conjunction with land/activity and groundwater use restrictions, is an appropriate corrective measure to meet the CAOs for the lower 1,4-dioxane plume. The lower 1,4-dioxane conceptual site model shows that based on the current onsite concentrations, there is minimal risk that 1,4-dioxane from the Site will migrate offsite to the municipal wells at concentrations exceeding the drinking water standard of 7.2 μg/L (Arcadis 2021b). The long-term goals of the biosparge system are 1) continued protection of the municipal drinking water supply wells by reducing the concentrations/mass of Site-related 1,4-dioxane-impacted groundwater available to migrate offsite laterally in the weathered bedrock zone at concentrations greater than 7.2 ug/L; and 2) reduction of the potential for migration of 1,4-dioxane downward substantially into less weathered bedrock. The biosparge remedy is being implemented with the short-term goal to reduce concentrations/mass of Site-related 1,4-dioxane along the core of the lower 1,4-dioxane weathered bedrock plume.

Current performance data indicate that the full-scale biosparge system has been successful at meeting the short-term objectives (Arcadis 2021c). During operation of the biosparge system, performance results will continue to be reviewed to determine if adjustments need to be made to the operation of the system to optimize treatment. RACER Trust will update EGLE on the performance of the biosparge system in ongoing meetings and will submit annual biosparge performance reports. After three years of operation, performance results would be evaluated to determine whether the system, or any portion of the system, has sufficiently met the long-term objectives or if the system has met the point of diminishing returns, such point to be agreed upon with EGLE.

5.8 Reporting and Five-Year Review

Reporting associated with ongoing monitoring, implementation of interim measures, and operation of the biosparge system will continue as agreed upon with EGLE. A five-year review will be conducted following implementation of the selected corrective measures. The effectiveness of the selected corrective measures will be reviewed to verify and optimize performance. The five-year review may include, but is not limited to, the following:

- Evaluation of infiltration management to determine if it is effective and/or necessary in all areas to meet the CAOs.

- Review of the exposure barrier inspection and maintenance plan.
- Review of storm sewer monitoring to determine if ongoing sampling is required.
- Evaluation to determine if Site redevelopment has or will result in changes to the Site-wide corrective measures and/or objectives.
- Assessment of the groundwater monitoring plan to determine if the frequency, analytes, and/or number of wells can be optimized during future routine sampling events.
- Review of biosparge performance results to evaluate whether the system, or any portion of the system, has sufficiently met the long-term objectives or if the system has met the point of diminishing returns, as agreed upon with EGLE.

If, during routine reporting or in the five-year review, data suggest that the selected corrective measures are not protective, contingency measures will be considered. Further evaluation of corrective measures included in this CMS Report or other measures identified as potentially applicable may be completed, as needed. Additional evaluation and pre-design activities may be required to determine the appropriate corrective measure(s).

6 Schedule

If necessary, a Corrective Measures Implementation Work Plan (or plans, as determined appropriate) will be submitted to EGLE within 90 days of approval of the corrective measures alternative. The work plan(s) will include more detailed descriptions of implementation activities and associated schedules.

7 References

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Arcadis. 2021b. Lower 1,4-Dioxane Conceptual Site Model – Draft, RACER Lansing Industrial Land, Lansing, Michigan. January 6.

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Arcadis. 2021f. 2020 Annual Groundwater Monitoring Report, RACER Trust Industrial Land, Landing, Michigan. May 6.

Arcadis. 2021g. Plants 2 and 6 Sewer Modification Completion Update Report, RACER Trust, Lansing, Michigan. September.

Arcadis. 2021h. Plants 2 & 3 Soil Corrective Measures Summary, RACER Trust Lansing Industrial Land MID 980 700 827 and MID 005 356 928, Lansing, Michigan. December.

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Tables

Table 1
Corrective Action Objectives
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Environmental Media	Human Health Residential	Human Health Non- Residential
Groundwater	Mitigate exposure to drinking water containing Site-caused and related COCs above drinking water critieria	Mitigate exposure to drinking water containing Site-caused and related COCs above drinking water critieria
Soil	N/A	Mitigate exposure to soil containing Site-caused and related COCs above relevant non-residential critieria
Surface Water	N/A	N/A
Air (Indoor)	Mitigate VI into current and potential future occupied structures at concentrations greater than those protective of human health	Mitigate VI into current and potential future occupied structures at concentrations greater than those protective of human health
LNAPL	N/A	Mitigate unacceptable exposure to LNAPL

Table 2
Corrective Measures Alternatives Screening Matrix

RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Media and Location	Area	Summary of Applicable Exceedances	Corrective Measures Evaluated	Protective of Human Health and the Environment (Yes/No)	Attain Media Cleanup Objectives (Yes/No)	Control the Source or Demonstrate Plume Stability (Yes/No)
Site Wide Plants 2, 3, and 6	Site Wide	SOIL: VOCs > DWP, GSIP, and SSVIAC SVOCs > DWP, GSIP and SSVIAC Metals > DWP, GSIP, and SSVIAC (Mercury only) PFAS > GSIP	**Site-Wide Corrective Measures**:			
			Land and Activity Use Restriction	Yes	No	No
			Groundwater Use Restriction	Yes	No	No
			Monitored Plume Stability	Yes	Yes	Yes
			Hydraulic Control	Yes	Yes	Yes
		GW: VOCs > DW, GSI, and SSVIAC SVOCs > DW and GSI Metals > DW and GSI PCBs > DW	**Site-Wide Corrective Measures:**			
			Land and Activity Use Restriction	Yes	No	No
			Groundwater Use Restriction	Yes	No	No
			Monitored Plume Stability	Yes	Yes	Yes
			Hydraulic Control	Yes	Yes	Yes
Soil Plants 2, 3 and 6	Area 2, 5-1, 5-2, 5-3, 5-6, 14, 16, 18, 19, 20, 21	SOIL: SVOCs > DC PCBs > DC Metals > DC and PSIC	**Soil Corective Measures**			
			Land and Activity Use Restriction	Yes	No	No
			Groundwater Use Restriction	Yes	No	No
			Monitored Plume Stability	Yes	Yes	Yes
			Hydraulic Control	Yes	Yes	Yes
			Exposure Barriers	Yes	Yes	Yes
			Targeted Excavation	Yes	Yes	Yes
LNAPL Plants 2 and 3	Area 5-2 and 17	LNAPL: Present	**LNAPL Corrective Measures**			
			Land and Activity Use Restriction	Yes	No	No
			Groundwater Use Restriction	Yes	No	No
			Monitored Plume Stability	Yes	Yes	Yes
			Hydraulic Control	Yes	Yes	Yes
			Natural Source Zone Depletion	Yes	Yes	Yes
			Cap	Yes	Yes	Yes
			Excavation	Yes	Yes	Yes
			LNAPL Recovery via Active Skimming	Yes	Yes	Yes
			In-Situ Stabilization	Yes	Yes	Yes
			Soil-Vapor Extraction	Yes	Yes	Yes
			Multiphase Extraction	Yes	Yes	Yes

Table 2
Corrective Measures Alternatives Screening Matrix

RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Media and Location	Area	Summary of Applicable Exceedances	Corrective Measures Evaluated	Protective of Human Health and the Environment (Yes/No)	Attain Media Cleanup Objectives (Yes/No)	Control the Source or Demonstrate Plume Stability (Yes/No)
PFAS (GW) Plants 2, 3, and 6	NA	GW: PFAS > DW and GSI	**PFAS Corrective Measures**			
			Land and Activity Use Restriction	Yes	No	No
			Groundwater Use Restriction	Yes	No	No
			Monitored Plume Stability	Yes	Yes	Yes
			Hydraulic Control	Yes	Yes	Yes
			Groundwater Ordinance	Yes	No	No
			Sewer Modifications[1]	Yes	No	No
			Cap	Yes	Yes	Yes
			PRB	Yes	Yes	Yes
			In-Situ Stabilization	Yes	Yes	Yes
Lower 1,4-Dioxane Plants 2 and 3	NA	GW: 1,4-dioxane > DW and GSI	**Lower 1,4-Dioxane Corrective Measures**			
			Land and Activity Use Restriction	Yes	No	No
			Groundwater Use Restriction	Yes	No	No
			Monitored Plume Stability	Yes	Yes	Yes
			Hydraulic Control	Yes	Yes	Yes
			Biosparging	Yes	Yes	Yes

Notes:

1. Sewer modifications effectively address the GSI pathway.

Acronyms and Abbreviations:
> = greater than
DC = Direct Contact Criteria
DW = Residential Drinking Water Criteria
DWP = Drinking Water Protection Criteria
GSI = Groundwater/Surface Water Interface
GSIP = Groundwater/Surface Water Interface Protection
GW = groundwater
LNAPL = light non-aqueous phase liquid
NA = Not Applicable
PCB = polychlorinated biphenyl
PFAS = per- and polyfluoroalkyl substances
PSIC = Particulate Soil Inhalation Criteria
SSVIAC = Site Specific Volatilization to Indoor Air Inhalation Criteria
SVOC = semivolatile organic compound
VOC = volatile organic compound

Table 3A
RCRA Balancing Criteria Screening: Site Wide Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost[3]				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation	Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Proposed Corrective Measure?	
Land and Activity Use Restrictions	Land and Activity Use Restrictions: Includes limiting future use of the Site to commercial and/or industrial, Site-wide contaminated soil management, Site-wide vapor intrusion exposure restrictions, subgrade utility restrictions, and health and safety requirements for intrusive activities[5].	E	NE	E	I	I	I	$	$	S	Yes	
Groundwater Use Restrictions	Groundwater Use Restrictions: Includes prohibiting the construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose, with the exception of evaluating groundwater, remediation of subsurface contamination, or short-term dewatering for construction purposes.	E	NE	E	I	I	I	$	$	S	Yes	
Monitored Plume Stability	Implementation of a Site-wide monitoring program that provides the data to continue to verify plume stability (perched and lower groundwater plumes). In addition, surface cover will be retained (e.g., building slabs, asphalt, concrete) near soil and groundwater impacts to minimize infiltration and maximize the potential for the perched groundwater plume to remain stable and on site.	SE	SE	E	I	I	I	$	$$	S	Yes	

Table 3A
RCRA Balancing Criteria Screening: Site Wide Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Legend:

Effectiveness Codes:

E	Effective
SE	Somewhat Effective
NE	Not Effective

Implementability Codes:

I	Implementable
SI	Somewhat Implementable
NI	Not Implementable

Cost Codes:

$	Relatively Low Cost
	Up to $500K capital, <$100K annual
$$	Relatively Moderate Cost
	$500K-$2M capital, $100K-$300K annual
$$$	Relatively High Cost
	Greater than $2M capital, greater than $300K annual

Sustainability Codes:

S	Sustainable
SS	Somewhat Sustainable
NS	Not Sustainable

Notes:
1. Effectiveness refers to the alternative's ability to handle the estimated areas or volumes of media and the remedial goal. It also considers potential impacts to human health and the environment during construction/implementation; and how proven/reliable the process is with respect to the contaminants and site conditions.
2. Institutional Implementability includes the ability to obtain necessary permits and access agreements; contract off-site treatment/storage/disposal; obtain specialized equipment; and hire skilled workers as needed. Technical Practicability refers to implementation given site-specific hydrogeologic (etc.) constraints.
3. Current hydraulic control has been evaluated under the worse-case scenario that the perched plume does not remain stable. Actual implementation of hydraulic control would be limited to areas with plume(s) that are not stable.
4. Health and safety requirements for intrusive activities are required Site-wide. Subgrade feature restrictions are required in Areas 2, 5-1, 5-2, 5-5, 5-6, 5-8, and 17, but as a conservative measure will be required site-wide.

Table 3B
RCRA Balancing Criteria Screening: Soil Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost[3]				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation	Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Proposed Corrective Measure?	
Land and Activity Use Restrictions	Land and Activity Use Restrictions: Includes limiting future use of the Site to commercial and/or industrial, Site-wide contaminated soil management, Site-wide vapor intrusion exposure restrictions, subgrade utility restrictions, and health and safety requirements for intrusive activities[5].	E	NE	E	I	I	I	$	$	S	Yes	
Exposure Barriers	An exposure barrier would be implemented to cover DC soil exceedances. The exposure barrier would be constructed using clean surface cover (soil or gravel) or existing cover (concrete or asphalt). An RC would be filed with the deed prohibiting the removal of the exposure barriers and require inspections and maintenance of the exposure barriers.	E	NE	E	I	SI	I	$	$	SS	Yes	
Targeted Excavations	Targeted excavations would be completed to remove soils exceeding DC. Excavated soils would be transported and disposed in accordance with applicable requirements of RCRA and all other relevant state and federal laws.	E	E	E	I	I	I	$$	$	NS	Yes	

Table 3B
RCRA Balancing Criteria Screening: Soil Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Legend:

Effectiveness Codes:

E	Effective
SE	Somewhat Effective
NE	Not Effective

Implementability Codes:

I	Implementable
SI	Somewhat Implementable
NI	Not Implementable

Cost Codes:

$	Relatively Low Cost
	Up to $500K capital, <$100K annual
$$	Relatively Moderate Cost
	$500K-$2M capital, $100K-$300K annual
$$$	Relatively High Cost
	Greater than $2M capital, greater than $300K annual

Sustainability Codes:

S	Sustainable
SS	Somewhat Sustainable
NS	Not Sustainable

Notes:
1. Effectiveness refers to the alternative's ability to handle the estimated areas or volumes of media and the remedial goal. It also considers potential impacts to human health and the environment during construction/implementation; and how proven/reliable the process is with respect to the contaminants and site conditions.
2. Institutional Implementability includes the ability to obtain necessary permits and access agreements; contract off-site treatment/storage/disposal; obtain specialized equipment; and hire skilled workers as needed. Technical Practicability refers to implementation given site-specific hydrogeologic (etc.) constraints.
3. Excavation volumes are rounded estimates.

Table 3C
RCRA Balancing Criteria Screening: Groundwater Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost[3]				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation	Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Proposed Corrective Measure?	
Land and Activity Use Restrictions	Land and Activity Use Restrictions: Includes limiting future use of the Site to commercial and/or industrial, Site-wide contaminated soil management, Site-wide vapor intrusion exposure restrictions, subgrade utility restrictions, and health and safety requirements for intrusive activities[5].	E	NE	E	I	I	I	$	$	S	Yes	
Groundwater Use Restrictions	Groundwater Use Restrictions: Includes prohibiting the construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose, with the exception of evaluating groundwater, remediation of subsurface contamination, or short-term dewatering for construction purposes.	E	NE	E	I	I	I	$	$	S	Yes	
Monitored Plume Stability	Implementation of a Site-wide monitoring program that provides the data to continue to verify plume stability (perched and lower groundwater plumes). In addition, surface cover will be retained (e.g., building slabs, asphalt, concrete) near soil and groundwater impacts to minimize infiltration and maximize the potential for the perched groundwater plume to remain stable and on site.	SE	SE	E	I	I	SI	$	$$	S	Yes	
Hydraulic Control	Hydraulic control (i.e., pump and treat) is composed of pumping wells located near the property boundaries to prevent off-site migration of source mass. Extracted groundwater would be treated with an above-grade system, and treated water would be discharged to a POTW or surface water body.	NE	SE	NE	NI	I	I	$$$	$$$	NS	No	

Table 3C
RCRA Balancing Criteria Screening: Groundwater Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Legend:

Effectiveness Codes:	E	Effective
	SE	Somewhat Effective
	NE	Not Effective
Implementability Codes:	I	Implementable
	SI	Somewhat Implementable
	NI	Not Implementable
Cost Codes:	$	Relatively Low Cost Up to $500K capital, <$100K annual
	$$	Relatively Moderate Cost $500K-$2M capital, $100K-$300K annual
	$$$	Relatively High Cost Greater than $2M capital, greater than $300K annual
Sustainability Codes:	S	Sustainable
	SS	Somewhat Sustainable
	NS	Not Sustainable

Notes:
1. Effectiveness refers to the alternative's ability to handle the estimated areas or volumes of media and the remedial goal. It also considers potential impacts to human health and the environment during construction/implementation; and how proven/reliable the process is with respect to the contaminants and site conditions.
2. Institutional Implementability includes the ability to obtain necessary permits and access agreements; contract off-site treatment/storage/disposal; obtain specialized equipment; and hire skilled workers as needed. Technical Practicability refers to implementation given site-specific hydrogeologic (etc.) constraints.
3. Current hydraulic control has been evaluated under the worse-case scenario that the perched plume does not remain stable. Actual implementation of hydraulic control would be limited to areas with plume(s) that are not stable.
4. Health and safety requirements for intrusive activities are required Site-wide. Site-wide subsurface feature restrictions will address Areas 2, 5-1, 5-2, 5-5, 5-6, 5-8, and 17, but as a conservative measure will be required site-wide.

Table 3D
RCRA Balancing Criteria Screening: LNAPL Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost[3]				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation		Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Proposed Corrective Measure?
Land and Activity Use Restrictions	Land and Activity Use Restrictions: Includes limiting future use of the Site to commercial and/or industrial, Site-wide contaminated soil management, Site-wide vapor intrusion exposure restrictions, subgrade utility restrictions, and health and safety requirements for intrusive activities.	E	NE	E	I	I	I	$	$	S	Yes	
Natural Source Zone Depletion	NSZD consists of a combination of processes, including dissolution, volatilization, and biodegradation, that reduce the mass of LNAPL in subsurface systems. NSZD is currently degrading LNAPL at the site at an estimated rate of 600 gallons per year. NSZD would be combined with restrictive covenant with land and activity use restrictions.	E	E	E	I	LI	LI	$	$	S	Yes	
Impermeable Cap	A cap would be implemented to cover the LNAPL plume (135,000 ft^2) [4]. In the area where the existing building slab covers the LNAPL plume, the building slab would serve as the cap (100,000 ft^2). The existing building slab would be extended over the remaining green space over the LNAPL footprint to prevent exposure and limit infiltration (35,000 ft^2). A restrictive covenant would be filed with the deed prohibiting the removal of the cap and requiring inspections and maintenance of the cap.	LE	NE	LE	I	I	I	$$	$	LS	No	
LNAPL Recovery (Skimmers)	LNAPL skimming would involve installation of skimmers (belt skimmers or skimmer pumps) in permanent recovery wells to remove free-phase LNAPL that collected in wells. LNAPL would be transferred to an above-grade storage tank or drummed and removed and disposed of in accordance with applicable requirements of RCRA and all other relevant state and federal laws.	NE	NE	NE	LI	I	I	$	$	NS	No	

Table 3D
RCRA Balancing Criteria Screening: LNAPL Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost[3]				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation		Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Proposed Corrective Measure?
Excavation	Excavation would be completed to remove LNAPL; excavated LNAPL-impacted soils would be transported and disposed of in accordance with applicable requirements of RCRA and all other relevant state and federal laws.	SE	E	E	NI	I	I	$$$	$	NS		No
SVE	SVE would involve installation of extraction wells to volatilize and extract vapor-phase contaminants, and enhanced aerobic degradation of the LNAPL. Extracted soil vapor would be treated with an above-grade system and would be discharged to the atmosphere.	NE	SE	NE	NI	I	I	$$	$$	NS		No
MPE	MPE would involve recovery of LNAPL and perched groundwater by pumping or high vacuum extraction. Soil vapor would also be removed to enhance recovery of the LNAPL and promote volatilization and aerobic biodegradation where applicable. Extracted soil vapor would be treated with an above-grade system and discharged to the atmosphere. Extracted groundwater would be treated with an above-grade system and discharged to a POTW or surface water body. LNAPL would be separated from groundwater in an above-grade system, transferred to an above-grade storage tank, and removed and disposed in accordance with applicable requirements of RCRA and all other relevant state and federal laws.	NE	SE	NE	NI	I	I	$$	$$	NS		No
In-Situ Soil Stabilization	ISS would be implemented within the footprint of the LNAPL mass at Plant 2 and/or Plant 3. ISS would prevent further infiltration to the source area and immobilize LNAPL. ISS area would be covered with topsoil and seeded.	NE	NE	NE	SI	I	I	$$$	$	NS		No

Table 3D
RCRA Balancing Criteria Screening: LNAPL Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Legend:

Effectiveness Codes:

E	Effective
SE	Somewhat Effective
NE	Not Effective

Implementability Codes:

I	Implementable
SI	Somewhat Implementable
NI	Not Implementable

Cost Codes:

$	Relatively Low Cost Up to $500K capital, <$100K annual
$$	Relatively Moderate Cost $500K-$2M capital, $100K-$300K annual
$$$	Relatively High Cost Greater than $2M capital, greater than $300K annual

Sustainability Codes:

S	Sustainable
SS	Somewhat Sustainable
NS	Not Sustainable

Notes:
1. Effectiveness refers to the alternative's ability to handle the estimated areas or volumes of media and the remedial goal. It also considers potential impacts to human health and the environment during construction/implementation; and how proven/reliable the process is with respect to the contaminants and site conditions.
2. Institutional Implementability includes the ability to obtain necessary permits and access agreements; contract off-site treatment/storage/disposal; obtain specialized equipment; and hire skilled workers as needed. Technical Practicability refers to implementation given site-specific hydrogeologic (etc.) constraints.
3. Excavation volumes are rounded estimates.

Table 3E
RCRA Balancing Criteria Screening: PFAS Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost[3]				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation	Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Proposed Corrective Measure?	
Land and Activity Use Restrictions	Land and ActivityUse Restrictions: Includes limiting future use of the Site to commercial and/or industrial, Site-wide contaminated soil management, Site-wide vapor intrusion exposure restrictions, subgrade utility restrictions, and health and safety requirements for intrusive activities[5].	E	NE	E	I	I	I	$	$	S	Yes	
Groundwater Use Restrictions	Groundwater Use Restrictions: Includes prohibiting the construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose, with the exception of evaluating groundwater, remediation of subsurface contamination, or short-term dewatering for construction purposes.	E	NE	E	I	I	I	$	$	S	Yes	
Groundwater Ordinance	Groundwater Use Restrictions: Includes prohibiting the construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose, with the exception of evaluating groundwater, remediation of subsurface contamination, or short-term dewatering for construction purposes.	E	NE	E	I	LI	I	$	$	S	Yes	
Monitored Plume Stability	Implementation of a Site-wide monitoring program that provides the data to continue to verify plume stability (perched and lower groundwater plumes). In addition, surface cover will be retained (e.g., building slabs, asphalt, concrete) near soil and groundwater impacts to minimize infiltration and maximize the potential for the perched groundwater plume to remain stable and on site.	SE	SE	E	I	I	LI	$	$$	S	Yes	
Sewer Modifications[3]	The sewer system at all three plants wouldl be sampled to identify the source of PFAS impacted water infiltrating the system. Sections of the sewer system would then be abandoned via concrete monolith installation, bulkhead installation, pipe plugging, and/or structure filling. All catch basins draining into the abandoned system would be capped to prevent further infiltration.	SE	SE	E	I	I	I	$$	$	SS	Yes	

Table 3E
RCRA Balancing Criteria Screening: PFAS Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Effectiveness[1]	Technical Implementation	Community Acceptance	Implementability[2]	State Acceptance	Capital Cost	Cost[3]	Maintenance Cost	Sustainability	Proposed Corrective Measure?
Cap	A cap would be implemented to prevent infiltration to the PFAS plume source area (90,000 ft^2). In the area where the existing building slab covers the PFAS source area, the building slab would serve at the cap (63,000 ft^2). Asphalt pavement would be implemented over the remaining green space over the PFAS source area footprint to prevent infiltration (27,000 ft^2). Cap could be constructed out of various materials. Asphalt was selected based on cost and a timeframe of 5 yrs - assuming redevelopment will be completed in that timeframe and the area will be paved and/or built over during redevelopment.	SE	NE	SE		I	I	I		$	$	SS	No
Permeable Reactive Barrier (PRB)	The objective of a PRB system would be to prevent impacted groundwater from migrating offsite to the east (Plant 3) and east and north (Plant 6). PRB would involve the installation of a barrier wall and gates to treat groundwater as it passes through the gates. Routine O&M would be required to inspect the wall and replace treatment media in the gates.	NE	SE	SE		SI	I	SI		$$$	$	SS	No
In-Situ Soil Stabilization	ISS would be implemented to address the PFAS plume source area (90,000 ft^2). ISS would prevent further infiltration to the source area. ISS area would be covered with topsoil and seeded.	SE	NE	SE		NI	I	I		$$$	$	NS	No

Table 3E
RCRA Balancing Criteria Screening: PFAS Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Legend:

Effectiveness Codes:

E	Effective
SE	Somewhat Effective
NE	Not Effective

Implementability Codes:

I	Implementable
SI	Somewhat Implementable
NI	Not Implementable

Cost Codes:

$	Relatively Low Cost Up to $500K capital, <$100K annual
$$	Relatively Moderate Cost $500K-$2M capital, $100K-$300K annual
$$$	Relatively High Cost Greater than $2M capital, greater than $300K annual

Sustainability Codes:

S	Sustainable
SS	Somewhat Sustainable
NS	Not Sustainable

Notes:
1. Effectiveness refers to the alternative's ability to handle the estimated areas or volumes of media and the remedial goal. It also considers potential impacts to human health and the environment during construction/implementation; and how proven/reliable the process is with respect to the contaminants and site conditions.
2. Institutional Implementability includes the ability to obtain necessary permits and access agreements; contract off-site treatment/storage/disposal; obtain specialized equipment; and hire skilled workers as needed. Technical Practicability refers to implementation given site-specific hydrogeologic (etc.) constraints.
3. Sewer modifications effectively address the GSI pathway. Sewer modification do not address site exposure risks, plume stability, or cleanup objectives.

Table 3F
RCRA Balancing Criteria Screening: Lower 1,4-Dioxane Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Remedial Option	Description	Effectiveness[1]			Implementability[2]			Cost				
		Long-Term Reliability and Effectiveness	Reduction of Toxicity, Mobility, or Volumes of Waste	Short-Term Effectiveness	Technical Implementation	Community Acceptance	State Acceptance	Capital Cost	Maintenance Cost	Sustainability	Retain for Consideration?	
Groundwater Use Restrictions	Groundwater Use Restrictions: Includes prohibiting the construction and use of wells or other devices on the Site to extract groundwater for consumption, irrigation, or any other purpose, with the exception of evaluating groundwater, remediation of subsurface contamination, or short-term dewatering for construction purposes.	E	NE	E	I	I	I	$	$	S	Yes	
Monitored Plume Stability	Implementation of a Site-wide monitoring program that provides the data to continue to verify plume stability (perched and lower groundwater plumes). In addition, surface cover will be retained (e.g., building slabs, asphalt, concrete) near soil and groundwater impacts to minimize infiltration and maximize the potential for the perched groundwater plume to remain stable and on	SE	SE	E	I	I	SI	$	$$	S	Yes	
Biosparge	The remedy consists of injection of propane, oxygen, and bacterial enhancements into the lower aquifer via injection wells to promote in-situ biodegradation of 1,4-dioxane. The system would consist of a network of vertical injection wells, and mechanical components including air compressors, compressed gas, manifold piping, valves and instrumentation.	E	E	E	I	I	I	$$	$$	S	Yes	
Hydraulic Control	Hydraulic control (i.e., pump and treat) is composed of pumping wells located near the property boundaries to prevent off-site migration of source mass. Extracted groundwater would be treated with an above-grade system, and treated water would be discharged to a POTW or surface water body.	NE	E	NE	NI	I	I	$$$	$$$	NS	No	

Table 3F
RCRA Balancing Criteria Screening: Lower 1,4-Dioxane Corrective Measures
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

Legend:

Effectiveness Codes:

E	Effective
SE	Somewhat Effective
NE	Not Effective

Implementability Codes:

I	Implementable
SI	Somewhat Implementable
NI	Not Implementable

Cost Codes:

$	Relatively Low Cost
	Up to $500K capital, <$100K annual
$$	Relatively Moderate Cost
	$500K-$2M capital, $100K-$300K annual
$$$	Relatively High Cost
	Greater than $2M capital, greater than $300K annual

Sustainability Codes:

S	Sustainable
SS	Somewhat Sustainable
NS	Not Sustainable

Notes:
1. Effectiveness refers to the alternative's ability to handle the estimated areas or volumes of media and the remedial goal. It also considers potential impacts to human health and the environment during construction/implementation; and how proven/reliable the process is with respect to the contaminants and site conditions.
2. Institutional Implementability includes the ability to obtain necessary permits and access agreements; contract off-site treatment/storage/disposal; obtain specialized equipment; and hire skilled workers as needed. Technical Practicability refers to implementation given site-specific hydrogeologic (etc.) constraints.
3. Current hydraulic control has been evaluated under the worse-case scenario that the perched plume does not remain stable. Actual implementation of hydraulic control would be limited to areas with plume(s) that are not stable.
4. Health and safety requirements for intrusive activities are required Site-wide. Site-wide subsurface feature restrictions will address Areas 2, 5-1, 5-2, 5-5, 5-6, 5-8, and 17, but as a conservative measure will be required site-wide.

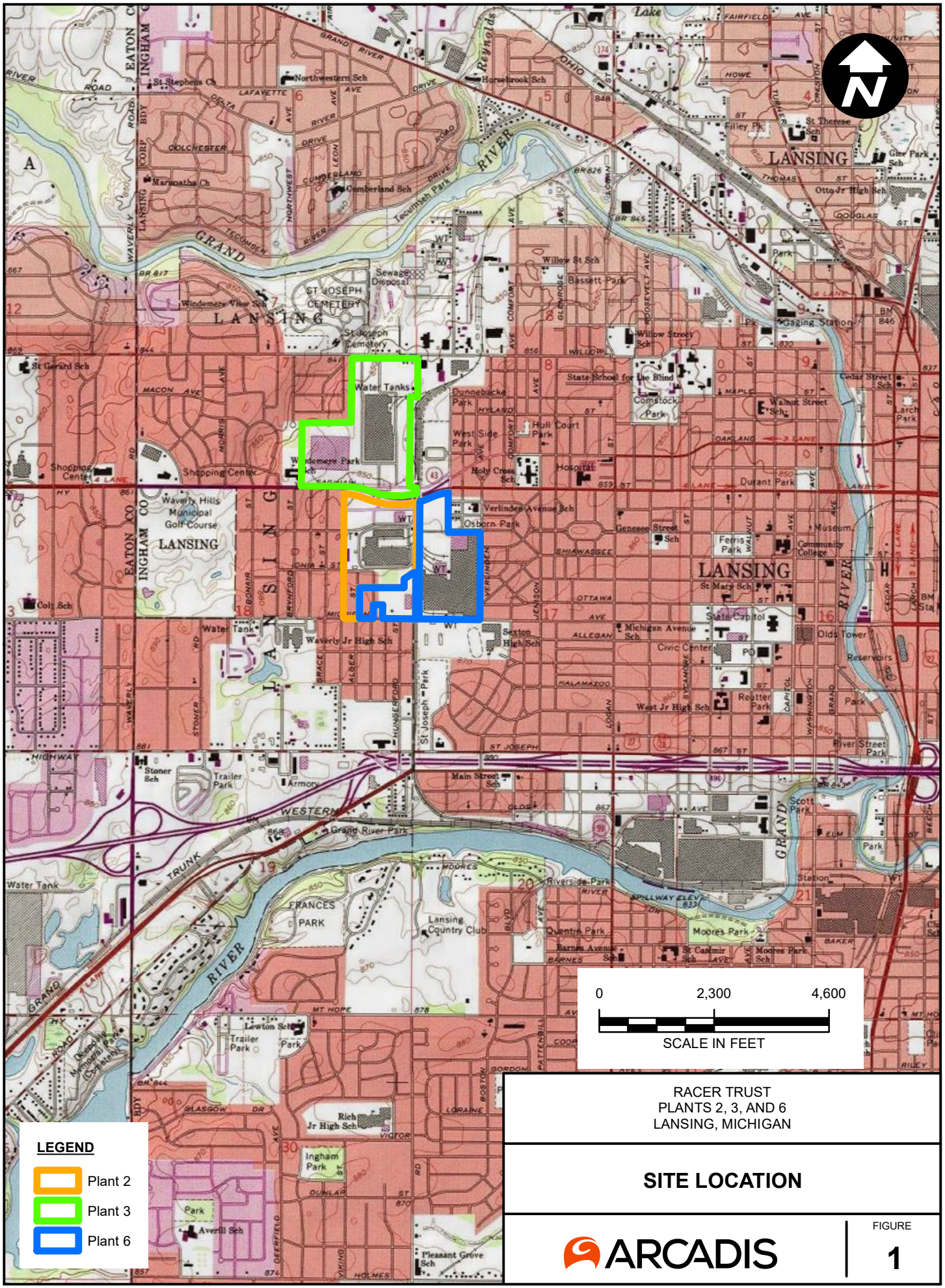
Table 4
Proposed Final Corrective Measures Alternative for Soil, Groundwater, and LNAPL
RCRA Corrective Action Corrective Measures Study
RACER Plants 2, 3, and 6
Lansing, Michigan

			TOTAL COST [1,2]
Land and Activity Use Restrictions			**$20,000**
Groundwater Use Restrictions			**$20,000**
Groundwater Ordinance			**$75,000**
Monitored Plume Stability			
Groundwater Monitoring (non-PFAS and 1,4-Dioxane)	=	$475,000	**$3,980,000**
Groundwater Monitoring PFAS	=	$2,400,000	
Groundwater Monitoring 1,4-Dioxane	=	$1,100,000	
Exposure Barriers - Inspect and Maintain			**$122,000**
Targeted Excavation - Complete			**$0**
NSZD			**$0**
PFAS Sewer Modifications			**$1,000,000**
Biosparge - O&M and Decommission			**$3,000,000**
		GRAND TOTAL	**$8,217,000**

Notes:
1. All cost estimates presented have been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the Site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within –30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended.
2. Estimated costs begin in year 2023 and go through 2051

Acronyms and Abbreviations:
O&M = operation and maintenance

Figures



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

SITE LOCATION

ARCADIS

FIGURE
1

CITY: KNOXVILLE DIV: ENV DB: A.SMITH PIC: J.BARRETT PM: T.LINDER TM: A.LORENZ TR: J.SALING PROJECT NUMBER: 30075941 COORDINATE SYSTEM: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl
T:_ENV\RACER\BuffaloMXDs\2021 CMS Report Updates\FIG 1 - SITE LOCATION.mxd PLOTTED: 7/13/2021 2:11:06 PM BY: Dressback

AREA 13

AREA 12

AREA 18

AREA 14

AREA 17

AREA 20

AREA 21

AREA 11

AREA 15

AREA 19

AREA 16

NOTES:

ADDITIONAL PROPOSED CORRECTIVE MEASURES FOR PLANTS 2, 3, AND 6 INCLUDE SITE-WIDE LAND, ACTIVITY, AND GROUNDWATER USE RESTRICTIONS.

PLUME STABILITY WILL BE MONITORED THROUGH THE IMPLEMENTATION OF A MONITORING PROGRAM. INFILTRATION MANAGEMENT AREAS WILL BE ESTABLISHED TO MINIMUZE INFILTRATION IN IMPACTED SOURCE AREAS THAT COULD ADVERSELY AFFECT GROUNDWATER.

RFI: RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION
VOCs: VOLATILE ORGANIC COMPOUNDS
LNAPL: LIGHT NON-AQUEOUS PHASE LIQUID

AREA 3

AREA 8

AREA 5-4

AREA 5-1

AREA 4

AREA 5-5

AREA 5-2

AREA 5-3

AREA 2

AREA 5-7

AREA 5-6

AREA 5-8

AREA 10

COMBINED TARGETED EXCAVATION AND COVER

AREA 1

AREA 9

AREA 6

AREA 7

0 400 800

SCALE IN FEET

LEGEND

- RFI PHASE 2 INVESTIGATION AREA
- COMPLETED OR PROPOSED EXPOSURE BARRIER
- AREA TO RETAIN SLAB OVER LNAPL/VOC SOURCE AREAS
- COMPLETED OR PROPOSED EXCAVATED AREA
- PLANT PROPERTY BOUNDARY
- BIOSPARGE SYSTEM BUILDING AND ASSOCIATED FENCED SUPPORT AREA
- TSCA LOW OCCUPANCY
- BIOSPARGE WELL
- HOSE CORRIDOR

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

COMPLETED INTERIM MEASURES AND PROPOSED CORRECTIVE MEASURES

ARCADIS

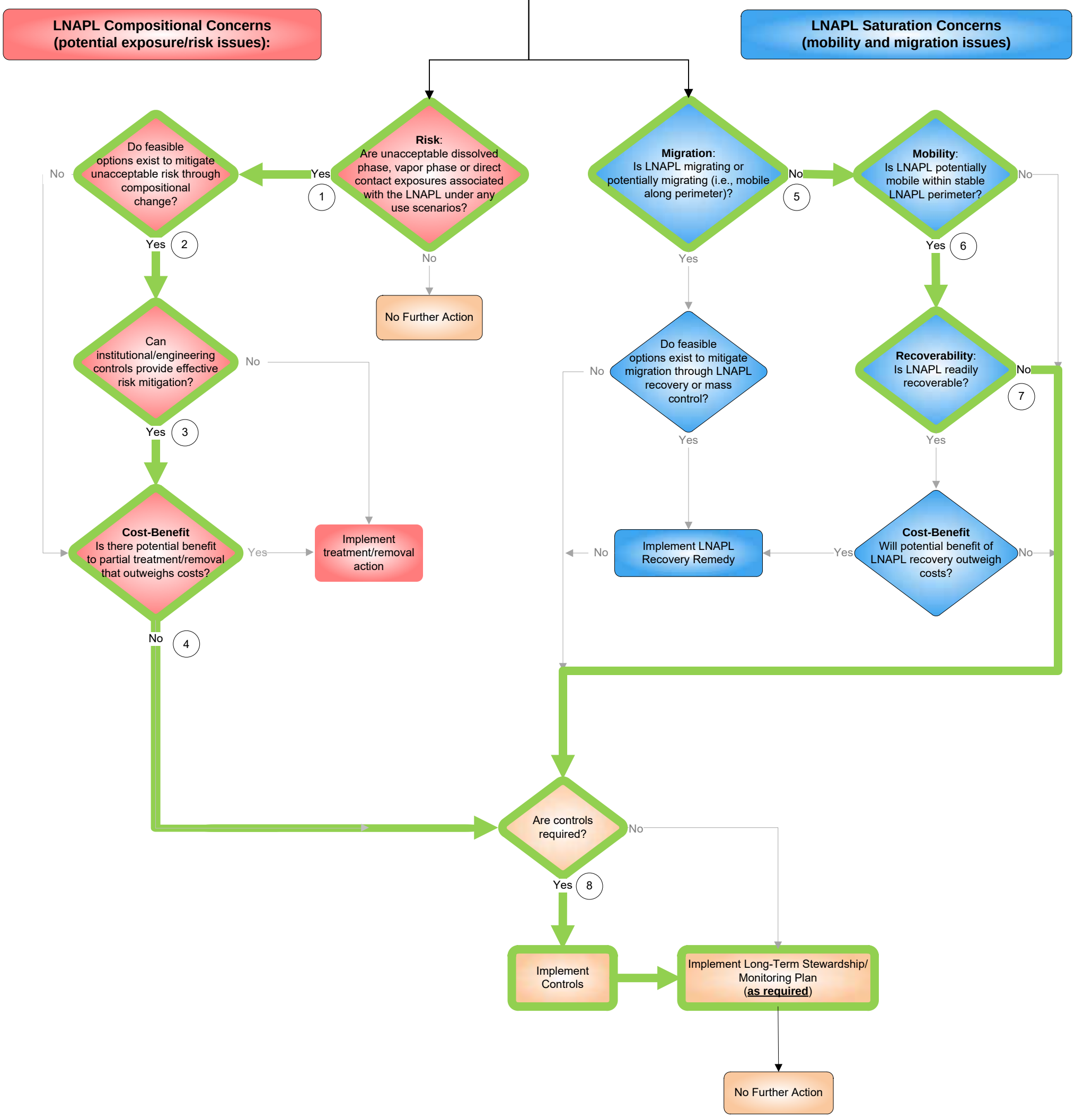
FIGURE
2

CITY: BRIGHTON DIV: ENV DB: D. OLEXA PIC: CHRIS PETERS PM: AMY HOEKSEMA TM: RANDY CHRISTENSEN TR: JACKIE SALING PROJECT NUMBER: B0064479.2013 COORDINATE SYSTEM: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl
T:_ENV\RACER\Buffalo\MXDs\2021 CMS Report Updates\FIG ES-1 - Corrective Measures Summary.mxd PLOTTED: 1/4/2022 2:24:50 PM BY: MJoye

Appendix A

Area 5-2 LNAPL Conceptual Site Model Decision Tree

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



(#) NOTES: See next page

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.

- 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).

- 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.

- 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 1.0×10^{-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, fifteen 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:
     - 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.

REFERENCES :

Arcadis 2020. Plant 2 LNAPL Conceptual Site Model. RACER Lansing Industrial Land, Lansing, Michigan. February 12.

ASTM International. 2006. Standard Guide for Development of Conceptual Site Models and Remediation Strategies for Light Nonaqueous-Phase Liquids Released to the Subsurface. Document: E 2531-06.

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Lundegard, P.D., and P.C. Johnson. 2006. Source zone natural attenuation at petroleum hydrocarbon spill Sites-II: application to a former oil field. Ground Water Monitoring and Remediation 26, no. 4: 93–106.

Sihota, N.J., O. Singurindy, and K.U. Mayer, 2011. CO2-Efflux Measurements for Evaluating Source Zone Natural Attenuation Rates in a Petroleum Hydrocarbon Contaminated Aquifer, Environ. Sci. Technol., 45:482-488.

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

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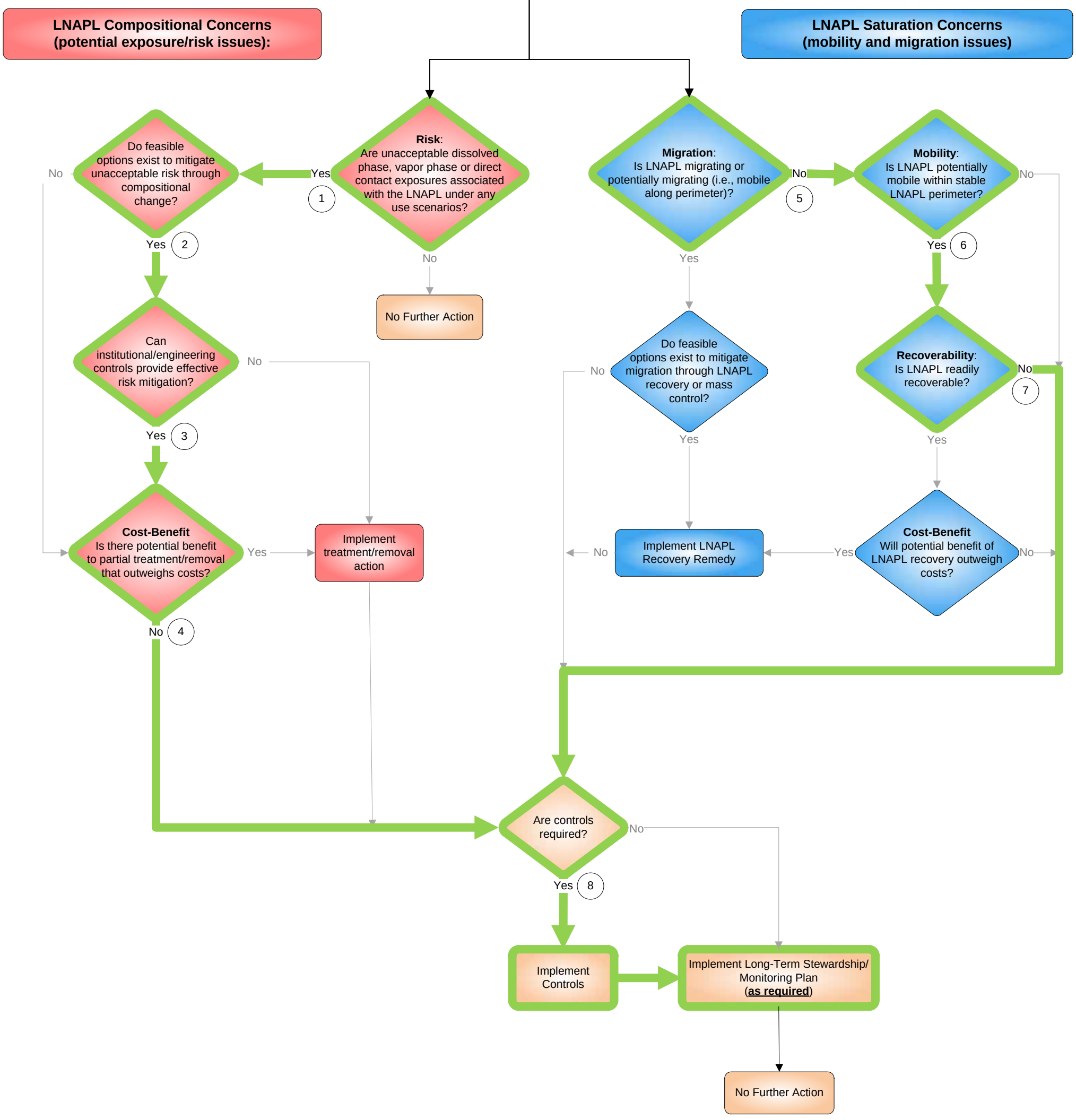
Appendix B

Area 17 LNAPL Conceptual Site Model Decision Tree

Attachment 1
LNAPL Remedial Decision Tree
Plant 3: Area 17



(#) Notes: See next page

APPENDIX B

LNAPL REMEDIATION DECISION TREE

RACER Trust Lansing Industrial Land, Plant 3, Area 17, Lansing, Michigan

LNAPL associated with a former underground storage tank is present within the shallow fill material in the north central portion of Plant 3 (Area 17). The LNAPL consists of gasoline with associated soil and groundwater impacts consisting primarily of benzene, toluene, ethylbenzene, and xylenes. A more comprehensive overview of the LNAPL conceptual site model for Area 17 can be found in the RFI Phase 1 Activities Summary Report (ARCADIS 2012) and the RFI Phase 2 Activities Summary Report (ARCADIS 2013). 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 17:
   - 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; SVOCs exceed residential drinking water criteria). Additionally, there are aesthetic concerns associated with groundwater use from Area 17. Data collected to date indicate that VOCs and SVOCs in groundwater (associated with LNAPL impacts in Area 17) are stable and have not migrated off-site, and thus the LNAPL in Area 17 does not present a risk to offsite properties. Additional groundwater monitoring and statistical trend analysis is currently underway to verify long-term stability of the dissolved-phase plume(s). A contingency remedy will be considered if groundwater use restrictions cannot be executed or the plume stability evaluation shows that the groundwater plume(s) is not stable and is migrating off site above RBSLs.
   - Volatilization Concerns: VOCs have been detected in soil at concentrations exceeding volatilization to indoor air inhalation criteria. Additionally, it is recognized that ?SHOULD THIS BE AEROBIC?anaerobic biodegradation of hydrocarbons will generate methane. While there are currently no structures in the area, it is likely that the Site will be redeveloped in the future, and presence of VOCs and the potential for methane generation could result in indoor air quality concerns for future structures.
   - Direct Contact Concerns: LNAPL impacts in Area 17 have been identified at shallow depths in several locations (within the upper 4 ft of soil), presenting a direct contact concern for Site workers and/or construction or utility workers.

2) YES - a general discussion regarding feasibility of various compositional change remediation strategies for Area 17 is provided below:

- Natural source zone depletion (NSZD) is proposed as a corrective measure for Area 17 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 nature of the gasoline, LNAPL loss via NSZD processes is likely higher than manual recovery rates.
- The bulk of the COCs in LNAPL in Area 17 are volatile and/or biodegradable, and thus remedial technologies which rely on vapor-phase partitioning or enhanced biodegradation were evaluated. Soil vapor extraction (SVE) and Multi-phase extraction (MPE) were both considered as potential corrective measures for Area 17. Neither SVE nor MPE was selected as a corrective measure for Area 17 on the basis that there is limited potential for LNAPL recoverability in Area 17 (see note 6, below), and anticipated implementation challenges associated with limited soil permeability and geologic heterogeneity.
- Excavation of the LNAPL was considered as a potential corrective measure for Area 17. Excavation was not proposed as a corrective measure because it would be costly and difficult to implement based on the estimated depth and need to handle perched groundwater. 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.
- 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.
- In situ chemical oxidation (ISCO) was not evaluated for Area 17 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 on-site. Based on data collected to date, constituents associated with LNAPL at Area 17 are defined onsite, and do not pose a risk to groundwater in areas downgradient of Area 17, or to the underlying deep overburden and bedrock aquifers. Additional groundwater monitoring and statistical trend analysis is currently underway 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 RBSLs. A contingency remedy will be considered if groundwater

use restrictions cannot be executed or the plume stability evaluation shows that the groundwater plume(s) is not stable and is migrating off site above RBSLs.

4) NO – Given that impacts in Area 17 are contained on-site and do not pose a risk to areas located hydraulically downgradient of Area 17, or to the underlying deep overburden and bedrock aquifers. Based on the present understanding of site conditions, risk can be effectively mitigated through institutional controls. However, additional groundwater monitoring and statistical trend analysis is currently underway to verify the long-term stability of the dissolved-phase plume(s). As a result, a contingency remedy will be considered if groundwater use restrictions cannot be executed or the plume stability evaluation shows that the groundwater plume(s) is not stable and is migrating off site above RBSLs.

5) NO – a comprehensive LNAPL mobility evaluation was completed for Area 17. The evaluation demonstrated that LNAPL is stable and not migrating. This finding is supported by 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 cm/s (the velocity criterion suggested by ASTM [2006]), indicating that LNAPL is functionally immobile in Area 17.
   - LNAPL pore-entry pressure analysis demonstrates that LNAPL thicknesses observed at the perimeter of the LNAPL body in Area 17 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, fifteen years ago. LNAPL bodies typically stabilize 2 to 5 years after the release has stopped (ITRC 2012).

6) YES - a comprehensive LNAPL mobility evaluation was completed in Area 17. The evaluation demonstrated that mobile LNAPL is present, 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 saturation.

7) NO - LNAPL recoverability was evaluated in Area 17 through field LNAPL transmissivity testing. EGLE has established an LNAPL transmissivity standard threshold value of 0.5 ft2/day to evaluate recovery to the maximum extent practicable (Swiger 2013), permitting the use of LNAPL transmissivity as a quantitative recoverability metric in the State of Michigan in the absence of risk-based LNAPL concerns. The LNAPL transmissivity measured at Area 17 (0.01 ft^2/d at UNK-14) is well below this criterion, indicating that LNAPL is minimally recoverable at Area 17, and LNAPL recovery efforts (through hydraulically-based remediation methods) will not result in a beneficial reduction in overall LNAPL mass.

Given that LNAPL body at Area 17 is currently stable, the risks associated with the LNAPL will not change appreciably as a result of active recovery efforts. While no formal assessment of NSZD rates has been completed for Area 17, based on recent literature publications (Lundegard and Johnson [2006], Sihota et al [2011]) and ARCADIS' experience, magnitudes of petroleum hydrocarbon-based LNAPL losses through NSZD typically fall within the range of hundreds to thousands of gallons per acre per year. Based on the limited LNAPL transmissivity values measured in Area 17, active LNAPL recovery is unlikely to yield significant additional mass by comparison to ongoing mass reduction through NSZD.

8) YES - the following controls are proposed for all LNAPL Area 17 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 that provides data to verify dissolved phase plume stability and preserves the current conditions of the existing surface

cover to minimize infiltration and maximize the potential for the groundwater plume to remain stable will be implemented.

- Caps: While capping is not proposed as an LNAPL corrective measure, cover over Area 17 exists and does provide the 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 Area 17 and this area would be included in the Infiltration Management Area identified in the Declaration of Restrictive Covenant.

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Appendix C

Soil Corrective Measures Summary Table

Soil Corrective Measures Summary Table

Area	Constituents > DCC and/or PSIC	Depth of Impacts Above DCC and/or PSIC	Corrective Measure Proposed
Plant 2 - Area 2	Manganese > Site-Specific PSIC	9-10 feet bgs	Notification in Amended DRC
	Arsenic > DCC	1-2 feet bgs	Excavation of one sub-area and Exposure Barrier consisting of existing concrete pavement over another sub-area
Plant 2 - Area 5-1	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene and dibenzo(a,h)anthracene > DCC	4-7 feet bgs	Notification in Amended DRC
Plant 2 – Area 5-2	Manganese > Site-Specific PSIC	2-3 feet bgs	Notification in Amended DRC
	Benzo(a)pyrene > DCC	0-1 foot bgs and 3-4 feet bgs	Notification in Amended DRC
	PCBs > DCC	4-5 feet bgs, 6-7 feet bgs, and 18-19 feet bgs	Included in designated low occupancy area with a TSCA cap (i.e. an Exposure Barrier) and/or low occupancy area without a TSCA cap per the TSCA Plan. Notification in Amended DRC.
Plant 2 – Area 5-3	Manganese > Site-Specific PSIC	1-2 feet bgs	Notification in Amended DRC
	Benzo(a)pyrene > DCC	1-2 feet bgs	Notification in Amended DRC
Plant 3 – Area 14	Cyanide > DCC and Site-Specific PSIC	0-1 foot bgs	Inspection and maintenance of existing exposure barrier
	Arsenic and Nickel > DCC and/or Site Specific PSIC	Greater than 2 feet bgs	Notification in Amended DRC

Area	Constituents > DCC and/or PSIC	Depth of Impacts Above DCC and/or PSIC	Corrective Measure Proposed
Plant 3 – Area 16	Lead > DCC	4-5 feet bgs and 9-10 feet bgs	Notification in Amended DRC
Plant 3 – Area 18	Benzo(a)pyrene > DCC	1-2 feet bgs	Installation, inspection, and maintenance of an exposure barrier
Plant 3 – Area 19	Arsenic > DCC	0-1 foot bgs and deeper intervals	Inspection and maintenance of existing exposure barrier
Plant 3 – Area 20	Manganese > Site-Specific PSIC	17-18 feet bgs	Notification in Amended DRC
Plant 3 – Area 21	Arsenic > DCC	22-23 feet bgs	Notification in Amended DRC
Plant 6 – Area 5-6	Lead > DCC	0.5-7.5 feet bgs	Inspection and maintenance of existing exposure barrier
Plant 6 – Area 5-7	Vanadium > DCC	4-5 feet bgs	Notification in Amended DRC

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