

Revitalizing Auto Communities Environmental Response
(RACER) Trust

In Situ Chemical Reduction with Zero Valent Iron Pilot Study Installation Summary

Pontiac North Campus, Former Fiero Property

March 2023

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Prepared By:

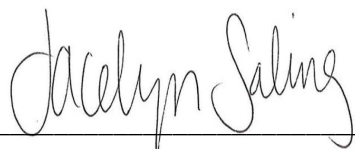
Arcadis of Michigan, LLC
28550 Cabot Drive, Suite 500
Novi, Michigan 48377
Phone: 248 994 2240

Prepared For:

RACER Trust

Our Ref:

30167840



Jackie Saling, P.E.
Technical Expert, Vice President



Andrew Lorenz, P.E.
Senior Environmental Engineer



Eric Feenstra
Environmental Specialist

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Acronyms and Abbreviations

Arcadis	Arcadis of Michigan, LLC
bgs	below ground surface
Cascade	Cascade Environmental
cis-1,2-DCE	cis-1,2-dichloroethene
CVOC	chlorinated volatile organic compound
ISCR	in situ chemical reduction
ITRC	Interstate Technology and Regulatory Council
MW	monitoring well
PCE	tetrachloroethene
PRB	permeable reactive barrier
RACER	Revitalizing Auto Communities Environmental Response Trust
ROI	radius of influence
TCE	trichloroethene
TGI	Technical Guidance Instruction
USEPA	United States Environmental Protection Agency
VAP	vertical aquifer profile
VI	vapor intrusion
ZVI	zero valent iron

1 Introduction

On behalf of Revitalizing Auto Communities Environmental Response Trust (RACER), Arcadis of Michigan, LLC (Arcadis) has prepared this In Situ Chemical Reduction (ISCR) Zero Valent Iron (ZVI) Injection Pilot Study Installation Summary Report for the former Fiero Assembly property (Site) at the RACER Pontiac North Campus in Pontiac, Michigan. ZVI borings were installed in December 2022 and January 2023 to evaluate the effectiveness of ISCR in reducing concentrations of tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE) in groundwater. Information collected during the pilot test along with monitoring data, evaluation of risks, and other corrective measure options will be used to evaluate implementation of future remedies at the Site. The ZVI injection was generally completed in accordance with the ZVI Injection Pilot Workplan (Arcadis 2023b). This report documents the work completed as part of the ZVI pilot test.

2 Site Description

The Pontiac North Campus property (property) is the location of a former automobile manufacturing facility. The Fiero Site (Site) comprises approximately 81 acres of the southwestern portion of the property. The northern portion of the Site is currently owned and occupied by Green for Life, a waste management company. Prior to the current owner and occupant, the area was most recently used for prototyping, storage, and other non-manufacturing processes. The southern portion of the Site included a former powerhouse and is now vacant. The Site is bounded by residences to the north; the General Motors Pontiac Stamping Plant to the east; Owens Street and residences to the south; and Baldwin, Kennett, and St. Clair Streets and then residences and businesses to the west. The pilot test location is near the center of the Site (**Figure 1**).

The lithology of the pilot test area consists of an interbedded mixture of clay with some sand from 0 to 15 feet below ground surface (bgs); interbedded sand, silts, and clays from 15 to 25 feet bgs; a fine sand unit from 25 to at least 40 feet bgs; and basal clay typically around 40 feet bgs. Depth to groundwater at the pilot test location ranges from approximately 20 to 25 feet bgs.

Near the source areas (**Figure 1**), high concentrations of chlorinated volatile organic compound (CVOC) impacts are retained in the lower transmissivity interbedded unit and are slowly migrating into the higher transmissivity sand unit below, where the concentrations decrease as a result of an increase in advective groundwater flow. The highest concentrations in groundwater near the source areas are observed in monitoring wells that intersect the interbedded zone. As the plume migrates downgradient, including at the pilot test area, the highest concentrations of CVOCs are located deeper within the sand unit as additional recharge and dilution occur within the shallower portion of the sand unit along the length of the plume. At the southeastern property boundary, CVOCs are detected at low levels, with TCE being the only compound that has been detected at the property boundary and offsite at concentrations exceeding the residential site-specific volatilization to indoor air criteria (Arcadis 2023a).

3 Zero Valent Iron Pilot Study Objectives

ISCR with ZVI was selected for pilot testing based on its ability to degrade CVOCs abiotically. This abiotic process oxidizes (corrodes) the ZVI and reduces the dissolved CVOC concentrations. The process induces highly reducing conditions that promote substitution of a chloride atom with a hydrogen atom in the CVOC molecule (Interstate Technology and Regulatory Council [ITRC] 2011). The products of the dechlorination reaction are chloride (Cl⁻), ferrous iron (Fe²⁺), nonchlorinated hydrocarbons (e.g., ethane), and hydrogen.

The objective of the pilot test is to evaluate the efficacy of treatment of PCE and TCE using ZVI. Potential offsite migration of groundwater containing PCE and TCE at concentrations above site-specific residential vapor intrusion (VI) criteria is a concern at the Site; therefore, ISCR with ZVI is ideal because it limits the potential for generation of daughter products that can result in VI concerns associated with biological degradation of CVOCs. Direct-push injection was selected as the ZVI delivery method based on its small installation footprint, quick installation time frame, and easy field adaptability, which is important given the uncertainty of ongoing/future construction and redevelopment activities at the Site.

The ZVI pilot study was conducted to collect the information required to evaluate the potential for success of the proposed remedial action and to provide a basis for the design of a full-scale ZVI barrier should such a barrier be determined necessary and cost-effective. The primary objectives of the pilot study were to:

- Quantitatively evaluate treatment of CVOCs onsite utilizing an injected ZVI barrier by monitoring upgradient and downgradient monitoring wells.
- Quantitatively evaluate treatment longevity of an injected ZVI wall by monitoring upgradient and downgradient monitoring wells over time.
- Verify the radius of influence (ROI) of the injected ZVI in the subsurface utilizing confirmatory borings after completion of all injections to verify overlap of ROIs and a continuous treatment barrier.
- Evaluate the potential for chlorinated byproduct generation (e.g., vinyl chloride) with potential to create VI risks to offsite receptors by monitoring downgradient monitoring wells.

4 Pilot Study Implementation

The ZVI pilot test scope consisted of the injection of ZVI solution via a direct-push rig to cover the extent of the PCE and TCE plume identified in a prior vertical aquifer profile (VAP) investigation. A baseline groundwater sampling event was conducted in November 2022; results are discussed in Section 6. A utility locate was completed on November 29, 2022, to identify any potential buried utilities and underground obstructions in the injection transect (none were identified).

4.1 ZVI Injection Summary

A total of 26 ZVI injection borings were installed over 15 working days between December 12, 2022, and January 11, 2023. Cascade Environmental (Cascade) performed the ZVI injections with oversight by an Arcadis geologist. ZVI was emplaced in discrete intervals via direct-push injections in the target zone of 25 to 40 feet bgs. Eight “emplacements” were targeted per injection location, spaced 2 feet apart vertically. Emplacements were staggered with nearby injection points for maximum vertical coverage. Following the injections, three confirmatory soil borings were installed and logged post-injection to verify ZVI distribution.

4.1.1 Injection Procedure

ZVI pilot injections were conducted according to the following procedure:

- A mixture of water, guar gum, and micro-scale ZVI powder was prepared for injection in a ChemGrout batch mixer tank.
- Cascade advanced its Geoprobe® rig tooling to the top of the uppermost emplacement interval and connected a hose from the tooling to the injection pump connected to the mixing tank.

- Approximately 5 to 10 gallons of potable water was injected into the formation to prevent the injection nozzle from clogging.
- The ZVI mixture was injected into the formation at the first emplacement while injection pressure and volume were monitored.
- Once the total planned mixture volume was injected into the first emplacement, the injection was considered complete.
- Approximately 5 to 10 gallons of water was injected to flush out the piping.
- The hose was disconnected and Cascade advanced the Geoprobe® rig 2 feet down to the next emplacement. This continued to the bottom of the injection interval.
- Injection locations were initially alternated between nonconsecutive points. As daylighting of fluid became a concern, injections were changed to alternate between the northern and southern halves of the pilot test area to allow the formation adequate time to accept the injected solution.
- Boreholes were abandoned by filling with BENSEAL® granular bentonite grout following completion of the injection.

Where drill rig refusal was encountered, Cascade relocated the boring a few feet away and successfully installed the boring. Once the site-specific process was determined, approximately two to three injection points were installed per day. Issues encountered at each injection point, if any, are summarized in **Table 1**. The injection field notes are included in **Appendix A**.

4.1.2 ZVI Material and Reagent Loading

Per the Work Plan, Ferox Flow ZVI, manufactured by Hepure Technologies of New Jersey, was used for the pilot study injections. Ferox Flow ZVI is a micro-scale powder-based formulation with a typical average particle size of 125 microns. On a per-weight basis, reaction rates increase as the surface area of the ZVI particles increases. Micro-scale ZVI such as Ferox Flow provides a greater reactive surface area than traditional coarser ZVI products (i.e., grain size of 0.25 to 2 millimeters), and therefore higher reaction rates.

ZVI was applied at a rate of approximately 0.5% of the weight of soil within the target treatment volume. Approximately 80 pounds of ZVI was originally planned at each emplacement (along with 20 gallons of water and 5 pounds of guar gum), assuming a 5-foot ROI, a soil bulk density of 110 pounds per cubic foot, and a 2-foot emplacement injection interval. These original estimates and assumptions were used to develop the ZVI mass loading rate were based on industry standards, ZVI vendor recommendations, injection subcontractor input, and ITRC guidance (ITRC 2011) to achieve a technically effective, implementable, and cost-efficient design.

The initial injection attempts were unsuccessful due to the mixture being too thick and causing clogging of the injection equipment. Changes were made to reagent loading during field implementation to provide the best injection mixture for the site-specific conditions. The final field-implemented injection mixture consisted of approximately 30 gallons of water, 3 pounds of guar, and 77 pounds of ZVI at each emplacement. In addition, to prevent the injection nozzle from clogging so that the ZVI mixture could effectively be injected into the formation, 5 to 10 gallons of clean water was injected into the formation prior to the ZVI mixture. The revised injection solution did not appreciably change the ZVI mass loading from the original plan; the calculated mass loading is 0.48% by weight, or only 0.02% different from the originally planned 0.5% by weight.

4.1.3 Boring Relocations and Daylighting

Injections in the northern half of the transect were successfully completed with only a few field adjustments. The two northernmost locations, ZVI-01-22 and ZVI-26-22 were relocated a few feet due to drilling refusal prior to reaching the target injection depth. Updated locations are depicted on **Figure 2**. Daylighting of a small volume of injection solution was observed at ZVI-24-22 approximately 10 feet east of the injection location. Observations, including instances of daylighting, noted during injection at each location are included in **Table 1**.

All injections were completed in the intended locations in the southern half of the transect. Daylighting of water and ZVI solution was observed more prevalently following injection in most of the points in the southern half of the transect. The first daylighting occurrence was observed at a previously abandoned boring, VAP-31-22. Following this observation, the VAP boring was re-plugged with bentonite to prevent daylighting during injection of ZVI at subsequent locations. Most of the subsequent daylighting observed occurred in the area between ZVI-10-22, 11-22, and 17-22. Daylighting was also observed at ZVI-08-22, 4 to 5 feet west of ZVI-11-22 and more than 20 feet from the injection location. No discrete vertical pathway was noted for daylighting, other than at previous VAP boring VAP-31-22.

The southern half of the pilot area has looser, less dense soil with no paved cover, potentially allowing more vertical migration of injected materials and daylighting. Daylighting was primarily observed 10 to 15 feet from the boring locations. Injection points were alternated between the northern and southern half of the area to allow the formation to rest between points, although daylighting still occurred in the southern area.

4.1.4 Confirmation Borings

Spacing of the injection points assumes a 5-foot ROI, with 3 feet of overlap between points. Two confirmatory soil borings were initially planned within the ROI of the injection points immediately following ZVI injections. Soil borings were completed at the maximum distance from each injection point. Based on the spacing of 7 feet, the soil borings were completed approximately 3.5 feet from injection points. The locations were determined based on field conditions and chosen to represent both the northern and southern halves of the transect.

The field geologist visually inspected the core samples and used a magnet to field screen for ZVI to verify the target ROI and emplacement depths of ZVI had been achieved. Cores were allowed to dry out and then were inspected again with a magnet. Confirmation boring logs are included in **Appendix B**. Results of this inspection are also presented on **Figure 3**, a profile view of the injection area and locations where ZVI was observed during the completion of the confirmation borings. Photographs of the ZVI emplacements are included in **Appendix C**.

ZVI lenses were observed within the 25 to 30 feet bgs interval at SB-ZVI-1, the northern confirmation boring. **Figure 3** shows the extent of the observed ZVI emplacement interval; within this 25 to 30 foot interval, 0.5-inch thick lenses of ZVI were emplaced horizontally at four discrete locations. This interval consists of silt and very fine sand. No ZVI was visually observed in the lower portion of the target interval (30 to 40 feet bgs). A step-out confirmation boring was advanced closer to the ZVI injection point (approximately 1.5 feet away) to identify ZVI emplacements in the lower interval. The step-out boring confirmed ZVI emplacements in the 25- to 30-foot-bgs interval, but similar to the first boring, no ZVI was observed at depths below 30 feet bgs.

ZVI was observed at 18 to 20 feet bgs at SB-ZVI-2, the southern confirmation boring (**Figure 3**). ZVI observed in SB-ZVI-2 was noted in an angled, near-vertical orientation in this interval. The depth of observed emplacement is shallower than the targeted injection interval of 25 to 40 feet bgs. ZVI was not observed deeper than 20 feet bgs in SB-ZVI-2.

4.2 ZVI Injection Conclusions

ZVI injections were successfully completed in December 2022 and January 2023. In the northern half of the transect, ZVI emplacements were confirmed in two confirmation borings from 25 to 30 feet bgs in a horizontal orientation, suggesting successful fracturing in finer-grained, lower conductivity sands and silt. No ZVI was visually observed in the lower portion of the target injection interval (below 30 feet bgs), even after the soil cores were dried completely and re-tested with a magnet. The 30 to 40 feet bgs interval consists of coarser-grained and higher conductivity sands.

ZVI injections were completed successfully in the southern half of the transect, although some daylighting of injection fluid occurred during installation of most of the points. The daylighting may have occurred because the southern half of the transect has looser soils with no paved cover, which may have provided less resistance to upward movement of injection solution. ZVI was observed in the confirmation boring at 18 to 19 feet bgs, above the target injection interval, and oriented at a near-vertical angle, suggesting that ZVI traveled upward from the target interval through vertical pathways (former borings or formerly disturbed soils). The ZVI was observed in the shallower interbedded silt and sand unit.

An objective of the pilot study was to verify the ROI of the injected ZVI in the subsurface utilizing confirmation borings to demonstrate overlap of ROIs between points and a continuous treatment barrier. Confirmation borings were installed at the midpoint between injection points, approximately 3.5 feet from each point. The ROI was confirmed in some but not all of the target intervals. The presence of ZVI at 25 to 30 feet bgs in SB-ZVI-1 and 18 to 20 feet bgs in SB-ZVI-2 confirms ZVI distribution in these intervals. Intervals where ZVI was not observed may indicate a smaller ROI or irregularly shaped distribution of ZVI.

In summary, the targeted mass of ZVI was delivered, but no visual evidence was collected to confirm distribution in the 30- to 40-foot-bgs interval. This could be for several reasons, including:

- ZVI entered the coarser-grained materials more diffusely, making it harder to detect.
- ZVI slurry in the coarser and very permeable sand unit was transported a short distance downgradient through advective flow.
- Distribution of ZVI was not radial and was not in the direction of the soil borings (internal to the injection transect).
- ZVI targeted for the 30- to 40-foot-bgs interval short-circuited up into shallower intervals.

Ultimately, quarterly performance monitoring results will be used to assess whether a sufficient amount of ZVI was injected to the target interval to treat CVOCs in groundwater.

5 Data Usability Evaluation

The objective of this pilot study is to evaluate the effectiveness of an injected ZVI barrier as a potential remedy to address CVOCs, specifically PCE and TCE, in groundwater at the Site. Data quality objectives were proposed in the workplan (Arcadis 2023b) to serve as the basis for collecting data of sufficient quality and quantity to support the goals of the study). The workplan describes information inputs, boundaries of the study, the analytical approach, and criteria for acceptance of the data (Arcadis 2023b). The purpose of this data usability evaluation is to determine if data quality objectives outlined in the workplan were met. This evaluation utilizes the findings of the validation performed on the laboratory data.

Data collected during the pilot study installation included baseline sampling laboratory data, well water level measurements, low-flow groundwater sampling parameters, utility locate data, injection volumes and emplacement depths, and soil lithology and observed ZVI emplacements as documented in confirmation boring logs. Field activities were executed in accordance with Technical Guidance Instruction (TGI) documents referenced and included in Appendix B of the workplan (Arcadis 2023b). Acceptance criteria for data are governed by satisfactory adherence to TGIs, percent completion of planned data collection of 95% or greater, and conformance to data validation metrics. Review of field documentation confirmed adherence to TGI documents and greater than 95% completion of planned data collection. Field data collected during the installation are suitable for use in the pilot study evaluation.

All laboratory data were validated to verify conformance to the data quality objectives. Data were reviewed in accordance with the USEPA National Functional Guidelines for Organic Superfund Methods Data Review, EPA 540-R-2017-002, January 2017 (with reference to the historical USEPA Contract Laboratory National Functional Guidelines for Organic Data Review, OSWER 9240.1-05A-P, October 1999, as appropriate). Data usability reports were prepared for documentation of groundwater samples and associated quality assurance/quality control samples collected during the baseline sampling event. The data usability reports are included in **Appendix D**. A summary of the reports is provided below:

- All samples were analyzed within the specified holding time for the analytical method.
- CVOCs were not detected at concentrations above the method detection limit in the associated blanks; therefore, detected sample results were not associated with blank contamination.
- Surrogate recoveries were within control limits.
- The laboratory control sample/laboratory control sample duplicate analysis exhibited recoveries and relative percent differences within the control limits.
- The calculated relative percent differences between the parent sample and the field duplicate were acceptable.
- The TCE sample for MW-16-22 exhibited a concentration greater than the linear range of the instrument calibration, resulting in an E-flag and subsequent dilution.
- Overall system performance was acceptable.

In summary, 100% of the data validated are suitable for their intended use, based on the deliverable items reviewed. No systematic accuracy or precision trends or biases were identified, and no sample results were rejected. Sample results that were qualified as estimated are usable for project decision purposes. The completeness goals for the number and type of samples required were met.

6 Performance Monitoring

As presented in the workplan (Arcadis 2023b), the ZVI performance monitoring network consists of five monitoring wells: MW-13-22, MW-14-22, MW-15-22, MW-16-22, and MWF16-16 (**Figure 4**). These wells are located upgradient and downgradient of the ZVI injection locations. Wells MW-15-22 and MW-16-22 were installed in November 2022, based on VAP borings, to supplement MW-13-22 and MW-14-22 (**Figure 1**).

The goal of the performance monitoring is to capture the expected cycle of decreasing, stabilizing, and increasing concentrations over time. It is expected that downgradient well concentrations will decrease as treated water migrates, will stabilize once the clean waterfront reaches the downgradient wells, and then may increase as the ZVI becomes passivated. The frequency of monitoring will be reassessed based on observations over the first year to efficiently capture this cycle. For example, if concentrations at downgradient wells are not changing

quickly enough to warrant quarterly sampling, the sampling frequency may be reduced to semiannual. Conversely, if concentrations are changing quickly and higher-resolution data provide value to the assessment of performance, more frequent sampling may be conducted.

Performance monitoring will include an evaluation of the potential generation of byproducts that could present VI concerns (e.g., vinyl chloride). Concentrations of chlorinated daughter products will be monitored downgradient of the treatment zone. Groundwater concentration trend graphs will be developed to track changes in concentrations of PCE, TCE, and chlorinated daughter products, and will be used to assess treatment performance. Performance monitoring results will also be evaluated for evidence of reduced treatment of CVOCs over time, which could be indicative of aging of the ZVI barrier. Reduced treatment of PCE, TCE, and cis-1,2-DCE downgradient of the ZVI barrier will be used as the indicator that passivation of the ZVI may be occurring.

6.1 Baseline Sampling

Baseline groundwater samples were collected from all five monitoring wells prior to the completion of ZVI injections using low-flow sampling techniques. The monitoring well samples were analyzed for CVOCs via USEPA Method 8260 and field parameters using a flow-through cell. Baseline sampling results are presented in **Table 2** and shown on **Figure 4**. Laboratory reports are included in **Appendix D**.

Prior to collecting groundwater samples, gauging was conducted during each monitoring event to evaluate localized groundwater flow direction. Baseline sample gauging has indicated a southwest flow direction with a 0.01-foot/foot gradient from upgradient well MWF16-16 to the downgradient wells near the ZVI injection area. The gradient will continue to be monitored to ensure that the ZVI material does not significantly disrupt the groundwater flow direction in the area.

Upon receipt of the final data packages from the project laboratory, the data were reviewed and validated as described in Section 5. The results of the sampling data validation are included in **Appendix D**.

6.2 Quarterly Sampling

Quarterly sampling will be conducted post-injection for up to eight quarters. The first quarterly sampling event will occur in March 2023. Prior to collecting groundwater samples, gauging will be conducted during each monitoring event to evaluate localized groundwater flow direction. All performance monitoring field activities will be completed following the applicable Arcadis TGIs as outlined in Appendix B of the ZVI Injection Pilot Workplan (Arcadis 2023b). Data from quarterly performance monitoring events will be included in the quarterly groundwater reports for the Site. Evaluation of the data, including an assessment of the longevity of the ZVI, will be discussed in the monitoring report after the initial four quarterly events. Any modifications to the proposed monitoring program will be recommended, as necessary, in that report. Updates on sampling results will also be provided in the routine calls with USEPA as data is obtained.

Previous onsite investigations have estimated the PCE and TCE transport rate to be approximately 1.1 feet per day and 1.3 feet per day, respectively. The distances from the ZVI pilot transect to the nearest downgradient performance monitoring wells (MW-13-22 and MW-14-22) and farthest downgradient well (MW-16-22) are approximately 60 feet and 100 feet, respectively. These distances indicate that reductions in PCE and TCE concentrations should be observed after approximately two to four months (i.e., by the second quarter sampling of 2023). Additional performance monitoring samples may be suggested for future events based on the results of the first four quarters of sampling, details of which will be outlined in future progress reports along with recommendations for continued performance monitoring, if warranted.

As noted, the primary objective of the pilot test is to evaluate the efficacy of reducing CVOC concentrations in groundwater to below residential VI criteria using an injected ZVI barrier. If adequate reductions in CVOCs are not observed, the remedy would not be carried forward for further consideration. Lack of CVOC treatment could be due to limitations of in situ distribution of the ZVI, interaction from non-target compounds, or a combination of both. It would be difficult to cost-effectively determine the root cause of performance issues during the field pilot test. If ZVI were to be considered in the future in a trenched PRB application, eliminating the in-situ distribution concern, a laboratory column test would be completed to test passivation potential as described in the ITRC PRB guidance (ITRC 2011).

7 References

Arcadis. 2023a. 2021-2022 Fiero Site Investigation Summary. Pontiac North Campus, Pontiac, Michigan. February 21.

Arcadis. 2023b. In Situ Chemical Reduction With Zero Valent Iron Pilot Study Workplan. Pontiac North Campus, Former Fiero Property. January 10.

ITRC. 2011. Permeable Reactive Barrier: Technology Update.

USEPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4.

USEPA. 2017. National Functional Guidelines for Organic Superfund Methods Data Review. EPA-540-R-2017-002.

Tables

Table 1
ZVI Pilot Injection Point Summary
RACER Trust Pontiac North Campus
Pontiac, Michigan



Injection ID	Target Emplacement Interval/Total Depth	Actual Emplacement Interval	Date/Time Completed	Comments
ZVI-01-22	25-39 ft	25-39 ft	12/16/22	Stepped 2.5' toward 02 for ZVI borehole (5.5' from 02).
ZVI-02-22	25-39 ft	25-33 ft	12/19/22	Refusal issues at 35' bgs w/ difficulty starting at 33'.
ZVI-03-22	25-39 ft	21-37 ft	12/14/22 - 12/15/22	Refusal issues at 37' & 39'; ~22 gallons or less at 37'; 21' & 23' injected due to depth count error
ZVI-04-22	25-39 ft	25-39 ft	12/16/22	No issues.
ZVI-05-22	25-39 ft	25-39 ft	12/15/22	No issues. 25' was ~45 gallon ZVI slurry.
ZVI-06-22	25-39 ft	25-39 ft	12/19/22	No issues.
ZVI-07-22	25-39 ft	25-39 ft	12/15/22	No issues.
ZVI-08-22	25-39 ft	25-39 ft	12/20/22 - 12/21/22	No issues.
ZVI-09-22	25-39 ft	25-39 ft	12/16/22 - 12/19/22	Daylighting by 10, 11, and 17 while injecting at 37'.
ZVI-10-22	25-39 ft	25-39 ft	12/21/22	Daylighting by 10, 11, & 17 and 4-5' west of 12 & 13.
ZVI-11-22	25-39 ft	25-39 ft	1/9/23	Daylighting ~4' east of 17 and ~5' north towards 18. (several small points)
ZVI-12-22	25-39 ft	25-39 ft	1/9/23	Daylighting ~4' east of 17 and ~5' north towards 18. (several small points)
ZVI-13-22	25-39 ft	25-38 ft	12/20/22	Daylighting by location 15 (old borehole) & near location 12.
ZVI-14-22	26-40 ft	26-40 ft	1/9/23	Daylighting between 14 & 13 closer to fence.
ZVI-15-22	26-40 ft	26-40 ft	1/10/23	Daylighting between 14 & 13, near 16, near 12, & at borehole; bottom up for 40-34'.
ZVI-16-22	26-40 ft	26-40 ft	1/4/23	Daylighting by 16, 15, 13, & 12 throughout.
ZVI-17-22	26-40 ft	26-40 ft	1/6/23	Daylighting by 17, 11, 10; between 09 & 10.
ZVI-18-22	26-40 ft	26-40 ft	1/5/23	Daylighting by 17, 11, 10; near 10; and ~5' west of 11 & 10.
ZVI-19-22	26-40 ft	26-40 ft	1/6/23	Daylighting by 17, 11, 10; near 10 (between 09 & 10); ~5' west of 10 & 11.
ZVI-20-22	26-40 ft	26-40 ft	12/22/22	No issues.
ZVI-21-22	26-40 ft	26-40 ft	1/6/23	No issues.
ZVI-22-22	26-40 ft	26-40 ft	12/21/22 - 12/22/22	No issues.
ZVI-23-22	26-40 ft	26-40 ft	1/5/23	One clog issues during ZVI injection at 36' bgs (then completed 36' emplacement).
ZVI-24-22	26-40 ft	26-40 ft	1/5/23	Daylighting by 24, 05, and 10' east of 24. (Complete)
ZVI-25-22	26-40 ft	26-40 ft	1/4/23	No issues.
ZVI-26-22	26-40 ft	26-40 ft	1/4/23; 1/10/23	Refusal at 6' bgs on 1/4/23. Stepped out 4.5' north of original 26 location.
SB-ZVI-1	40 ft TD	N/A	1/11/23	ZVI present: Y / N : Additional information on boring logs in Appendix B.
SB-ZVI-2	40 ft TD	N/A	1/11/23	ZVI present: Y / N : Additional information on boring logs in Appendix B.

Abbreviations:

bgs = below ground surface

ft = feet

N/A = not applicable

TD = Total Depth

ZVI = zero valent iron

Table 2
 Baseline Sampling Groundwater Analytical Results
 RACER Trust Pontiac North Campus
 Pontiac, Michigan



Location ID: Date Collected: Sample Name:	Res Fiero SSVIAC SOG	Res Fiero SSVIAC BASE	NR Fiero SSVIAC <50k SOG	Unit	MW-13-22 11/28/22 MW-13-22_GW-112822	MW-14-22 11/28/22 MW-14-22_GW-112822	MW-15-22 11/29/22 DUP-03_GW-112922	MW-15-22 11/29/22 MW-15-22_GW-112922	MW-16-22 11/29/22 MW-16-22_GW-112922	MWF16-16 12/05/22 MWF16-16_GW-120522
Volatile Organics										
Acetone	32,000,000	18,000,000	240,000,000	µg/L	< 50 U	< 50 U	< 50 U	< 50 U	< 50 U	< 50 U
Benzene	34	18	1,100	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Bromodichloromethane	60	31	1,700	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Bromoform	6,400	3,200	200,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Bromomethane	59	33	1,200	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
2-Butanone	4,000,000	2,200,000	59,000,000	µg/L	< 25 U	< 25 U	< 25 U	< 25 U	< 25 U	< 25 U
Carbon Disulfide	2,200	1,200	46,000	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
Carbon Tetrachloride	14	7.2	440	µg/L	< 1 U	2	< 1 U	< 1 U	4	< 1 U
CFC-11	300	160	6,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
CFC-12	71	38	1,400	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
Chlorobenzene	1,300	720	27,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Chlorodibromomethane	58	29	4,400	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
Chloroethane	15,000	8,600	320,000	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
Chloroform	19	10	610	µg/L	< 1 U	1	< 1 U	< 1 U	4	< 1 U
Chloromethane	340	200	7,400	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
Cyclohexane	2,600	1,400	53,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,2-Dibromo-3-chloropropane	0.00045	0.00045	0.042	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
1,2-Dibromoethane	8	4	250	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,2-Dichlorobenzene	19,000	9,900	160,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,3-Dichlorobenzene	130	70	2,700	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,4-Dichlorobenzene	310	160	9,800	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,1-Dichloroethane	160	88	5,300	µg/L	< 1 U	4	< 1 U	< 1 U	12	2
1,2-Dichloroethane	50	27	1,600	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,1-Dichloroethene	410	220	8,300	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	1	< 1 U
cis-1,2-Dichloroethene	110	62	2,300	µg/L	< 1 U	14	< 1 U	< 1 U	55	2
trans-1,2-Dichloroethene	480	260	9,800	µg/L	< 1 U	1	< 1 U	< 1 U	4	< 1 U
Dichloromethane	9,100	5,000	190,000	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
1,2-Dichloropropane	100	56	2,100	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
cis-1,3-Dichloropropene	--	--	--	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
trans-1,3-Dichloropropene	--	--	--	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Ethylbenzene	110	60	3,600	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Isopropylbenzene	26	13	810	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Methyl acetate	--	--	--	µg/L	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
Methyl N-Butyl Ketone	24,000	12,000	490,000	µg/L	< 50 U	< 50 U	< 50 U	< 50 U	< 50 U	< 50 U
Methylcyclohexane	--	--	--	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
4-Methyl-2-pentanone	1,600,000	810,000	19,000,000	µg/L	< 50 U	< 50 U	< 50 U	< 50 U	< 50 U	< 50 U
Methyl tert-butyl ether	10,000	5,300	320,000	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
Styrene	1,400	740	45,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,1,1,2-Tetrachloroethane	130	66	4,100	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Tetrachloroethylene	250	130	3,400	µg/L	< 1 U	98	< 1 U	< 1 U	306 E	109
Toluene	56,000	30,000	530,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
1,2,4-Trichlorobenzene	270	130	5,100	µg/L	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U	< 5 U
1,1,1-Trichloroethane	22,000	11,000	210,000	µg/L	< 1 U	9	< 1 U	< 1 U	10	4
1,1,2-Trichloroethane	21	11	410	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Trichloroethylene	15	8.1	210	µg/L	< 1 U	18	< 1 U	< 1 U	27	4
1,1,2-trichloro-1,2,2-trifluoroethane	7,100	3,600	140,000	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Vinyl Chloride	2.2	1.2	260	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
m&p-Xylene	--	--	--	µg/L	< 2 U	< 2 U	< 2 U	< 2 U	< 2 U	< 2 U
o-Xylene	--	--	--	µg/L	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
Total Xylenes	3,000	1,600	60,000	ug/L	< 2 U	< 2 U	< 2 U	< 2 U	< 2 U	< 2 U

Table 2
Baseline Sampling Groundwater Analytical Results
RACER Trust Pontiac North Campus
Pontiac, Michigan

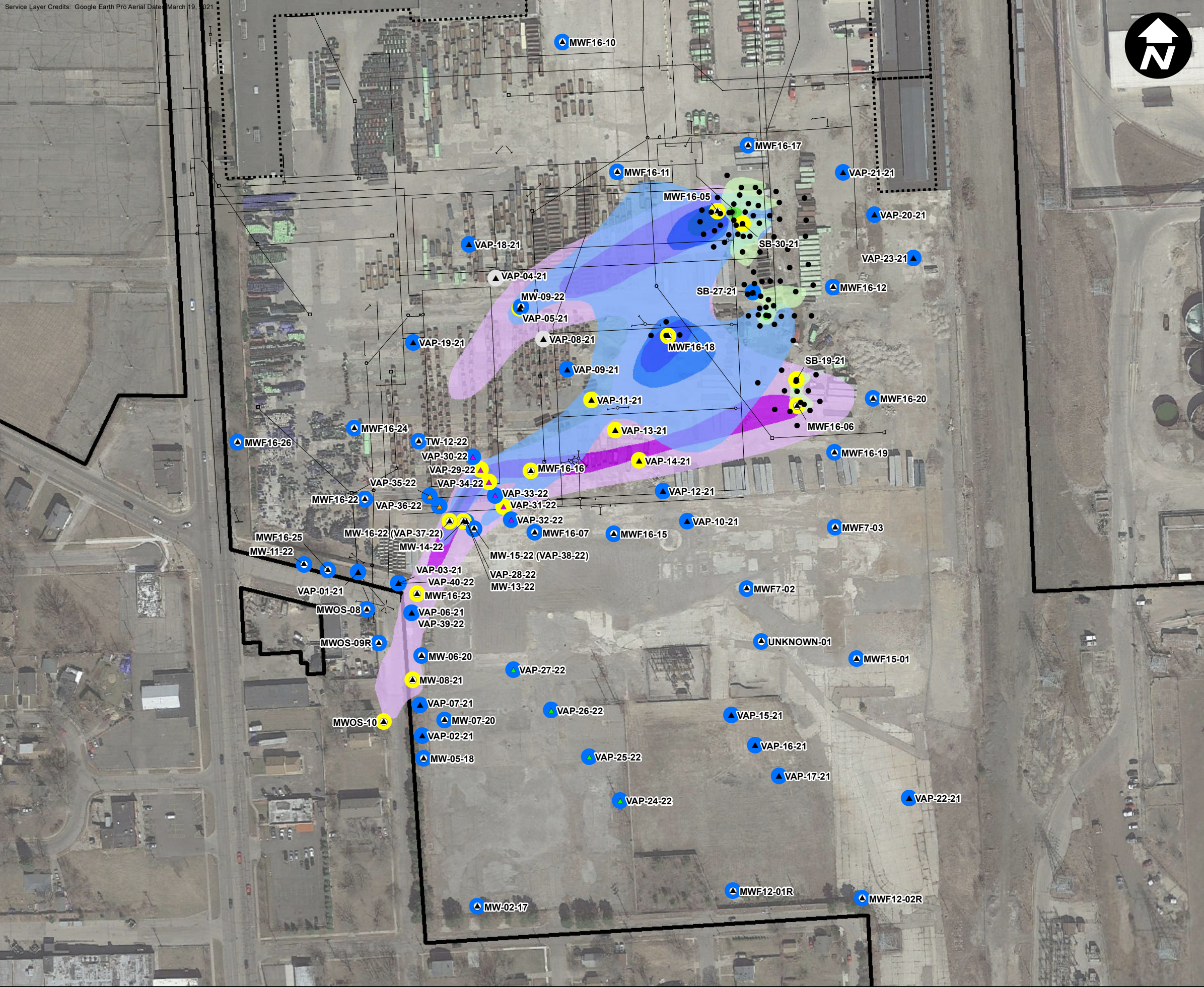
Notes:

- 1) Criteria listed are from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Former Fiero Assembly Site-Specific Criteria Evaluation dated April 21, 2020.
- 2) Bold italics and orange highlight denote exceedance and/or equal to Residential Site-Specific Volatilization to Indoor Air Criteria.

Abbreviations:

µg/L	micrograms per liter
BASE	basement scenario
NR	nonresidential
Res	residential
SOG	slab-on-grade scenario
SSVIAC	Site-Specific Volatilization to Indoor Air Criteria
E	Concentration exceeds calibration range.
U	Compound was analyzed for but not detected. The associated value is the compound quantitation limit.
Y	Elevated reporting limit due to high target concentration.
<50k	less than 50,000 square feet
>50k	greater than 50,000 square feet

Figures



LEGEND

- SOIL BORING
- ▲ MONITORING WELL
- ▲ VERTICAL AQUIFER PROFILE (VAP, ARCADIS OCTOBER 2021)
- ▲ VERTICAL AQUIFER PROFILE (VAP, ARCADIS FEBRUARY 2022)
- ▲ VERTICAL AQUIFER PROFILE (VAP, ARCADIS JUNE 2022)
- ▲ VERTICAL AQUIFER PROFILE (VAP, ARCADIS SEPTEMBER 2022)
- EXCEEDS RESIDENTIAL FIERO SSVIAC BASEMENT (TCE >8.1 µg/L, PCE >130 µg/L)
- DOES NOT EXCEED RESIDENTIAL FIERO SSVIAC BASEMENT (TCE <8.1 µg/L, PCE <130 µg/L)
- UNABLE TO COLLECT VAP SAMPLE
- PROPOSED OR EXISTING BUILDING
- PROPOSED OR EXISTING UTILITY
- ▭ CURRENT OR FORMER RACER PROPERTY

CONCENTRATION OF TETRACHLOROETHYLENE IN SOIL

- 1,000 - 5,000 µg/kg
- 5,000 - 10,000 µg/kg
- 10,000 µg/kg

CONCENTRATION OF TETRACHLOROETHYLENE IN GROUNDWATER

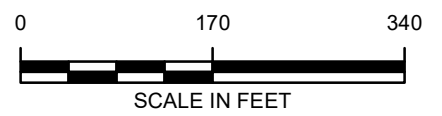
- 130 - 500 µg/L
- >500 µg/L

CONCENTRATION OF TRICHLOROETHYLENE IN GROUNDWATER

- 8.1 - 20 µg/L
- 20 - 35 µg/L
- >35 µg/L

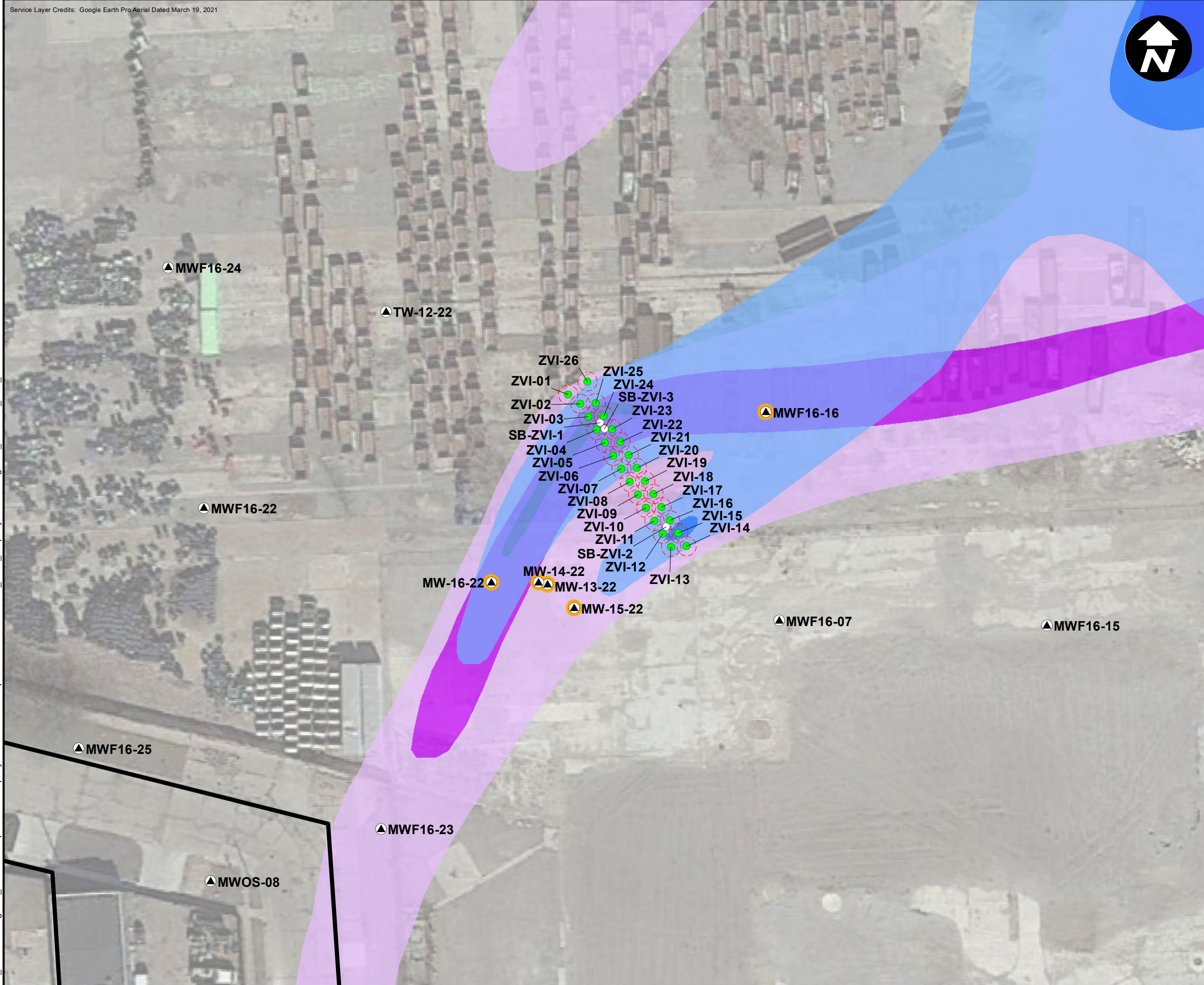
NOTES:

1. ALL CONCENTRATIONS ARE PRESENTED IN MICROGRAMS PER LITER (µg/L) AND MICROGRAMS PER KILOGRAM (µg/kg).
2. GROUNDWATER RESULTS ARE FROM THIRD QUARTER 2022.
3. SSVIAC - SITE-SPECIFIC VOLATILIZATION TO INDOOR AIR CRITERIA.
4. CRITERIA FROM DEPARTMENT OF ENVIRONMENT, GREAT LAKES AND ENERGY (EGLE) DEVELOPED SITE-SPECIFIC VOLATILIZATION TO INDOOR AIR CRITERIA FOR THE FORMER FIERO ASSEMBLY PLANT, APRIL 21, 2020.



RACER TRUST
 PONTIAC NORTH CAMPUS
 PONTIAC, MICHIGAN

DISTRIBUTION OF TETRACHLOROETHYLENE AND TRICHLOROETHYLENE IN GROUNDWATER, CONCENTRATION OF TETRACHLOROETHYLENE IN SOIL



LEGEND

- ZVI PILOT INJECTION POINT
- CONFIRMATORY SOIL BORINGS
- RADIUS OF INFLUENCE (5 FEET)
- PERFORMANCE MONITORING WELL
- MONITORING WELL
- CURRENT OR FORMER RACER PROPERTY

CONCENTRATION OF TETRACHLOROETHYLENE IN GROUNDWATER

- 130 - 500 µg/L
- >500 µg/L

CONCENTRATION OF TRICHLOROETHYLENE IN GROUNDWATER

- 8.1 - 20 µg/L
- 20 - 35 µg/L
- >35 µg/L

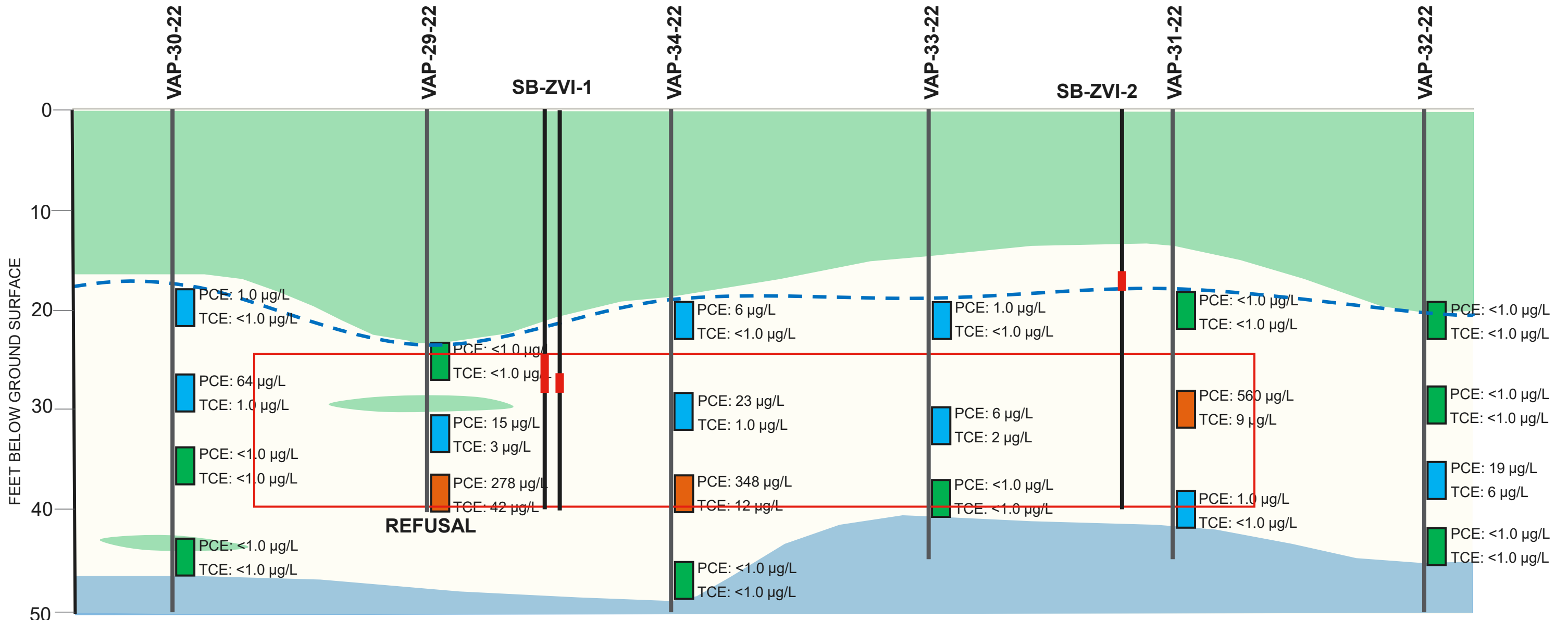


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FIERO PLANT ZVI PILOT STUDY LAYOUT

NORTHWEST

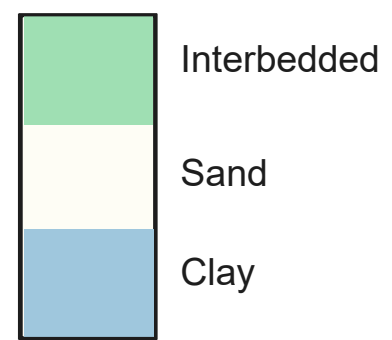
SOUTHEAST



LEGEND

- Water Table (approximate)
- VAP Sample Interval (non-detect)
- VAP Sample Interval (below criteria)
- VAP Sample Interval (above criteria)
- Target ZVI Emplacement Interval
- Verified ZVI Emplacement

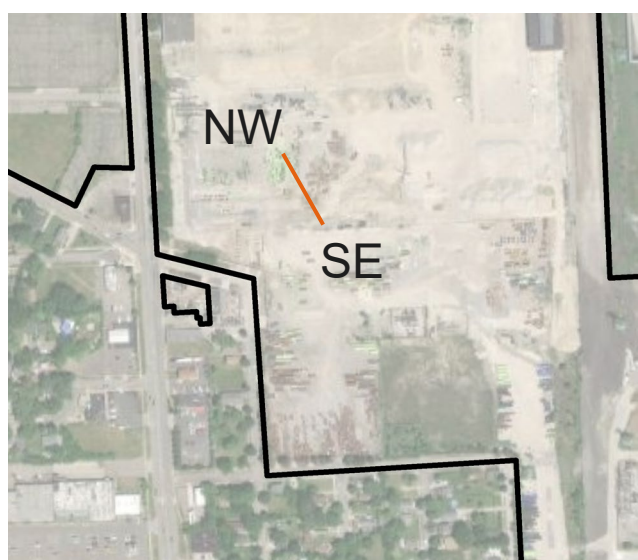
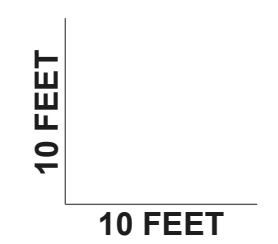
GEOLOGIC UNITS



NOTES:

1. Scale is approximate.
 2. Ground surface elevation is assumed to be flat.
 3. Results compared to residential SSVIAC (PCE – 130 µg/L and TCE – 8.1 µg/L)
- VAP – vertical aquifer profile
 µg/L – micrograms per liter
 ZVI – Zero Valent Iron

SCALE

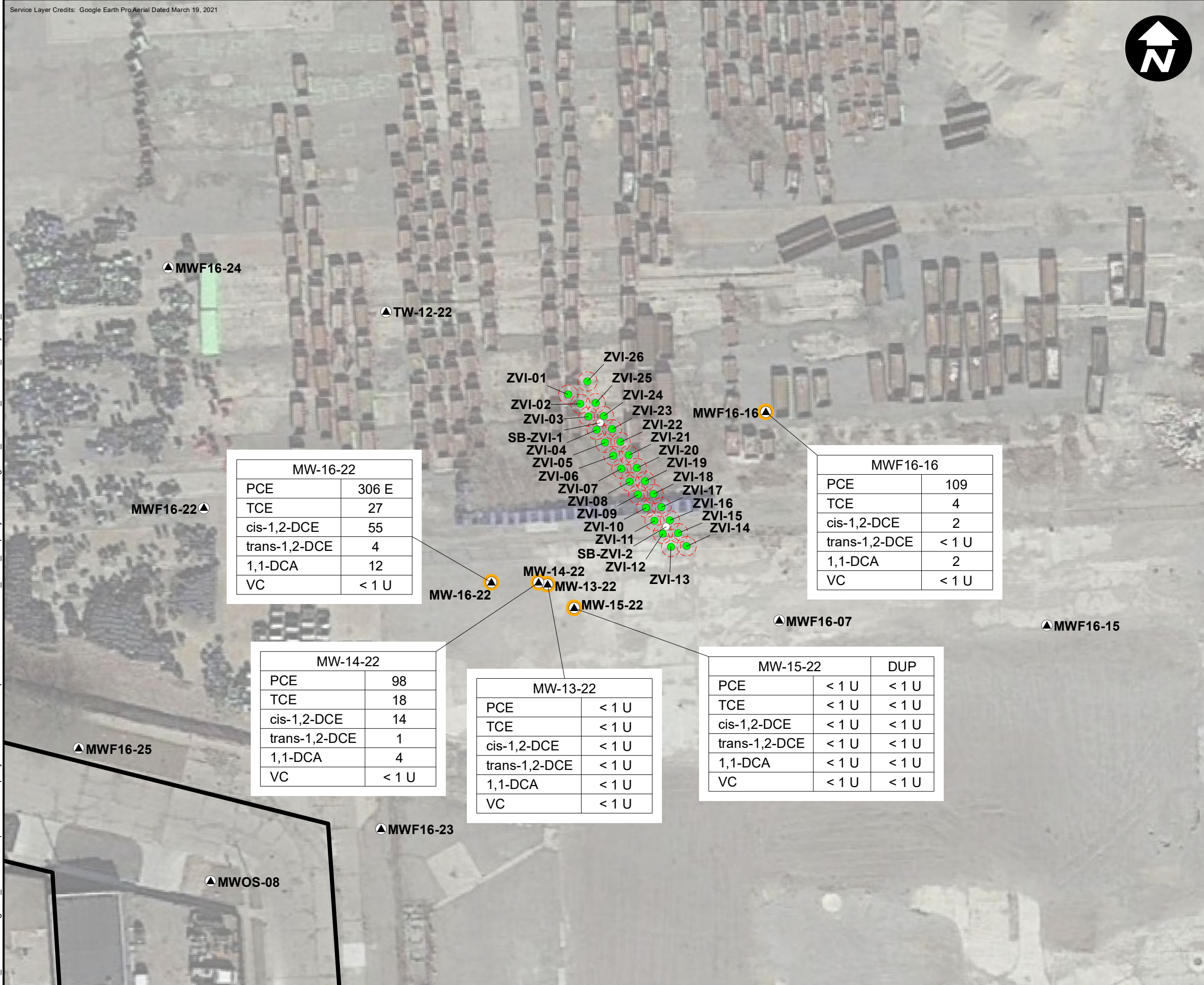


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 PONTIAC, MICHIGAN

VERTICAL AQUIFER PROFILE CROSS SECTION WITH VERIFIED ZVI EMBLACEMENTS

FIGURE 3

D:\GIS\Project Files\MotoristLiquidaionCompany\PontiacNorthCampus\BoringLogs
 CITY: LANSING DIV: ENV DB: TRY PIC:S:INSALACO PM: B. SAUNDERS TM: L. CRISP TR: PROJECT NUMBER: 30112891.0005



LEGEND

- ZVI PILOT INJECTION POINT
- CONFIRMATORY SOIL BORINGS
- RADIUS OF INFLUENCE (5 FEET)
- PERFORMANCE MONITORING WELL
- ▲ MONITORING WELL
- CURRENT OR FORMER RACER PROPERTY

- E CONCENTRATION EXCEEDS CALIBRATION RANGE
- U UNDER DETECTION LIMIT
- DUP DUPLICATE SAMPLE
- PCE TETRACHLOROETHYLENE
- TCE TRICHLOROETHYLENE
- cis-1,2-DCE CIS-1,2-DICHLOROETHENE
- trans-1,2-DCE TRANS-1,2-DICHLOROETHENE

NOTE: ALL RESULTS ARE IN MICROGRAMS PER LITER (µg/L)



RACER TRUST
PONTIAC NORTH CAMPUS
PONTIAC, MICHIGAN

**BASELINE MONITORING RESULTS
NOVEMBER 2022**



MW-16-22	
PCE	306 E
TCE	27
cis-1,2-DCE	55
trans-1,2-DCE	4
1,1-DCA	12
VC	< 1 U

MWF16-16	
PCE	109
TCE	4
cis-1,2-DCE	2
trans-1,2-DCE	< 1 U
1,1-DCA	2
VC	< 1 U

MW-14-22	
PCE	98
TCE	18
cis-1,2-DCE	14
trans-1,2-DCE	1
1,1-DCA	4
VC	< 1 U

MW-13-22	
PCE	< 1 U
TCE	< 1 U
cis-1,2-DCE	< 1 U
trans-1,2-DCE	< 1 U
1,1-DCA	< 1 U
VC	< 1 U

MW-15-22		DUP
PCE	< 1 U	< 1 U
TCE	< 1 U	< 1 U
cis-1,2-DCE	< 1 U	< 1 U
trans-1,2-DCE	< 1 U	< 1 U
1,1-DCA	< 1 U	< 1 U
VC	< 1 U	< 1 U

Appendix A

Field Notes – Groundwater Sampling and ZVI Injections

Project Name : RACER Pontiac North Campus 2022

Weather(°F) : Cloudy, 32-37°F

Project Number : 30112891

Prepared By: Kara Donahue

Purpose : ZVI Injection Pilot

PPE : Level D

Equipment: Water Level Meter (WLM)

Date	Time	Description of Activities
12/12/2022	07:47	Arrived on-site. Eric Feenstra on-site coordinating with security.
12/12/2022	07:52	Cascade arrived on-site (Luke T. and Collin F.).
12/12/2022	08:10	Mob to injection pilot work area. Five roll-offs obstructing injection work area. Eric called facility contact to arrange having them moved.
12/12/2022	08:15	H&S tailgate meeting and review HASP. Discussed site traffic and trucks, uneven ground and debris, wear Level D PPE, cold weather.
12/12/2022	08:20	Cascade unloading equipment.
12/12/2022	08:35	Cascade goes their shop in Flint, MI to pickup rental skid steer and check for ZVI materials delivery.
12/12/2022	08:40	GFL moving the five roll-offs out of our injection work area.
12/12/2022	09:00	Locating surrounding monitoring wells.
12/12/2022	09:45	Cascade returned to site. Untied rentals had dropped off the skid steer to site without informing Cascade of the plan change. Dropped it off with bucket instead of forks as planned. Cascade unloading more supplies.
12/12/2022	10:05	Gauging DTW ft bTOC of the five surrounding monitoring wells for pre injection measurements. MW-13-22 = 22.70; MW-14-22 = 23.00; MW-15-22 = 23.13; MW-16-22 = 23.06; MWF16-16 = 23.09.
12/12/2022	10:25	Cascade leaves site.
12/12/2022	10:55	Cascade returns to site with forks for skid steer. Unloading equipment from truck bed and staging near the injection area.
12/12/2022	11:12	Cascade leaves site to go to their shop to get ZVI and guar gum materials. Will have to wait until ZVI is delivered.
12/12/2022	15:12	Cascade returns to site. Unloading injection material pallets.
12/12/2022	15:45	Cascade departs site. Picking up more guar gum and will bring to site tomorrow morning. Barrel cones and caution tape placed around work area.
12/12/2022	16:07	Departed site.

Signature: 

Waste Management:

Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
12/12/2022	no					no				

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 28-31°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)

Date	Time	Description of Activities
12/13/2022	07:40	Arrived on-site. Cascade already on-site (Luke T. And Collin F.).
12/13/2022	07:45	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan.
12/13/2022	08:00	Designated West transect as Line 1 (25-29' bgs ZVI emplacements) and East transect as Line 2 (26-40' bgs ZVI emplacements). Cascades plan is to conduct injection work using bottom up approach (confirmed with Eric Feenstra/Arcadis). Advantages of this approach is to prevent clogging of the tooling and so not bringing tooling up ~0.5' at each target depth to expose the probe injection ports.
12/13/2022	08:15	Positioning Geoprobe rig at first location. ZVI-01-22 (north most location of Line 1; see marked up field map for boring identification).
12/13/2022	08:20	Started drilling at ZVI-01-22. Used drill bit to get through surface concrete. Direct push drilling with pressure activated injection probe down to 39' bgs.
12/13/2022	08:55	Down to 39' bgs. Cascade works to set up injection equipment. Fixing valve assembly parts to correct size for hoses.
12/13/2022	09:15	Making ZVI slurry mixture using 19 gallons of water, 1.85 lbs of guar gum, and 76.34 lbs of ZVI using a ChemGrout mixer and pump unit (amounts from Cascades project team). Cascade indicated it's about 24 gallons of slurry per emplacement.
12/13/2022	09:25	Attempt pumping at the 39' bgs emplacement.
12/13/2022	09:30	Not pumping properly. Cascade testing assembly parts and hoses.
12/13/2022	09:40	Attempting to clear out clog in the ChemGrout mixer/pump.
12/13/2022	09:45	Cascade calls their project team to notify and help solve issue.
12/13/2022	09:55	Taking apart the ChemGrout assembly parts. Observed pipes are full of ZVI. Working to clean out parts. It seems the ZVI settled out from the slurry mixture and caused the clog. Will likely need to adjust the consistency of the slurry mixture to make it more viscous.
12/13/2022	10:05	Updated Eric Feenstra (Arcadis Engineer/TM).
12/13/2022	10:22	Attempted pumping again. Still not working. Checked TD of injection probe. Push rods and injection probe are likely clogged too.
12/13/2022	10:30	Pulling up tooling.
12/13/2022	10:40	Push rods and probe are clogged with ZVI. Clearing out material and pushing back downhole.
12/13/2022	10:52	Attempting pumping again. Still not pumping/injecting properly.
12/13/2022	11:00	Cascade calls their project team. Lance Rogers and Erik M. of Cascade are figuring out slurry component adjustments needed to solve the ZVI settling issue. Need the slurry to be more viscous.
12/13/2022	11:10	Pulling up tooling.
12/13/2022	11:30	Clearing out settled ZVI from ChemGrout and hose, and sand from push rods.
12/13/2022	11:55	Pushing tooling back downhole. Preparing slurry mixture using same quantities as first batch.
12/13/2022	12:28	Testing pumping by injecting water only.
12/13/2022	12:48	Pulling up tooling.

Daily Log

12/13/2022	12:54	Injection probe clogged with ZVI. When pumping water only still get residual ZVI clogging the probe.
12/13/2022	13:03	Pushing tooling back downhole.
12/13/2022	13:14	Pumping ZVI. Adding slurry mixture into pump in small batches to help prevent settling.
12/13/2022	13:20	Stopped injection, still not injecting properly.
12/13/2022	13:26	Pulling up tooling.
12/13/2022	13:36	Cascade calls their project team to confer about injection issues.
12/13/2022	14:10	Cascade is having trouble figuring out a solution to why the material isn't injecting/pumping as expected. Decided to try injecting at a different interval in the middle of the 25-39' injection zone. Lowering tooling downhole, setting probe at 33' bgs.
12/13/2022	14:26	Attempting injecting at 33' bgs.
12/13/2022	14:32	Stopped injection. Not working. ZVI slurry is filling up the rods and not going into sand formation (filled up all 33' of rods). Pumps ZVI slurry at 400-500 psi, then struggles and jumps up to 1,500 psi from rods filling up.
12/13/2022	14:50	Pulling up rods.
12/13/2022	15:01	Cascade cleaning out clogged rods. Putting the ZVI slurry into 5-gal bucket.
12/13/2022	15:15	Moved drill rig to staging area. Cleaning up work area and equipment.
12/13/2022	15:38	Placed cone over ZVI-01-22 borehole. Placed barrel cones and caution tape around work area.
12/13/2022	15:42	Loading water tote onto trailer to refill for tomorrow's activities.
12/13/2022	16:07	Cascade departed site.
12/13/2022	16:10	Made 5 ZVI injection attempts today at ZVI-01-22; 4 ZVI attempts at 39' bgs, 1 attempt water only, and 1 ZVI attempt at 33' bgs. Lance Rogers of the Cascade project team is planning to be on-site tomorrow to help solve injection issues.
12/13/2022	16:35	Departed site.

Signature: 

Waste Management:

Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
12/13/2022	no					no				

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 29-36°F, Wind 10 mph
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)

Date	Time	Description of Activities
12/14/2022	07:40	Arrived on-site. Cascade already on-site (Luke T. And Collin F.).
12/14/2022	07:55	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Ice on ground in work area slip hazard. Expecting Lance Rogers (Cascade) to be on-site to assist with solving injection issues from yesterday. No injections have been successful yet. Cascade plans to do a water test.
12/14/2022	08:00	Cascade starts preparing equipment and supplies for today's work (unloading water tote, attaching hoses, warming up tools and machines, cleaning injection probes, etc.).
12/14/2022	08:30	Positioning Geoprobe rig at ZVI-03-22.
12/14/2022	08:38	Abandoned ZVI-01-22 borehole to surface with BENSEAL granular bentonite grout.
12/14/2022	09:15	Started drilling at ZVI-03-22. Used drill bit to get through surface concrete. Direct push drilling with pressure activated injection probe.
12/14/2022	09:28	Lance Rogers (Cascade) arrives on-site. Signed H&S tailgate.
12/14/2022	09:43	Down to 39' bgs at ZVI-03-22. Cascade works to set up injection equipment (checked pump by using water at surface, attach hose and valves at well head).
12/14/2022	09:48	Start Water Tests. Injecting water at 39' bgs. Pulling up to inject throughout 25-39' bgs zone. Pump is pumping intermittently, not at steady continuous flow. Cascade indicated the intermittent pumping is correct.
12/14/2022	10:35	Water Tests conducted from 39-25' bgs, successfully injected water. Cascade still works on trouble shooting why the slurry won't inject. Suspect pressure gauge might be incorrect or sand is difficult to inject into (silty sand or hard sand). Also, suspect a new slurry mixture could help, but need Arcadis approval and indicate new quantities of slurry mixture. Works to take apart ChemGrout piping to add new pressure gauge part.
12/14/2022	10:50	Cascade discussing plan and searching for stock of new pressure gauge parts for the injection assembly.
12/14/2022	11:15	Cascade leaves site to get all necessary parts. Also getting lunch while off-site.
12/14/2022	12:50	Cascade returns on-site. Installing new pressure gauge and putting ChemGrout parts back together.
12/14/2022	13:06	Testing gauge by pumping water into tote.
12/14/2022	13:10	Test injecting water at 25' bgs (ZVI-03-22).
12/14/2022	13:16	Lance makes call to Eric M. (Cascade technical expert).
12/14/2022	13:35	Cascade proposes new slurry mixture of: 30 gal water, 3 lbs guar gum, and 76.34 lbs ZVI. Asks me to send to my Arcadis project team for approval.
12/14/2022	13:38	Lance departs site to retrieve different hose fittings from his office. Need different fittings for H&S reasons.
12/14/2022	13:50	Arcadis project team approved new slurry mixture.
12/14/2022	15:05	Lance returns to site.
12/14/2022	15:10	Putting on new (bigger) hose fittings.

Daily Log

12/14/2022	15:20	Using top down approach for ZVI-03-22 due to having pulled up to shallow depth of injection zone during the water tests. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.
12/14/2022	15:25	Making ZVI slurry mixture. One batch per emplacement is ~34-35 gallons. 30 gal water, 3 lbs guar gum, and 76.34 lbs ZVI.
12/14/2022	15:30	Pumped water down at 25' bgs to fill rods and hose with water.
12/14/2022	15:33	Started injecting ZVI slurry at 21' bgs (ZVI-03-22). Cascade thought they were at 25' bgs by mistake, realized mistake when reached 33' bgs.
12/14/2022	15:36	Full amount of slurry injected into 21' bgs emplacement. Pumped 10 gallons of water down to flush all slurry out of hose and rods into the emplacement.
12/14/2022	15:38	Pushing down to 23' bgs (again Cascade thought they were at 27' bgs at the time).
12/14/2022	15:45	Same injection process. Injection at (ZVI-03-22) 23' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/14/2022	15:59	Injection at (ZVI-03-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/14/2022	16:10	Injection at (ZVI-03-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/14/2022	16:21	Injection at (ZVI-03-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/14/2022	16:33	Injection at (ZVI-03-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/14/2022	04:50	Cascade indicated they are now pushed down to 33' bgs, realized they started at two 2' intervals shallower by mistake.
12/14/2022	16:58	Injection at (ZVI-03-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/14/2022	17:02	Done with injections for today. Completed 7 ZVI injections today; Will finish last 3 emplacements at ZVI-03-22 tomorrow morning. Pushed rods flush to ground surface (~2' down).
12/14/2022	17:04	Tear down/cleanup.
12/14/2022	17:20	Discussing plan for getting more water totes to site. Need more water now due to new slurry mixture and flushing procedures. Cascades water source is from their shop (Mundy Township water).
12/14/2022	17:28	Cascade departed site.
12/14/2022	17:35	Departed site.

Signature: 

Waste Management:

Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
12/14/2022	no				Good	yes	1	55-gallon	Good	Added ZVI slurry waste to drum approximately 14 gallons

Equipment and Calibration Information:

Supplier: Geotech **Model:** MiniRAE 3000

Rental Number: 5860 **Calibrated:** no

Bump Checked: no **Calibration Passed:**

PIDSN: 592-918932

Date	Time	Calibrated Fluid and Value	Lot #	Expiration Date	Initial Reading	Final Reading
12/14/2022	--					

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 37-42°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)


Date	Time	Description of Activities
12/15/2022	07:30	Arrived on-site. Luke Taylor (Cascade) already on-site. Collin Fernald is filling water totes at Cascade's shop. Luke starts getting supplies ready.
12/15/2022	08:15	Collin arrived on-site with 3 full water totes.
12/15/2022	08:18	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Rained heavily overnight, water pools on ground in work area, careful of slippery surface and tools.
12/15/2022	08:23	Cascade starts preparing equipment and supplies for today's work (unloading water totes, attaching hoses and injection parts).
12/15/2022	08:25	<p>ZVI slurry mixture per emplacement is ~34-35 gallons:</p> <ul style="list-style-type: none"> - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, then ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
12/15/2022	08:30	Andrew Lorenz arrived on-site. Signed H&S tailgate.
12/15/2022	08:35	Injection probe positioned at (ZVI-03-22) 35' bgs emplacement. Pumping water at 35' bgs.
12/15/2022	08:41	Injecting ZVI slurry at (ZVI-03-22) 35' bgs.
12/15/2022	08:45	Done flushing with water at (ZVI-03-22) 35' bgs.
12/15/2022	08:48	Pushing down to (ZVI-03-22) 37' bgs.
12/15/2022	08:53	Injecting water at (ZVI-03-22) 37' bgs.
12/15/2022	09:00	Project team meeting. Arcadis team indicated to conduct work using the Top Down approach. Prioritize completing all 13 locations on Line 1 first, then Line 2 if schedule permits. Prioritize ZVI injections within schedule timeframe over confirmation borings.
12/15/2022	09:15	Having injection issues at (ZVI-03-22) 37' bgs. Seems to be a clog or issue with the pump.
12/15/2022	09:22	Luke calling Cascade team.
12/15/2022	09:40	Issues with pumping, cascade takes apart ChemGrout mixer/pump and works to troubleshoot.
12/15/2022	09:50	Andrew departs site.
12/15/2022	10:00	Testing pumping at 37' bgs.
12/15/2022	10:30	Pumping ZVI. Going very slow, but seems to have some going into ground.
12/15/2022	11:00	Hose apart and pump off, Luke on call with Cascade team. I indicated to Luke that we could skip this depth and try at the next and final depth 39' bgs. Cascades team directed him to troubleshoot the pump.
12/15/2022	11:10	Taking apart ChemGrout again to troubleshoot/try fixing pump.

Daily Log

12/15/2022	11:53	Put ChemGrout together and pump on with water. Leaking at T joint pipe at bottom of bucket. Tightened connections.
12/15/2022	12:00	Pumping ZVI slurry.
12/15/2022	12:05	Trying water again. Cascade estimated a total of approximately 25 gallons of ZVI slurry have been injected at 37' bgs (ZVI-03-22).
12/15/2022	12:15	Called Lance Rogers (Cascade PM) to discuss issues and plan. He indicated it was directed by their technical expert (Eric M.) to work on pump/parts thinking that was the issue. But seems may be a tight formation preventing proper pumping/injection. Decided to move to next depth 39' bgs and try injecting there, if it doesn't work move on to new location.
12/15/2022	12:20	Pushing down to (ZVI-03-22) 39' bgs.
12/15/2022	12:25	Attempting to inject water at (ZVI-03-22) 39' bgs. Formation is not taking water. Suspect we must be in an unexpected clay zone in 37-39' bgs injection refusal zone. Project team checked VAP boring logs which indicated refusal here too.
12/15/2022	12:30	Moved Geoprobe rig to ZVI-05-22.
12/15/2022	12:34	Started drilling at ZVI-05-22. Direct push drilling with pressure activated injection probe.
12/15/2022	12:47	Injection at (ZVI-05-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. Injected the leftover slurry (from ZVI-03-22 37' batch) ~10 gallons of ZVI slurry. Mixed new full batch and went through water, ZVI, water flush process again at 25' bgs at 1256. (ZVI-05-22) 25' bgs emplacement has approximately 45 gallons total slurry injected.
12/15/2022	13:11	Injection at (ZVI-05-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	13:24	Injection at (ZVI-05-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	13:39	Injection at (ZVI-05-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	13:50	Injection at (ZVI-05-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	14:03	Injection at (ZVI-05-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	14:14	Injection at (ZVI-05-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	14:25	Lance Rogers arrived on-site. Brought guar gum and assisting field team.
12/15/2022	14:26	Injection at (ZVI-05-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	14:30	Completed ZVI-05-22. All 8 emplacements 25-39' bgs.
12/15/2022	14:37	Moved Geoprobe rig to ZVI-07-22.
12/15/2022	14:41	Started drilling at ZVI-07-22. Direct push drilling with pressure activated injection probe.
12/15/2022	15:01	Injection at (ZVI-07-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	15:17	Injection at (ZVI-07-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

12/15/2022	15:28	Injection at (ZVI-07-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	15:41	Injection at (ZVI-07-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	15:45	Observed little water coming up from top of rods left in place at ZVI-05-22; Also some water coming out at ZVI-07-22 when adding new rod to push to 33' bgs; no water coming out at ZVI-03-22.
12/15/2022	15:51	Injection at (ZVI-07-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	16:06	Injection at (ZVI-07-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	16:17	Injection at (ZVI-07-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	16:20	Water coming up out the well head as Cascade switched attachments to push down to next target depth. More water than previously observed.
12/15/2022	16:31	Injection at (ZVI-07-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/15/2022	16:36	Completed ZVI-07-22. All 8 emplacements 25-39' bgs.
12/15/2022	16:38	Tear down/cleanup.
12/15/2022	16:40	Done with injections for today. Completed ZVI-05-22 and ZVI-07-22 both 25-39' bgs; and finished ZVI-03-22 35-37' bgs (21-37' bgs 12/14-12/15/22; skipped 39' bgs due to injection refusal). Leaving rods in place overnight at 03, 05, and 07.
12/15/2022	17:00	Cascade departed site.
12/15/2022	17:04	Departed site.

Signature: 

Waste Management:

Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
12/15/2022	yes	1	55-gallon	Stainless Steel		no				Did not have slurry waste to add to drum.

Equipment and Calibration Information:



Daily Log

Supplier: Geotech

Model: MiniRAE 3000

Rental Number: 5860

Calibrated: no

Bump Checked: no

Calibration Passed:

PIDSN: 592-918932

Date	Time	Calibrated Fluid and Value	Lot #	Expiration Date	Initial Reading	Final Reading
12/15/2022	--					

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 29-34°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)

Date	Time	Description of Activities
12/16/2022	07:27	Arrived on-site. Luke Taylor (Cascade) already on-site. Collin Fernald is filling water totes at Cascade's shop.
12/16/2022	07:40	Collin arrived on-site with 3 full water totes. Cascade unloading water totes.
12/16/2022	07:45	Lance Roger (Cascade) on-site to assist field team and run water totes.
12/16/2022	07:52	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Light snow overnight, slippery and cold surfaces. Working every other location continuing down Line 1 (west transect), then locations go back up Line 1.
12/16/2022	08:00	Cascade starts pulling up rods from ZVI-07-22, ZVI-05-22, and ZVI-03-22. Left rods in ground down to 39' bgs overnight. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
12/16/2022	08:40	ZVI slurry clogged/filled in 3 push rods pulled out at ZVI-03-22 (location where refusal 37-39' bgs). Equates to ~2.5 gallons. Yesterday estimated ~25 gallons of slurry was injected at ZVI-03-22 37' bgs, subtract ~2.5-3 gallons for more accurate injection estimate; ~22 gallons at 37' bgs ZVI-03-22.
12/16/2022	08:50	Moved Geoprobe rig to ZVI-09-22. Washing injection probes and preparing injection supplies.
12/16/2022	09:00	Started drilling at ZVI-09-22. Direct push drilling with pressure activated injection probe.
12/16/2022	09:15	<p>ZVI slurry mixture per emplacement is ~34-35 gallons:</p> <ul style="list-style-type: none"> - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
12/16/2022	09:23	Injection at (ZVI-09-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	09:35	Injection at (ZVI-09-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	09:47	Injection at (ZVI-09-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	10:00	Injection at (ZVI-09-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	10:13	Injection at (ZVI-09-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

12/16/2022	10:24	Injection at (ZVI-09-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	10:41	Injection at (ZVI-09-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	10:43	Daylighting of ZVI slurry mix observed while injecting the ZVI-09-22 37' bgs emplacement by locations 10, 11, and 17. Took photos and notified Arcadis team. Stopped work at 09 borehole and do not work in daylighting area today.
12/16/2022	10:50	Completed ZVI-09-22. 7 emplacements 25-37' bgs.
12/16/2022	10:59	Moved Geoprobe rig to ZVI-01-22. Location 01 borehole was worked on unsuccessfully on 12/13/22 when issues with clogging were occurring with the original slurry mixture, and abandoned on 12/14/22. Injecting today at stepped out location 2.5' towards location 02 on Line 1.
12/16/2022	11:06	Started drilling at ZVI-01-22. Direct push drilling with pressure activated injection probe. Lance departs site for meeting and to get more water totes.
12/16/2022	11:15	Gauging DTW ft bTOC of the five surrounding monitoring wells for during injection measurements. MW-13-22 = 22.69 @1135; MW-14-22 = 22.98 @1137; MW-15-22 = 23.11 @1132; MW-16-22 = 23.05 @1140; MWF16-16 = 23.08 @1116. Measurements are very close to pre-injection values, doesn't appear to be affected by the daylighting.
12/16/2022	11:20	Bolt snapped on drill rig.
12/16/2022	11:46	Fixed rig and completed drilling to 25' bgs. Preparing injection supplies.
12/16/2022	11:54	Injection at (ZVI-01-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	12:05	Injection at (ZVI-01-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	12:16	Injection at (ZVI-01-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	12:28	Injection at (ZVI-01-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	12:40	Injection at (ZVI-01-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	12:55	Injection at (ZVI-01-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	13:14	Injection at (ZVI-01-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	13:31	Injection at (ZVI-01-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	13:37	Completed ZVI-01-22. All 8 emplacements 25-39' bgs.
12/16/2022	13:40	Moved Geoprobe rig to ZVI-04-22.
12/16/2022	13:45	Measured ZVI-01-22 is 2.5 feet towards location 02 on Line 1. 5.5 feet NW of location 02. 7 feet away from location 26.
12/16/2022	14:03	Started drilling at ZVI-04-22. Direct push drilling with pressure activated injection probe.
12/16/2022	14:25	Injection at (ZVI-04-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

12/16/2022	14:36	Injection at (ZVI-04-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	14:48	Injection at (ZVI-04-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	14:59	Injection at (ZVI-04-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	15:13	Injection at (ZVI-04-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	15:17	Out of water.
12/16/2022	15:20	Cascade cleaning up the daylighted slurry and bentonite grout with shovel and adding to waste drum. Residual left on ground that is unable to be picked up with shovel. Some small pools left in dirt area. Cascade plans to check on the daylight area on Monday and assess if need to clean up more (Contact Lance Rogers with questions about how cleaning the day lighted waste was handled).
12/16/2022	15:30	Lance arrives with two full water totes.
12/16/2022	15:43	Injection at (ZVI-04-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	15:56	Injection at (ZVI-04-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	16:08	Injection at (ZVI-04-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/16/2022	16:15	Done with injections for today. Completed 3 locations: ZVI-09-22 25-37' bgs, ZVI-01-22 25-39' bgs, ZVI-04-22 25-39'; Leaving rods in place over the weekend at 09, 01, and 04 (cone placed next to each stick-up rod).
12/16/2022	16:30	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
12/16/2022	17:05	Departed site.

Signature: 

Waste Management:

Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
12/16/2022	yes	1	55-gallon	Stainless Steel		yes	0			Added ZVI slurry waste and bentonite grout to the 1 waste drum. About 1/2 full.

Equipment and Calibration Information:



Daily Log

Supplier: Geotech

Model: MiniRAE 3000

Rental Number: 5860

Calibrated: no

Bump Checked: no

Calibration Passed:

PIDSN: 592-918932

Date	Time	Calibrated Fluid and Value	Lot #	Expiration Date	Initial Reading	Final Reading
12/16/2022	--					

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 23-29°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)

Date	Time	Description of Activities
12/19/2022	07:45	Arrived on-site. Cascade already on-site Luke Taylor, Collin Fernald, and Sammie Milton.
12/19/2022	07:50	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Light snow overnight, slippery icy and cold surfaces, freezing temperatures. Don't rush, stay warm, and work safely.
12/19/2022	07:55	Cascade preparing equipment (unloading water totes, warming up machines and pump parts). Eric Feenstra (Arcadis) confirmed for us to push to inject at ZVI-09-22 39' bgs. Ground material had time to settle over the weekend after the daylighting from last Friday.
12/19/2022	08:15	Cascade tests pumping water at ZVI-09-22 37' bgs to see if rods are clogged. Test looks good, formation took water; Cascade pushed to 39' bgs.
12/19/2022	08:28	<p>ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI</p> <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
12/19/2022	08:35	Injection at (ZVI-09-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	08:41	Cascade starts pulling up rods from ZVI-09-22, ZVI-04-22, and ZVI-01-22. Left rods in ground over the weekend. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
12/19/2022	09:30	Moved Geoprobe rig to ZVI-02-22. Washing injection probes and preparing injection supplies.
12/19/2022	09:33	Started drilling at ZVI-02-22. Direct push drilling with pressure activated injection probe.
12/19/2022	09:54	Injection at (ZVI-02-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	10:16	Injection at (ZVI-02-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	10:32	Injection at (ZVI-02-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	10:45	Injection at (ZVI-02-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	11:25	Injection probe/rods clogged up or not opening when injecting at 33' bgs. Pulled up rods, cleaned probe and rods, pushed back down to 33' bgs.

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12/19/2022	11:58	Injection at (ZVI-02-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	12:09	Attempted injection at 35' bgs, but seems like the probe is not opening or clogged. Must be very tight formation similar to what we experienced at ZVI-03-22. Put small rods down casing to try pushing probe open.
12/19/2022	12:20	Injection not working. Cascade calls team. I call Eric Feenstra. Determined best to pull up and move on to new location due to the refusal.
12/19/2022	12:50	Luke informed me the probe head had gray very fine-grains in it, meaning formation is likely very fine or silty and getting into the probe or preventing it from opening all the way. I observed the material inside the probe and confirmed it is a very fine grain, silty clay, gray. Called Eric F. to discuss previous VAP boring logs.
12/19/2022	13:00	Completed ZVI-02-22. 5 emplacements 25-33' bgs.
12/19/2022	13:05	Moved Geoprobe rig to ZVI-06-22. Abandoned ZVI-02-22 borehole to surface with BENSEAL granular bentonite grout
12/19/2022	13:15	Started drilling at ZVI-06-22. Direct push drilling with pressure activated injection probe.
12/19/2022	13:36	Injection at (ZVI-06-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	13:55	Injection at (ZVI-06-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	14:13	Injection at (ZVI-06-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	14:37	Injection at (ZVI-06-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	15:06	Injection at (ZVI-06-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	15:15	Probe clogging issue again, Luke on call, helpers pulled up tooling.
12/19/2022	15:30	Drilling down again.
12/19/2022	15:55	Injection at (ZVI-06-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	16:14	Injection at (ZVI-06-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	16:30	Injection at (ZVI-06-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/19/2022	16:40	Completed ZVI-06-22. All 8 emplacements 25-39' bgs.
12/19/2022	16:42	Done with injections for today. Completed 2 locations: ZVI-02-22 25-33' bgs and ZVI-06-22 25-39' bgs; Also injected 39' at ZVI-09-22, updating 09 notes to 25-39' bgs for completed emplacements. Leaving rods in place overnight at 06.
12/19/2022	16:50	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
12/19/2022	17:00	Departed site.

Signature: 

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 24-33°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)

Date	Time	Description of Activities
12/20/2022	07:30	Arrived on-site. Luke Taylor (Cascade) already on-site.
12/20/2022	07:35	Collin Fernald and Sammie Milton arrive on-site with water totes.
12/20/2022	07:50	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Light snow overnight, slippery icy and cold surfaces, freezing temperatures. Don't rush, stay warm, and work safely.
12/20/2022	07:55	Cascade preparing equipment (unloading water totes, warming up machines and pump parts).
12/20/2022	08:05	Cascade pulling up rods from ZVI-06-22 and abandoned borehole to surface with BENSEAL granular bentonite grout.
12/20/2022	08:30	Moved Geoprobe rig to ZVI-08-22. Washing injection probes and preparing injection supplies.
12/20/2022	08:35	<p>ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI</p> <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
12/20/2022	08:44	Started drilling at ZVI-08-22. Direct push drilling with pressure activated injection probe.
12/20/2022	09:11	Injection at (ZVI-08-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	09:26	Injection at (ZVI-08-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	09:38	Pushed to 29' bgs and observed small amount of daylighting coming up at two points about 4-5 feet west of location 11. Stopped work at location 08. Is the same general area as previous daylighting. Took photos and notified the Arcadis project team. Called Eric Feenstra and decided to leave rods in at ZVI-08-22 and move to down to work at location 13.
12/20/2022	09:45	Completed ZVI-08-22. 2 emplacements 25-27' bgs.
12/20/2022	09:48	Moved Geoprobe rig to ZVI-13-22.
12/20/2022	09:53	Started drilling at ZVI-13-22. Used drill bit to get through surface concrete, then direct push drilling with pressure activated injection probe.
12/20/2022	10:02	Cascade moving ChemGrout mixer/pump and water totes closer to ZVI-13-22.
12/20/2022	10:50	Injection at (ZVI-13-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

12/20/2022	11:03	Injection at (ZVI-13-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	11:08	Daylighting by location 15. Stop work. Notified Arcadis project team and had discussions.
12/20/2022	12:30	Team instructed to continue injecting at ZVI-13-22 and document when and where daylighting occurs. Inject complete ZVI slurry at each emplacement even if daylighting. Give some time between pushing to next emplacement depth after daylighting.
12/20/2022	12:36	Resumed work pushing to 29' bgs at ZVI-13-22.
12/20/2022	12:43	Injection at (ZVI-13-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	12:46	Daylighting again at same spot by location 15. Seems like more amount of ZVI slurry this time. Notified Arcadis team.
12/20/2022	13:10	Cascade pokes and digs around the daylight point (by location 15) and indicates there seems to be previous borehole at the daylight surfacing point. Cascade filled in with bentonite grout about 3' down.
12/20/2022	13:20	Injection at (ZVI-13-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry. No daylighting at the Bentonite plugged daylight point/previous borehole ~3' down (by location 15). But some small spots seeping up near it and under the drill rig by location 12.
12/20/2022	13:40	Clog or probe not opening while injecting water at 33' bgs. Pulling up rods, cleaned out probe, and pushed back downhole.
12/20/2022	14:12	Injection at (ZVI-13-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry. Cascade indicated the pressure was higher and harder to inject, injection probe head was likely partially opened. No daylighting at the Bentonite plugged daylight point/previous borehole ~3' down (by location 15). But some small spots seeping up near it and under the drill rig by location 12.
12/20/2022	14:30	Injection at (ZVI-13-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	15:00	Clog or probe not opening while injecting water at 37' bgs. Pulling up rods, cleaned out probe, and pushed back downhole.
12/20/2022	15:30	Injection at (ZVI-13-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	15:50	Injection at (ZVI-13-22) 38' bgs emplacement; Difficult to inject at 39' bgs, Cascade suspect it could be silty clay zone, had to pull up 1' to complete injection at 38' bgs. Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/20/2022	16:05	Completed ZVI-13-22. All 8 emplacements 25-38' bgs. Daylighting occurred after 27' and 29' injections, some small seep spots after 31-38' bgs near location 15 and small spot under drill rig near location 12.
12/20/2022	16:10	Done with injections for today. Completed 1.25 locations: ZVI-13-22 25-38' bgs and ZVI-08-22 25-27' bgs. Cascade packing up work area.
12/20/2022	16:30	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
12/20/2022	16:40	Departed site.

Signature: 

Daily Log

12/21/2022	10:50	Moved Geoprobe rig to ZVI-10-22.
12/21/2022	10:56	Started drilling at ZVI-10-22. Direct push drilling with pressure activated injection probe. Colby (Cascade) arrived on-site.
12/21/2022	11:13	Injection at (ZVI-10-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	11:15	Daylighting at center of location 10, 11, and 17 triangle. Same daylight spot as last Friday while working at ZVI-09-22.
12/21/2022	11:20	Cascade inspected the daylight point and decided to use the rig to push down 5' and fill with bentonite grout to try to plug and prevent the slurry from surfacing. Does not seem to be a borehole.
12/21/2022	11:40	Another daylight point observed ~4-5' West of locations 12 and 13. Cascade digs around surfacing point. Not a borehole. Waiting few minutes to let the grout settle near location 10.
12/21/2022	12:15	Injection at (ZVI-10-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	12:22	Slowly daylighting at same spots. All seems mostly guar water mixture, yes little ZVI present, but seems like most ZVI is staying in the ground.
12/21/2022	12:32	Injection at (ZVI-10-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry. Daylighting at same spots, with little more ZVI surfacing at the 10, 11, 17 spot.
12/21/2022	12:40	Called Eric F. to provide update. Confirmed to continue injecting with the daylighting.
12/21/2022	13:05	Injection at (ZVI-10-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	13:15	Colby departs site to fill water totes.
12/21/2022	13:29	Injection at (ZVI-10-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	13:45	Injection at (ZVI-10-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	14:00	Injection at (ZVI-10-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	14:20	Injection at (ZVI-10-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	14:25	Completed ZVI-10-22. All 8 emplacements 25-39' bgs. Daylighting occurred during or after each emplacement at two spots: center of locations 10, 11, and 17, & 4-5' West of locations 12 and 13.
12/21/2022	14:30	Cascade pulling up rods from ZVI-08-22 and ZVI-13-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout. Leaving rods in place at ZVI-10-22.
12/21/2022	15:05	Cascade cleaning up daylighted guar/slurry waste with shovels.
12/21/2022	15:50	Filled 2.5 drums. Informed Eric F. Leaving residual on ground.
12/21/2022	16:00	Moved Geoprobe rig to ZVI-22-22.
12/21/2022	16:06	Started drilling at ZVI-22-22. Direct push drilling with pressure activated injection probe.
12/21/2022	16:33	Injection at (ZVI-22-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/21/2022	16:36	Done with injections for today. Completed 2 locations: ZVI-08-22 29-39' bgs and ZVI-10-22 25-39' bgs. And started 3rd location ZVI-22-22 26' bgs. Cascade packing up work area.

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 30-35°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment: Photoionization Detector (PID), Water Level Meter (WLM)

Date	Time	Description of Activities
12/22/2022	07:35	Arrived on-site. Luke Taylor (Cascade) already on-site.
12/22/2022	07:44	Collin Fernald arrive on-site with water totes.
12/22/2022	07:55	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Fieldwork cancelled for tomorrow due to incoming snowstorm. Don't rush, stay warm, and work safely.
12/22/2022	08:00	Cascade preparing equipment (unloading water totes, warming up machines and pump parts).
12/22/2022	08:15	Geoprobe rig set up at ZVI-22-22 to resume injections (completed 26' bgs emplacement yesterday).
12/22/2022	08:20	<p>ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI</p> <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
12/22/2022	08:27	Injection at (ZVI-22-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	08:41	Injection at (ZVI-22-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	08:57	Injection at (ZVI-22-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	09:17	Injection at (ZVI-22-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	09:27	Injection at (ZVI-22-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	09:45	Injection at (ZVI-22-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	10:00	Injection at (ZVI-22-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	10:02	Completed ZVI-22-22. 7 emplacements 28-40' bgs. All 8 emplacements are now completed 26-40' bgs.
12/22/2022	10:05	Moved Geoprobe rig to ZVI-20-22.

Daily Log

12/22/2022	10:08	Started drilling at ZVI-20-22. Direct push drilling with pressure activated injection probe.
12/22/2022	10:30	Injection at (ZVI-20-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	10:40	Gauging DTW ft bTOC of the five surrounding monitoring wells for during injection measurements. MW-13-22 = 22.76 @1057; MW-14-22 = 22.98 @1058; MW-15-22 = 23.10 @1052; MW-16-22 = 23.05 @1102; MWF16-16 = 23.05 @1041.
12/22/2022	10:44	Injection at (ZVI-20-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	10:45	Lance Rogers dropped off helper (Cascade) on-site.
12/22/2022	10:57	Injection at (ZVI-20-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	11:18	Injection at (ZVI-20-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	11:30	Injection at (ZVI-20-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	11:45	Injection at (ZVI-20-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	12:00	Injection at (ZVI-20-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	12:17	Injection at (ZVI-20-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
12/22/2022	12:22	Completed ZVI-20-22. All 8 emplacements 26-40' bgs.
12/22/2022	12:26	Cascade pulling up rods from ZVI-10-22, ZVI-20-22, and ZVI-22-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
12/22/2022	13:00	Done with injections for today. Completed 2 locations: ZVI-22-22 28-40' bgs (26-40') and ZVI-20-22 26-40' bgs. Cascade packing up work area and organizing supplies to leave on-site over the break. Exclusion zone set up around work area (cones and flagging tape). Remarkered boring locations with spray paint. Fieldwork to resume January 4, 2023.
12/22/2022	13:15	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
12/22/2022	13:45	Departed site.

Signature: 

Waste Management:										
Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
12/22/2022	yes	4	55-gallon	Stainless Steel		no				No waste added to drums today.

Equipment and Calibration Information:



Daily Log

Supplier: Geotech

Model: MiniRAE 3000

Rental Number: 5860

Calibrated: no

Bump Checked: no

Calibration Passed:

PIDSN: 592-918932

Date	Time	Calibrated Fluid and Value	Lot #	Expiration Date	Initial Reading	Final Reading
12/22/2022	--					

Project Name : RACER Pontiac North Campus 2022

Weather(°F) : Cloudy, Fog, Rain, 44-52°F

Project Number : 30112891

Prepared By: Kara Donahue

Purpose : ZVI Injection Pilot

PPE : Level D

Equipment:

Date	Time	Description of Activities
01/04/2023	07:32	Arrived on-site. Started paperwork.
01/04/2023	08:02	Cascade on there way to site.
01/04/2023	08:38	Luke Taylor arrived on-site (Cascade).
01/04/2023	09:00	Collin Fernald and Brad Slenzak arrived on-site (Cascade) with water totes.
01/04/2023	09:06	Geoprobe rig set up at ZVI-26-22.
01/04/2023	09:10	H&S tailgate meeting. Reviewed hazards, site conditions, and work plan. Don't rush and work safely.
01/04/2023	09:15	Started drilling at ZVI-26-22. Drill bit head to get through surface, then direct push drilling with pressure activated injection probe. Hit refusal at 6' bgs. Pulling up to step out.
01/04/2023	09:30	Stepped out 2' towards location 25 along line 2 and started drilling at ZVI-26-22. Drill bit head to get through surface, then direct push drilling with pressure activated injection probe. Hit refusal again at 6' bgs. Pulling up to move to new location.
01/04/2023	09:36	Moved Geoprobe rig to ZVI-25-22.
01/04/2023	09:40	Started drilling at ZVI-25-22. Direct push drilling with pressure activated injection probe.
01/04/2023	10:10	ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth. Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.
01/04/2023	10:16	Injection at (ZVI-25-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	10:37	Injection at (ZVI-25-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	10:53	Injection at (ZVI-25-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	11:07	Injection at (ZVI-25-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	11:20	Injection at (ZVI-25-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

01/04/2023	11:34	Injection at (ZVI-25-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	11:45	Injection at (ZVI-25-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	11:56	Injection at (ZVI-25-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	12:00	Completed ZVI-25-22. All 8 emplacements 26-40' bgs.
01/04/2023	12:05	Moved Geoprobe rig to ZVI-16-22.
01/04/2023	12:10	Started drilling at ZVI-16-22. Direct push drilling with pressure activated injection probe.
01/04/2023	12:25	Injection at (ZVI-16-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	12:30	Small amount of daylighting begins near location 16. Appears to be mostly water and guar gum surfacing.
01/04/2023	12:40	Injection at (ZVI-16-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	13:00	Injection at (ZVI-16-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	13:10	More daylighting occurring near location 16, 15, 13, & 12. Appears to be mostly water and guar gum surfacing.
01/04/2023	13:15	Injection at (ZVI-16-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	13:30	Issues with probe clogging/injection not working at 34' bgs. Cascade pulling up rods to clear out clog. Made few attempts and worked on troubleshooting.
01/04/2023	15:00	Injection at (ZVI-16-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	15:20	Issues with probe clogging/injection not working again at 36' bgs. Cascade pulling up rods to clear out clog.
01/04/2023	15:58	Injection at (ZVI-16-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	16:17	Injection at (ZVI-16-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	16:30	Issues with probe clogging/injection not working again at 40' bgs. Cascade pulling up rods to clear out clog.
01/04/2023	16:58	Injection at (ZVI-16-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/04/2023	17:03	Completed ZVI-16-22. All 8 emplacements 26-40' bgs. Large amount of material daylighting in the area. Cascade is bringing drums to clean it up tomorrow.
01/04/2023	17:05	Done with injections for today. Completed 2 locations: ZVI-26-22 26-40' bgs and ZVI-16-22 26-40' bgs; daylighting occurred during ZVI-16-22. Cascade packing up work area and organizing supplies. Exclusion zone set up around work area.
01/04/2023	17:15	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
01/04/2023	17:30	Departed site.

Signature: 

Waste Management:

Drums On Site

Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
01/04/2023	yes	4	55-gallon	Stainless Steel		no				No waste added to drums today.


Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, Snow, Rain, 34-37°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment:

Date	Time	Description of Activities
01/05/2023	07:30	Arrived on-site. Started paperwork. Luke Taylor already on-site (Cascade).
01/05/2023	07:45	Collin Fernald and Brad Slenzak arrived on-site (Cascade) with water totes.
01/05/2023	07:55	H&S tailgate meeting.
01/05/2023	08:00	Cascade setting up for work. Pulling up rods from ZVI-16-22 and ZVI-25-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
01/05/2023	08:54	Started drilling at ZVI-23-22. Direct push drilling with pressure activated injection probe.
01/05/2023	09:00	<p>ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI</p> <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
01/05/2023	09:15	Injection at (ZVI-23-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	09:30	Injection at (ZVI-23-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	09:45	Injection at (ZVI-23-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	10:00	Injection at (ZVI-23-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	10:15	Injection at (ZVI-23-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	10:30	Clog issue while attempting to inject at 36' bgs.
01/05/2023	11:13	Injection at (ZVI-23-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	11:30	Injection at (ZVI-23-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	11:45	Injection at (ZVI-23-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	11:50	Completed ZVI-23-22. All 8 emplacements 26-40' bgs.

01/05/2023	12:00	Moved Geoprobe rig to ZVI-18-22.
01/05/2023	12:03	Started drilling at ZVI-18-22. Direct push drilling with pressure activated injection probe.
01/05/2023	12:20	Injection at (ZVI-18-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	12:38	Injection at (ZVI-18-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	12:40	Daylighting begins near location 18, 17, 11, and 10. Appears to be ZVI slurry material.
01/05/2023	12:52	Injection at (ZVI-18-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	13:04	Injection at (ZVI-18-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	13:18	Injection at (ZVI-18-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	13:30	Injection at (ZVI-18-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	13:40	Updated the Arcadis project team about the occurring daylighting. (Spot between 17, 10, and 11; near 10, and ~5 ft west of 11 there is cluster of surfacing points).
01/05/2023	13:45	Injection at (ZVI-18-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	14:00	Injection at (ZVI-18-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	14:05	Completed ZVI-18-22. All 8 emplacements 26-40' bgs. Large amount of material daylighted in the area. Cascade works on cleaning up and drumming waste.
01/05/2023	14:10	Pulling up rods from ZVI-23 and abandoned borehole to surface with BENSEAL granular bentonite.
01/05/2023	14:40	Moved Geoprobe rig to ZVI-24-22.
01/05/2023	14:45	Started drilling at ZVI-24-22. Used drill bit to get through surface concrete, then direct push drilling with pressure activated injection probe.
01/05/2023	15:10	Injection at (ZVI-24-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	15:30	Injection at (ZVI-24-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	15:46	Injection at (ZVI-24-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	16:00	Injection at (ZVI-24-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	16:05	Daylighting begins near location 24, 5, and ~10 ft East of 24. Appears to be ZVI slurry material.
01/05/2023	16:17	Injection at (ZVI-24-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	16:30	Injection at (ZVI-24-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

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01/05/2023	16:40	Injection at (ZVI-24-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	16:50	Injection at (ZVI-24-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/05/2023	16:54	Completed ZVI-24-22. All 8 emplacements 26-40' bgs.
01/05/2023	16:55	Done with injections for today. Completed 3 locations: ZVI-23-22 26-40' bgs, ZVI-18-22 26-40' bgs, and ZVI-24-22; daylighting occurred during ZVI-18-22 and ZVI-24-22. Cascade packing up work area and organizing supplies. Exclusion zone set up around work area.
01/05/2023	17:02	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
01/05/2023	17:26	Departed site.

Signature: 

Waste Management:										
Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
01/05/2023	yes	4	55-gallon	Stainless Steel	Good	yes	5	55-gallon	Good	Created ZVI slurry waste and bentonite waste drums.

Project Name : RACER Pontiac North Campus 2022

Weather(°F) : Cloudy, 33-36°F

Project Number : 30112891

Prepared By: Kara Donahue

Purpose : ZVI Injection Pilot

PPE : Level D

Equipment:

Date	Time	Description of Activities
01/06/2023	07:35	Arrived on-site. Started paperwork. Luke Taylor already on-site (Cascade).
01/06/2023	07:45	Collin Fernald and Brad Slenzak arrived on-site (Cascade) with water totes.
01/06/2023	07:58	H&S tailgate meeting. Cascade filling out paperwork.
01/06/2023	08:20	Cascade unloading water totes and staging waste drums. Pulling up rods from ZVI-24-22 and ZVI-18-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
01/06/2023	09:05	Started drilling at ZVI-19-22. Direct push drilling with pressure activated injection probe.
01/06/2023	09:15	ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth. Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.
01/06/2023	09:50	Injection at (ZVI-19-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	10:30	Injection at (ZVI-19-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	10:45	Injection at (ZVI-19-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	10:55	Daylighting begins at same locations as yesterday during ZVI-18-22 injections; middle of 17, 11, and 10; ~5' west of 10 and 11; between 09 and 10. Appears to be ZVI slurry material. It's multiple small points/clusters daylighting at the areas. None are obvious boreholes.
01/06/2023	11:12	Injection at (ZVI-19-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	11:25	Injection at (ZVI-19-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	11:38	Injection at (ZVI-19-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	11:52	Injection at (ZVI-19-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

01/06/2023	12:03	Injection at (ZVI-19-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	12:08	Completed ZVI-19-22. All 8 emplacements 26-40' bgs. Large amount of material daylighted in the area. Cascade works on cleaning up and drumming waste.
01/06/2023	12:13	Moved Geoprobe rig to ZVI-21-22.
01/06/2023	12:20	Started drilling at ZVI-21-22. Direct push drilling with pressure activated injection probe.
01/06/2023	12:45	Injection at (ZVI-21-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	12:53	Injection at (ZVI-21-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	13:15	Injection at (ZVI-21-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	13:30	Injection at (ZVI-21-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	13:52	Injection at (ZVI-21-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	14:03	Injection at (ZVI-21-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	14:17	Injection at (ZVI-21-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	14:32	Injection at (ZVI-21-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	15:38	Completed ZVI-21-22. All 8 emplacements 26-40' bgs. No daylighting.
01/06/2023	15:00	Moved Geoprobe rig to ZVI-17-22.
01/06/2023	14:48	Started drilling at ZVI-17-22. Direct push drilling with pressure activated injection probe.
01/06/2023	15:12	Injection at (ZVI-17-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	15:28	Injection at (ZVI-17-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	15:30	Daylighting begins at same locations as during ZVI-19-22 injections; middle of 17, 11, and 10; ~5' west of 10 and 11; between 09 and 10. Appears to be ZVI slurry material. It's multiple small points/clusters daylighting at the areas. None are obvious boreholes. Cascade works on cleaning up and drumming waste throughout injections.
01/06/2023	15:45	Injection at (ZVI-17-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	15:57	Injection at (ZVI-17-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	16:08	Injection at (ZVI-17-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	16:20	Injection at (ZVI-17-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

01/06/2023	16:32	Injection at (ZVI-17-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	16:45	Injection at (ZVI-17-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/06/2023	16:48	Completed ZVI-17-22. All 8 emplacements 26-40' bgs. Large amount of material daylighted in the area.
01/06/2023	16:50	Done with injections for today. Completed 3 locations: ZVI-19-22 26-40' bgs, ZVI-21-22 26-40' bgs, and ZVI-17-22; daylighting occurred during ZVI-19-22 and ZVI-17-22. Cascade packing up work area and organizing supplies. Exclusion zone set up around work area.
01/06/2023	17:02	Filling out paperwork and sending update to Arcadis team.
01/06/2023	17:20	Departed site.
01/06/2023	17:25	Cascade departed site.

Signature: 

Waste Management:										
Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
01/06/2023	yes	9	55-gallon	Stainless Steel	Good	yes	6	55-gallon	Good	Created ZVI slurry/bentonite grout waste drums.

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Sunny, 26-38°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment:


Date	Time	Description of Activities
01/09/2023	07:35	Arrived on-site. Started paperwork. Luke Taylor already on-site (Cascade).
01/09/2023	08:05	Cascade pulling up rods from ZVI-17-22, ZVI-19-22, and ZVI-21-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout. (Luke indicated they used more grout in ZVI-19-22 than the usual boreholes which could indicate a void space at ~6-7' bgs).
01/09/2023	08:13	Mark Frisbie arrived on-site (Cascade) with skid steer.
01/09/2023	08:40	Collin Fernald arrived on-site (Cascade) with water totes.
01/09/2023	08:45	H&S tailgate meeting.
01/09/2023	08:50	Moved Geoprobe rig to ZVI-14-22. Washing off injection probe heads.
01/09/2023	09:00	Started drilling at ZVI-14-22. Used drill head to get through surface concrete, then direct push drilling with pressure activated injection probe. Unloading water totes.
01/09/2023	09:15	<p>ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI</p> <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
01/09/2023	09:36	Injection at (ZVI-14-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	09:49	Injection at (ZVI-14-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	09:55	Daylighting begins near ZVI-14 borehole and ~3' away between location 13 and 14, closer to the fence. Appears to be ZVI slurry material. None are obvious boreholes; small seeping points.
01/09/2023	10:04	Injection at (ZVI-14-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	10:18	Injection at (ZVI-14-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	10:32	Injection at (ZVI-14-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	10:54	Injection at (ZVI-14-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.

Daily Log

01/09/2023	11:05	Injection at (ZVI-14-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	11:17	Injection at (ZVI-14-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	11:20	Completed ZVI-14-22. All 8 emplacements 26-40' bgs. Large amount of material daylighted in the area between location 14 and 13 and the fence. Cascade works on cleaning up and drumming waste.
01/09/2023	11:26	Moved Geoprobe rig to ZVI-11-22.
01/09/2023	11:30	Started drilling at ZVI-11-22. Direct push drilling with pressure activated injection probe.
01/09/2023	11:48	Injection at (ZVI-11-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	12:14	Injection at (ZVI-11-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	12:18	Daylighting begins ~4' East of ZVI-11-22. Appears to be ZVI slurry material. No obvious boreholes; several small seeping points.
01/09/2023	12:25	Clog or probe not opened while at 29' bgs. Cascade works to pull up rods and clear out probe head.
01/09/2023	12:55	Injection at (ZVI-11-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	13:00	More daylighting at several small points, ~4' East of location 17, and ~5' North of location 17 along Line 2.
01/09/2023	13:08	Injection at (ZVI-11-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	13:21	Injection at (ZVI-11-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	13:35	Injection at (ZVI-11-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	13:45	Injection at (ZVI-11-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	13:55	Injection at (ZVI-11-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	13:57	Completed ZVI-11-22. All 8 emplacements 25-39' bgs. Large amount of daylighting occurred during injections at several small points, ~4' East of location 17, and ~5' North of location 17 along Line 2.
01/09/2023	13:58	Moved Geoprobe rig to ZVI-12-22.
01/09/2023	14:00	Started drilling at ZVI-12-22. Direct push drilling with pressure activated injection probe.
01/09/2023	14:18	Injection at (ZVI-12-22) 25' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	14:28	Injection at (ZVI-12-22) 27' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	14:30	Daylighting begins at same locations as during ZVI-11-22 injections; several small points, ~4' East of location 17, and ~5' North of location 17 along Line 2. No obvious boreholes; several small seeping points. Cascade works on cleaning up and drumming waste throughout injections.

Daily Log

01/09/2023	14:39	Injection at (ZVI-12-22) 29' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	14:49	Injection at (ZVI-12-22) 31' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	15:01	Injection at (ZVI-12-22) 33' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	15:15	Clog or probe not opened while at 36' bgs. Cascade works to pull up rods and clear out probe head.
01/09/2023	15:36	Injection at (ZVI-12-22) 35' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	15:44	Injection at (ZVI-12-22) 37' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	16:05	Injection at (ZVI-12-22) 39' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/09/2023	16:10	Completed ZVI-12-22. All 8 emplacements 25-39' bgs. Large amount of material daylighted at several small points, ~4' East of location 17, and ~5' North of location 17 along Line 2.
01/09/2023	16:12	Done with injections for today. Completed 3 locations: ZVI-14-22 26-40' bgs, ZVI-11-22 25-39' bgs, and ZVI-12-22 25-39' bgs; daylighting occurred during injections at all 3 locations. Cascade packing up work area, shoveling daylighted ZVI slurry into drums, and organizing supplies. Exclusion zone set up around work area.
01/09/2023	16:35	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
01/09/2023	16:50	Departed site.

Signature: 

Waste Management:										
Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
01/09/2023	yes	15	55-gallon	Stainless Steel	Good	yes	8	55-gallon	Good	Created ZVI slurry/bentonite grout waste drums.

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, 27-35°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot
PPE : Level D
Equipment:

Date	Time	Description of Activities
01/10/2023	07:43	Arrived on-site. Started paperwork. Luke Taylor already on-site (Cascade).
01/10/2023	07:50	Collin Fernald and Brad Slenzak arrived on-site (Cascade) with water totes.
01/10/2023	08:02	H&S tailgate meeting.
01/10/2023	08:07	Cascade begins moving drums and unloading water totes.
01/10/2023	08:17	Cascade pulling up rods from ZVI-12-22, ZVI-11-22, and ZVI-14-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
01/10/2023	08:48	Moved Geoprobe rig to ZVI-15-22.
01/10/2023	08:52	Started drilling at ZVI-15-22. Direct push drilling with pressure activated injection probe.
01/10/2023	09:00	<p>ZVI slurry mixture per emplacement is ~34-35 gallons: - 30 gal water - 3 lbs guar gum - 76.34 lbs ZVI</p> <p>Using Top Down approach. For top down approach they push down ~0.5' passed the target emplacement depth, then pull back up 0.5' to expose the injection ports positioned at the target emplacement depth.</p> <p>Injecting water first, mixing ZVI slurry batch, injecting ZVI slurry, then water immediately after to flush the total ZVI slurry into formation. Cascade let's ZVI slurry into pump bucket little by little to allow smooth flow through as slurry enters piping/hose.</p>
01/10/2023	09:07	Injection at (ZVI-15-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	09:18	Injection at (ZVI-15-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	09:25	Daylighting begins between location 13 and 14, closer to the fence, near 16, and near 12 (under the rig). Appears to be ZVI slurry material. None are obvious boreholes; small seeping points.
01/10/2023	09:30	Clog while at 30' bgs. Cascade pulls up rods. After pushing back downhole, clogged again and pulled up again. (Clogged two times attempting to inject at 30' bgs).
01/10/2023	10:16	Injection at (ZVI-15-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	10:28	Clog while at 32' bgs. Cascade pulls up rods.
01/10/2023	10:50	Injection at (ZVI-15-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	11:00	Clog while at 34' bgs. Cascade pulls up rods. The borehole has been worked a lot from having to pull up and push rods back down several times and water and guar are coming up/daylighting around the borehole/rods. Cascade recommended we switch to Bottom Up approach instead of Top Down for the rest the injections here (ZVI-15-22; 40', 38', 36', and 34'). Called Eric Feenstra (Arcadis) and got approval to switch to Bottom Up here.

Daily Log

01/10/2023	11:30	Injection at (ZVI-15-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	11:38	Injection at (ZVI-15-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	11:48	Injection at (ZVI-15-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	11:58	Injection at (ZVI-15-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	12:00	Completed ZVI-15-22. All 8 emplacements 26-40' bgs. Large amount of material daylighted in the area between location 14 and 13, near 16, near 12, and at the 15 borehole walls. Cascade works on cleaning up and drumming waste.
01/10/2023	12:10	Moved Geoprobe rig to ZVI-26-22. Previously hit refusal at 6' bgs here. Stepped out 2' North along Line 2 - refusal, stepped out to between 26 and 01 - refusal, stepped out East of 26 - refusal. 4th attempt was successful/no refusal when stepped out to 4.5 ft North of 26.
01/10/2023	12:27	Started drilling at ZVI-26-22. Used drill head to get through surface concrete, then direct push drilling with pressure activated injection probe (4.5 ft North of original 26 location).
01/10/2023	12:52	Injection at (ZVI-26-22) 26' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	13:05	Clog while at 28' bgs. Cascade pulls up rods.
01/10/2023	13:30	Injection at (ZVI-26-22) 28' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	13:42	Injection at (ZVI-26-22) 30' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	13:53	Injection at (ZVI-26-22) 32' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	14:05	Injection at (ZVI-26-22) 34' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	14:18	Injection at (ZVI-26-22) 36' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	14:30	Injection at (ZVI-26-22) 38' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	14:42	Injection at (ZVI-26-22) 40' bgs emplacement; Pump water down first, then ZVI slurry injection, then pump water to flush. 10 gallons of water before and 10 gallons after ~35 gallons of ZVI slurry.
01/10/2023	14:45	Completed ZVI-26-22. All 8 emplacements 25-39' bgs. No daylighting.
01/10/2023	14:50	Done with all injections. Completed final 2 locations: ZVI-15-22 26-40' bgs and ZVI-26-22 26-40' bgs; daylighting occurred during injections at 15. Cascade packing up work area and organizing supplies. Exclusion zone set up around work area. Plan to do the two confirmation borings tomorrow.
01/10/2023	15:20	Cascade departed site. Filling out paperwork and sending update to Arcadis team.
01/10/2023	15:38	Departed site.

Signature: 

Waste Management:


Drums On Site

Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
01/10/2023	yes	23	55-gallon	Stainless Steel	Good	yes	4	55-gallon	Good	Created ZVI slurry/bentonite grout waste drums.

Project Name : RACER Pontiac North Campus 2022 **Weather(°F) :** Cloudy, light rain, 33-40°F
Project Number : 30112891 **Prepared By:** Kara Donahue
Purpose : ZVI Injection Pilot Confirmation Borings
PPE : Level D
Equipment: Photoionization Detector (PID)

Date	Time	Description of Activities
01/11/2023	07:37	Arrived on-site. Started paperwork. Luke Taylor already on-site (Cascade).
01/11/2023	07:48	Collin Fernald and Brad Slenzak arrived on-site (Cascade).
01/11/2023	08:12	H&S tailgate meeting.
01/11/2023	08:17	Cascade pulling up rods from ZVI-26-22 and ZVI-15-22. Abandoned boreholes to surface with BENSEAL granular bentonite grout.
01/11/2023	08:20	No calibration gas present for the Geotech QRae 3 LEL.
01/11/2023	08:35	Cascade loading ChemGrout mixer/pump onto trailer.
01/11/2023	08:55	Moved Geoprobe rig to SB-ZVI-1. (Located at center between ZVI-04-22 and ZVI-24-22).
01/11/2023	09:10	Started drilling SB-ZVI-1. Collin Fernald is driller.
01/11/2023	09:30	QRae 3 LEL not functioning properly; unable to end low oxygen alarm, measures % LEL, and no calibration gas supplied by rental company. No PID readings recorded.
01/11/2023	10:25	No recovery for 15-25' bgs. Luke takes over drilling of SB-ZVI-1 for 25-40' bgs.
01/11/2023	11:50	ZVI observed from 25-30' bgs at SB-ZVI-1 (four ZVI spots observed at depths similar to the emplacement depths). No ZVI observed from 30-40' bgs. Called Eric Feenstra (Arcadis) to provide update on confirmation boring observations.
01/11/2023	12:00	Moved Geoprobe rig to SB-ZVI-2. (Located at center between ZVI-12-22 and ZVI-16-22)
01/11/2023	12:15	Started drilling SB-ZVI-2. Collin Fernald is driller.
01/11/2023	13:00	ZVI observed from 18-19' bgs at SB-ZVI-2 (pocket at 18' bgs observed down to ~18.4' bgs, and ZVI observed at 18.9' bgs). No ZVI observed from 20-40' bgs.
01/11/2023	13:55	Call with Eric Feenstra (Arcadis) indicating to go back to near SB-ZVI-1 and drill to collect soil sample of 30-35' bgs (sand with no ZVI observed) from about 1 ft from a ZVI injection boring. Cascades technical team thinks it's possible the ZVI is observed due to dispersion of the ZVI in the sand grains and magnet unable to detect it due to wet soils. Also, provided update about seeing same situation at SB-ZVI-2 where no ZVI is observed in the sand units. Indicated to collect samples of those sand units too.
01/11/2023	14:30	Collected sample of 25-30', 30-35, and 35-40' bgs at SV-ZVI-2 due to no observed ZVI. Could be too wet for magnet to detect, and maybe ZVI is too dispersed through the sand grains to observe. Taking samples to try magnet once soils dry out.
01/11/2023	14:40	Moved rig and started drilling 1' from ZVI-04-22. Blind drill to collect 30-35' bgs sample. Pulled up soils from 20-35' bgs, soils closely match SB-ZVI-1 log (no soil boring log recorded for this boring).
01/11/2023	15:45	Collected sample of 25-28' and 30-35' bgs at SB by ZVI-04-22. ZVI only observed from 28-29' bgs (ZVI at ~28' and ~29'). Cascade packing up and cleaning work area.
01/11/2023	16:15	28 total drums staged on-site by injection pilot; 27 ZVI slurry/bentonite grout drums, and 1 soil cuttings drum. Cascade will be back on-site tomorrow to pick up the rest of their equipment and supplies. All 3 soil borings were abandoned to surface with BENSEAL granular bentonite grout.
01/11/2023	16:20	Cascade departed site. Filling out paperwork and sending update to Arcadis team.

01/11/2023	17:10	Departed site.
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Signature: 

Waste Management:										
Drums On Site										
Date	Are there any waste drums on site?	Number of Drums upon Arrival	Size of Drums	Type of Drums	Condition of Drums	Waste Drummed Today?	Number of drums Created	Size of drums	Condition of Drums	General Waste Comments
01/11/2023	yes	27	55-gallon	Stainless Steel	Good	yes	1	55-gallon	Good	Created one soil cuttings waste drum.

Other Photos



null



null



null

Equipment and Calibration Information:

FieldNow - Daily Field Log (Tier 1)



Daily log for field activities to be used to chronicle your daily activities on site. SME: Ian Drost Developer: Brian Webb Updated 2019-12-23 to include equipment section with calibration details

November 29, 2022, RACER Trust, Fourth Quarter Ground Water Sampling, Christina Weaver, RACER Pontiac North Campus 2022

11/30/2022, 11:12:21 PM UTC



CREATED

🕒 11/29/2022, 12:50:57 PM UTC
👤 by Christina Weaver

UPDATED

🕒 11/30/2022, 11:12:21 PM UTC
👤 by Christina Weaver

STATUS

🔴 In Progress

LOCATION

📍 42.659754, -83.298632

ASSIGNED TO

👤 Christina Weaver

Have you read the Quality Procedure (QP) and/or Technical Guidance Instruction (TGI) relevant to this use case? Yes

Selecting "Yes" confirms your digital signature as having read the QP and/or TGI relevant to this use case.

Basic Information

Select Project Number	30112891, RACER Trust, RACER Pontiac North Campus 2022
Project Name	RACER Pontiac North Campus 2022
Project Number	30112891
Client	RACER Trust
Date	November 29, 2022
Completed By	Christina Weaver
Purpose	Fourth Quarter Ground Water Sampling
Weather	41 degrees F and Cloudy. The wind is blowing NW at 5 mph, 83% humidity, 30.06 inHg.
PPE	Level D

Daily Log of Activities

Notes (16 Items)

Notes - 1. 07:00, Depart from office.

Time	07:00
Description of Task	Depart from office.

Notes - 2. 07:53, Arrive onsite, health and safety tailgate with self, bump check equipment and set up for ground water sampling.

Time	07:53
Description of Task	Arrive onsite, health and safety tailgate with self, bump check equipment and set up for ground water sampling.

Notes - 3. 08:39, Finish prep for sampling. Mobilize to site. See full GWS logs for additional sampling details.

Time	08:39
Description of Task	Finish prep for sampling. Mobilize to site. See full GWS logs for additional sampling details.

Notes - 4. 09:15, SSI survey team on-site. Review scope and health and safety.

Time	09:15
Description of Task	SSI survey team on-site. Review scope and health and safety.

Notes - 5. 09:50, Finish survey of two new wells MW-16-22 and MW-15-22 uses reference wells MW-OS-08 and MW-OS-09R. Mobilize to GFL for ZVI survey. Contact Lexi to inform roll offs cover our location. Survey what is available. Gary (Arcadis)to get in contact with Frank(GFL) to see if we can move anything. Note that the man door near MWF16-23 has the chain cut and not our lock. Relay info to Lexi (Arcadis)

Time	09:50
Description of Task	Finish survey of two new wells MW-16-22 and MW-15-22 uses reference wells MW-OS-08 and MW-OS-09R. Mobilize to GFL for ZVI survey. Contact Lexi to inform roll offs cover our location. Survey what is available. Gary (Arcadis)to get in contact with Frank(GFL) to see if we can move anything. Note that the man door near MWF16-23 has the chain cut and not our lock. Relay info to Lexi (Arcadis)

Notes - 6. 10:42, Finish surveying available ZVI locations. SSI places a magnetic spike with ribbon at each location and spray paints number. Placed barrels around Northern area to decrease chance of being covered. We were able to locate 52, 53, 54, 55, 60, 69, 71, and 72 in concrete /asphalt. 36, 57, 50, 49, 38 were located in concrete under a layer of gravel that will cover the magnetic spike once the roll offs are moved. Gary confirms that there is no one available to remove roll offs from our locations this week. Contact Lexi (Arcadis) and relay information. SSI off-site mobilize on-site.

Time	10:42
Description of Task	Finish surveying available ZVI locations. SSI places a magnetic spike with ribbon at each location and spray paints number. Placed barrels around Northern area to decrease chance of being covered. We were able to locate 52, 53, 54, 55, 60, 69, 71, and 72 in concrete /asphalt. 36, 57, 50, 49, 38 were located in concrete under a layer of gravel that will cover the magnetic spike once the roll offs are moved. Gary confirms that there is no one available to remove roll offs from our locations this week. Contact Lexi (Arcadis) and relay information. SSI off-site mobilize on-site.

Notes - 7. 11:00, Begin GWS activities in Fiero South, see GWS logs for full sampling details.

Time	11:00
Description of Task	Begin GWS activities in Fiero South, see GWS logs for full sampling details.

Notes - 8. 11:45, Collect sample MW-07-20_GW-112922

Time	11:45
Description of Task	Collect sample MW-07-20_GW-112922

Notes - 9. 12:00, Doug (Merit) on-site. Gary (Arcadis) meets to relinquish samples (3-day rush) maintain standard TAT samples.

Time | 12:00

Description of Task | Doug (Merit) on-site. Gary (Arcadis) meets to relinquish samples (3-day rush) maintain standard TAT samples.

Notes - 10. 12:58, Collect sample MW-02-17_GW-112922

Time | 12:58

Description of Task | Collect sample MW-02-17_GW-112922

Notes - 11. 14:02, Collect sample MW-02-17_GW-112922

Time | 14:02

Description of Task | Collect sample MW-02-17_GW-112922

Notes - 12. 15:00, Collect sample MWF7-02_GW-112922 with MS/MSD

Time | 15:00

Description of Task | Collect sample MWF7-02_GW-112922 with MS/MSD

Notes - 13. 15:20, Return to site shed, dispose of purge water. Send summary to team.

Time | 15:20

Description of Task | Return to site shed, dispose of purge water. Send summary to team.

Notes - 14. 15:53, Depart from site.

Time | 15:53

Description of Task | Depart from site.

Notes - 15. 16:35, Arrive at office, store samples in cold storage. Store equipment.

Time | 16:35

Description of Task | Arrive at office, store samples in cold storage. Store equipment.

Notes - 16. 16:50, Depart from office.

Time	16:50
Description of Task	Depart from office.

Equipment & Calibration Information

Are you using equipment?	Yes
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Equipment Information (5 Items)

Equipment Information - 1. Turbidity Meter, Portable, Geotech

Supplier	Geotech
Type of Equipment	Turbidity Meter
Model	Portable
Rental Number	5640
Serial Number	NA
Calibrated?	No
Bump checked?	Yes
Calibration/bump check time	08:10

Turbidity Meter Calibration Information

Calibration Standards (4 Items)

Calibration Standards - 1. GeoTech, 800, 849

Manufacturer of Standards	GeoTech
Value of Standard (NTU)	800
Turbidity Lot Number	53D
Turbidity Expiration Date	September 29, 2024
Turbidity Check Reading	849

Calibration Standards - 2. GeoTech, 100, 108

Manufacturer of Standards	GeoTech
Value of Standard (NTU)	100
Turbidity Lot Number	53D
Turbidity Expiration Date	September 29, 2024

Turbidity Check Reading		108
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Calibration Standards - 3. GeoTech, 20, 21.2

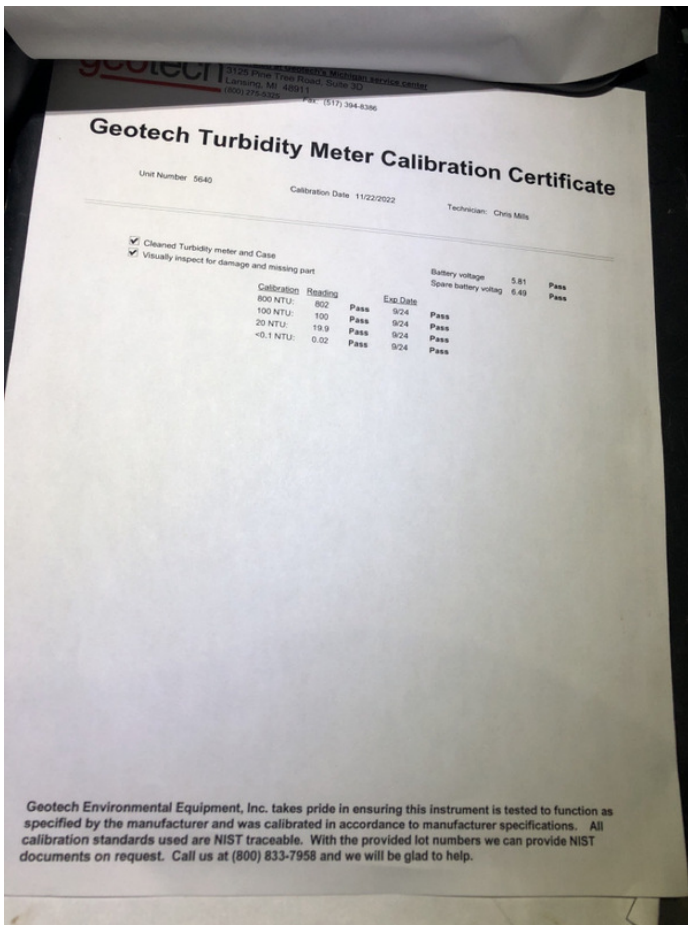
Manufacturer of Standards		GeoTech
Value of Standard (NTU)		20
Turbidity Lot Number		53D
Turbidity Expiration Date		September 29, 2024
Turbidity Check Reading		21.2

Calibration Standards - 4. GeoTech, 0.02, 0.02

Manufacturer of Standards		GeoTech
Value of Standard (NTU)		0.02
Turbidity Lot Number		53D
Turbidity Expiration Date		September 29, 2024
Turbidity Check Reading		0.02

Calibration Documents present from supplier?		Yes
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Calibration Documents



Equipment Information - 2. Water Quality Meter (i.e. YSI), Professional , Geotech

Supplier	Geotech
Type of Equipment	Water Quality Meter (i.e. YSI)
Model	Professional
Rental Number	6814
Serial Number	NA
Calibrated?	No
Bump checked?	Yes
Calibration/bump check time	08:28

Water Quality Meter Calibration Information

Manufacturer of Calibration Fluids	GeoTech
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Calibration Standards (5 Items)

Calibration Standards - 1. pH, 7

Calibration Fluid Type	pH
Calibration Fluid Value and Units	7
Calibration Fluid Lot Number	2GA918
Calibration Fluid Expiration Date	January 28, 2024
Bump Check Reading	7.02

Calibration Standards - 2. pH, 10

Calibration Fluid Type	pH
Calibration Fluid Value and Units	10
Calibration Fluid Lot Number	2GB069
Calibration Fluid Expiration Date	February 1, 2024
Bump Check Reading	10.01

Calibration Standards - 3. pH, 4

Calibration Fluid Type	pH
Calibration Fluid Value and Units	4
Calibration Fluid Lot Number	2GB002
Calibration Fluid Expiration Date	February 1, 2024
Bump Check Reading	4.18

Calibration Standards - 4. conductivity, 1.413 ms/cm

Calibration Fluid Type	conductivity
Calibration Fluid Value and Units	1.413 ms/cm
Calibration Fluid Lot Number	2GA843
Calibration Fluid Expiration Date	January 1, 2023
Bump Check Reading	1.43

Calibration Standards - 5. ORP, 220

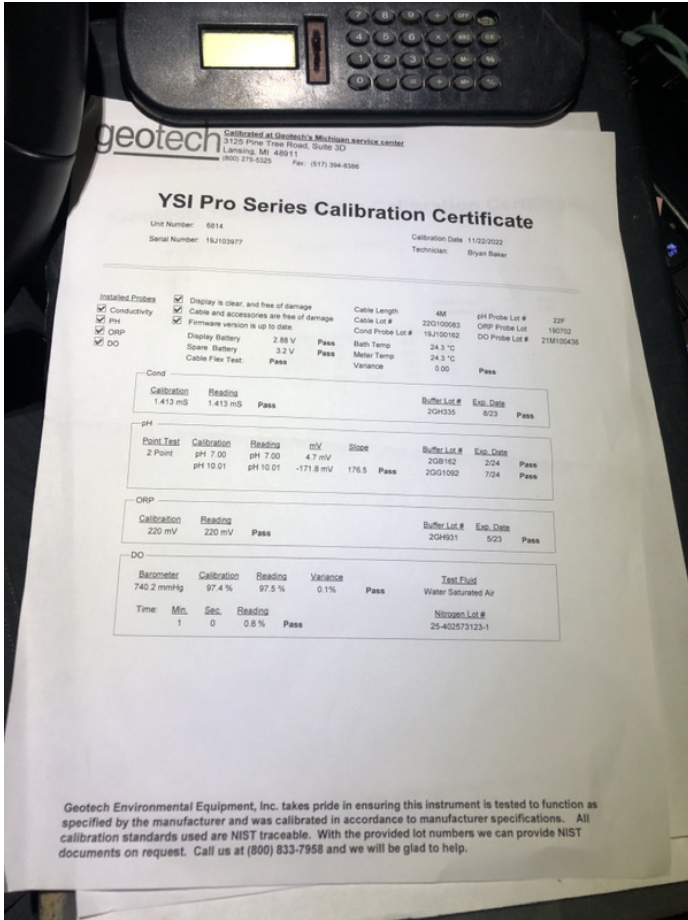
Calibration Fluid Type	ORP
Calibration Fluid Value and Units	220
Calibration Fluid Lot Number	2GE948
Calibration Fluid Expiration Date	November 29, 2022

Bump Check Reading | 225.7

Notes

Calibration Documents present from supplier? | Yes

Calibration Documents



Equipment Information - 3. Peristaltic Pump, GeoTech, Geotech

Supplier | Geotech

Type of Equipment | Peristaltic Pump

Model | GeoTech

Rental Number | 7231

Serial Number | NA

Calibration Documents present from supplier? | No

Calibration Documents

Equipment Information - 4. Water Level Meter (WLM), 200', Geotech

Supplier	Geotech
Type of Equipment	Water Level Meter (WLM)
Model	200'
Rental Number	3110
Serial Number	NA
Calibration Documents present from supplier?	No
Calibration Documents	

Equipment Information - 5. 12V Battery, NA, Geotech

Supplier	Geotech
Type of Equipment	12V Battery
Model	NA
Rental Number	1365, 6721
Serial Number	
Calibration Documents present from supplier?	No
Calibration Documents	
List of Equipment Used	Turbidity Meter, Water Quality Meter (i.e. YSI), Peristaltic Pump, Water Level Meter (WLM), 12V Battery

Waste Management

Are there any waste drums on site?	Yes
Number of Drums upon Arrival	13
Size of Drums	55-gallon
Type of Drums	Stainless Steel
Condition of Drums	Good
Did you drum any waste today?	Yes
Number of Drums Created during Activities	1
Size of Drums	55-gallon
Type of Drum	Stainless Steel
Condition of Drums	Good
General Waste Comments	Adding to a single drum during GWS event
For a more comprehensive drum inventory, please use the Fulcrum app: FieldNow - Waste Log/Inventory (Tier 1)	

COC Photos

Photos

Other Photos

Signature

A large, stylized handwritten signature in black ink, consisting of several loops and a long horizontal stroke.

Signed 11/29/2022, 1:39:39 PM UTC

Have you performed work in accordance with the applicable QP/TGI?

Yes

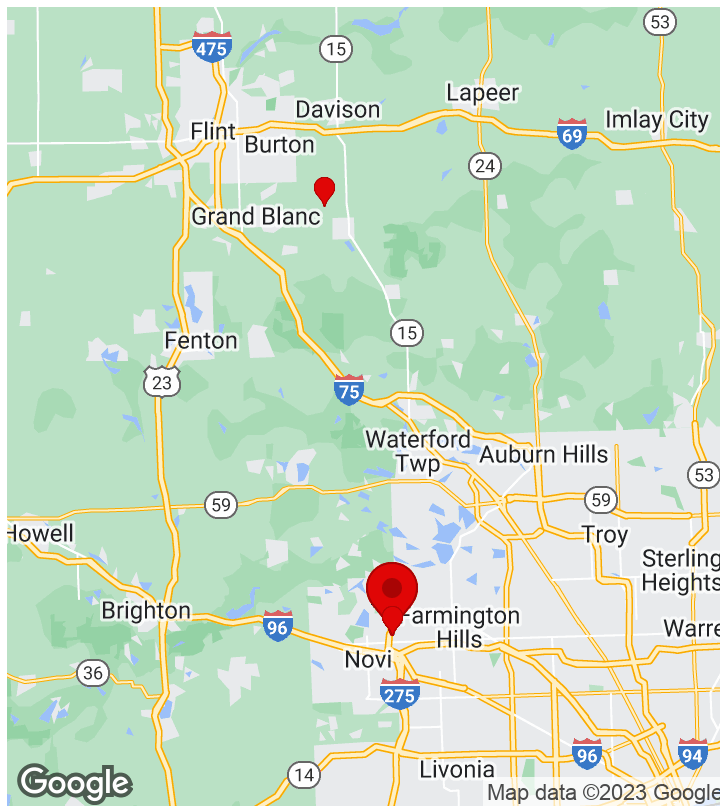
FieldNow - Daily Field Log (Tier 1)



Daily log for field activities to be used to chronicle your daily activities on site. SME: Ian Drost Developer: Brian Webb Updated 2019-12-23 to include equipment section with calibration details

November 29, 2022, RACER Trust, GWS, Gary Schafer, RACER Pontiac North Campus 2022

12/12/2022, 11:29:16 AM UTC



CREATED

🕒 12/2/2022, 6:31:22 PM UTC
👤 by Gary Schafer

UPDATED

🕒 12/12/2022, 11:29:16 AM UTC
👤 by Gary Schafer

STATUS

🟢 QC Complete

LOCATION

📍 42.503875, -83.442406

ASSIGNED TO

👤 Gary Schafer

Have you read the Quality Procedure (QP) and/or Technical Guidance Instruction (TGI) relevant to this use case? Yes

Selecting "Yes" confirms your digital signature as having read the QP and/or TGI relevant to this use case.

Basic Information

Select Project Number	30112891, RACER Trust, RACER Pontiac North Campus 2022
Project Name	RACER Pontiac North Campus 2022
Project Number	30112891
Client	RACER Trust
Date	November 29, 2022
Completed By	Gary Schafer
Purpose	GWS
Weather	Overcast temp 45
PPE	Level D

Daily Log of Activities

Notes (17 Items)

Notes - 1. 08:00, Arrived on site at shed met with Christina, went over scope of work

Time	08:00
Description of Task	Arrived on site at shed met with Christina, went over scope of work

Notes - 2. 08:30, Bump checked YSI and Turbidity meters

Time	08:30
Description of Task	Bump checked YSI and Turbidity meters

Notes - 3. 08:53, Started purging well MW-15-22

Time	08:53
Description of Task	Started purging well MW-15-22

Notes - 4. 08:55, Started recording field parameters and every 5 minutes after

Time	08:55
Description of Task	Started recording field parameters and every 5 minutes after
Notes - 5. 09:31, Sampled well MW-15-22 and collected DUP-03, then Decon equipment	
Time	09:31
Description of Task	Sampled well MW-15-22 and collected DUP-03, then Decon equipment
Notes - 6. 09:45, Help Christina with the surveying crew locating area	
Time	09:45
Description of Task	Help Christina with the surveying crew locating area
Notes - 7. 11:03, Started purging well MW-16-22	
Time	11:03
Description of Task	Started purging well MW-16-22
Notes - 8. 11:05, Started recording field parameters and every 5 minutes after	
Time	11:05
Description of Task	Started recording field parameters and every 5 minutes after
Notes - 9. 11:36, Sampled well MW-16-22, then Decon equipment and meeting Doug from Merit for pickup of samples	
Time	11:36
Description of Task	Sampled well MW-16-22, then Decon equipment and meeting Doug from Merit for pickup of samples
Notes - 10. 12:57, Started purging well MWF16-05	
Time	12:57
Description of Task	Started purging well MWF16-05
Notes - 11. 13:00, Started recording field parameters and every 5 minutes after	
Time	13:00
Description of Task	Started recording field parameters and every 5 minutes after

Notes - 12. 14:01, Sampled well MWF16-05, then Decon equipment

Time	14:01
Description of Task	Sampled well MWF16-05, then Decon equipment

Notes - 13. 14:28, Started purging well MWF16-06

Time	14:28
Description of Task	Started purging well MWF16-06

Notes - 14. 14:30, Started recording field parameters and every 5 minutes after

Time	14:30
Description of Task	Started recording field parameters and every 5 minutes after

Notes - 15. 15:01, Sampled well MWF16-06 then Decon equipment and heading to shed

Time	15:01
Description of Task	Sampled well MWF16-06 then Decon equipment and heading to shed

Notes - 16. 15:25, Dump purge water into drum

Time	15:25
Description of Task	Dump purge water into drum

Notes - 17. 15:45, Leaving site for the day

Time	15:45
Description of Task	Leaving site for the day

Equipment & Calibration Information

Are you using equipment?	Yes
--------------------------	-----

Equipment Information (4 Items)**Equipment Information - 1. Water Quality Meter (i.e. YSI), Geotech**

Supplier	Geotech
Type of Equipment	Water Quality Meter (i.e. YSI)
Model	
Rental Number	6815
Serial Number	
Calibrated?	
Bump checked?	Yes
Calibration/bump check time	08:40

Water Quality Meter Calibration Information

Manufacturer of Calibration Fluids	
------------------------------------	--

Calibration Standards (4 Items)

Calibration Standards - 1. pH, 4.0

Calibration Fluid Type	pH
Calibration Fluid Value and Units	4.0
Calibration Fluid Lot Number	
Calibration Fluid Expiration Date	
Bump Check Reading	3.99

Calibration Standards - 2. pH, 7.0

Calibration Fluid Type	pH
Calibration Fluid Value and Units	7.0
Calibration Fluid Lot Number	
Calibration Fluid Expiration Date	
Bump Check Reading	7.01

Calibration Standards - 3. pH, 10.0

Calibration Fluid Type	pH
Calibration Fluid Value and Units	10.0
Calibration Fluid Lot Number	
Calibration Fluid Expiration Date	
Bump Check Reading	10

Calibration Standards - 4. conductivity, 1413

Calibration Fluid Type	conductivity
------------------------	--------------

Calibration Fluid Value and Units	1413
-----------------------------------	------

Calibration Fluid Lot Number	
------------------------------	--

Calibration Fluid Expiration Date	
-----------------------------------	--

Bump Check Reading	1.55
--------------------	------

Notes	
-------	--

Calibration Documents present from supplier?	Yes
--	-----

Calibration Documents

Equipment Information - 2. Turbidity Meter, Geotech

Supplier	Geotech
----------	---------

Type of Equipment	Turbidity Meter
-------------------	-----------------

Model	
-------	--

Rental Number	6587
---------------	------

Serial Number	
---------------	--

Calibrated?	
-------------	--

Bump checked?	Yes
---------------	-----

Calibration/bump check time	08:30
-----------------------------	-------

Turbidity Meter Calibration Information

Calibration Standards (1 Item)

Calibration Standards - 1. 20, 20.9

Manufacturer of Standards	
---------------------------	--

Value of Standard (NTU)	20
-------------------------	----

Turbidity Lot Number	
----------------------	--

Turbidity Expiration Date	
---------------------------	--

Turbidity Check Reading	20.9
-------------------------	------

Calibration Documents present from supplier?	Yes
--	-----

Calibration Documents

Equipment Information - 3. Peristaltic Pump, Geotech

Supplier	Geotech
Type of Equipment	Peristaltic Pump
Model	
Rental Number	6196
Serial Number	
Calibration Documents present from supplier?	No

Calibration Documents

Equipment Information - 4. Water Level Meter (WLM), Geotech

Supplier	Geotech
Type of Equipment	Water Level Meter (WLM)
Model	
Rental Number	5983
Serial Number	
Calibration Documents present from supplier?	No

Calibration Documents

List of Equipment Used | Water Quality Meter (i.e. YSI), Turbidity Meter, Peristaltic Pump, Water Level Meter (WLM)

Waste Management

Are there any waste drums on site?	No
Did you drum any waste today?	Yes
Number of Drums Created during Activities	1
Size of Drums	55-gallon
Type of Drum	Stainless Steel
Condition of Drums	Good

General Waste Comments

For a more comprehensive drum inventory, please use the Fulcrum app: FieldNow - Waste Log/Inventory (Tier 1)

COC Photos

Photos

Other Photos

Signature



Signed 12/12/2022, 11:29:06AM UTC

Have you performed work in accordance with the applicable QP/TGI?

Yes

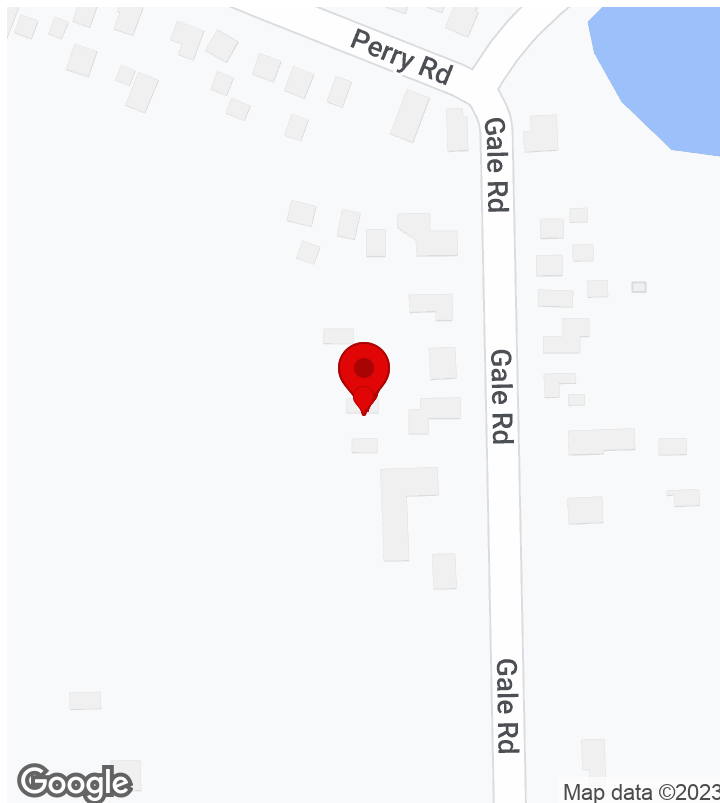
FieldNow - Daily Field Log (Tier 1)



Daily log for field activities to be used to chronicle your daily activities on site. SME: Ian Drost Developer: Brian Webb Updated 2019-12-23 to include equipment section with calibration details

December 5, 2022, RACER Trust, Finishing GWS, Gary Schafer, RACER Pontiac North Campus 2022

12/12/2022, 12:58:09 PM UTC



CREATED

🕒 12/12/2022, 11:59:38 AM UTC
👤 by Gary Schafer

UPDATED

🕒 12/12/2022, 12:58:09 PM UTC
👤 by Gary Schafer

STATUS

🟢 QC Complete

LOCATION

📍 42.936556, -83.535055

ASSIGNED TO

👤 Gary Schafer

Have you read the Quality Procedure (QP) and/or Technical Guidance Instruction (TGI) relevant to this use case? Yes

Selecting "Yes" confirms your digital signature as having read the QP and/or TGI relevant to this use case.

Basic Information

Select Project Number	30112891, RACER Trust, RACER Pontiac North Campus 2022
Project Name	RACER Pontiac North Campus 2022
Project Number	30112891
Client	RACER Trust
Date	December 5, 2022
Completed By	Gary Schafer
Purpose	Finishing GWS
Weather	Overcast temp 40
PPE	Level D

Daily Log of Activities

Notes (9 Items)

Notes - 1. 08:00, Arrived on site and contacted Frank to have roll-offs moved from wells MWF16-24, TW-12-22, MWF16-16

Time	08:00
Description of Task	Arrived on site and contacted Frank to have roll-offs moved from wells MWF16-24, TW-12-22, MWF16-16

Notes - 2. 09:37, Started purging well TW-12-22

Time	09:37
Description of Task	Started purging well TW-12-22

Notes - 3. 09:40, Started recording field parameters and every 5 minutes after, at well TM-12-22

Time	09:40
Description of Task	Started recording field parameters and every 5 minutes after, at well TM-12-22

Notes - 4. 10:51, Sampled well TM-12-22, then Decon equipment

Time	10:51
Description of Task	Sampled well TM-12-22, then Decon equipment

Notes - 5. 11:38, Started purging well MWF16-16

Time	11:38
Description of Task	Started purging well MWF16-16

Notes - 6. 11:40, Started recording field parameters and every 5 minutes at well MWF16-16

Time	11:40
Description of Task	Started recording field parameters and every 5 minutes at well MWF16-16

Notes - 7. 12:21, Sampled well MWF16-16, then Decon

Time	12:21
Description of Task	Sampled well MWF16-16, then Decon

Notes - 8. 12:55, Dumped purge water into drum

Time	12:55
Description of Task	Dumped purge water into drum

Notes - 9. 13:15, Leaving site heading to another client site, will drop off samples at Merit lab. Later this afternoon

Time	13:15
Description of Task	Leaving site heading to another client site, will drop off samples at Merit lab. Later this afternoon

Equipment & Calibration Information

Are you using equipment?	Yes
--------------------------	-----

Equipment Information (4 Items)

Equipment Information - 1. Water Quality Meter (i.e. YSI), Geotech

Supplier	Geotech
Type of Equipment	Water Quality Meter (i.e. YSI)
Model	
Rental Number	6815
Serial Number	
Calibrated?	
Bump checked?	Yes
Calibration/bump check time	09:30

Water Quality Meter Calibration Information

Manufacturer of Calibration Fluids

Calibration Standards (4 Items)

Calibration Standards - 1. pH, 4.0

Calibration Fluid Type	pH
Calibration Fluid Value and Units	4.0
Calibration Fluid Lot Number	
Calibration Fluid Expiration Date	
Bump Check Reading	4.02

Calibration Standards - 2. pH, 7.0

Calibration Fluid Type	pH
Calibration Fluid Value and Units	7.0
Calibration Fluid Lot Number	
Calibration Fluid Expiration Date	
Bump Check Reading	7.01

Calibration Standards - 3. pH, 10.0

Calibration Fluid Type	pH
Calibration Fluid Value and Units	10.0
Calibration Fluid Lot Number	

Calibration Fluid Expiration Date	
-----------------------------------	--

Bump Check Reading	10.02
--------------------	-------

Calibration Standards - 4. conductivity, 1413

Calibration Fluid Type	conductivity
------------------------	--------------

Calibration Fluid Value and Units	1413
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Calibration Fluid Lot Number	
------------------------------	--

Calibration Fluid Expiration Date	
-----------------------------------	--

Bump Check Reading	1.56
--------------------	------

Notes	
-------	--

Calibration Documents present from supplier?	Yes
--	-----

Calibration Documents	
-----------------------	--

Equipment Information - 2. Turbidity Meter, Geotech

Supplier	Geotech
----------	---------

Type of Equipment	Turbidity Meter
-------------------	-----------------

Model	
-------	--

Rental Number	6587
---------------	------

Serial Number	
---------------	--

Calibrated?	
-------------	--

Bump checked?	Yes
---------------	-----

Calibration/bump check time	09:30
-----------------------------	-------

Turbidity Meter Calibration Information

Calibration Standards (1 Item)

Calibration Standards - 1. 20, 21.0

Manufacturer of Standards	
---------------------------	--

Value of Standard (NTU)	20
-------------------------	----

Turbidity Lot Number	
----------------------	--

Turbidity Expiration Date	
---------------------------	--

Turbidity Check Reading	21.0
-------------------------	------

Calibration Documents present from supplier?	Yes
--	-----

Calibration Documents	
-----------------------	--

Equipment Information - 3. Peristaltic Pump, Geotech

Supplier	Geotech
----------	---------

Type of Equipment	Peristaltic Pump
-------------------	------------------

Model	
-------	--

Rental Number	6196
---------------	------

Serial Number	
---------------	--

Calibration Documents present from supplier?	No
--	----

Calibration Documents	
-----------------------	--

Equipment Information - 4. Water Level Meter (WLM), Geotech

Supplier	Geotech
----------	---------

Type of Equipment	Water Level Meter (WLM)
-------------------	-------------------------

Model	
-------	--

Rental Number	5986
---------------	------

Serial Number	
---------------	--

Calibration Documents present from supplier?	No
--	----

Calibration Documents	
-----------------------	--

List of Equipment Used	Water Quality Meter (i.e. YSI), Turbidity Meter, Peristaltic Pump, Water Level Meter (WLM)
------------------------	--

Waste Management

Are there any waste drums on site?	No
------------------------------------	----

Did you drum any waste today?	Yes
-------------------------------	-----

Number of Drums Created during Activities	1
---	---

Size of Drums	55-gallon
---------------	-----------

Type of Drum	Stainless Steel
--------------	-----------------

Condition of Drums	Good
--------------------	------

General Waste Comments	
------------------------	--

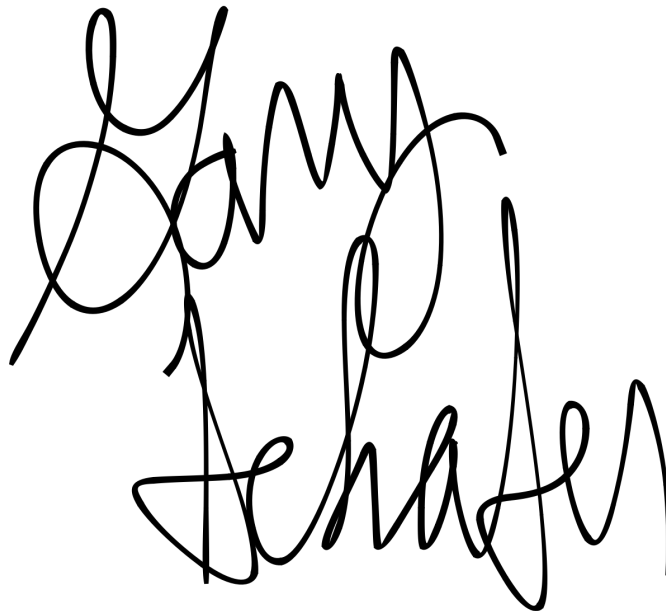
For a more comprehensive drum inventory, please use the Fulcrum app: FieldNow - Waste Log/Inventory (Tier 1)

COC Photos

Photos

Other Photos

Signature



Signed 12/12/2022, 12:58:03 PM UTC

Have you performed work in accordance with the applicable QP/TGI?

Yes

Table 1
ZVI Emplacement Information Table
RACER Trust Pontiac North Campus
Pontiac, Michigan

Injection ID	Target Emplacement Interval/ Total Depth	Actual Emplacement Interval	Date/Time Completed	Comments
ZVI-01-22	25-25-39 ft 39'	25-39'	12/16/2022	Stepped 2.5' toward 02 for ZVI borehole 15.5' from 02).
ZVI-02-22	25-26-40 ft	25-33'	12/19	Refused issues @ 36' bgs w/difficulty starting at 33'.
ZVI-03-22	25-25-39 ft	21-37'	12/14-12/15/2022	Refused issues @ 37' & 39'; no 22 gal or less at 37', 21' & 33' due to count error.
ZVI-04-22	25-26-40 ft	25-39'	12/16/2022	No issues.
ZVI-05-22	25-25-39 ft	25-39'	12/15/2022	No issues. 25' was 245 gal ZVI slurry.
ZVI-06-22	25-26-40 ft	25-39'	12/14/22	
ZVI-07-22	25-25-39 ft	25-39'	12/15/2022	
ZVI-08-22	25-26-40 ft	25-39'	12/20-12/21/22	
ZVI-09-22	25-25-39 ft (39')	25-37' 39'	12/16/2022-12/19	Daylighting by 10, 11, and 17 while injecting at 39'.
ZVI-10-22	25-26-40 ft	25-39'	12/21/22	Daylighting by 10, 11 & 17 and 4-5' west of 12 & 13.
ZVI-11-22	25-25-39 ft	25-39'	1/9/23	Daylighting by 4' east of 17 and 5' north towards 18. Some small points.
ZVI-12-22	25-26-40 ft	25-39'	1/9/23	Daylighting by 4' east of 17 and 5' north towards 18.
ZVI-13-22	25-25-39 ft	25-38'	12/20/22	Daylighting by loc. 15 (old borehole) & near loc. 12
ZVI-14-22	25-26-40 ft (40')	26-40'	1/9/23	Daylighting between 14 & 13 (closer to fence)
ZVI-15-22	25-25-39 ft	26-40'	1/10/23	Daylighting between 14 & 13 near 16, near 12 & at borehole; bottom up for 40-34'
ZVI-16-22	25-26-40 ft	26-40'	1/4/23	Daylighting by 16, 15, 13, & 12 throughout.
ZVI-17-22	25-25-39 ft	26-40'	1/16/23	Daylighting by 17, 11, 10; between 09 & 10
ZVI-18-22	25-26-40 ft	26-40'	1/5/23	Daylighting by 17, 11, 10; near 10; under 5' west of 11 & 10.
ZVI-19-22	25-25-39 ft	26-40'	1/16/23	Daylighting by 17, 11, 10; near 10 (between 09 & 10); 5' west of 10 & 11.
ZVI-20-22	25-26-40 ft	26-40'	12/22/22	No issues.
ZVI-21-22	25-25-39 ft	26-40'	1/16/23	No daylighting.
ZVI-22-22	25-26-40 ft	26-40'	2/21-12/22	No issues.
ZVI-23-22	25-25-39 ft	26-40'	1/5/23	One log issue during ZVI injection at 36' bgs (then completed ZVI emplacement)
ZVI-24-22	25-26-40 ft	26-40'	1/5/23	Daylighting by 24, 05, and 10' east of 24. (Concrete)
ZVI-25-22	25-25-39 ft	26-40'	1/4/23	No issues
ZVI-26-22	25-26-40 ft	26-40'	1/4/23, 1/10/23	Refused at 6' bgs on 14/13. Stepped out 4.5' North of original 26 loc.
SB-XX-22	40 ft TD			ZVI present: Y / N
SB-XX-22	40 ft TD			ZVI present: Y / N

Line -
14-26
210-210

25-39'
39'

1/10/23

Appendix B

ZVI Pilot Confirmation Boring Logs

Soil Boring Log

Project Name: RACER Pontiac North Campus Date Started: 01/11/2023 Logger: K. Donahue
 Project Number: 30112891 Date Completed: 01/11/2023 Editor: K. Donahue
 Project Location: Pontiac, MI Weather Conditions: 36° F, Cloudy

Depth (feet)	Sample Interval	Blow Counts	Recovery (in.)	Sample ID	PID (ppm)	USCS Class	Description	Construction Details
1					NM	(0.0-0.8')	SAND, very fine to very coarse, subrounded to subangular; and GRANULES to large PEBBLES, subrounded to angular; poorly sorted; dry; light gray (10YR 7/2).	
2			45		NM	(0.8-9.7')	CLAY, medium to high plasticity, no dilatancy; little silt; trace sand, very fine to coarse, subrounded to subangular; trace granules to small pebbles, subrounded to subangular; medium stiff; poorly sorted; dry; yellowish brown (10YR 5/4) and gray (10YR 6/1). Note: Change to stiff at 2.0' bgs.	
3					NM			
4					NM			
5					NM			
6			48		NM			
7					NM			
8					NM			
9					NM			
10					NM			
11			43		NM	(9.7-10.4')	SAND, very fine to coarse, subangular to subrounded; some silt, nonplastic, rapid dilatancy; little granules to large pebbles, subangular to subrounded; poorly sorted; wet; brown (10YR 5/3).	
12					NM	(10.4-15.0')	CLAY, high plasticity, no dilatancy; trace silt; trace granules, subangular to subrounded; very stiff; well sorted; moist to wet; gray (10YR 5/1).	
13					NM			
14					NM			
15					NM			
16			0		NM	(15.0-25.0')	No Recovery.	
17					NM			
18					NM			
19					NM			
20					NM			

Drilling Co.: Cascade Sampling Method: 5' Macrocore
 Driller: Collin Fernald & Luke Taylor Sampling Interval: Continuous
 Drilling Method: Direct Push Water Level Start: 5.8
 Drilling Fluid: None Water Level Finish: NA
 Remarks: _____ Converted to SVMP: Yes No
 Surface Elev.: _____
 North Coord.: _____
 East Coord.: _____

SOIL BORING LOG C:\USERS\KDONAHUE\ARCADIS\RACER PONTIAC NORTH CAMPUS - GINT\RACER_PNC_MASTER_122322.GPJ ARCADIS GDT 2/9/23

Soil Boring Log

Project Name: RACER Pontiac North Campus Date Started: 01/11/2023 Logger: K. Donahue
 Project Number: 30112891 Date Completed: 01/11/2023 Editor: K. Donahue
 Project Location: Pontiac, MI Weather Conditions: 36° F, Cloudy

Depth (feet)	Sample Interval	Blow Counts	Recovery (in.)	Sample ID	PID (ppm)	USCS Class	Description	Construction Details
21			0		NM		(15.0-25.0') No Recovery.	
22					NM			
23					NM			
24					NM			
25					NM			
26			44		NM		(25.0-28.5') SAND, very fine; trace silt; well sorted; wet; light yellowish brown (10YR 6/4).	
27					NM			
28					NM			
29					NM			
30					NM		(28.5-30.0') SILT, nonplastic, rapid dilatancy; some sand, very fine; well sorted; wet; gray (10YR 6/1). Note: ZVI injections observed from 25.0-30.0' bgs.	
31					NM			
32					NM			
33					NM			
34					NM			
35			32		NM		(30.0-40.0') SAND, very fine to medium, subangular to subrounded; trace silt; well sorted; wet; brown (10YR 5/3). Note: Poor recovery 35.0-40.0' bgs. Note: No ZVI observed 30.0-40.0' bgs.	
36					NM			
37					NM			
38					NM			
39					NM			
40			16		NM		End of boring at 40.0' bgs.	
36					NM			
37					NM			
38					NM			
39					NM			

Remarks: _____

Soil Boring Log

Project Name: RACER Pontiac North Campus
 Project Number: 30112891
 Project Location: Pontiac, MI

Date Started: 01/11/2023 Date Completed: 01/11/2023
 Logger: K. Donahue Editor: K. Donahue
 Weather Conditions: 37° F, Cloudy, Light Rain

Depth (feet)	Sample Interval	Blow Counts	Recovery (in.)	Sample ID	PID (ppm)	USCS Class	Description	Construction Details
1					NM		(0.0-0.2') GRAVEL.	
2				NM	(0.2-5.2') CLAY, medium to high plasticity, no dilatancy; little silt; trace sand, very fine to very coarse, subangular to subrounded; trace granules to large pebbles, subangular to subrounded; medium stiff; poorly sorted; yellowish brown (10YR 5/4).			
3		49		NM				
4				NM				
5				NM				
6				NM		(5.2-5.9') CLAY, medium plasticity, no dilatancy; little silt; trace sand, very fine to fine, subangular to subrounded; soft; well sorted; moist; very dark gray (10YR 3/1).		
7				NM		(5.9-9.5') CLAY, medium to high plasticity, no dilatancy; little silt; trace sand, very fine to coarse, subangular to subrounded; trace granules to large pebbles, subangular to subrounded; medium stiff; poorly sorted; moist; gray (10YR 5/1).		
8		51		NM				
9				NM				
10				NM				
11				NM		(9.5-15.0') CLAY, high plasticity, no dilatancy; trace silt; trace sand, very fine to medium, subangular to subrounded; trace granules to very large pebbles, subangular to subrounded; very soft; poorly sorted; wet; gray (10YR 5/1).		
12				NM				
13		44		NM				
14				NM				
15				NM				
16				NM		(15.0-18.0') SAND, very fine; trace silt; well sorted; moist; pale brown (10YR 6/3).		
17				NM				
18		37		NM				
19				NM		(18.0-19.8') SILT, nonplastic, rapid dilatancy; little clay, low plasticity, rapid dilatancy; trace sand, very fine; well sorted; moist; light grayish brown (10YR 6/2).		
20				NM				

Drilling Co.: Cascade Sampling Method: 5' Macrocore
 Driller: Collin Fernald Sampling Interval: Continuous
 Drilling Method: Direct Push Water Level Start: 9.5
 Drilling Fluid: None Water Level Finish: NA
 Remarks: _____ Converted to SVMP: Yes No
 _____ Surface Elev.: _____
 _____ North Coord.: _____
 _____ East Coord.: _____

SOIL BORING LOG C:\USERS\KDONAHUE\ARCADIS\RACER PONTIAC NORTH CAMPUS - GINT\RACER_PNC_MASTER_122322.GPJ ARCADIS GDT 2/9/23

Soil Boring Log

Project Name: RACER Pontiac North Campus Date Started: 01/11/2023 Logger: K. Donahue
 Project Number: 30112891 Date Completed: 01/11/2023 Editor: K. Donahue
 Project Location: Pontiac, MI Weather Conditions: 37° F, Cloudy, Light Rain

Depth (feet)	Sample Interval	Blow Counts	Recovery (in.)	Sample ID	PID (ppm)	USCS Class	Description	Construction Details
21			31		NM		(19.8-28.0') SAND, very fine to fine, subangular to subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3). Note: No ZVI observed 20.0-25.0' bgs. Note: Color is strong brown (7.5YR 5/8) from 21.3 to 21.5' bgs.	
22					NM			
23					NM			
24					NM			
25					NM			
26			44		NM			
27					NM			
28					NM			
29					NM			
30			54.5		NM		(28.0-34.5') SAND, very fine to medium, subangular to subrounded; trace silt; trace medium pebbles, subrounded; well sorted; wet; brown (10YR 5/3).	
31					NM			
32					NM			
33					NM			
34					NM			
35			39		NM		(34.5-40.0') SAND, very fine to fine, subangular to subrounded; trace silt; well sorted; wet; gray (10YR 6/1). Note: No ZVI observed 25.0-40.0' bgs.	
36					NM			
37					NM			
38					NM			
39					NM			
40					NM		End of boring at 40.0' bgs.	

Remarks:

SOIL BORING LOG C:\USERS\KDONAHUE\ARCADIS\RACER PONTIAC NORTH CAMPUS - GINT\RACER_PNC_MASTER_122322.GPJ ARCADIS GDT 2/9/23

Appendix C

Photographic Log

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 1

Description: ZVI injection pilot work area looking south.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/22/2022



Photograph: 2

Description: ZVI injection pilot work area. Injection boring locations marked with orange spray paint. Line 1 (right) Line 2 (left).

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/22/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 3

Description: Geoprobe rig positioned at ZVI-03-22.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/14/2022



Photograph: 4

Description: Water supply totes and ZVI slurry batch plant.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/20/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 5

Description:
ChemGrout mixer injection pump.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 12/14/2022



Photograph: 6

Description: ZVI raw material.

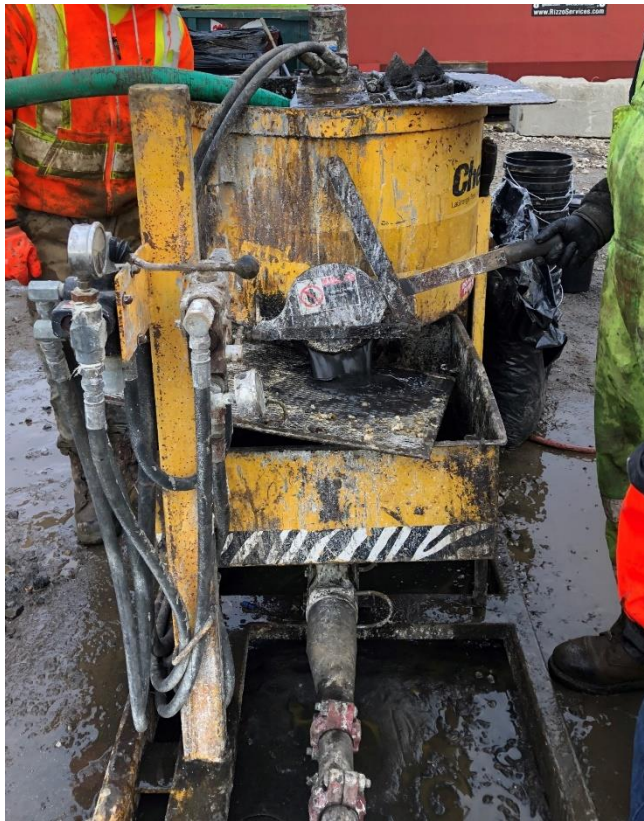
Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 12/13/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 7

Description: ZVI slurry while injecting at ZVI-07-22.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/15/2022



Photograph: 8

Description: ChemGrout repairs.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/14/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 9

Description: Injection pump hose attached to well head.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/14/2022



Photograph: 10

Description: Injection pump hose attached to well head.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/14/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 11

Description: Injection probe head (closed).

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/14/2022



Photograph: 12

Description: Injection probe heads (opened) showing injection holes. 4 holes per probe.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/14/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 13

Description: Injection in progress at ZVI-24-22.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 1/5/2023



Photograph: 14

Description: Daylighted slurry material near location 15, contained by granular bentonite grout on the ground surface. Daylighting occurred while injecting at ZVI-13-22.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 12/20/2022

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 15

Description:

Daylighted slurry material near location 15, contained by granular bentonite grout on the ground surface. Daylighting occurred while injecting at ZVI-13-22 (where rig is positioned).

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 12/20/2022



Photograph: 16

Description: Slurry waste inside drums.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/6/2023

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 17

Description: Waste drums staged at the ZVI pilot injection work area.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 1/11/2023



Photograph: 18

Description: Confirmation boring SB-ZVI-1 soil cores.

Location: RACER PNC

Photograph taken by: Kara Donahue

Date: 1/11/2023

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 19

Description:

ZVI confirmation at SB-ZVI-1.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023



Photograph: 20

Description:

ZVI confirmation at SB-ZVI-1.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 21

Description:

ZVI confirmation at SB-ZVI-1.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023



Photograph: 22

Description:

ZVI confirmation at SB-ZVI-1.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 23

Description:
Confirmation boring
SB-ZVI-2 soil cores.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023



Photograph: 24

Description:
ZVI confirmation at SB-
ZVI-2. ZVI observed at
~18' and ~19' bgs.

Location: RACER
PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 25

Description:

ZVI confirmation at SB-ZVI-2 at ~18' bgs.

Location: RACER
PNC

Photograph taken by:

Kara Donahue

Date: 1/11/2023



Photograph: 26

Description:

Confirmation boring soil cores stepped out from SB-ZVI-1 location (1 foot from ZVI-04).

Location: RACER
PNC

Photograph taken by:

Kara Donahue

Date: 1/11/2023

Photograph Log

RACER Pontiac North Campus ZVI Pilot Study Installation



Photograph: 27

Description:
ZVI confirmation at 29' bgs at boring stepped out from SB-ZVI-1 location (1 foot from ZVI-04).

Location: RACER PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023



Photograph: 28

Description:
ZVI confirmation at 28' bgs at boring stepped out from SB-ZVI-1 location (1 foot from ZVI-04).

Location: RACER PNC

Photograph taken by:
Kara Donahue

Date: 1/11/2023

Appendix D

Data Usability Reports and Laboratory Reports

RACER TRUST PONTIAC NORTH CAMPUS

Data Review

Pontiac, Michigan

Volatile Organic Compounds Analyses

SDG #S42910

Analyses Performed By:
Merit Laboratories, Inc.
East Lansing, Michigan

Report #48648R
Review Level: Stage 2
Project: 30167840.00005

Summary

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # S42910 for samples collected in association with the RACER Trust site in Pontiac, Michigan. The review was conducted as a Stage 2 evaluation and included review of data package completeness. Only analytical data as reported by the laboratory were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis			
					VOC	SVOC	MET	MISC
TRIP BLANK_20221129	S42910.01	Water	11/29/2022		X			
MW-13-22_GW-112822	S42910.02	Water	11/28/2022		X			
MW-14-22_GW-112822	S42910.03	Water	11/28/2022		X			
MW-15-22_GW-112922	S42910.04	Water	11/29/2022		X			
MW-16-22_GW-112922	S42910.05	Water	11/29/2022		X			
DUP-03_GW-112922	S42910.06	Water	11/29/2022	MW-15-22_GW-112922	X			

Analytical Data Package Documentation

The table below evaluates the data package completeness.

Items Reviewed	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Sample receipt condition		X		X	
2. Requested analyses and sample results		X		X	
3. Master tracking list		X		X	
4. Methods of analysis		X		X	
5. Reporting limits		X		X	
6. Sample collection date		X		X	
7. Laboratory sample received date		X		X	
8. Sample preservation verification (as applicable)		X		X	
9. Sample preparation/extraction/analysis dates		X		X	
10. Fully executed chain-of-custody form		X		X	
11. Narrative summary of QA or sample problems provided		X		X	
12. Data package completeness and compliance		X		X	

Note:

QA quality assurance

Organic Analysis Introduction

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Method 8260C. Data were reviewed in accordance with USEPA National Functional Guidelines for Organic Superfund Methods Data Review", EPA 540-R-2017-002, January 2017 (with reference to the historical USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, OSWER 9240.1-05A-P, October 1999, as appropriate).

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes in accordance with USEPA National Functional Guidelines:

- Concentration (C) Qualifiers
 - U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
 - UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
 - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
 - UB Compound is considered non-detect at the listed value due to associated blank contamination.
 - N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
 - R The sample results are rejected.

The "R" flag means that the associated value is unusable. In other words, due to significant quality control (QC) problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data but any value potentially contains error.

Volatile Organic Compound (VOC) Analyses

1. Holding Times

The specified holding times for the following methods are presented in the table below.

Method	Matrix	Holding Time	Preservation
SW-846 8260C	Water	14 days from collection to analysis; 7 days from collection to analysis if unpreserved	Cool to <6 °C; preserved to a pH of less than 2 s.u.

Note:

s.u. = standard units

All samples were analyzed within the specified holding times.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, rinse, and trip blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks and trip blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank (common laboratory contaminant compounds are calculated at ten times) is calculated for QA blanks containing concentrations greater than the method detection limit (MDL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

VOCs were not detected above the MDL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Surrogates/System Monitoring Compounds

All samples to be analyzed for organic compounds are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. VOC analysis requires that all surrogates associated with the analysis exhibit recoveries within the laboratory-established acceptance limits.

Surrogate recoveries were within control limits.

4. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must exhibit an RPD within the laboratory-established acceptance limits.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was not performed using a sample from this SDG.

5. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) Analysis

The LCS/LCSD analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The RPDs between the LCS and LCSD results must be within the laboratory-established acceptance limits.

The LCS/LCSD analysis exhibited recoveries and RPDs within the control limits.

6. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 30% for water matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the RL, a control limit of two times the RL is applied for water.

Results for duplicate samples are summarized in the following table.

Sample ID/ Duplicate ID	Compound	Sample Result	Duplicate Result	RPD
MW-15-22_GW-112922 / DUP-03_GW-112922	All compounds within this report	Not detected	Not detected	AC

Note:

AC = acceptable

The calculated RPDs between the parent sample and field duplicate were acceptable.

7. System Performance and Overall Assessment

Sample results associated with compounds that exhibited a concentration greater than the linear range of the instrument calibration are summarized in the following table.

Sample ID	Compound	Original Analysis	Diluted Analysis	Reported Analysis
MW-16-22_GW-112922	Tetrachloroethene	306 E	310 D	310 D

Note: In the instance where both the original analysis and the diluted analysis sample results exhibited a concentration greater than and/or less than the calibration linear range of the instrument; the sample result exhibiting the greatest concentration will be reported as the final result.

Data Review Report

Sample results associated with compounds exhibiting concentrations greater than the linear range are qualified as documented in the table below when reported as the final reported sample result.

Reported Sample Results	Qualification
Diluted sample result within calibration range	D

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

Data Validation Checklist for VOCs

VOCs: SW-846 8260C	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)					
Tier II Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Trip blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
Laboratory Control Sample Duplicate (LCSD) %R		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate (MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field/Lab Duplicate (RPD)		X		X	
Surrogate Spike Recoveries		X		X	
Dilution Factor		X		X	
Moisture Content	X				X

Notes:

%R = percent recovery

RPD = relative percent difference

VALIDATION PERFORMED BY: Todd Church

SIGNATURE:



DATE: February 16, 2023

PEER REVIEW: Dennis Capria

DATE: February 24, 2023

Chain of Custody and Corrected Sample Analysis Data Sheets



2680 East Lansing Dr., East Lansing, MI 48823
 Phone (517) 332-0167 Fax (517) 332-4034
 www.meritlabs.com

C.O.C. PAGE # _____ OF _____ 158112

REPORT TO

CHAIN OF CUSTODY RECORD

INVOICE TO

CONTACT NAME Lexi Crisp
 COMPANY Arcadis
 ADDRESS 28550 Cabot Dr. Suite 500
 CITY Novi STATE MI ZIP CODE 48377
 PHONE NO. 937-206-4009 CELL NO. _____ P.O. NO. 30112891.00005
 E-MAIL ADDRESS Lexi.Crisp@arcadis.com QUOTE NO. _____

CONTACT NAME _____ SAME
 COMPANY _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP CODE _____
 PHONE NO. _____ E-MAIL ADDRESS _____

PROJECT NO./NAME 30112891.00005 Recer PNC SAMPLER(S) - PLEASE PRINT/SIGN NAME Gary Schaefer
 TURNAROUND TIME REQUIRED 1 DAY 2 DAYS 3 DAYS STANDARD OTHER _____
 DELIVERABLES REQUIRED STD LEVEL II LEVEL III LEVEL IV EDD OTHER _____

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

Containers & Preservatives

MERIT LAB NO. <small>FOR LAB USE ONLY</small>	COLLECTION		SAMPLE TAG IDENTIFICATION-DESCRIPTION	MATRIX	# OF BOTTLES	NONE	HCl	HNO ₃	H ₂ SO ₄	NaOH	MeOH	OTHER	Certifications	Project Locations	Special Instructions
	DATE	TIME													
42910.01	11/29/22		Trip Blank	C	1		1						<input type="checkbox"/> OHIO VAP <input type="checkbox"/> Drinking Water	<input type="checkbox"/> Detroit <input type="checkbox"/> New York	
.02	11/28/22	1421	MW-13-22-GW-112822	GW	3		3						<input type="checkbox"/> DoD <input type="checkbox"/> NPDES		
.03	11/28/22	1544	MW-14-22-GW-112822	GW	3		3								
.04	11/29/22	0931	MW-15-22-GW-112922	GW	3		3								
.05	11/29/22	1134	MW-16-22-GW-112922	GW	3		3								
.06															

Site-Specific Vials
Site-Specific Vials

RELINQUISHED BY: Mary Schaefer Arcadis Sampler DATE 11/29/22 TIME 18:01
 RECEIVED BY: [Signature] DATE 11/29/22 TIME 17:00
 RELINQUISHED BY: [Signature] DATE 11/29/22 TIME 16:15
 RECEIVED BY: M. Calcott DATE 11/29/22 TIME 16:15

RELINQUISHED BY: _____ DATE _____ TIME _____
 SIGNATURE/ORGANIZATION _____
 RECEIVED BY: _____ DATE _____ TIME _____
 SIGNATURE/ORGANIZATION _____
 SEAL NO. _____ SEAL INTACT YES NO INITIALS _____
 SEAL NO. _____ SEAL INTACT YES NO INITIALS _____
 NOTES: TEMP. ON ARRIVAL 3.7

PLEASE NOTE: SIGNING ACKNOWLEDGES ADHERENCE TO MERIT'S SAMPLE ACCEPTANCE POLICY ON REVERSE SIDE



Analytical Laboratory Report

Lab Sample ID: S42910.01

Sample Tag: Trip Blank

Collected Date/Time: 11/29/2022 00:01

Matrix: Water

COC Reference: 158112

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
1	40ml Glass	HCL	Yes	3.7	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/01/22 11:20	KAG	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 15:09, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	Not detected	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	Not detected	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	Not detected	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	Not detected	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	Not detected	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	Not detected	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S42910.01 (continued)

Sample Tag: Trip Blank

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 15:09, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	Not detected	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	



Analytical Laboratory Report

Lab Sample ID: S42910.02

Sample Tag: MW-13-22_GW-112822

Collected Date/Time: 11/28/2022 14:21

Matrix: Groundwater

COC Reference: 158112

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	3.7	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/01/22 11:20	KAG	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 17:05, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	Not detected	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	Not detected	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	Not detected	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	Not detected	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	Not detected	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	Not detected	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S42910.02 (continued)

Sample Tag: MW-13-22_GW-112822

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 17:05, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	Not detected	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	



Analytical Laboratory Report

Lab Sample ID: S42910.03

Sample Tag: MW-14-22_GW-112822

Collected Date/Time: 11/28/2022 15:46

Matrix: Groundwater

COC Reference: 158112

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	3.7	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/01/22 11:20	KAG	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 17:25, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	2	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	1	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	14	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	1	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	9	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	98	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	18	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S42910.03 (continued)

Sample Tag: MW-14-22_GW-112822

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 17:25, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	4	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	



Analytical Laboratory Report

Lab Sample ID: S42910.04

Sample Tag: MW-15-22_GW-112922

Collected Date/Time: 11/29/2022 09:31

Matrix: Groundwater

COC Reference: 158112

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	3.7	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/01/22 11:20	KAG	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 17:44, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	Not detected	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	Not detected	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	Not detected	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	Not detected	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	Not detected	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	Not detected	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S42910.04 (continued)

Sample Tag: MW-15-22_GW-112922

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 17:44, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	Not detected	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	



Analytical Laboratory Report

Lab Sample ID: S42910.05

Sample Tag: MW-16-22_GW-112922

Collected Date/Time: 11/29/2022 11:36

Matrix: Groundwater

COC Reference: 158112

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	3.7	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/01/22 11:20	KAG	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 18:04, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	4	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	4	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	55	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	4	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	10	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	310	300	1	ug/L	1	127-18-4	E D
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	27	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	

E-Concentration exceeds calibration range



Analytical Laboratory Report

Lab Sample ID: S42910.05 (continued)

Sample Tag: MW-16-22_GW-112922

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 18:04, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
o-Xylene	Not detected	1		ug/L	1	95-47-6	
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	12	1		ug/L	1	75-34-3	
1,1-Dichloroethene	1	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	

Volatile Organics - Arcadis (Replicate 01), Method: SW5030C/8260C, Run Date: 12/01/22 22:01, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	500		ug/L	10	67-64-1	Y
2-Butanone (MEK)	Not detected	250		ug/L	10	78-93-3	Y
Benzene	Not detected	10		ug/L	10	71-43-2	Y
Bromodichloromethane	Not detected	10		ug/L	10	75-27-4	Y
Bromoform	Not detected	10		ug/L	10	75-25-2	Y
Bromomethane	Not detected	50		ug/L	10	74-83-9	Y
Carbon disulfide	Not detected	50		ug/L	10	75-15-0	Y
Carbon tetrachloride	Not detected	10		ug/L	10	56-23-5	Y
Chlorobenzene	Not detected	10		ug/L	10	108-90-7	Y
Chloroethane	Not detected	50		ug/L	10	75-00-3	Y
Chloroform	Not detected	10		ug/L	10	67-66-3	Y
Chloromethane	Not detected	50		ug/L	10	74-87-3	Y
1,2-Dibromo-3-chloropropane	Not detected	50		ug/L	10	96-12-8	Y
1,2-Dichlorobenzene	Not detected	10		ug/L	10	95-50-1	Y
1,2-Dichloroethane	Not detected	10		ug/L	10	107-06-2	Y
1,2-Dichloropropane	Not detected	10		ug/L	10	78-87-5	Y
1,3-Dichlorobenzene	Not detected	10		ug/L	10	541-73-1	Y
1,4-Dichlorobenzene	Not detected	10		ug/L	10	106-46-7	Y
cis-1,2-Dichloroethene	50	10		ug/L	10	156-59-2	Y
Dibromochloromethane	Not detected	50		ug/L	10	124-48-1	Y
Dichlorodifluoromethane	Not detected	50		ug/L	10	75-71-8	Y
trans-1,2-Dichloroethene	Not detected	10		ug/L	10	156-60-5	Y
Ethylbenzene	Not detected	10		ug/L	10	100-41-4	Y
2-Hexanone	Not detected	500		ug/L	10	591-78-6	Y
4-Methyl-2-pentanone (MIBK)	Not detected	500		ug/L	10	108-10-1	Y
tert-Methyl butyl ether (MTBE)	Not detected	50		ug/L	10	1634-04-4	Y
Methylene chloride	Not detected	50		ug/L	10	75-09-2	Y
Styrene	Not detected	10		ug/L	10	100-42-5	Y
1,1,1-Trichloroethane	Not detected	10		ug/L	10	71-55-6	Y
1,1,2-Trichloroethane	Not detected	10		ug/L	10	79-00-5	Y
1,2,4-Trichlorobenzene	Not detected	50		ug/L	10	120-82-1	Y
Tetrachloroethene	310	10		ug/L	10	127-18-4	Y
Toluene	Not detected	10		ug/L	10	108-88-3	Y

Y-Elevated reporting limit due to high target concentration



Analytical Laboratory Report

Lab Sample ID: S42910.05 (continued)

Sample Tag: MW-16-22_GW-112922

Volatiles Organics - Arcadis (Replicate 01), Method: SW5030C/8260C, Run Date: 12/01/22 22:01, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Trichloroethene	30	10		ug/L	10	79-01-6	Y
Trichlorofluoromethane	Not detected	10		ug/L	10	75-69-4	Y
Vinyl chloride	Not detected	10		ug/L	10	75-01-4	Y
o-Xylene	Not detected	10		ug/L	10	95-47-6	Y
p,m-Xylene*	Not detected	20		ug/L	10		Y
Isopropylbenzene	Not detected	10		ug/L	10	98-82-8	Y
Cyclohexane	Not detected	10		ug/L	10	110-82-7	Y
1,1-Dichloroethane	10	10		ug/L	10	75-34-3	Y
1,1-Dichloroethene	Not detected	10		ug/L	10	75-35-4	Y
Methyl Acetate	Not detected	100		ug/L	10	79-20-9	Y
Methyl cyclohexane	Not detected	10		ug/L	10	108-87-2	Y
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	10		ug/L	10	76-13-1	Y
1,2-Dibromoethane	Not detected	10		ug/L	10	106-93-4	Y
1,1,2,2-Tetrachloroethane	Not detected	10		ug/L	10	79-34-5	Y
cis-1,3-Dichloropropene	Not detected	10		ug/L	10	10061-01-5	Y
trans-1,3-Dichloropropene	Not detected	10		ug/L	10	10061-02-6	Y

Y-Elevated reporting limit due to high target concentration



Analytical Laboratory Report

Lab Sample ID: S42910.06

Sample Tag: DUP-03_GW-112922

Collected Date/Time: 11/29/2022 00:01

Matrix: Groundwater

COC Reference: 158112

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	3.7	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/01/22 11:20	KAG	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 18:24, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	Not detected	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	Not detected	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	Not detected	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	Not detected	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	Not detected	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	Not detected	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S42910.06 (continued)

Sample Tag: DUP-03_GW-112922

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 11/30/22 18:24, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	Not detected	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	

RACER TRUST PONTIAC NORTH CAMPUS

Data Review

Pontiac, Michigan

Volatile Organic Compounds Analyses

SDG #S43109

Analyses Performed By:
Merit Laboratories, Inc.
East Lansing, Michigan

Report #48649R
Review Level: Stage 2
Project: 30167840.00005

Summary

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # S43109 for samples collected in association with the RACER Trust site in Pontiac, Michigan. The review was conducted as a Stage 2 evaluation and included review of data package completeness. Only analytical data as reported by the laboratory were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody. Analyses were performed on the following samples:

Sample ID	Lab ID	Matrix	Sample Collection Date	Parent Sample	Analysis			
					VOC	SVOC	MET	MISC
TRIP BLANK 06_20221205	S43109.01	Water	12/5/2022		X			
TW-12-22_GW-120522	S43109.02	Water	12/5/2022		X			
MWF16-16_GW-120522	S43109.03	Water	12/5/2022		X			

Analytical Data Package Documentation

The table below evaluates the data package completeness.

Items Reviewed	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
1. Sample receipt condition		X		X	
2. Requested analyses and sample results		X		X	
3. Master tracking list		X		X	
4. Methods of analysis		X		X	
5. Reporting limits		X		X	
6. Sample collection date		X		X	
7. Laboratory sample received date		X		X	
8. Sample preservation verification (as applicable)		X		X	
9. Sample preparation/extraction/analysis dates		X		X	
10. Fully executed chain-of-custody form		X		X	
11. Narrative summary of QA or sample problems provided		X		X	
12. Data package completeness and compliance		X		X	

Note:

QA quality assurance

Organic Analysis Introduction

Analyses were performed according to United States Environmental Protection Agency (USEPA) SW-846 Method 8260C. Data were reviewed in accordance with USEPA National Functional Guidelines for Organic Superfund Methods Data Review", EPA 540-R-2017-002, January 2017 (with reference to the historical USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, OSWER 9240.1-05A-P, October 1999, as appropriate).

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes in accordance with USEPA National Functional Guidelines:

- Concentration (C) Qualifiers
 - U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
 - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
 - E The compound was quantitated above the calibration range.
 - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
 - J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
 - UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
 - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
 - UB Compound is considered non-detect at the listed value due to associated blank contamination.
 - N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
 - R The sample results are rejected.

The "R" flag means that the associated value is unusable. In other words, due to significant quality control (QC) problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data but any value potentially contains error.

Volatile Organic Compound (VOC) Analyses

1. Holding Times

The specified holding times for the following methods are presented in the table below.

Method	Matrix	Holding Time	Preservation
SW-846 8260C	Water	14 days from collection to analysis; 7 days from collection to analysis if unpreserved	Cool to <6 °C; preserved to a pH of less than 2 s.u.

Note:

s.u. = standard units

All samples were analyzed within the specified holding times.

2. Blank Contamination

Quality assurance (QA) blanks (i.e., method, rinse, and trip blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks and trip blanks measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank (common laboratory contaminant compounds are calculated at ten times) is calculated for QA blanks containing concentrations greater than the method detection limit (MDL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

VOCs were not detected above the MDL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

3. Surrogates/System Monitoring Compounds

All samples to be analyzed for organic compounds are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. VOC analysis requires that all surrogates associated with the analysis exhibit recoveries within the laboratory-established acceptance limits.

Surrogate recoveries were within control limits.

4. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must exhibit an RPD within the laboratory-established acceptance limits.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on sample locations where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was not performed using a sample from this SDG.

5. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) Analysis

The LCS/LCSD analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The RPDs between the LCS and LCSD results must be within the laboratory-established acceptance limits.

The LCS/LCSD analysis exhibited recoveries and RPDs within the control limits.

6. Field Duplicate Analysis

Field duplicate analysis is used to assess the overall precision of the field sampling procedures and analytical method. A control limit of 40% for water matrices is applied to the RPD between the parent sample and the field duplicate. In the instance when the parent and/or duplicate sample concentrations are less than or equal to 5 times the RL, a control limit of two times the RL is applied for water.

A field duplicate sample was not collected in association with this SDG.

7. System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

Data Validation Checklist for VOCs

VOCs: SW-846 8260C	Reported		Performance Acceptable		Not Required
	No	Yes	No	Yes	
GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)					
Tier II Validation					
Holding times		X		X	
Reporting limits (units)		X		X	
Blanks					
A. Method blanks		X		X	
B. Equipment blanks	X				X
C. Trip blanks		X		X	
Laboratory Control Sample (LCS) %R		X		X	
Laboratory Control Sample Duplicate (LCSD) %R		X		X	
LCS/LCSD Precision (RPD)		X		X	
Matrix Spike (MS) %R	X				X
Matrix Spike Duplicate (MSD) %R	X				X
MS/MSD Precision (RPD)	X				X
Field/Lab Duplicate (RPD)	X				X
Surrogate Spike Recoveries		X		X	
Dilution Factor		X		X	
Moisture Content	X				X

Notes:

%R = percent recovery

RPD = relative percent difference

VALIDATION PERFORMED BY: Todd Church

SIGNATURE:



DATE: February 16, 2023

PEER REVIEW: Dennis Capria

DATE: February 24, 2023

Chain of Custody and Corrected Sample Analysis Data Sheets



2680 East Lansing Dr., East Lansing, MI 48823
 Phone (517) 332-0167 Fax (517) 332-4034
 www.meritlabs.com

C.O.C. PAGE # _____ OF _____ 155251

REPORT TO

CHAIN OF CUSTODY RECORD

INVOICE TO

CONTACT NAME: Lexi Crisp / Tiffany Linden
 COMPANY: Arcadis
 ADDRESS: 28550 Cabot DR Suite 500
 CITY: Novi STATE: MI ZIP CODE: 48377
 PHONE NO.: 937-206-4005 CELL NO.: _____ P.O. NO.: _____
 E-MAIL ADDRESS: Lexi.Crisp@arcadis.com QUOTE NO.: _____

CONTACT NAME: _____ SAME
 COMPANY: _____
 ADDRESS: _____
 CITY: _____ STATE: _____ ZIP CODE: _____
 PHONE NO.: _____ E-MAIL ADDRESS: _____

ANALYSIS (ATTACH LIST IF MORE SPACE IS REQUIRED)

PROJECT NO./NAME: 30112891.00005 Racer PVC SAMPLER(S) - PLEASE PRINT/SIGN NAME: Gary Schuster
 TURNAROUND TIME REQUIRED 1 DAY 2 DAYS 3 DAYS STANDARD OTHER _____
 DELIVERABLES REQUIRED STD LEVEL II LEVEL III LEVEL IV EDD OTHER _____

Certifications
 OHIO VAP Drinking Water
 DoD NPDES
 Project Locations
 Detroit New York
 Other _____
 Special Instructions

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

Containers & Preservatives

MERIT LAB NO. <small>FOR LAB USE ONLY</small>	COLLECTION		SAMPLE TAG IDENTIFICATION-DESCRIPTION	MATRIX	# OF BOTTLES	# Containers & Preservatives								Site-Specific Vials
	DATE	TIME				NONE	HCl	HNO ₃	H ₂ SO ₄	NaOH	MeOH	OTHER		
43109.01	12/5/22		Trip Blank 06		1									X
.02	12/05/22		TW-12-22-GW-120522	GW	3		3							X
.03	12/05/22		MWF16-16-GW-120522	GW	3		3							X

RELINQUISHED BY: Gary Schuster / Arcadis Sampler DATE: 12/05/22 TIME: 1704
 RECEIVED BY: _____ DATE: _____ TIME: _____

RELINQUISHED BY: _____ DATE: _____ TIME: _____
 RECEIVED BY: _____ DATE: _____ TIME: _____

RELINQUISHED BY: Ment DropBox DATE: 12/06/2022 TIME: 0800
 RECEIVED BY: Bonnie Ball DATE: 12/06/2022 TIME: 0800

SEAL NO. SEAL INTACT INITIALS NOTES: TEMP. ON ARRIVAL 4.0
 YES NO
 SEAL NO. SEAL INTACT INITIALS
 YES NO



Analytical Laboratory Report

Laboratory Certifications

Authority	Certification ID
Michigan DEQ	#9956
DOD ELAP/ISO 17025	#69699
WBENC	#2005110032
Ohio VAP	#CL0002
Indiana DOH	#C-MI-07
New York NELAC	#11814
North Carolina DENR	#680
North Carolina DOH	#26702
Alaska CSLAP	#17-001
Pennsylvania DEP	#68-05884
Wisconsin DNR	FID# 399147320

Qualifier Descriptions

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

Glossary of Abbreviations

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



Analytical Laboratory Report

Lab Sample ID: S43109.01

Sample Tag: Trip Blank 06

Collected Date/Time: 12/05/2022 00:01

Matrix: Water

COC Reference: 155251

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
1	40ml Glass	HCL	Yes	4.0	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/12/22 10:30	BDO	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 12/10/22 01:10, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	Not detected	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	Not detected	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	Not detected	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	Not detected	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	Not detected	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	Not detected	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S43109.01 (continued)

Sample Tag: Trip Blank 06

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 12/10/22 01:10, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	Not detected	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	



Analytical Laboratory Report

Lab Sample ID: S43109.02

Sample Tag: TW-12-22_GW-120522

Collected Date/Time: 12/05/2022 00:01

Matrix: Groundwater

COC Reference: 155251

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	4.0	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/12/22 10:30	BDO	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 12/10/22 03:23, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	8	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	51	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	3	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	6	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	Not detected	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	5	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S43109.02 (continued)

Sample Tag: TW-12-22_GW-120522

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 12/10/22 03:23, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	13	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	



Analytical Laboratory Report

Lab Sample ID: S43109.03

Sample Tag: MWF16-16_GW-120522

Collected Date/Time: 12/05/2022 00:01

Matrix: Groundwater

COC Reference: 155251

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
3	40ml Glass	HCL	Yes	4.0	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
pH check for VOCs*	<2	N/A	12/12/22 10:30	BDO	

Organics - Volatiles

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 12/10/22 03:42, Analyst: KAG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Acetone	Not detected	50		ug/L	1	67-64-1	
2-Butanone (MEK)	Not detected	25		ug/L	1	78-93-3	
Benzene	Not detected	1		ug/L	1	71-43-2	
Bromodichloromethane	Not detected	1		ug/L	1	75-27-4	
Bromoform	Not detected	1		ug/L	1	75-25-2	
Bromomethane	Not detected	5		ug/L	1	74-83-9	
Carbon disulfide	Not detected	5		ug/L	1	75-15-0	
Carbon tetrachloride	Not detected	1		ug/L	1	56-23-5	
Chlorobenzene	Not detected	1		ug/L	1	108-90-7	
Chloroethane	Not detected	5		ug/L	1	75-00-3	
Chloroform	Not detected	1		ug/L	1	67-66-3	
Chloromethane	Not detected	5		ug/L	1	74-87-3	
1,2-Dibromo-3-chloropropane	Not detected	5		ug/L	1	96-12-8	
1,2-Dichlorobenzene	Not detected	1		ug/L	1	95-50-1	
1,2-Dichloroethane	Not detected	1		ug/L	1	107-06-2	
1,2-Dichloropropane	Not detected	1		ug/L	1	78-87-5	
1,3-Dichlorobenzene	Not detected	1		ug/L	1	541-73-1	
1,4-Dichlorobenzene	Not detected	1		ug/L	1	106-46-7	
cis-1,2-Dichloroethene	2	1		ug/L	1	156-59-2	
Dibromochloromethane	Not detected	5		ug/L	1	124-48-1	
Dichlorodifluoromethane	Not detected	5		ug/L	1	75-71-8	
trans-1,2-Dichloroethene	Not detected	1		ug/L	1	156-60-5	
Ethylbenzene	Not detected	1		ug/L	1	100-41-4	
2-Hexanone	Not detected	50		ug/L	1	591-78-6	
4-Methyl-2-pentanone (MIBK)	Not detected	50		ug/L	1	108-10-1	
tert-Methyl butyl ether (MTBE)	Not detected	5		ug/L	1	1634-04-4	
Methylene chloride	Not detected	5		ug/L	1	75-09-2	
Styrene	Not detected	1		ug/L	1	100-42-5	
1,1,1-Trichloroethane	4	1		ug/L	1	71-55-6	
1,1,2-Trichloroethane	Not detected	1		ug/L	1	79-00-5	
1,2,4-Trichlorobenzene	Not detected	5		ug/L	1	120-82-1	
Tetrachloroethene	109	1		ug/L	1	127-18-4	
Toluene	Not detected	1		ug/L	1	108-88-3	
Trichloroethene	4	1		ug/L	1	79-01-6	
Trichlorofluoromethane	Not detected	1		ug/L	1	75-69-4	
Vinyl chloride	Not detected	1		ug/L	1	75-01-4	
o-Xylene	Not detected	1		ug/L	1	95-47-6	



Analytical Laboratory Report

Lab Sample ID: S43109.03 (continued)

Sample Tag: MWF16-16_GW-120522

Volatile Organics - Arcadis, Method: SW5030C/8260C, Run Date: 12/10/22 03:42, Analyst: KAG (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
p,m-Xylene*	Not detected	2		ug/L	1		
Isopropylbenzene	Not detected	1		ug/L	1	98-82-8	
Cyclohexane	Not detected	1		ug/L	1	110-82-7	
1,1-Dichloroethane	2	1		ug/L	1	75-34-3	
1,1-Dichloroethene	Not detected	1		ug/L	1	75-35-4	
Methyl Acetate	Not detected	10		ug/L	1	79-20-9	
Methyl cyclohexane	Not detected	1		ug/L	1	108-87-2	
1,1,2-Trichloro-1,2,2-trifluoroethane	Not detected	1		ug/L	1	76-13-1	
1,2-Dibromoethane	Not detected	1		ug/L	1	106-93-4	
1,1,2,2-Tetrachloroethane	Not detected	1		ug/L	1	79-34-5	
cis-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-01-5	
trans-1,3-Dichloropropene	Not detected	1		ug/L	1	10061-02-6	