REMEDIATION WORK PLAN

Revision 2

Former Exide Corporation
303 Water Street
Logansport, Indiana 46947

Indiana Brownfields #4221108
State Cleanup #0000971

December 27, 2024

BCA Project No. 24-066

BCA Environmental Consultants

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Prepared for:
City of Logansport
and
Logansport Utilities

Respectfully Submitted by:
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EXECUTIVE SUMMARY

<u>Source of Contamination</u>

The Former Exide Corporation facility is located at 303 Water Street in Logansport, Indiana (Subject Site) and consists of a single parcel totaling approximately 17.41 acres of land located within city limits. The Subject Site operated as a rail yard and was part of the Terre Haute & Indianapolis Railroad – Vandalia Line from at least 1885 – 1930s. Former railroad operations associated with the Subject Site included rail sidings and maintenance facilities (roundhouse). The Site also operated as the National Steel Construction Company – Logansport Plant, manufacturers of steel products from at least 1949 to the late 1950's. General Tire reportedly operated the plant until it was purchased by Exide in 1959. Exide operated the Subject Site as a lead-acid storage battery manufacturing facility for the automotive industry from about 1960 into the 1990's, and at a limited capacity before fully shutting down in 2009. The factory buildings were demolished in 2016 and the Subject Site has since been vacant. The area near the Subject Site is largely residential land with other industrial properties nearby. The Site is located on the south side of Water Street, between Aster Street and residential properties to the west and commercial properties to the east. The former Logansport & Eel River Short Line railroad (abandoned) adjoins along the south side of the Site with the former Trelleborg Automotive property beyond. Residential and commercial properties are located to the north across Water Street. Aside from the former factory building's concrete floor and footprint, no structures exist on the Subject Site.

Initial investigations concerning the Subject Site were conducted from 2020 to 2022. The investigations identified the presence of lead above the IDEM Risk-based Closure Guide (RbCG or R2) Excavation Direct Contact Human Health Levels (EDC HHLs) in the shallow soils throughout the north half of the Subject Site around the former building, and the presence of chlorinated aliphatic hydrocarbons (CAHs), specifically trichloroethene (TCE) in the soil and groundwater at the east end of the former factory building. The potential is present for the TCE to migrate off-site in excess of the IDEM R2 HHLs. The potential for vapor migration and vapor intrusion to adjoining properties to the east has also been identified. There is also potential future direct contact exposure of site occupants to the lead in shallow soil.

The nature and extent of impacted soil and groundwater has been fully delineated. However, soil gas and the potential for vapor encroachment or vapor intrusion into adjoining properties have not been fully investigated.

<u>Exposure Pathways</u>

Currently, no exposure pathways are known to be complete. Potential (not confirmed) exposure pathways are limited to vapor intrusion to adjoining commercial property.

Potential future exposure pathways are limited to site occupants or excavation worker direct contact exposure to lead and CAHs in soil.

Data Gap Investigations

1. No Data Gaps are present for the property

Recommended Remediation

The recommended remediation is described in detail in Section 6 of this RWP. To summarize, the recommended remediation includes:

- Removal of the remaining structure (concrete slab and foundations)
- Insitu soil treatment for all areas where lead impacted soils exceed 1,380 mg/kg.
- Excavation and removal of all lead impacted soils above 2x the IDEM R2 EDC HHL and other high-impacted soils (below 2x R2 EDC HHL) until the average concentration in the impacted area is less than the industrial direct contact HHL.
- Excavation and removal of TCE impacted soils (at both the HS-1 and HS-5 hotspots) above the IDEM R2 EDC HHLs.
- Application of soil amendment in the HS-1 and HS-5 TCE impacted areas.
- Use of institutional controls (ICs) to prohibit future use of groundwater for potable purposes, including an Environmental Restrictive Covenant (ERC) for the Subject Site. A current local ordinance exists that restricts the installation and use of potable water wells within Logansport City limits and no privately-owned drinking water wells have been identified within the area around the Subject Site. Additional ICs may be used as necessary to address any groundwater risks post remediation.
- Use of ERCs on the Subject Site requiring the use of vapor mitigation systems such as vapor barriers (passive) and sub-slab depressurization systems (active) for any future structure(s) situated in the east end of the Subject Site. Alternatively, demonstrate through post-remediation soil gas sampling that vapor mitigation is not necessary.
- Install monitoring wells to conduct groundwater sampling to monitor for changes to the limits and concentrations within the TCE plume.

Table of Contents

Figures

Tables

Appendices

List of Abbreviations

AOC	Area of Contamination (EPA Policy)
BCA	BCA Environmental Consultants, LLC
BGS	Below Ground Surface
CAHs	Chlorinated Aliphatic Hydrocarbons
CV	Conduit Vapor
CVOCs	Chlorinated Volatile Organic Compounds
EC	Engineering Control
EPA	United States Environmental Protection Agency
ERC	Environmental Restrictive Covenant
ESA	Environmental Site Assessment
GPM	Gallons per Minute
GPS	Global Positioning System
GW	Groundwater
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HHL	Human Health Level (replaced by PLs)
IC	Institutional Control
IDEM	Indiana Department of Environmental Management
LCS	Laboratory Control Standard
mg/kg	milligrams per kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTGW	Migration to Groundwater – from IDEM 2012 Remediation Closure Guide
PID	Photo-Ionization Detector
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
PL	Published Level (from IDEM R2)
R2 or RbCG	Risk-based Closure Guide or R2
RbCG EDC-PL	Excavation Direct Contact Published Level (Soil)
RbCG IDC-PL	Commercial/Industrial Direct Contact Published Level (Soil)
RbCG RD-PL	Residential Direct Contact Published Level (Soil)
RbCG RGWPL	Residential Groundwater Published Level (Groundwater)
RbCG V PL	Vapor Exposure Published Levels (Soil Gas, Indoor Air)
RCRA	Resource Conservation and Recovery Act
RECs	Recognized Environmental Conditions
RPD	Relative Percent Difference
RoW	Right of Way
SAP	Sampling and Analysis Plan
SGe	Exterior Soil Gas
SGss	Sub-slab Soil Gas
SLs	Screening Levels (replaced by HHLs)
SOP	Standard Operating Procedures
SVOCs	Semi-Volatile Organic Compounds
ug/kg	micrograms per kilogram
ug/L	micrograms per Liter
USCS	Unified Soil Classification System
USTs	Underground Storage Tanks
VFC	IDEM Virtual File Cabinet
VI	Vapor Intrusion
VOCs	Volatile Organic Compounds
WHPA	Well Head Protection Area

1.0 INTRODUCTION

1.1 Project Background

The Subject Site operated as a rail yard and was part of the Terre Haute & Indianapolis Railroad – Vandalia Line from at least 1885 – 1930s. Former railroad operations associated with the Subject Site included rail sidings and maintenance facilities (roundhouse). The Subject Site also operated as the National Steel Construction Company – Logansport Plant, manufacturers of steel products from at least 1949 to the late 1950's. General Tire reportedly operated the plant until it was purchased by Exide in 1959. Exide operated the Subject Site as a lead-acid storage battery manufacturing facility for the automotive industry from 1960 into the 1990's, and at a limited capacity before fully shutting down in 2009. The factory buildings were demolished in 2016 and the Subject Site has since been vacant. Initial site investigations concerning the Subject Site were conducted from 2020 to 2022 and included a Phase I ESA, Phase II ESA, Supplemental Phase II ESA, and 2nd Supplemental Phase II ESA, and additional soil delineation was conducted in 2023 and 2024. The investigations identified extensive lead impacts in the surface and shallow sub-surface soils around the former factory building and the presence of chlorinated aliphatic hydrocarbons (CAHs) in the soil and groundwater beneath the east end of the former factory building. The potential for vapor migration and vapor intrusion to adjoining structures have also been identified.

1.2 Project Identification

The Subject Site consists of a single large parcel totaling approximately 17.41 acres of land located within the City of Logansport, Indiana (Figures 1 & 2), located on the south side of Water Street, between Aster Street and residential properties to the west and commercial properties to the east. The former Logansport & Eel River Short Line railroad (abandoned) adjoins along the south side of the Subject Site with the former Trelleborg Automotive property beyond. Residential and commercial properties are located to the north across Water Street. Aside from the former factory building's concrete floor and footprint, no structures exist on the Subject Site. Overgrown gravel lots are located on the east and west sides of the former factory building.

The Subject Site is currently owned by the City of Logansport Site. Contacts for this remediation project are:

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1.3 Historical Environmental Investigations

1.3.1 Phase I ESA

A Phase I Environmental Site Assessment (ESA) of the Subject Site was conducted for the City of Logansport, by BCA Environmental Consultants, LLC (BCA), dated September 25, 2020. The Phase I ESA was funded through a U.S. EPA Brownfield Assessment Grant to the City of Logansport (Cooperative Agreement No. BF-00E02313). The Phase I ESA identified the following RECs:

- The Subject Site had been used as a rail maintenance yard and rail lines for over 60 years. There is minor risk of spillage from railroad operations along the main lines and sidings.
- Coal ash and cinders (CAC) were observed on the ground surface along the southern fence line of the Subject Site.
- Herbicides were commonly used on rail lines to control vegetation.
- Former operations as a steel product manufacturer from about 1948 to 1959
- Former operations as lead-acid battery manufacturing facility from 1960 until 1989.
- Lead impacts have been found in surface soils on and around the perimeter of the Site.

1.3.2 Phase II ESA

A Phase II ESA of the Subject Site was conducted by BCA for the City of Logansport, with the report dated June 1, 2021. The investigation was also funded through the EPA Grant (Cooperative Agreement No. BF-00E02313). The Phase II identified shallow soil (0-4' depths) impacts from lead, exceeding the then current IDEM Remediation Closure Guide (RCG) industrial direct contact screening level (IDC SL) and excavation direct contact SLs (ExDC SL or ESL) in 18 sampled locations throughout the Site, including samples collected from within historical excavation/remediation areas. Trichloroethene (TCE) was detected in groundwater samples exceeding the RCG Industrial Vapor Intrusion Groundwater Screening Level (I-VIGWSL) at one location and exceeded the RCG Residential VIGWSL at a second (VIGWSLs are no longer applicable for closure). The two probes were located near the eastern property line away from the historical production area and the groundwater flow is likely to the south or southeast. An auto repair facility is located to the north across Water Street and a Pepsi distribution site adjoins Exide to the east. Neither was identified in the Phase I ESA as a REC for chlorinated solvents, but both were identified as potential sources or contributors (in addition to historical Exide operations) to the TCE. Several groundwater samples exceeded the RCG RGSL for lead in the unfiltered samples. Field filtered samples from 5 of the sampled locations were analyzed for lead and exceeded the RCG RGSL in four

(4) of those samples. Recommendations for additional investigation based on the results of the Phase II ESA included:

- Determine the extents of lead in excess of the RCG ESLs identified in the shallow soils.
- Install permanent monitoring wells to confirm the presence or absence of lead and arsenic in the groundwater.
- Investigate further the TCE identified in the groundwater samples from the east end of the Subject Site.

1.3.3 Supplemental Phase II ESA

Based on the results of the 2021 Phase II ESA, a Supplemental Phase II ESA of the Subject Site was conducted by BCA for the City of Logansport, with the report dated August 15, 2022 (VFC # 83371930). The investigation was funded through the EPA Grant (Cooperative Agreement No. BF-00E02875). The Supplemental Phase II included advancing 21 soil and groundwater probes and five (5) permanent monitoring wells on the Subject Site at locations based on the recommendations of the Phase II ESA and to delineate the extent of the impacts. Soil samples were collected from each boring location, and groundwater was sampled from the six (6) designated probe and five (5) monitoring well locations. Soil was analyzed for lead by EPA Method 6010, and groundwater samples were analyzed for VOCs by EPA Method 8260, and lead and arsenic by EPA Method 6010. Based on field observations made and XRF screening during the Phase II activities, twenty-two (22) surface soil samples were also collected and analyzed for lead only. Acidic odors and discoloration of the gravel and surface was noted at and around the former Acid Charge Area during the May 25, 2022, site visit. Soil pH was tested on three samples.

Shallow sub-surface and surface soils at some locations on the eastern portion and the northern edge and along the Water Street right-of-way was found to be impacted by metals and are above the RCG RDCSL for lead in several locations. Surface and shallow sub-surface soils in areas of the former battery manufacturing operations were found to be impacted by lead in excess of the RCG ESL at one location near the southern fence.

Groundwater exceeded the former residential VIGWSL for TCE in one location, and the RCG RGWSL at one location near the northeastern property line. In addition to on-site sources, off-site operations could potentially have contributed to the TCE. However, borings SB-21 and SB-22, located in the upgradient direction to the northeast and northwest of SB-23 and MW-5, were below detection limits for VOCs, suggesting that migration from an upgradient, off-site source is unlikely.

Although field observations of the Acid Charge Area suggested impacts, the soil pH at one location did not show significant impact. However, acid impacts at other locations nearby could not be ruled out.

Recommendations based on the results of the Supplemental Phase II ESA included:

- Determine the extents of lead in excess of the RCG ESLs identified in the shallow soils defined by sample SB-30.
- Further delineate the extent of lead in soils near and beneath the footprint of the building.
- Investigate further the TCE identified in the groundwater samples from the northeast end of the Subject Site.
- Further characterize the possible acid release at and around the Acid Charge Area.

1.3.4 2nd Supplemental Phase II ESA

Based on the results of the 2022 Supplemental Phase II ESA, a 2nd Supplemental Phase II ESA of the Subject Site was conducted by BCA for the City of Logansport, with the report dated November 8, 2022. The investigation was funded through the EPA Grant (Cooperative Agreement No. BF-00E02875). The subsurface investigation was conducted in two phases on September 9th and 23rd 2022 (soil gas survey) and on October 14, 2022, (soil sampling) for the purpose of determining subsurface environmental conditions on the Subject Site. The subsurface investigation included installing 26 shallow soil gas samplers to investigate further the TCE identified in the groundwater samples from the northeast end of the Subject Site, at or near a former loading dock area. The investigation also included advancing seven (7) soil probes on the Subject Site to attempt to identify the source of the VOCs and to further delineate the lead impacts identified in the 2021 Phase II and 2022 Supplemental Phase II ESAs.

Based on the results of the soil gas survey, four (4) soil probes (HS-1 through HS-4) were located within the soil gas hot spots and the collected soil samples were analyzed for VOCs by EPA Method 8260. The remaining three (3) soil probes (SB-42 through SB-44) were located in the area between SB-8, SB-26, and SB-28 where no sample data was collected during the previous investigations, and soil samples analyzed for lead by EPA Method 6010. In addition to the probes, three (3) surface material samples were collected from the former Acid Charge Area and analyzed for pH via method 9045C. The analytical results were compared to IDEM's R2 Residential Direct Contact (RDC), Commercial/Industrial Direct Contract (IDC), and Excavation Direct Contact (EDC) HHLs (RbCG Risk Screening Table, Table 1: Human Health Levels - 2022).

TCE was detected above the R2 Residential SGe HHL in three of the 23 shallow soil gas sample locations, exceeded the Industrial SGe HHL in one location, and the Large Industrial SGe HHL in one location. TCE was also detected above the industrial Sub-slab Soil Gas (SGss) HHL in one SGss location, situated approximately 60 feet away from the highest TCE concentration in the SGe samples, but still in the former loading dock area. The two locations may be independent hotspots, or they may represent a single continuous source area.

Field screening of the subsequent soil probes HS-1 through HS-4 suggested the presence of VOCs in the soil cores from HS-1 at 0-2' and 5-6'. TCE was found to exceed the R2 IDC HHL in the soil samples from HS-1 (2') and HS-1 (6'). Boring HS-1 was located within 2 feet of the SGe point where TCE was above the R2 Large Industrial SGe HHL. Several VOCs, including c-DCE, PCE, 1,1,1-TCA, and 1,1,2-TCA were detected above IDEM's former RCG migration to groundwater screening levels. Many of these compounds, particularly 1,1,1-TCA, were detected in the soil gas samples as well. HS-1 was located along the south side of a former loading dock area. Although the TCE soil gas concentrations at the SGss point are similar to those at the high SGe point, soil concentrations are likely much lower since the concrete slab often causes higher soil gas concentrations, it was concluded that the TCE soil concentration at HS-1 likely do not extend far.

Surface and shallow sub-surface soils showed lead impacts exceeding the R2 RDC HHL in the soil sample from SB-42 (1.0 – 2.0'), the IDC HHL in the soil sample from SB-42 (0-1.0'), and the EDC HHL in the samples from SB-43 (1.0-2.0'), SB-44 (0-1.0'). The data closed a data gap from previous investigations.

Field evidence of staining and odor suggested possible acid impacts throughout the former Acid Charge Area. Samples collected of the flooring material of the former Acid Charge Area (AC-1, AC-2, and AC-3) were analyzed for pH by the laboratory. Two of the three samples showed lowered pH levels, indicating impacts from residuals from the acid charge activities are present.

Recommendations based on the results of the 2nd Supplemental Phase II ESA included:

Develop a Remediation Work Plan (RWP) to:

- Remove / remediate lead impacted soils in excess of the RCG ISL to facilitate commercial redevelopment.
- Remove / remediate TCE impacted soils
- Monitor and/or remediate groundwater to the extent necessary.
- Remove acid impacted building materials.

- Establish use restrictions on the property to eliminate potential pathways of exposure to residual impacted soil and groundwater.
- Establish use restrictions on the property to eliminate potential vapor exposure pathways

1.3.5 3rd Supplemental Phase II ESA / Additional Soil Delineation

A 3rd Supplemental Phase II ESA on the Subject Site was conducted by BCA for the City of Logansport with a report dated April 5, 2024 to further delineate the extents of lead and TCE hotspots which will require remediation. Fieldwork was completed in two phases, the first occurring in late August to early September, and the second in early November 2023. The first phase included two (2) sewer gas samples, six (6) sub-slab soil gas samples, 48 soil probes, and 43 surface soil samples, while the second phase of this investigation included 54 soil probes and four (4) groundwater samples.

Sewer gas samples were collected from two manhole locations to the east and northeast of the Subject Site and were analyzed for VOCs by EPA method TO-15 LL. Sub-slab soil gas samples were collected at 20-foot step-outs from SGss-1 where TCE exceeded the commercial / industrial sub-slab HHL in the previous investigation, and west of the TCE hotspot at HS-1. Sewer gas samples were all below HHLs while two sub-slab samples exceeded the large commercial/industrial soil gas HHL, suggesting that a secondary TCE hotspot is present to the northwest of the loading dock area.

Groundwater samples were collected from four (4) locations (3 temporary / 1 permanent monitoring wells) to further define the areas impacted by TCE. TCE was found in all groundwater samples exceeding the R2 PLs with the highest located at the HS-5 hotspot (468 ug/L). PCE also slightly exceeded the R2 PLs at this location.

Results of soil sampling indicate that the TCE soil hotspot at HS-1 does not appear to be extensive in size and does not extend more than 10 feet laterally. TCE was also found to be present in the soil at HS-5, located approximately 100 feet to the north-northwest of HS-1. Soil and soil gas samples in between these two locations do not show exceedances for TCE, confirming that HS-5 is a secondary, independent hotspot. In the 2nd phase of the investigation, 20’ step out samples were collected around HS-5, and the northern and eastern probes were found to be free of TCE contamination. The soil sample from HS-5 20’W (3’) contained TCE at 1040 mg/kg, exceeding the R2 EDC PL, however samples from 4.5’ and 6’ bgs were both well below all R2 PLs. Further samples around HS-5 20’W were not collected, so delineation remains incomplete at this location, and the full extent of chlorinated compounds near HS-5 remains unknown.

To further the delineation for lead in the shallow soils, Initial samples in the first phase were placed around several hotspots found in previous Phase II investigations, however sample results suggested these hotspots were more extensive than previously thought.

In the second phase, soil samples were collected to fill in gaps and provide better sample density throughout the area south of the former building footprint. In total, about 750 soil samples were screened by a handheld XRF device, and 291 of those samples were analyzed for lead. Of the 291 samples, 103 exceeded the R2 IDC HHL (800 mg/kg) and 86 exceeded the R2 EDC HHL (1,000 mg/kg).

Areas to the east and northeast of the former building footprint were consistently above 1,000 mg/kg (in the top 12 to 18" bgs) and often much higher, with the average for this area exceeding 5,000 mg/kg. A large swath of the grassy area south of the building footprint is also impacted to a lesser extent. Shallow soils in these areas vary from a few hundred mg/kg up to about 5,000 mg/kg in the top 12" to 18", with an average closer to about 2,000 mg/kg. The soils underneath the concrete slab at the southwest corner have also been found to be impacted by lead to about 5 feet bgs at highly variable levels ranging from a few hundred mg/kg up to a high of 40,500 mg/kg in one of the step-out samples around SB-9.

A total of 34 of the above soil samples were also analyzed for TCLP lead where lead total results varied from a low of 804 mg/kg up to 46,000 mg/kg. Of those TCLP samples, 23 exceeded the 5.0 mg/L threshold for characteristic hazardous waste. Almost all samples over 1760 mg/kg total lead failed TCLP while all samples under 1380 mg/kg passed TCLP. All six (6) samples from above 1380 to 1760 mg/kg passed TCLP.

1.3.6 Additional Delineation Sampling

Additional soil and groundwater samples were collected in the vicinity of the HS-5 hotspot in August 2024 to further delineate the TCE impacted area. Ten (10) probes were advanced in this area, with groundwater collected from three (3) of the sample points. Step outs were initially placed at 20' to the north, south, and west of HS-5 20W (HS-520). Field screening revealed no indication of VOC contamination at the 20' south location, and only minimal impacts at the north and west locations. The highest sample collected from these 10 probes was 143 mg/kg at HS520-14'SW at 3' BGS. The next highest sample was 35.4 mg/kg at HS520-20'N at 3' BGS. Based on the results of the August 2024 sampling the HS-5 hotspot is fully delineated.

1.3.7 EPA Neighborhood / Residential Cleanup

In November 2021, US EPA began a Removal Site Assessment for the communities surrounding the Exide property. Based on the presence of TCE in the groundwater, EPA installed 17 temporary soil gas probes near residences in the downgradient direction (south and southeast of the site) and analyzed samples for TCE. All soil gas samples were below the laboratory detection limits for TCE. Additionally, soil samples from 73 nearby (mostly northeast of the site) residential properties have been collected and analyzed for lead, of which 57 had concentrations which exceed the EPA Removal

Management Level (RML) of 200 mg/kg. Beginning in August 2023, EPA began soil removal activities at targeted locations and as of the end of 2024 has cleaned up 34 residential properties, with an additional 24 scheduled for 2025. (EPA 2024).

1.4 Remedial Action Objectives

Performance-based and numerical Remedial Action Objectives (RAOs) are proposed for mitigation of the contamination beneath the Subject Site as described herein. If the numerical objectives are met, the performance objectives are considered to be fulfilled. Where numerical objectives are not met, performance-based objectives will be used to prevent completion of exposure pathways.

1.4.1 Performance-Based Remedial Action Objectives

Performance-based RAOs focus on the removal of contaminants and mitigation of current and future potential exposure or continued migration. These objectives are qualitative, yet are considered primary for the success of the remedial action:

a) The bulk of the lead in surface and shallow subsurface soils will be removed to the extent practical.
b) The bulk of the source of the TCE in the soils will be removed.
c) The presence of TCE in groundwater will be mitigated by removal of the bulk of the source and application of commercially available chemical reduction material.
d) Risk of intrusion of TCE vapors to future on-site and off-site improvements will be mitigated through source removal and application of chemical reduction materials.
e) Risk of harm from intrusion of TCE vapors to future occupied improvements will be controlled through the use of ICs.
f) ICs will be used to prohibit future production and use of groundwater.
g) Create and maintain a soil management plan.
h) Groundwater sampling will be conducted quarterly to monitor for changes to the limits and concentrations within the TCE plume and to demonstrate plume stability.

1.4.2 Numerical Remedial Action Objectives

The IDEM's R2 provides numeric Remediation PLs for the relevant exposure routes and land uses. The Subject Site is currently vacant and zoned for industrial use. The current redevelopment plan for the Exide property is for reuse as a municipal property (utilities, streets and police). Certain R2 PLs were selected as the RAOs at the Subject Site, including the following:

a) Groundwater – Residential Groundwater PL.
b) Soil – Average in the 0-1', 1-2', and 2-4' intervals below the Commercial/ Industrial

Direct Contact (IDC) PL.

c) Exterior soil gas – commercial
d) Subslab soil gas - commercial

Soils at the Site have exceeded the following numeric objectives:

a) Soil – IDC PL

For COCs detected at concentrations above applicable soil SLs, the following numerical remedial objectives for soil are provided:

Soil Remedial Action Objectives

	Units	**Lead**	**TCE**
CAS Number		156-59-2	7439-92-1
RbCG Residential Direct Contact Human Health Level*	mg/kg	**400**	**---**
RbCG Commercial/Industrial Direct Contact Human Health Level*	mg/kg	**800**	**---**
RbCG Excavation Direct Contact Human Health Level*	mg/kg	**1000**	**200**

Risk-based Closure Guide (R2), IDEM Published Levels Table 1: 2023

Groundwater and Soil Gas at the Subject Site have exceeded the following numeric objectives:

a) Groundwater – RGW PL
b) Soil Gas – Industrial shallow Exterior Soil Gas and Sub-Slab Soil Gas PLs

For VOCs detected at concentrations above applicable PLs, the following numerical remedial objectives for groundwater and soil gas are provided:

Groundwater and Vapor Intrusion Remedial Action Objectives

	Units	**TCE**	
CAS Number		79-01-6	
RbCG Residential Groundwater Human Health Level	ug/L	**5**	
RbCG Residential Exterior Soil Gas Human Health Levels	ug/m3	**20**	
RbCG Commercial/Industrial Exterior Soil Gas Human Health Levels	ug/m3	**90**	
RbCG **Large** Commercial/Industrial Exterior Soil Gas Human Health Levels	ug/m3	**900**	

Risk-based Closure Guide (R2), IDEM Published Levels Table 1: 2023

TCE in the shallow groundwater exceeds the IDEM R2 RG PLs on-site but samples indicate that contamination has not migrated off-site. Off-site, the risk of future human exposure to impacted groundwater is eliminated through City of Logansport Ordinance, Chapter 50, Art. IV, § 50-93(g) (Appendix A), which limits private ownership and use of groundwater wells for potable use within City limits. The City of Logansport Municipal Utilities has confirmed that all the properties in the area are connected to the LMU Public Water Supply system; and, to its knowledge, there are no privately-owned wells in the area. There are no publicly owned water supply wells presenting an unacceptable risk of impact from TCE associated with the Subject Site. Any remaining risk to human exposure from TCE impacted groundwater may be controlled using additional ICs, as necessary, to further eliminate the need for RAOs for the groundwater to tap water pathway downgradient of the Subject Site.

1.5 Summary of Remedial Work Plan

To meet the RAOs for the Subject Site, a combination of remedial methods is proposed.

a) Lead impacted soils above 1,380 mg/kg will be treated to reduce leachability.
b) The lead impacted soils above 2x the EDC HHL (2000 mg/kg) will be excavated and removed as practicable. Additional soil (1500 to 2000 mg/kg) will be removed until the average soil concentration is less than the IDC HHL (800 mg/kg).
c) The TCE impacted soils greater than the EDC HHL (200 mg/kg) will be removed. The goal will be to remove most soil greater than about 5.0 mg/kg.
d) Application of In-Situ Chemical Reduction (ISCR) soil amendment in the TCE impacted area.
e) Use of institutional controls (ICs) to prohibit future use of groundwater for potable purposes, including an Environmental Restrictive Covenant (ERC) for the Subject Site and an existing Environmental Restrictive Ordinance (ERO).
f) Based on post-remediation soil gas and indoor air sampling, it is possible (though unlikely) that a vapor mitigation system (VMS) may be needed on the property to the east. In addition, a VMS may be needed on the Subject Site for future construction, which would be assured by placing an ERC on the Subject Site and,
g) Install monitoring wells and conduct quarterly groundwater sampling to monitor for changes to the limits and concentrations within the TCE plume and to demonstrate plume stability.

2.0 SITE BACKGROUND

2.1 Site History

The Subject Site operated as a rail yard and was part of the Terre Haute & Indianapolis Railroad – Vandalia Line from at least 1885 – 1930s. Former railroad operations associated with the Subject Site included rail sidings and maintenance facilities (roundhouse). The Subject Site also operated as the National Steel Construction Company – Logansport Plant, manufacturers of steel products from at least 1949 to the late 1950's. General Tire reportedly operated the plant until it was purchased by Exide in 1959. Exide operated the Subject Site as a lead-acid storage battery manufacturing facility for the automotive industry from about 1960 into the 1990's, and at a limited capacity before fully shutting down in 2009. Documentation reviewed in the IDEM VFC indicate the Exide facility was serviced by truck and railcar. At least four (4) loading docks have been identified by either historical aerial photos or VFC documents, and the remnants of the rail siding to the plant remain on-site, with the rails and ties having been removed during the demolition of the factory buildings in 2016. The Subject Site has since been vacant.

According to the Remedial Action Proposal (RAP) for Exide Corporation's Logansport, Indiana Facility (Kirkland & Ellis, 1984; IDEM VFC # 47594180), primary operations included the manufacturing of "Lead acid storage batteries, used primarily in automobiles, are constructed from cast lead grids to which has been added a leady paste. These grids are assembled into a multi-cell case, interconnected, and then covered and sealed. Sulfuric acid is added, and the batteries are given an initial or formation charge." The report states that in addition to the manufacturing operations, storage and inventory functions have taken place at various locations both inside and outside the Exide plant since operations began in 1960, and the report indicates that machinery had been controlled as required since at least the early 1970's with baghouses, scrubbers, and other control equipment designed to minimize lead and other emissions inside and outside the plant. The report also states that there were used baghouses stored on-site from other plants and facilities.

The Kirkland & Ellis proposal states that lead and other raw materials were shipped into the plant by truck or railroad car on a daily basis during operational periods. They indicate that lead arrived in the form of bars or pigs that were stored in inventory then processed at the plant into lead parts and lead oxide powder. They note that the lead oxide powder was collected in drums for later use in the plant. Their records state that prior to 1983, lead oxide was also produced at Logansport and shipped to other Exide plants, and that inventory drums of lead oxide as well as other inventory may have been stored outside the building at various times in the past. The 1984 RAP also stated that Exide recycled virtually all of its lead-related by-products off-site and that the site property had occasionally been “used for the storage of used equipment intended for reuse, such as used baghouses, or for other activities that may have resulted in the inadvertent deposition of small quantities of lead.” Maps provided in the RAP included an unlabeled plant layout as of 1983, proposed remedial sections and areas, as well as sample points used to determine the extents of the impacted areas circa 1983.

According to the RAP, a minimum of 1750 cubic yards of soil were proposed to be removed. The proposed remedial action stated that only material and shallow soils, no more than 6” in depth and containing more than 2000 ppm lead, were to be excavated. Upon completion, the plan stated an estimated 2100 tons of impacted soil was removed from the Subject Site.

2.2 Geologic Information

2.2.1 Surficial and Unconsolidated Geology

The Logansport area in which the Subject Site is located approximately on the border between the two physiographic provinces known as the Tipton Till Plain and the Steuben Lacustrine Plain of the Northern Moraine and Lake Region (Fenelon, et al, 1994). The landforms encountered in the Logansport area are glacially or post-glacially derived. The relief around the area tends to reflect the Steuben Lacustrine Plain in the form of till knobs or kame knobs, as much of the Steuben Lacustrine Plain province consists of kame complexes. The kames are comprised of ice-contact sand and gravel deposits (Fenelon, et al, 1994).

The unconsolidated deposits of the Logansport area are predominantly outwash deposits (Gray, 1989). These Wisconsinan age glacial outwash deposits are comprised of sand and gravel deposits of the Atherton Formation (Gray, 1989). Up to eighty feet of unconsolidated sediments overlie the bedrock in the area. However, refusal, likely bedrock, has been encountered at depths ranging from 11.5 to more than 20 feet at the Subject Site. Conceptual geological cross sections are presented in Figures 3a – 3c.

The soil under the Subject Site is mapped as belonging a single soil type: the Gilford loam, gravelly substratum (Gg) with 0 to 2 percent slopes, covering 100% of the site. The Gilford series soils consist of deep, poorly drained, gently sloping soils situated in depressions on outwash plains, formed from loamy outwash over sandy and gravely outwash (Web Soil Survey – Appendix B).

2.2.2 Bedrock Geology

The bedrock geology of the area is recognized as part of the Wabash Formation (Gray, et al, 1987). The Wabash Formation is comprised of limestone, dolomite, and argillaceous dolomite, which is Silurian in age. The bedrock physiographic province is known as the Bluffton Plain (Fenelon, et al, 1994).

Argillaceous limestone of the Wabash formation is present throughout the Logansport area. Depth to refusal (likely bedrock) ranges from 11.5 feet BGS in SB-21 the eastern edge of the Subject Site to more than 20 feet BGS at SB-9. Depth to bedrock has not been determined at the west end of the Subject Site. Borings SB-11 / MW-2, SB-17 - SB-20 / MW-1 were terminated at 15 feet due to encountering a clayey layer between 12 and 15' BGS. There is a known presence of large cobble fields in the area in and around Logansport. Encountering these cobbles will mimic the resistance of bedrock when encountered by a direct-push drill rig. Smaller cobbles will block the opening of the probe rod cutting shoe, preventing soils from entering the soil core liner, resulting in little to no sample recovery in that depth interval. Therefore, refusal at shallower depths could be the result of cobbles or a cobble layer.

A generalized cross section model is presented in Figures 3a – 3c and is based on geologic information ascertained from boring locations that encountered bedrock. The bedrock appears to gently slope from east-northeast to the west-southwest.

2.2.3 Hydrogeology

The Subject Site is located within the hydrogeologic province of the Upper Wabash River Basin, which is considered to be the largest water management basin in Indiana (Fenelon, et al, 1994). The main tributary of the area is the Upper Wabash River. There are minor tributaries associated with the basin, more specifically, as located in Logansport, is the Eel River. Three aquifers have been identified in the area around Logansport: a surficial sand and gravel aquifer; a buried sand and gravel aquifer; and a carbonate bedrock aquifer (Fenelon, et al, 1994). The City of Logansport is served by a public water supply. Static water level in the area is approximately 21 feet to 24 feet BGS (Fenelon, et al, 1994). Water levels collected from the temporary monitoring well network during the previous investigation indicate static water levels between 5.80 and 7.45 feet BGS throughout the Site. Groundwater flow at the Subject Site is estimated to be to the southwest (Figure 4) toward the Wabash River.

Surface contours and the locations of the rivers suggest that the larger area groundwater flow direction is probably to the south toward the Wabash River (0.6 mile away). However, the nearest river is the Eel River located 0.35 mile to the southeast.

Based on measurements derived from the monitoring well borings and groundwater elevation data, the thickness of the unconsolidated aquifer ranges from approximately 2.8 feet to more than 15 feet. The aquifer appears to be thickest at the center of the monitoring well network, and thins out to the eastern, western, and northern edges of the area. The groundwater flow pattern could potentially be influenced by the shape of the aquifer and the underlying bedrock within the area.

2.3 Preliminary Evaluation of Potentially Susceptible Areas

2.3.1 Geologic

The Upper Wabash River Basin Aquifer System is geologically susceptible to impacts resulting from releases of hazardous substances. Susceptible areas include the buried sand and gravel aquifer as well as the carbonate bedrock aquifer.

2.3.2 Wellhead Protection Areas

The Subject Site is not located within an identified WHPA.

BCA searched the Indiana Department of Natural Resources (IDNR) online water well database for wells located near the Subject Site and tabulated and mapped the results as shown in Appendix C. The survey and potential receptors study included searching the IDNR electronic Well Record Database for low capacity wells (less than 70 GPM) within a 1-mile radius and high capacity wells (greater than 70 GPM) within a 2-mile radius of the Subject Site. The potable well survey has identified 4 wells records within a 1-mile radius that are in the general downgradient direction of the Subject Site:

- Record number 96597, Dicko Bait Shop, US24W.
- Record number 104355, KLK Manufacturing, 1121 Magnolia St.
- Record number 104410, Alpha Industries, 615 Center Avenue.
- Record number 104385, USGS, Logansport Sewage Pumping Station.

Although the DNR plotting of these wells indicates they are in the general down-gradient direction, the actual location of 104355 is on Magnolia Street, 1100 feet east, which is cross-gradient of the Subject Site. Wells 96597 and 104410 are located 2,200 to 2,800 feet west-southwest. Based on the groundwater flow direction determined from the monitoring wells on the Subject Site, these wells are also cross-gradient of the Subject Site.

Well 104385 is an USGS observation well located on the north shore of the Eel River, 3,400 feet south-southeast of the Subject Site. The well is located on the City of Logansport's sewage pumping station property, situated on Front Street.

A well record (104360) was found for The Electric Storage Battery (parent company of Exide Corporation) facility at 301 Water Street. The well was completed on April 15, 1960. The precise location of the well is unknown. However, a structure is present on-site that may be a well vault. The structure is situated south of the former building and upon opening the steel access cover, standing water was present preventing the observation of any interior features.

Observations made from City ROW of nearby properties identified a well 1,200 feet to the southwest of the Subject Site, on an industrial property (Matthew Warren Inc., 810 Bates Street). No well record has been found for the site.

The risk of human exposure from impacted groundwater to any of the known downgradient wells is very low because the TCE plume does not appear to be currently migrating off the Subject Site. Other groundwater wells located to the east, north, and west of the Subject Site, and south of the Wabash and Eel Rivers, will have no potential for impact by any release from the Subject Site.

2.3.3 Social

The Subject Site is located within an area used for residential and commercial purposes and may include socially sensitive areas such as the adjacent residences.

2.3.4 Ecological

The closest surface water is the Eel River, located 1,760 feet to the southeast of the Subject Site. The Wabash River is located 3,500 feet south of the Subject Site. No other potential ecologically sensitive areas (Eco SAs) were identified within the area of the Subject Site. Eco SAs can include karst terrain; surface waters, including wetlands and riparian areas; parks, preserves, and other protected areas; and habitats used by endangered or threatened species, or species of special concern.

2.4 Contaminants of Concern

The contaminants of concern (CoC) identified during the sub-surface investigations includes lead on most of the site and VOCs (TCE) at the east end of the site. The following specific VOCs were detected above the PLs in the groundwater and soil gas at the Subject Site:

- TCE

The following specific constituents were detected above the EDC PLs in the soil on the Subject Site:

- Lead
- TCE

Slag was also noted in the 2020 Phase I ESA along the southern property boundary fence line, adjacent to the railroad. If the presence of slag or coal-ash becomes a concern for the redevelopment of the property, it will be handled appropriately.

2.5 Preliminary Evaluation of Contaminant Transport Mechanisms

Results of the subsurface investigations indicate that the primary contaminant transport mechanisms include:

- Downward migration of TCE from source area soil to groundwater beneath the Subject Site.
- Southerly advective groundwater flow and dispersion through the lower reach of the unconsolidated aquifer.
- Vaporization and upward vertical transport of TCE from the water table to the Subject Site shallow soils.
- Wind transport of fine dust containing lead can potentially be dispersed to nearby areas.

2.6 Preliminary Evaluation of Potential Human Exposure Pathways

Identified preferential pathways include potential vapor migration via utility conduits such as sewer lines. Figure 2 shows locations of known buried utilities at and near the Subject Site. Wastewater from the former building discharged into the sanitary sewer under Water Street. The sanitary lines exited the building on the north side of the building. The sewer line runs east-west under Water Street. Logansport Municipal Utilities as-built maps indicate a 24” sanitary line runs north-south along the east property line, connecting Water Street to the north to Plum Street to the south across the rail corridor. The 18” sanitary from the former Trelleborg site, adjacent to the south, also connects to this line. Soil and groundwater samples collected in the vicinity and adjacent to the sanitary line on the Subject Site show no indication of leaking or release from the sanitary sewer.

The LMU as-built maps show a buried 6” water main enters the Subject Site from the southeast corner from Vine Street to the southeast. The depth of the main is unknown but is likely 3 – 4’ below grade. The main entered the former factory near the east loading docks. Borings HS-1, SB-7, SB-25, SB-27, and monitoring well MW-5 are located near and along the water main. Analytical results (HS-1, SB-7/MW-5) indicate the water main could potentially provide a preferential pathway.

Gas lines run to the north side of the former building from Water Street to the north. No borings were placed near the gas line as the location of the line is away from identified areas of concern.

Environmental conditions at the Subject Site, current land use, and anticipated future land use and identified lead in the surface and shallow sub-surface soils, and TCE concentrations in the soil and groundwater suggest that the following human exposure routes are relevant for the indicated media and potentially exposed populations:

a) Lead is present on the surface and in the shallow sub-surface soils in the area south, east, and northeast of the former factory building. The areas appear to be localized but are not fully delineated, and samples exceed the R2 EDC PL for lead. This pathway is incomplete as direct exposure to lead impacted soils since the site is not occupied, is fenced off and current conditions are not generating dust. However, a small area is outside the fence along the street which may result in a completed exposure pathway. The pathway will be controlled in the future through substantive removal of the lead impacted soils, a health and safety plan for the workers, and ICs if there is residual.
b) TCE is present exceeding the R2 EDC PL in the sub-surface soils in the area east of the former factory building and in the groundwater in that area. These pathways are incomplete as direct exposure to impacted soils as the site is not occupied and the groundwater is not used. The pathway will be controlled through partial removal of the TCE impacted soils, a health and safety plan for the workers, and ICs if there is residual.
c) Groundwater on-site and within 100 feet of existing adjoining structures exceeds the former RCG RG PL for TCE. There is potential for VI from groundwater to indoor air of structures adjoining the Site and planned structures on the Site. The investigation of the off-site pathway suggests that offsite transport is not occurring. The on-site pathway will be controlled by removal of the source area soils, ISCO application and treatment of residuals, and ICs requiring a passive system and post-construction VI sampling with an active VMS installed if the IA RAO's are not met.
d) Ingestion of groundwater (with TCE) off-site. This pathway is incomplete since the plume is limited to the Subject Site. There are no drinking water wells nearby and future use of groundwater is also restricted by City Ordinance.
e) Ingestion of groundwater beneath the Subject Site. As indicated above, this pathway is considered incomplete and otherwise controlled through ICs.

f) Migration of lead or TCE from on-site soils to groundwater, thence to ingestion on-site or downgradient. As indicated above, this pathway is considered incomplete and otherwise controlled through ICs.

g) Transport of contaminated groundwater and ingestion of groundwater from downgradient off-site areas. As indicated above, this pathway is considered incomplete and otherwise controlled through ICs.

EXPOSURE PATHWAY EVALUATION

Pathway	On/Off-site	Is Pathway Complete?	If Incomplete, how presently known or controlled?	How controlled in Future	R2 PL
Lead					
Soil Direct	On-site	No	No site occupants and fenced.	Remediation	EDC PL
Soil Direct	On-site	Yes	Small area outside fence.	Remediation	EDC PL
Soil Direct	Off-site	No	Delineation (<PL)	NA	NA
GW Ingestion	On-site	No	Delineation (<PL)	NA	NA
GW Ingestion	Off-site	No	Delineation (<PL)	NA	NA
Chlorinated Solvent Area(s)					
Soil Direct	On-site	No	Below surface and no site occupants	Remediation	EDC PL
Soil Direct	Off-site	No	Delineation (<PL)	NA	NA
GW Ingestion	On-site	No	No GW use	IC #1, IC #2	> PL
GW Ingestion	Off-site	No	Delineation (<PL)	NA	NA
GW to VI	On-site non-resid	No	No structures	Monitoring & IC #3	SG PL
GW to VI	Off-site	No	SGe & SWG delineation	NA	NA PL
IA	On-site non-resid	No	No structures	IC #3	NA
IA	Off-site	No	SGe & SWG delineation	NA	NA

Notes:
Delineation = delineation has shown CAHs less than SL
NA = not applicable due to control or delineation
IC #1 = Current Institutional Control governing local groundwater for potable use
IC #2 = Institutional Control prohibiting potable use of groundwater on the Subject Site
IC #3 = Institutional Control requiring vapor mitigation system for occupied on-site structures.
IC #4 = Institutional Control requiring vapor mitigation system for occupied off-site structures.
PL = monitor for GW >RG PL w/in 100' of occupied structure

2.7 Identification of Historical Data Gaps

No data gaps are present for the Exide property.

3.0 METHODS OF INVESTIGATION

3.1 Sampling and Analysis Plan

No further investigations are planned at this time.

3.2 Analytical Work

Soil metals (lead) samples were/will be analyzed by EPA Method 6010B. All soil and groundwater VOC/CAH samples were/will be analyzed by EPA Method 8260. All soil gas samples will be analyzed by EPA Method 8260C for passive samplers or TO-15 for Summa Canisters. Prior investigations included the full range of VOCs. Previous analytical laboratory reports included Full QA/QC data packages. Summaries of the results of analytical work are included in Tables 1-13. Future VOC analyses will be limited to CAHs that have been detected above/near the HHLs at some point: TCE, c-DCE, VC, 1,1-DCE, 1,1-DCA.

3.3 Field QA/QC Samples

Field QA/QC samples for past investigations included field duplicates, MS/MSD, equipment blanks and trip blanks. Specific information on the QA/QC samples with each data set is included with the corresponding investigation reports. Summaries of the results of equipment blanks and field duplicates are included in Tables 1 - 13. Any additional investigations will meet the IDEM R2 minimum data deliverable requirements.

4.0 INVESTIGATION RESULTS

Soil, groundwater, and soil gas sampling collected throughout the series of Site Investigations from 2020 through 2024 and included 160 soil borings, 54 surface soil/material samples, five (5) permanent monitoring wells, 25 temporary monitory wells, and 29 SGe / conduit vapor samples. The boring logs are included in Appendix D, GPS coordinate data tables for soil boring, monitoring well, and SGe sample locations are included in Appendix E, Low Flow Sampling Logs are included in Appendix F, and figures, tables and XRF data from previous investigation reports are included in Appendix G.

4.1 Subsurface Geology Investigation Results

4.1.1 Soil Lead

Out of a total of 420 soil samples analyzed, Lead was detected in 124 samples above the EDC HHL (1000 mg/kg), from soil probes and surface samples, and more than half of those were greater than 2x the EDC PL. The average lead concentration for all samples exceeded 1.5x the EDC PL, with the highest concentrations found in the surface soils in the northeast portion of the Subject Site and in areas underneath the southwest portion of the building slab. Samples collected from the south side of the former building footprint routinely exceed the EDC PL. Figure 5 shows the soil sample locations exceeding the IDC PL. Figure 6 shows estimated areas where lead concentrations in the soil exceed the R2 ESL of 1000 mg/kg.

4.1.2 Lead TCLP

Thirty-four samples with total lead concentrations ranging from 804 mg/kg up to 46,900 mg/kg were analyzed for leachable lead by a TCLP test. Every sample below 1,380 mg/kg (9 samples) passed the TCLP test (<5 ug/L) while almost every sample which were greater than or equal to 1,800 mg/kg (23 of 24 samples) failed (>5 ug/L). All six (6) samples which fell between 1,380 and 1,800 mg/kg passed the TLCP test.

4.1.3 Lead Treatability Study

A lead treatability study was performed in early 2024 to determine the effect of certain amendments on the lead impacted soils of the Subject Site. Four different amendments were tested; 1) Blastox®, 2) Terrabond®, 3) Blast furnace slag with MagOx, and 4) Phosphate with MagOx. Dosage rates varied from 3% to 5% (by weight) for each amendment. The results of the treatability study indicated that a 5% Terrabond® application would be effective at reducing leachable lead to below the 5 ug/L TLCP threshold for characteristic hazardous waste. A confirmatory test was conducted by the Terrabond supplier, where results agreed with the 2024 treatability study. (Appendix L)

4.1.4 Soil TCE

During the initial Phase II, TCE was detected in the groundwater on the eastern side of the property at levels exceeding regulatory screening levels, however no indication of contaminated soil was found. During a follow-up investigation, a soil gas survey was conducted (discussed in Section 4.3) in an attempt to locate hotspots where the soil might be impacted. Based on soil gas results, soil samples were collected and analyzed from five (5) additional locations (HS-1 through HS-5) (plus step-out probes) on the eastern side of the property, and regulatory exceedances for TCE were found in two (2) of those locations. Soil VOC samples were collected from locations as shown in Figure 7.

HS-1 hotspot – this sample was co-located with A-5 of the soil gas survey, and soil sampling at this location has been sufficient to fully define the extents of TCE contamination. During the final phase of investigations, 10- and 20-foot step-outs were collected from around HS-1 and it was found that the areas to the south and east contain only trace or low levels of TCE. Concentrations in HS-1 itself were found to slightly exceed the EDC SL (200 mg/kg), while concentrations in the 10-foot west step out were as high as 746 mg/kg. This sampling indicates that the actual hotspot is likely located somewhere between HS-1 and HS-1 10'W. However, based on the presence of a gravel filled loading dock, subsurface samples were not collected to the north of HS-1, and it is possible that soil contamination is present underneath the concrete base of the loading dock.

HS-5 hotspot – this sample was co-located with SGss-1(2) of the soil gas survey, Soil samples collected from HS-5 had elevated concentrations of TCE present, however they were still below screening levels, while samples from the northern and eastern step-outs contained only trace or low-level detections. One sample from the 20-foot west step-out (HS-5 20'W (3')) contained TCE at 1,040 mg/kg, however TCE concentrations in the samples below 3' dropped off rapidly. Ten (10) additional probes were installed in August 2024 to complete the delineation of the HS-5 hotspot. Step outs were initially placed at 20' to the north, south, and west of HS-5 20W (HS-520). Field screening revealed no indication of TCE contamination at the 20' south location, and only minimal impacts at the north and west locations. The highest sample collected during this deployment was 143 mg/kg at HS520-14'SW at 3' BGS. The next highest sample was 35.4 mg/kg at HS520-20'N at 3' BGS. All collected samples indicate the hotspot is present in the vicinity of HS-5 20W', and that the hotspot is not extensive in size. TCE concentrations in the groundwater at HS-5 were almost an order of magnitude greater than those found elsewhere on the site, however it is suspected that this high concentration of TCE in this groundwater sample was most likely due to collodial carryover.

Based on the probes the soils on the site are silty and sandy clays grading to sand and gravel generally starting around 2.0 – 5.0 feet BGS. Refusal, likely bedrock, was encountered at about 11 – 13.0 feet BGS in most locations (SB-GW-25, SB-GW-23, SB-GW-21, SB-GW-22, SB-GW-24, MW-4, and MW-5) and around 14 - 20 feet BGS at all other probe locations (SB-GW-26, MW-1 through MW-3). However, large cobbles are known to be present in the subsurface throughout the Logansport area. Other investigations in the area have reported large cobbles being encountered below 8 feet. Shallow refusal encountered in some on-site borings could be due to cobbles.

4.2 Hydrogeology Investigation Results

Groundwater samples have been collected from five (5) permanently installed monitoring wells, as well as 26 temporary monitoring wells installed on the Subject Site. During the initial Phase II investigation groundwater samples were analyzed for VOC, PAH, and metals. After the installation and initial sampling of five permanent monitoring wells, subsequent groundwater samples were analyzed for VOCs only.

4.2.1 Groundwater TCE

During the initial Phase II, TCE was detected in the groundwater at SP-GW-6 and SP-GW-7 exceeding regulatory screening levels suggesting a TCE groundwater plume might be present on the eastern side of the Subject Site, however further groundwater sampling from temporary monitoring wells to the east and south have shown that this plume does not extend offsite. To date, the highest TCE concentration was present from a temporary monitoring well located at HS-5 (468 ug/L). Additional groundwater samples were collected from three locations around the HS-5 hotspot, where sample results varied from below laboratory detection limits up to 16 ug/L. It is suspected that the high concentration seen in the HS-5 sample was most likely due to colloidal carryover, as low flow conditions from this temporary well were not met.

4.2.2 Groundwater Lead

Lead, along with several other metals analytes, were detected exceeding regulatory screening levels in both filtered and unfiltered samples during the initial Phase II investigation. After the installation and development of five permanently installed monitoring wells, the wells were sampled and field filtered samples were found to be below laboratory detection limits for lead and arsenic at all sample locations. This indicates that the exceedances noted in the initial Phase II were due to colloidal carryover in the groundwater samples, and that metals (including lead and arsenic) are not present in the dissolved or mobile phase of the onsite groundwater.

4.2.3 Natural Attenuation

At sampling locations where parent CAH compounds (TCE and 1,1,1-TCA) were found, daughter products (c-DCE, VC, 1,1-DCA and 1,1-DCE) were also detected, although at low to trace concentrations. The presence of daughter products indicates biological reductive dechlorination could be occurring and suggests that natural attenuation could be an effective remediation method.

4.2.4 Permeability Testing

No permeability study has been conducted on any of the wells within the monitoring well network. However, almost all of the monitoring wells have enough permeability to sustain low-flow sampling, indicating moderate to low permeability. Based on flow rates and draw-down data collected during low-flow sampling throughout the monitoring well network, horizontal permeability (k_h) is estimated to range from 10^{-4} to 10^{-5} cm/sec in the unconsolidated aquifer system.

4.2.5 Monitoring Well Installation

Monitoring well construction diagrams are provided in Appendix D. Groundwater analytical laboratory results and QA/QC analysis are summarized in Tables 9-11 and are shown on Figures 8-9. The following chart summarizes well installation history:

Well Number	Date Installed	Depth	Notes
MW-1	3/31/2022	16.18’	GeoProbe Direct Push Rig
MW-2	3/31/2022	14.30’	GeoProbe Direct Push Rig
MW-3	3/31/2022	14.95’	GeoProbe Direct Push Rig
MW-4	3/31/2022	13.00’	GeoProbe Direct Push Rig
MW-5	3/31/2022	11.80’	GeoProbe Direct Push Rig

4.3 Vapor Investigation Results

Based on the detections of chlorinated compounds in the soil and groundwater on the eastern side of the Subject Site, a shallow soil gas and conduit vapor survey was conducted during a supplemental Phase II to identify locations of higher soil gas concentrations that would be indicative of a potential source area(s) and to evaluate the potential for vapor migration and vapor intrusion (VI) to future on-site structures and adjoining properties. Follow up sub-slab soil gas and vapor conduit samples were collected in 2023 to determine if the 2022 soil gas detections were all resulting from a single source or to determine if a secondary source was present onsite. Conduit vapor samples from the sanitary sewer along the eastern property line adjacent to the neighboring commercial building were also collected.

4.3.1 Exterior Soil Gas Survey

During the 2022 Supplemental Phase II, a total of 26 shallow exterior soil gas (SGe), sub-slab soil gas (SGss) and conduit (sewer) vapor (CV) samples were collected from the area around boring SB-6 where TCE was detected above the RCG I-VIGWSL in the initial Phase II.

The soil gas points were laid out on a grid pattern with 30-foot spacing with additional locations added along the eastern property line. The grid covered a 120 ft x 90 ft area with 20 sample points as shown on Figure 10. A gravel-filled loading dock was discovered during the layout of the grid, resulting in two sample point locations, A-4 and B-4 being omitted and relocated to the south end of the grid and designated C-6 and D-6. Three (3) SGe points were located along the eastern fence-line to assess the potential for vapor migration to the adjoining buildings. Two (2) sample points were installed as SGss points through the slab of the former building, and one sample point (CV-1) was deployed in an on-site sewer manhole to determine if vapors might propagate through the on-site sewer and storm drain conduits.

The samples were collected by passive sampling methods. The sample apparatus, provided by Beacon Environmental, consisted of a small passive sampler (Beacon PSG Sampler) placed in a 3 ft deep x1 inch hole for soil gas, or suspended by wire in sewer manholes to within 1 foot of the high-water mark of the manhole for the CV sample. The sampler deployment, retrieval, and handling procedures followed the guidelines and instructions as indicated in Beacon's Passive Soil Gas Testing – Standard for Site Characterization Rev5 (Appendix H). After collection, the samples were shipped to the Beacon Environmental laboratory for analysis following EPA Method 8260C. The survey report included color isopleth maps indicating areas of highest soil gas concentrations of target compounds (Appendix I).

Analysis of the SGe samples were limited to a target compound list consisting of tetrachloroethene (PCE), TCE, 1,1,1-trichloroethane (TCA), cis-1,2-dichloroethene (c-DCE) and vinyl chloride (VC). Analytical laboratory results are summarized in Tables 12-13 and are shown on Figure 10. TCE exceeded the R2 Large Industrial SGe HHL in samples A-5 and SGss-1, exceeded the R2 Industrial SGe HHL in B-5, and was found in three locations (A-3, B-3, C-3) exceeding the RCG Residential Exterior Soil Gas SLs.

Based on the significant TCE detections in SGss-1 and A-5 (approximately 75 feet apart), follow up samples were collected in 2023 to determine if these two detections were resultant from the same source or if an additional TCE source was present. During this Additional Delineation Sampling, six (6) additional sub-slab soil gas samples were collected at 20 foot stepouts around SGss-1, and to the south between SGss-1 and A-5. A 1" hammer drill was used to penetrate the concrete slab, and a sampling point, connected by ¼ poly tubing, was placed below the slab. The hole was sealed with granular bentonite and the sample location was purged using a PID for 5 minutes. Afterwards, a 1L Summa cannister was attached to the poly tubing and a sample was collected for approximately 5 minutes. Sample logs are available in Appendix F. Results from this round of samples showed a significantly higher detection in the northern step-out of SGss-1 (SGss-1(2) @ 257,000 ug/m3), and an elevated detection in the eastern step-out (SGss-3 @ 1,030 ug/m3). Samples SGss-4 and SGss-5, located between the SGss-1 and A-5 hotspots were both well below regulatory screening levels, suggesting that two separate hotspots were likely present. Sample SGss-6, located approximately 20 feet west of the A-5 hotspot and 20 feet south of SGss-5, also exceeded the large commercial / industrial SL. Based on these detections, additional soil samples were collected from the vicinity of SGss-1(2) (see Section 4.1).

4.3.2 Vapor Conduit Survey

Additional Delineation Sampling also included two (2) vapor conduit samples collected from manholes located along the sanitary line just off the eastern edge of the property. During this sampling, 6L Summa cannisters were suspended under the manhole covers and left in place for 24 hours. Sample logs are available in Appendix F. The results of both these samples were below screening levels, suggesting that offsite vapor migration through the sanitary sewer is not occurring. Additional sewer gas samples will be collected post remediation.

4.4 Data Quality Assessment

4.4.1 Sample Delivery and Analytical Work

During Site investigation activities, all soil and groundwater samples were placed on ice and hand-delivered to the analytical laboratory within 24 to 72 hours. Pursuant to EPA Method 5035A (terra core samplers), soil samples for VOCs were stored on ice and frozen within 48 hours of collection.

EPA Method 5035A/8260 (VOCs), EPA Method 8270SIM (PAHs), EPA Methods 6010B, 7470, 7471 (metals), EPA Method 8151 (herbicides), and EPA Method 8260C (VOCs soil gas) were the primary analysis conducted for the on-site investigations supporting this RWP.

4.4.2 Field QA/QC Results

Full QA/QC reports are included with, and the results of QA/QC samples are discussed in detail in each of the investigation reports. The results of the field duplicates and field equipment blanks are included in the appropriate data summary tables. The groundwater sampling results generally showed high precision based on low field duplicate RPD. Low matrix interference was indicated by acceptable MS/MSD recoveries and low carry-over interference from field equipment blanks (usually no detections).

4.5 Data Quality Objectives

The DQOs include acceptable precision (based on field duplicate RPD), acceptable matrix interference based on acceptable MS/MSD recoveries, low blank interference based on field equipment and trip blanks and good sensitivity based on analytical reporting limits at or below the RCG SLs. DQOs were generally met on investigation data sets.

5.0 SITE INVESTIGATION CONCLUSIONS

5.1 Summary of Conclusions

5.1.1 Lead

Soil samples from 51 sampled locations exceed 2x the R2 EDC HHL for lead. Figure 6 shows the estimated extents of lead in shallow soils in excess of the EDC HHL (1000 mg/kg). In general, where present, lead is usually in narrow intervals, often the 0-12" layer.

Filtered groundwater samples exceed the R2 RGW HHL for lead in four of the temporary sample locations. However, samples from the permanent monitoring wells were below detection limits for lead, indicating that lead is not present in dissolved or mobile phase groundwater.

5.1.2 VOCs (TCE)

Soil samples from boring location HS-1, HS-1 10'W, and HS-5 20'W indicate TCE impacts above the R2 EDC HHL. Estimated extents of two (2) soil TCE hotspots are presented in Figure 7.

Groundwater samples SB-6, SB-7, SB-23, HS-1 10'E, HS-1 10'W, MW-5, HS-5, HS520-14NE, and HS520-20W exceeded the R2 Residential GW HHL for TCE. The estimated limits of TCE concentrations in the groundwater is presented in Figure 8. Plume limits are based on groundwater samples collected from temporary sample points as well as the permanent monitoring well.

SGe and SGss samples have indicated the presence of TCE vapors above IDEM VI/SGe commercial/industrial PLs near the two hotspots discussed above.

5.2 Summary of Potential Risks Associated with the Site

Completed pathways include:

- None

Potential future risks include:

- Soil Direct Contact for construction workers from lead and TCE.
- Soil Direct Contact for site occupants from lead and/or TCE-impacted shallow soils at the east end and along the south sides of the former factory.
- TCE vapor migration into future occupied structures on the Subject Site.
- Future ingestion of groundwater on the Subject Site (there is no current use of the groundwater, and the City Ordinance restricts use of the groundwater).

6.0 REMEDIATION PLAN

6.1 Extent of Remediation

Subsurface soil and groundwater at the east end of the former building has been impacted by TCE above the former IDEM RCG SLs and current R2 PLs. SGe and SGss samples indicate continuous off-gassing of TCE and other CAHs from the soil and groundwater beneath the former building in excess of the SGe I-PL. Remediation of the TCE area is planned through a combination of excavation and removal of the TCE impacted soils (source area), application of in-situ chemical reduction (ISCR), long-term monitoring, plume trend analysis, IC's and VMS where needed to prevent completion of pathways.

Lead is present on the surface, under the southwest portion of the concrete slab, and in the shallow subsurface soils in the areas east and south of the former building. There is no evidence of significant downward migration of lead to deeper soils or groundwater. To reduce future potential for direct exposure during planned construction and redevelopment, excavation/removal of the most highly lead-impacted soil is planned. To avoid the high costs of hazardous waste disposal, lead impacted soils will be treated in-situ prior to excavation and disposal.

6.2 Relevant Data Gaps

No data gaps are present for the Exide property.

6.3 Evaluation and Selection of Remedial Alternatives

Sufficient data exists to identify and support the selection of relevant remedial actions.

6.3.1 Potentially Applicable Remedial Technologies

Remedial alternatives evaluated herein are reasonably capable of meeting the remediation objectives stated in Section 1.4. Additional supporting measures will include, but not be limited to, reliance on institutional controls to mitigate future exposure to residual lead and CAHs likely to remain after remediation is complete to the extent practicable.

6.3.2 Evaluation of Applicable Remedial Technologies

In developing this RWP, three (3) soil lead and twelve (12) TCE remedial approaches have been considered as follows:

1. <u>Soil / Concrete Excavation and Disposal</u>

Soil / concrete and fill material that exceeds the PLs on the Subject Site may be removed and replaced with soil that is not impacted. The removed soil / concrete could be disposed of at a landfill pending suitable disposal analysis. Removal of lead and TCE impacted soils would significantly reduce the levels in the soil and groundwater at the Subject Site. Depth and area of excavation(s) may be more clearly defined for TCE to facilitate final design.

2. Soil/Pavement/Stone/Hardscape Cover
A layer of soil, stone, pavement, or building pad cap/cover may be constructed over impacted soils on the Subject Site to prevent direct contact exposure. A maintenance plan and environmental restrictive covenant would be needed to maintain the cover. If it is necessary to maintain the grade, then soil would have to be removed before placement of the cover.
3. In-situ Soil Treatment
In-Situ Soil Treatment involves importing an approved amendment material and mixing that material with contaminated soil. For lead contaminated soils, treatment does not physically remove contaminants, rather it locks contaminants in the soil matrix preventing potential to leach as measured through TCLP.
4. Vapor Barrier
Installation of a vapor barrier (geomembrane) system beneath future structures at and near the source area would significantly reduce the potential of residual CAH vapors from migrating into occupied spaces.
5. Soil Vapor Extraction
SVE can be an effective means of removing CAHs from the soil and can remove some from the top of the water table. By drawing low-CAH air across the top of high CAH groundwater, SVE induces diffusion of CAHs out of the aquifer. The size of the identified source area and the size of the groundwater impacted area is relatively small. However, infrastructure to support a system is not currently present at the Subject Site.
6. Air Sparging
Air sparging (AS) includes pumping compressed air into the aquifer below the plume. The air rises through the aquifer in channels, and pore-scale fingering volatilizes CAHs. The sparged air and CAHs passes through the vadose zone and vents to the atmosphere unless it is drawn into SVE wells. In some areas, AS should be combined with SVE to prevent the risk of migration of CAH vapors to residential basements and structures. By introducing oxygen into the subsurface, AS chemically conflicts with attenuation through anaerobic biodegradation.
7. C-Sparging
A C-Sparging (ozone sparging) (CS) includes pumping ozone rich compressed air into the aquifer below the plume. The primary means of CAH removal is believed to be direct oxidation of the CAH molecule within the bubble to CO_2 and HCl. CS is combined with SVE when utilized near structures to capture the sparged gases

and unreacted ozone and CAHs. By introducing oxygen into the subsurface, CS chemically conflicts with attenuation through anaerobic biodegradation.

8. Pump and Treat

   The affected groundwater could be removed through several high capacity or many lower capacity wells. The groundwater would be treated on the surface and discharged to the sanitary sewer system. Treatment could include air stripping, carbon adsorption, biological treatment or UV/ozonation. Pump-and-treat is not a cost-effective means of remediating low solubility groundwater constituents, such as CAHs, and would not affect the source area soils. While technically feasible, it is cost prohibitive and remediation times are excessive.

9. Chemical Oxidation – H_2O_2

   CAHs may be oxidized to Cl^- and CO_2 by the *in-situ* addition of hydrogen peroxide (H_2O_2 (Fenton's reaction)). Hydrogen peroxide is a strong oxidizer which will oxidize iron II, forming a hydroxyl radical, which directly oxidizes CAHs. The H_2O_2 is injected into the aquifer through wells or temporary injection points. The off gasses must be collected by means of SVE to prevent buildup of oxygen and reaction products. There are many interfering reactions.

10. ISCO

   In-Situ Chemical Oxidation (ISCO) is the addition of oxidants to soil or groundwater to chemically breakdown contaminants. CAHs may be oxidized to Cl^- and CO_2 by the *in-situ* addition of potassium permanganate ($KMnO_4$) or sodium persulfate ($Na_2S_2O_8$). The oxidant may be mixed with unsaturated soil through soil mixing, applied to soil dissolved in water, or injected into the aquifer in aqueous form through a recirculation well, standard well or temporary injection point. Any off gases from the application of ISCO should be vented from enclosed occupied spaces.

9. ISCR

   In-situ Chemical Reduction (ISCR) is the addition of various chemicals to a subsurface environment to create a strongly reducing environment in which CAHs will be converted to ethene, ethane and chloride through chemically induced reductive dechlorination. Sulfidated zero-valent iron (ZVI) is one such product. The iron filings may be placed in a trench or injected in a slurry across the path of the plume creating a barrier such that all affected groundwater must pass through the remediation barrier. The thickness of the trench is determined by the concentration of the contaminant and the groundwater flow velocity. This technology is proven for CAHs and is ideal for locations where the source area is either undefined or inaccessible, but the plume is narrow. The ZVI may also be mixed as an amendment to saturated soil at the base of an excavation.

10. Bioremediation – Injection Points

   Electron donors may be introduced to the aquifer through slow release compounds

(HRC^{TM}; Hicks and Koenigsberg, 1998 and Koenigsberg and Farone, 1999). A polylactate ester slowly releases lactic acid into water for a period of 6 to 12 months. The HRC is in slurry form, which can be injected into the aquifer through numerous probe holes (typically at 10-foot or 15-foot spacing). The line of HRC injection points creates a biodegradation zone equivalent to approximately six to twelve months' worth of groundwater migration. The zone would form a remediation barrier in which CAHs would be degraded through anaerobic reductive dechlorination to non-toxic products. The zone would continue to function until electron acceptors (oxygen and nitrate) migrate into the zone from upgradient or diffuse into the groundwater from the vadose zone above. The selection of lactic acid in a slow-release formulation may optimize the hydrogen concentration in the affected zone, thereby minimizing competing methanogenic reactions. Production of VC is a known risk associated with the anaerobic reduction of PCE and TCE. VC production, if encountered, would require injections of ORC or an oxidizer in the down gradient zones of the plume to alleviate production of VC. Bioremediation is often a cost effective and can provide rapid results compared to other remedies. However, pilot tests are necessary, (have not been conducted) and can create minor delays in remedy deployment.

11. Bioremediation - Inoculated Amendment (Bio-Augmentation) Injection Points
    Bioremediation can be augmented with the introduction of mixtures of beneficial microbes with the selected electron donor compounds. The microbe species are selected based on the COCs, existing biota, and aerobic or anaerobic conditions of the Site. Like bioremediation above, inoculated amendments need specific pilot studies to determine the environmental conditions for the microbes to thrive. The pilot studies (have not been conducted and) are frequently conducted in conjunction with testing feasibility of other alternatives.
12. Plume Trend Analysis
    Natural attenuation includes intrinsic bioremediation, hydrolysis, retardation, dispersion and volatilization. A detailed evaluation of feasibility of natural attenuation has not been fully conducted. Plume trend analysis so far indicates insufficient evidence of statistically significant trend, therefore additional monitoring may demonstrate plume stability/contraction.

6.4 Recommended Remedial Alternative(s)

The recommended remediation alternatives include:

Lead - a combination of in-situ soil treatment followed by soil excavation and disposal. Some treated soil below 2-foot depth may be left in place with an ERC to prevent exposure.

TCE – a combination of soil excavation and disposal, the application of ISCR, and plume stability monitoring in conjunction with appropriate IC's and ERC's within the CAH areas. Both soil hotspots (HS-1 and HS-5 20'W) will be excavated to 8' BGS in the area of highest concentrations, and then to 4' BGS in the surrounding areas. The goal for the TCE soil excavation will be to remove all soil which exceeds 5 mg/kg TCE prior to the application of the soil amendment.

The extent of excavation for both lead and TCE areas will depend on field screening and confirmation sampling results. Success of the TCE remediation will be confirmed by closure sampling, quarterly monitoring in existing and planned permanent monitoring wells, and significant reduction or absence of TCE in future soil gas samples. Lead remediation will be confirmed by closure samples of the soil.

With the removal of the TCE soil hotspot and application of soil amendment, it is likely that groundwater conditions on the property will improve over time. Additional permanent monitoring wells will be installed and TCE impacts to the site's groundwater will be re-evaluated post remediation during a minimum of four (4) rounds of quarterly sampling. If groundwater conditions do not show signs of improvement post remediation, amendment injections will be considered at targeted locations.

The future on-site, groundwater consumption exposure pathway is addressed by a current City ordinance and a planned ERC restricting groundwater use. ERCs will be placed on Subject Site restricting access to the groundwater and requiring passive vapor mitigation systems be installed during construction of any structures, followed by monitoring and (where needed) active VMS systems. Additional ICs may be considered as necessary. Post-remediation groundwater monitoring will be implemented to confirm the plume stability and limits. Post-remediation soil gas sampling will be conducted to confirm the status of potential on-site vapor intrusion. The ERC will also require a soil management plan for deeper soils (below 2 feet) containing lead above the R2 IDC PL.

6.4.1 Area of Contamination (AOC)

The EPA's area of contamination (AOC) policy allows certain discrete areas of generally dispersed contamination to be considered a RCRA unit, where consolidation and treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for the purposes of RCRA. An AOC will be established on the Site which includes all areas where lead impacted soils will excavated and treated. Contaminated soils will be consolidated into stockpiles and treated for lead contamination. After soil treatment is complete, stockpiles will be analyzed as required to meet landfill disposal requirements.

6.4.1 Hazardous Waste Area

At the HS-1 hotspot, soils in the 18" are affected by both TCE and lead. TCE concentrations vary, however lead concentrations in this area are consistently above the short-term excavation screening levels. Based on the comingling of the contaminants and the expected requirements in a contained-in determination, approximately 30 tons of soil around the HS-1 hotspot are expected to require hazardous waste disposal. The soil in this area will be stockpiled and treated with the Terrabond amendment as discussed in 6.4.2 below and immediately loaded into lined roll off boxes. Roll off boxes will be covered and transported to a RCRA hazardous waste landfill after disposal analysis sampling is completed.

6.4.2 Treatment and Excavation of Lead Impacted Soils

TCLP analysis of the Subject Site's soils suggests that lead levels exceeding 1,760 mg/kg would likely fail TCLP (and a very low risk at 1,380 mg/kg could fail), which would require disposal at a hazardous waste landfill. Direct excavation of lead impacted soils would generate thousands of tons of hazardous wastes, equating to several millions of dollars for disposal only. Soil treatment does not physically remove contaminants, rather it locks contaminants in the soil matrix preventing potential to leach as measured through TCLP. Soil treatment would allow any lead contaminated soil over 1,380 mg/kg which is excavated to be disposed of as non-hazardous wastes rather than hazardous wastes at significant cost savings. After soil treatment, the purpose of the excavation is to remove as much of the highest lead-impacted soils as necessary to reduce the average soil concentration in affected area to below the IDC PL (800 mg/kg). The lead concentrations in the shallow soil northeast of the building are much higher so all of the more impacted soil at this location will be removed. Initially, shallow soil will be removed from the area extending from the street to south of SB-6 to a depth of 12-inches. Based on field screening and confirmation sampling, the excavation may be extended vertically or horizontally. In addition, shallow soil in the grassy areas to the south of the building footprint will be removed to 0.5 to 2.0 feet, depending upon location. The hotspot removals will be extended horizontally and vertically based on field screening and laboratory confirmation samples. The excavations will be extended until the average of all remaining shallow soil samples in the area is below the IDC PL (800 mg/kg), all shallow soil >1,380 mg/kg has been treated and all identified soil greater than 2x EDC HHL (2,000 mg/kg) has been removed.

Based on the results of a treatability study, once treated with the in-situ soil amendment, soils should not fail a TCLP test and will be acceptable for disposal at a Subtitle D (non-hazardous waste) landfill. Impacted soils will be concentrated into stockpiles (within the AOC) adjacent to the concrete slab where the soil amendment will be applied at a 5%

weight ratio. The soil / amendment will be mixed by an excavator using a standard excavator bucket or mixing attachment until uniformity throughout the soil is achieved. After soil mixing is complete, samples will be collected and analyzed for lead by TCLP at a rate required by the Subtitle-D landfill. After confirmation that the stockpiles do not exceed the threshold for characteristic hazardous waste (5.0 mg/L lead), the stockpiles will be live loaded into trucks and transported to the nearby subtitle-D landfill for non-hazardous disposal. Any sample / volume which fails the TCLP test will be retreated in place with an additional volume of the soil amendment. Once re-treatment has been completed, additional soil samples will be collected as discussed above. If it becomes apparent that the soil cannot be successfully treated, the stockpile will be classified as hazardous waste and transported to a RCRA hazardous waste landfill for disposal. Terrabond product details, SDS, and treatability study results can be found in Appendix M.

Upon completion the excavation will be backfilled and compacted with granular fill from either a commercial source or using crushed concrete (either from the remnants of the Exide concrete pad or concrete from the nearby Trelleborg site) under an IDEM approved legitimate reuse approval. Monitoring well MW-5 will be destroyed during the excavation and replaced upon completion of the remediation project to monitor the TCE plume (see below). Additional monitoring wells will also be installed in vicinity of the HS-1 and HS-5 hotspots, while exact locations may vary slightly due to structures or utilities present in site redevelopment plans.

6.4.3 Excavation of TCE Impacted Soils

The purpose of the excavation is to remove as much of the more highly TCE-impacted soils as practical including all over the R2 Excavation worker PL (100 mg/kg) (there is no R2 PL for IDC). The goal for the excavation will be to remove all TCE impacted soil which exceeds 5 mg/kg. Bulk removal of the source will help ensure that the remaining groundwater impact will attenuate naturally. The expected excavation area for TCE impacted soils is shown on Figure 7. The core area of the hotspot will be excavated down to 8' BGS, while the surrounding area will be excavated down to 4' BGS. Excavated soils will be placed in plastic lined roll-off boxes. Soil in the roll-off boxes will be tested for total TCE, and soil <10 mg/kg TCE are expected to meet the requirement of an IDEM approved contained-in determination and will be transported to a subtitle D non-hazardous waste landfill. Soil 10-19 mg/kg will be tested for TCLP TCE and, if <0.5 mg/L, will also be disposed at a Subtitle D landfill. Soil that is >0.5 mg/L TCE TCLP or >19 mg/kg total TCE will be transported and disposed at a hazardous waste landfill. Based on field screening and closure sampling results (see below) the excavation may be extended to meet the goal of 5 mg/kg.

Upon completion of the excavation, a commercially available chemical reducing agent (e.g. zero-valent iron or ZVI) will be added to the bottom of the excavation at/near the water table and mixed in to help remove residual TCE in saturated soils. After confirmation sampling results are obtained, the excavation will be backfilled and compacted with granular fill from either legitimate reuse approved crushed concrete, or a commercial source.

6.4.4 Exide Concrete Pad

Once all lead contaminated soils are treated and removed from the property, the concrete slab onsite will be demolished. Samples collected from the concrete slab suggest that it meets the criteria for legitimate reuse, and this concrete will be crushed and stockpiled or windrowed at locations agreed to by the site's redevelopment engineer / contractor. This crushed concrete will be used as fill material beneath future building slabs or asphalt parking lots. A soil management plan will be prepared for the facility detailing locations where this lightly impacted concrete is located.

6.4.4 Institutional Controls

Per the city municipal code (Logansport, Indiana, Code of Ordinances, Chapter 50, Article IV, § 50-93(g) (Appendix A)) the installation of groundwater wells and the extraction of groundwater for potable use is generally prohibited within 300' of an existing City of Logansport water main. A statement will be obtained from the City of Logansport to confirm that the ordinance is intended and will be used to prevent potable wells on and near the Subject Site. The City of Logansport Utilities has confirmed that all of the residential properties in the area are connected to the municipal water system. To its knowledge, there are no private drinking water wells located within the area. Accordingly, the risk of human groundwater consumption is considered eliminated based upon existing local controls both on-site and off-site.

In addition to the restrictions imposed by the ERO, an ERC will be placed on the Subject Site to prohibit the use of groundwater for any purpose other than environmental sampling. The ERC will also require a vapor intrusion assessment and/or the installation and use of vapor mitigation systems for any occupied structures at the east end of the property in the areas affected by soil gas exceeding the R2 PLs. The site ERC will prohibit residential redevelopment without further remediation or sampling and will require a Soil Management Plan for soil more than 2 feet below grade that exceeds the closure goals. Any remaining risk can be addressed through the use of further ICs, as necessary.

6.4.5 Local, State or Federal Permits

A Board of Public Works approval is required prior to installation of any wells or other cuts in public right-of-way. Approval of private property owners must be obtained if wells or other cuts are performed on other private property. Landfill disposal approvals will be needed for soil disposal. IDEM approval is required for a Contained-In Determination for TCE-impacted soil disposal as non-hazardous waste.

Due to the size of the area for concrete removal and soil excavation, a Storm Water permit will be required. No other need for permits is anticipated at this time.

6.4.6 Contingent Remediation Plan

If post remediation sampling and/or final closure samples do not meet the closure goals, additional remediation measures will be evaluated.

6.4.7 Cost Estimate

The estimated cost of the project, including the removal of the concrete slab of the former buildings is summarized below:

Summary Budget	Subtotals	Totals
PRE_REMEDIATION		
Hot Spot delineation & reports		$100,000
REMEDIATION	---	
Lead Soil Treatment / Mixing		$715,000
TCE Soil Treatment Amendment		$44,000
Remediation Contractor		
--Mob / Demob	$35,000	
--Safety / Decon	$25,000	
--Wheel Wash	$40,000	
--Storm water & dust control	$25,000	
--Excavation / Equipment / Labor (10,000 tons @ $60/ton)	$600,000	
--Backfill (10,000 tons @ $30/ton)	$300,000	
--Concrete Breaking / Crushing / Stockpiling	$120,000	
Total Contractor Budget		$1,259,500
Landfill - Lead Contaminated Soil (9,741 tons @ $32/ton)		$342,883
Landfill - TCE Contaminated Soil (356 tons @ $32/ton)		$12,531
Consulting / Engineering (incl Completion Rpt)		$361,970
POST REMEDIATION MONITORING		
GW Well Installation		$65,000
Quarterly Monitoring x 8 w/ reports		$95,000

Total Budget $2,995,884

6.5 Sampling Plan(s) for Remediation

This section addresses monitoring and closure sampling in support of the remediation and includes closure samples during the soil excavation, SGe sampling and groundwater sampling to monitor the status and stability of the TCE plume.

6.5.1 Soil Excavation Closure Samples

When the excavation of lead impacted areas has reached the predetermined limits or based on XRF or PID field screening, confirmation samples will be collected. The confirmation samples will include soil samples only. The bottom and sidewalls of the excavations will be screened (XRF or PID) and soil samples will be collected at a maximum of 20-foot intervals at locations indicated by field screening as representative (generally the highest screened location). The soil samples will be collected from within six inches of the exposed surface. The soil samples for TCE will be collected by EPA Method 5035A, placed on ice and frozen within 48 hours. Soil samples will be analyzed by EPA Method 8260 for TCE and Method 6010B for lead. SPLP samples will be analyzed as necessary. QA/QC samples will include trip blanks, field blanks, field duplicates, and MS/MSD samples. The laboratory reports will include full (Level IV) QA/QC data package.

TCE results will be compared to the excavation goal of 5 mg/kg and the EDC PL to determine whether any remaining restriction to exposure is needed. The average of all remaining soil lead concentrations will be compared to the IDC PL (800 mg/kg) and the peak to the 1,380 mg/kg TCLP potential range and to the 2,000 mg/kg project goal.

6.5.2 Post-Remediation Groundwater Sampling and Monitoring

The monitoring well network currently consists of 5 permanent 1" wells at depths ranging from 11 feet to 15 feet BGS. Additional shallow monitoring wells will be installed in and downgradient of the TCE impacted area at or near HS-5, HS-1, SB-6, SB-26 and MW-5. In addition, deeper (bedrock) wells will be installed at the HS-1 and HS-5 (source area) locations. Monitoring well locations may vary slightly depending upon site redevelopment designs. Groundwater monitoring will be conducted quarterly for a minimum of 4 quarters and until clean-up goals are met, plume stability is demonstrated, or site closure is granted from IDEM. Additional options will be evaluated for groundwater remediation if necessary. Groundwater will be purged and sampled following the IDEM Micro-Purge (Low-Flow) Sampling Option (updated May 11, 2021) to the extent possible and analysis will be for CAHs by EPA method 8260. Water levels will be collected from all wells and groundwater flow maps created. The results of the monitoring along with other remediation progress information will be included in each QMPR.

6.5.3 Post-Remediation Vapor Intrusion Monitoring

Post-remediation soil gas sampling will be conducted in the TCE-impacted soil area. If the results do not confirm that vapor exposure levels are below PLs, then the ERC will require vapor mitigation on future buildings near the affected area. At least one round of IA sampling will be conducted in future structures prior to occupancy to test the effectiveness of the vapor barrier or vapor mitigation systems, if present.

6.6 Schedule for Submittal of Results

A Remediation Implementation Report will be prepared and submitted to IDEM following completion of the treatment, excavation, and backfill activities, installation of monitoring wells, and first round of groundwater sampling. The report will include documentation of soil removal, disposal, and closure sample results.

6.6.1 Data Management

Soil sample results from the excavation closure will be summarized in a single table for lead and a second for CAHs. Historical soil testing results are summarized in the attached tables.

All groundwater monitoring data will be summarized in tables of current results as well as a larger database of historical groundwater monitoring results. Groundwater monitoring data will also be summarized in figures showing monitoring well locations, and the extent of the groundwater plume and recent monitoring well testing results. QA/QC sample (field duplicates and blanks) results will be summarized in a separate table.

Any IA, SGe, and SGss samples will be summarized in a single table organized by location and including any historical data for comparison. VI sample results will also be summarized on figures showing sampling locations.

6.7 Projected Work Schedule

The projected work schedule for implementation of the tasks described in this RWP is discussed in the following sections.

6.7.1 Implementation Schedule

The following schedule is anticipated for implementation of the remediation:

Months after approval of RWP Rev	Task
2	Excavation Contractor Coordination
2-3	Begin soil treatment (lead)
3-6	Excavation and removal of TCE and lead impacted soils
3-6	Excavation confirmation sampling, concrete break & crush
3-6	Backfill and cover
7	Install permanent monitoring wells
8	Conduct quarterly groundwater monitoring; SGe Closure Sampling (1^{st} round)
9	Remediation Implementation Report
11	Conduct quarterly groundwater monitoring.
13	QMPR
14	Conduct quarterly groundwater monitoring.
16	QMPR
17	Conduct quarterly groundwater monitoring.
19	QMPR
20	Request for Closure and Post-Closure monitoring plan, if applicable.

Up to eight (8) rounds of quarterly groundwater monitoring (Section 6.5.2) will be conducted, if necessary. QMPRs will be submitted after each calendar quarter and will summarize the events in the preceding quarter.

6.7.2 Closure

After closure is obtained, the monitoring wells will be maintained (repaired and replaced as necessary) for the duration of the post-closure monitoring requirement, if applicable. All monitoring wells that are not required for post closure monitoring will be abandoned by a licensed well driller as per Indiana Code (25-39 and 312 IAC 13).

6.8 Health and Safety Plan

See attached Appendix J.

6.9 Quality Assurance Project Plan

See attached Appendix K.

7.0 COMMUNITY RELATIONS

The following Community Relations Plan ("CRP") is included pursuant to the requirements of the Indiana Remediation Program Guide (RPG) and Indiana Code Section 13-25-5-7. Indiana Code Section 13-25-5-7 requires that a Remedial Work Plan include provisions for "community relations and community comment in planning, cleanup objectives, and implementation processes."

Community relations and public comments are the responsibility of the City of Logansport. The primary purpose of a community relations plan is to provide a means of informing the public regarding the project. The main components include public meetings associated with the review and approval of proposals to the City for the redevelopment of the Subject Site. The meetings will be held in conjunction with approval of any new contracts for the redevelopment by the City of Logansport. Remediation plans and progress are also presented at board meetings which are open to the public. A Public Comment period is required prior to approval of the RWP by the IDEM and will be conducted by IDEM. City of Logansport officials and public bodies will be kept apprised of the status of the project by means of internal progress reports.

8.0 QUALIFICATIONS AND LIMITATIONS

BCA Environmental Consultants, LLC prepared this RWP in accordance with the IDEM RCG and Risk-based Closure Guide and generally accepted practices in a manner consistent with that level of care exercised by other members of our profession in the same locality and practicing under similar circumstances. Our professional opinions are based upon available information describing the Subject Site and area and the results we obtained for widely spaced samples of soil and groundwater. Conditions in areas not specifically sampled or analyzed may differ significantly from those inferred in this RWP. Although the scope of the remediation discussed in this RWP is believed to be appropriate to address the stated objectives, we note that no environmental assessment can completely eliminate uncertainty with respect to the presence, concentration, or extent of chemicals of concern in soil or groundwater, and that no RWP is likely to anticipate all relevant environmental conditions that may be encountered as remediation is performed. The timing and cost for implementation and completion may therefore be either more or less than those estimated herein.

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