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MITIGATION OF CHLORINATED SOLVENT GROUNDWATER PLUMES WITH COLLOIDAL ACTIVATED CARBON

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MITIGATION OF CHLORINATED SOLVENT GROUNDWATER PLUMES WITH
COLLOIDAL ACTIVATED CARBON.

BY

SARA JANE HAUPT

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
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MASTER OF SCIENCE IN CHEMICAL ENGINEERING

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2019

ABSTRACT

Chlorinated volatile organic solvents (CVOCs) can form a contamination plume in groundwater that needs to be managed to protect human health and the environment. There are many injectable products available to treat contamination plumes in groundwater using a number of specific technologies, individually and in combination. This study evaluates the effectiveness of injectable colloidal activated carbon (PlumeStop® Liquid Activated Carbon™) at two sites in Rhode Island with chlorinated solvent groundwater contamination plumes. The injectate was introduced via low-pressure injection methods to avoid mobilizing additional contaminants.

The initial results show a reduction in contaminant levels downgradient of the injection points for both Sites. The long-term effectiveness of the injectate remains to be seen. GZA will continue to monitor the groundwater quality downgradient of the injections to evaluate breakthrough of the Permeable Reactive Barrier (PRB) formed by the PlumeStop injections.

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CHAPTER 1

INTRODUCTION

Chlorinated volatile organic solvents (CVOCs) can form a contamination plume in groundwater that needs to be managed to protect human health and the environment. There are many injectable products available to treat contamination plumes in groundwater using a number of specific technologies, individually and in combination. This study evaluates the effectiveness of injectable colloidal activated carbon at two sites. The first site (Site I) is the Central Landfill Superfund Site in Johnston, Rhode Island. The second site (Site II) is a Former Plating Facility in Providence, Rhode Island.

Site I Central Landfill Background

The Central Landfill Superfund site is a solid waste disposal facility in Johnston, Rhode Island. The Site has a long history of use as a solid waste disposal facility spanning from approximately 1955 to the present. Phase I of the landfill is a 121-acre cell that is unlined underneath the landfill. Phase I began operation in 1955 and was closed in 1997. The current extent of the landfill occupies approximately 154-acres on a 1,330-acre property. An engineered cap has been installed over the 154-acre landfill. The engineered cap includes an 80-mil LLDPE liner. The landfilling operations filled in the former Cedar Swamp Brook. Groundwater flow through the landfill generally follows the former path of Cedar Swamp Brook, (Figure 1).

Between 1976 and 1979 a portion of Phase I was used for liquid industrial waste and hazardous waste disposal. This area, covering less than one acre along the eastern

flank of the Phase I Landfill, was identified through aerial photograph analysis conducted by the EPA and has been designated as a Hot Spot. The Hot Spot is the primary identified source of a Volatile Organic Compound (VOC) plume in groundwater derived primarily from the presence of dense, non-aqueous phase liquids (DNAPLs). The predominant VOCs detected in the Hot Spot groundwater plume are chlorobenzene and 1,2-dichlorobenzene.

Figure 1: Plan View of Contamination plume, and Monitoring Wells of Central Landfill.

GZA GeoEnvironmental Inc. (GZA) operated a groundwater pump and treat system, herein referred to as the Hot Spot Hydrodynamic Containment System (HSHCS) from 2004 to 2016. The HSHCS extracted groundwater from source area

well MW03-ML11 (herein referred to as ML-11). Based on the groundwater monitoring data for ML-11, GZA determined that the plume had migrated beyond the ML-11 extraction well. Therefore, a new series of extraction wells were installed downgradient to capture the remaining plume.

As part of the decommissioning of extraction well ML-11, the United States Environmental Protection Agency (EPA) requested in-situ treatment of the source area around ML-11. After evaluating treatment alternatives, PlumeStop® Liquid Activated Carbon™ (PlumeStop) was selected as the preferred treatment method for the source area. PlumeStop was selected over alternative treatment methods because it can be injected at low pressures due to its water-like viscosity. PlumeStop is composed of colloidal scale (1 to 2 micron) activated carbon particles applied in an aqueous solution. The particles are manufactured with an anti-clumping agent (polymer coating). PlumeStop is designed to absorb and immobilize contaminants once the polymer coating breaks down, refer to Figure 2 depicting the general process.

Figure 2: PlumeStop General Process Diagram

The PlumeStop injection was anticipated to minimize the risk of causing contaminant migration during the injection process and form a Permeable Reactive

Barrier (PRB) to treat the plume. Based on information provided by the manufacturer, PlumeStop adsorption sites are regenerated as the contaminant is bio-degraded, therefore, PlumeStop is expected to provide long term mitigation of the source area, refer to Figure 3 for the treatment process flow diagram.

Figure 3: PlumeStop Treatment Process Flow Diagram

ML-11 consists of a bedrock extraction well which is a 4-inch diameter, 189-foot deep well. Depth to groundwater in ML-11 is typically 85 feet below grade. The well is equipped with casing from the ground surface to a depth of 83-feet below grade (approximately the thickness of the landfill) and is an open borehole in fractured bedrock below that depth. The bedrock in the area consists of an igneous granite gneiss with no primary porosity or permeability, therefore groundwater movement and associated contaminant migration is limited to bedrock fractures. Figure 4 presents the profiles of ML-11 and the downgradient monitoring well ML-12. Monitoring well

ML-12 is a multi-level well with well screened intervals 12A (elevation 317.6 feet to 328.6 feet), 12B (elevation 279.6 to 300.6 feet), MLC (elevation 235.6 to 245.6 feet), MLD (elevation 209.6 to 222.6 feet), and 12E (elevation 148.6 to 158.6 feet).

Figure 4: Profiles of Monitoring Wells ML-11 and ML-12

GZA conducted packer testing of ML-11 in 2003 to evaluate the hydraulic conductivity of bedrock in the vicinity of the borehole. The packer testing consisted of lowering two inflatable packers into the open borehole of the well to isolate 5-foot intervals of the exposed bedrock. The groundwater in the 5-foot interval is then evacuated, and the time to fill the void with groundwater is measured to estimate the hydraulic conductivity of the interval. Bedrock packer permeability testing was performed in approximately 5-foot intervals starting below the steel casing and

running the length of the borehole. These data were used to estimate the bedrock hydraulic conductivity. As a part of previous investigations, GZA also conducted a suite of geophysical testing on ML-11 in 2003, including digital acoustic televiewer (ATV) logging. Based on the ATV logging and bedrock packer permeability testing described above, GZA calculated the average hydraulic aperture (i.e., effective fracture opening size) for ML-11. The hydraulic aperture for each ML-11 packer test zone ranged between 15 to 110 microns, this aperture size is large enough to accommodate the 1-2-micron sized PlumeStop particles.

Site II: Former Plating Facility Background

A former metal plating facility in Providence, Rhode Island is contaminated with chlorinated ethenes and their breakdown products (tetrachloroethene (PCE), trichloroethene (TCE), cis 1,2-dichloroethene (DCE) and vinyl chloride (VC)) from jewelry plating operations. The approximately 0.5-acre site consists of a paved parking area. Soil strata at the site generally consist of approximately 2-5 feet of fill (urban fill), underlain by approximately 4-15 feet of silty sand and/or sand and silt. The site is equipped with a Soil Vapor Extraction (SVE) system, and groundwater monitoring wells GZ-2 through GZ-10, and MW-2D. The SVE system remediates contamination above the static water table at the Site, but not below the static water table.

In September 2011, a combined abiotic/biotic enhanced reductive dechlorination (ERD) remedy involving injection of zero valent iron (ZVI) and organic carbon electron donors (lactose and inactivated yeast) was implemented in contaminant source areas at the Site, below the static water level. ERD remediation is a process that breaks down PCE into daughter products like TCE, DCE and VC through

sequential removal of chlorine molecules from the ethene structure. When reductive dichlorination is occurring reductions in PCE concentrations result in a corresponding increase in TCE, reductions in TCE have a corresponding increase in DCE, and reductions in DCE have a corresponding increase in VC. The ZVI injections significantly reduced PCE and TCE (increased daughter products like DCE and VC) initially; however, contaminant levels began increasing (rebounded) in 2015. Groundwater monitoring results suggested that reductive dechlorination was still occurring onsite. However, the data also suggest that supplemental treatment along the downgradient edge of property would be beneficial for continuing the remediation process and minimizing offsite plume migration. After reviewing alternatives, PlumeStop was selected as the preferred treatment alternative. The PlumeStop injections serve as a PRB to mitigate offsite migration of contaminants.

For both sites the PlumeStop activated carbon injectate was paired with Hydrogen Release Compound (HRC). The HRC stimulates bacterial growth to jumpstart the bioremediation process. Therefore, the overall treatment from the injection of PlumeStop and HRC should reduce contaminant concentrations by adsorption and biodegradation.

CHAPTER 2

REVIEW OF LITERATURE

There are many alternatives for implementing PRBs for in-situ treatment of groundwater contamination plumes. Traditional PRBs require trench excavation and fill utilizing the proposed treatment compound, such as granular ZVI, activated carbon, or other reactive materials (Tosco, et al. 2014). Due to limitations (e.g., high cost, spatial constraints, etc.) for installation of PRB via excavation, injectable treatment materials have been developed. Nanoscale ZVI particles are commonly used for remediation because they can be injected into the soil matrix, and due to their large surface area Nano-ZVI has been shown to be more effective at degrading contaminants than granular ZVI (Zhang, et al. 1998). Although Nanoscale ZVI particles are small enough to pass through the soil matrix, the mobility of these particles is limited due to agglomeration and adhesion to the soil matrix (O-Carroll, et al. 2013). Nano-ZVI particles can be modified with various coatings and metal catalysts or suspended in emulsions to improve their mobility and efficacy (Comba, et al. 2011). Similar to Nano-ZVI, granular activated carbon is also an effective material for PRBs (Ruiz, et al. 2014). However, granular activated carbon particles also have limited mobility in the soil matrix.

Regenesis® (San Clemente, California) has developed an activated carbon-based injectate called PlumeStop® Liquid Activated Carbon™ (United States of America Patent No. 9,770,743, September 26, 2017).

The polymer coating improves the ability to distribute the activated carbon into the soil matrix, by preventing the particles from adhering to each other or to soil particles. The PlumeStop colloidal mixture has similar viscosity to water. As the coating degrades, the activated carbon particles adhere to the soil matrix and/or bedrock and form a matrix that promotes bacterial growth. Figure 5 below, depicts a Scanning Electron Microscope (SEM) image of sand particles without PlumeStop, Figures 6 and 7 depict SEM images of sand particles with PlumeStop coating. Note, Figures 5 through 7 have differing scales. The sand particles depicted in the Figures are approximately the same size.

Figure 5: SEM Image of Sand Particles without PlumeStop (Provided by Regensis)

Figure 6: SEM Image of Sand Particles Coated with PlumeStop (provided by Regensis)

Figure 7: SEM Image of Sand Particles coated with PlumeStop (provided by Regensis)

The PlumeStop is intended to form a bio-remediation barrier in the soil matrix. As contaminated groundwater migrates through the PRB formed by the PlumeStop particles, contaminants adsorb to the carbon surface and should degrade more effectively due to the longer residence time and direct contact with bacteria. According to the manufacturer, as the contaminants degrade, adsorption sites again become available to adsorb additional contaminant (Birnstingl, et al. 2014) allowing for long term mitigation of contaminant plumes. In order for the long-term treatment to be effective, biodegradation of the contaminants of concern must be possible, and the rate of biodegradation must be greater than or equal to the rate of adsorption under saturation conditions. The sorption capacity of PlumeStop depends on the surface area of the activated carbon particles. Information provided by Regenesis does not provide the surface area to mass ratio for PlumeStop. However, published data for surface areas of activated carbon products can range from 34 m²/g (Jaroniec et al. 1989) to 2696 m²/g (Lih, E. Y. et al. 2016).

PlumeStop is an aqueous-phase amendment (i.e., active only in the saturated portion of an aquifer) that is typically injected via direct push injection methods but can also be emplaced using monitoring wells and open boreholes.

This study evaluates the effectiveness of PlumeStop injections at two sites. Both sites contain chlorinated solvents. The main contaminants of concern at Central Landfill are 1,2-dichlorobenzene and chlorobenzene. Both 1,2-dichlorobenzene and chlorobenzene have been found to biodegrade from bacterial growth/metabolism (Reineke et al. 1984) (Haigler et al. 1988) (Seigneur et al. 2001) (Ziagova et al. 2007).

The main contaminants of concern at the Former Plating Facility are PCE, TCE, DCE, and VC. Under anaerobic conditions PCE undergoes reductive dichlorination/biodegradation to form TCE, which is dechlorinated to DCE, and ultimately VC (Ni, Z. et al. 2014) (Bradley 2000). Given that the contaminants of concern for both sites can undergo bioremediation, long-term treatment should be possible.

At Central Landfill PlumeStop was injected via low-pressure gravity feed into fractured bedrock and at the Former Plating Facility direct push injection methods were utilized to inject PlumeStop into silty sand soils. Direct Push Injection is a process where a probe or in this case tubing is pushed into the ground via vibratory or percussion hammering instead of drilling. In situ groundwater treatment in fractured bedrock is an emerging technology and the effects of chemical injection into bedrock can be highly variable due to preferential flow paths (i.e., treatment may be observed in some areas and not others due to the heterogeneous nature of fractured bedrock).

CHAPTER 3

METHODOLOGY

Central Landfill Injection Methods and Procedures

First Injection June to July 2016

The injectate was introduced to the former bedrock extraction well by gravity feed. Direct push injection is typically the method used to inject PlumeStop, however, this method is not possible at Central Landfill because it would require puncturing the landfill cap liner. Instead of direct push, the PlumeStop was added via gravity feed to ML-11 to avoid puncturing the liner. The low-pressure gravity feed injection approach was chosen over other remediation technologies to avoid altering site hydrodynamic conditions and limit the potential to alter current contaminant distribution patterns. During the injections the hydraulic head was limited to approximately 10 feet (4.3 pounds per square inch) above the static water level in the well. Dense Non-Aqueous Phase Liquid (DNAPL) is known to be present within the bedrock aquifer in the Hot Spot area, therefore, it was important to avoid injecting any of the additives under significant pressure because of the potential to mobilize contaminant source material to areas that are currently un-impacted. Based on GZA's evaluation of hydraulic conductivities and fracture spacing in ML-11, it was determined that injection within a specific well bore zone using zone isolation packers was not necessary and would increase the risk of applying a large hydraulic head to the borehole fractures.

The ML-11 extraction system (HSHCS) was removed from service in April 2016, and the static water level was allowed to equilibrate (2 months) prior to the injection.

In preparation for the in-situ treatment program, the injection well (ML-11) was developed to remove accumulated sediment to increase the injection rate. The well development process essentially cleans the borehole to remove sediment and improve the hydraulic conductivity of the borehole.

A total of 1,200 pounds (lbs.) of PlumeStop was mixed with potable water in 50-gallon batches and applied via gravity-feed injection as a 15% (by volume) colloidal solution. Approximately 250 gallons of 15% PlumeStop were injected into ML-11 once a week for five weeks. The total volume of injectate was approximately 1,250 gallons. Following the final PlumeStop injection, approximately 150 pounds of a lactate-based anaerobic bioremediation additive, Hydrogen Release Compound® (HRC, containing glycerol tri-polylactate, glycerin, and lactic acid), was mixed 1:1 with potable water and injected into the borehole. The HRC serves as an electron donor for dechlorinating bacteria by degrading to fatty acids and hydrogen.

The injectate was mixed in 50-gallon batches, and pumped from the base of the landfill, in the vicinity of the Hot Spot treatment system up to ML-11. Flow rates were adjusted during the injection event to maintain less than 10 feet of hydraulic head above the static water level. Each 50-gallon batch required approximately 1.5 to 2 hours to inject. During the first day of injections, GZA attempted to continuously circulate water within the borehole using a small submersible pump¹. However, the submersible pump failed shortly after the first injection began. GZA repeated this attempt to circulate water in the borehole using submersible pumps, the second and

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¹ The purpose was to prevent separation of the PlumeStop material from the aqueous carrier, but through field observations and discussion with the manufacturer we determined that this was not necessary.

third day of injections, however these pumps also failed. During the fourth and fifth days of injections, the water in the borehole was not circulated.

Second Injection July to August 2017

A total of 800 lbs. of PlumeStop was mixed with potable water and applied via gravity-feed injection as a 12 to 15% (by volume) colloidal solution. The second injection of PlumeStop utilized a different formulation of the injectate. The formulation for the second injection had a thinner coating of polymer on the activated carbon particles. This formulation is intended to fall out of suspension in the groundwater faster and adhere to the soil matrix closer to the injection point.

Approximately 200 gal. of PlumeStop colloidal solution was injected into ML-11, once a week for four weeks. The total volume of injectate was approximately 800 gallons. Following the final PlumeStop injection, 30 lbs. of a fermentable, lactate-based organic carbon source HRC was gravity-injected, to serve as an electron donor (fatty acids and hydrogen) for dechlorinating bacteria. GZA mixed 200-gallon batches at the beginning of each day at the landfill plateau. The injectate was then gravity fed via 1.5-inch tubing from the plateau to ML-11. Again, the hydraulic head was limited to 10-feet above the static water level. During this round of injections, GZA attempted to also inject PlumeStop into an upgradient monitoring well (MW56). MW56 is a 2-inch diameter well with PVC casing extending into shallow bedrock approximately 90 feet below grade with a well screen at depths of 331.6 to 341.6 feet bgs. After adding approximately 10-gallons to MW56, the water level rose to approximately 25-feet above the static water level. The flow of injectate was stopped, and the water level was

allowed to drop down to the static water level. Due to the low hydraulic conductivity observed, no additional injections were attempted in MW56.

Third Injection March to April 2018

A total of 2,000 lbs. of PlumeStop were injected into MW11 via gravity-feed injection as a 12 to 15% (by volume) colloidal solution in batches over the course of eight weeks. The total volume of injectate was approximately 2,100 gallons. The hydraulic head was again limited to 10 feet above ambient to limit the potential for migration of non-aqueous phase contaminants in the aquifer. Following the final PlumeStop injection, 30 lbs. of the HRC organic carbon source was gravity-injected, to serve as an electron donor for dechlorinating bacteria. Following the third injection, ML-11 was decommissioned (filled with a cement-bentonite grout and closed) in order to accommodate additional landfilling activities in the area.

Post Injection Monitoring

Following the first injection event, groundwater samples were collected from ML-11 and MW03-ML12 (zones A through E) on a monthly basis for VOC analysis for three months and quarterly thereafter. ML-12 is the closest downgradient monitoring point to ML-11 (located approximately 230 feet downgradient of ML-11). After the second and third injections, sampling was performed on a quarterly basis. ML-11 was decommissioned in April 2018, shortly after the third injection. The last sampling round of ML-11 was performed in February 2018. Quarterly sampling of ML-12 is ongoing, the most recent sampling round was performed in May 2019.

Samples were collected utilizing pneumatic pumps integral to the Solinst Multi-Level Well system in general accordance with the USEPA's September 19, 2017 Low Stress (low flow) Purging and Sampling Procedure (EPA SOP-001).

During the sampling, field readings were recorded for pH, temperature, specific conductance, turbidity, Oxidation-Reduction Potential (ORP) and dissolved oxygen (DO) using an YSI Multi-meter® with a flow-through cell and a LaMotte 2020 turbidity meter. Depths to groundwater were also recorded during sampling. The field readings indicate whether the well has stabilized (i.e. if the groundwater in the well is representative of the groundwater in the soil matrix) and is ready to be sampled. Groundwater samples were collected in Laboratory-provided, hydrochloric acid-preserved 40 ml glass vials with septa caps and were used for aqueous phase VOC analysis via EPA Method 8260B. The samples were packed in an ice chest and transported under chain-of-custody protocol to Microbac Laboratories Inc. located in Dayville, CT for analysis.

The sampling and laboratory analysis were conducted in accordance with GZA's Sampling and Analysis Plan (SAP) and the Quality Assurance Project Plan (QAPP) for the Hot Spot Groundwater Containment System for the Central Landfill dated March 2004.

Former Plating Facility Injection Methods and Procedures

From August 15 through 18, 2016, the injectate was introduced to 19 injection points IP-1 through IP-19 via direct push method. The direct push method of injection involves installing the injection tubing to depth (in this case 20-feet below ground surface) and adding the injectate as the tubing is withdrawn. HRC was applied to all

but two injection points a day before the PlumeStop injections. HRC was not injected in IP-12 and IP-19. HRC was not applied to IP-12 because this injection point hit refusal at 5 feet bgs. IP-19 was created the day of the PlumeStop injections (i.e. the day after the HRC injection). IP-19 was added to the injection program because IP-10 was abandoned during the PlumeStop injection due to the appearance of PlumeStop that was observed in monitoring wells MW-2D and GZ-4 during the injection.

A total of 4,400 pounds (lbs.) of PlumeStop was mixed with potable water to make a 10 percent (%) solution, approximately 4,000 parts per million (ppm), and injected via Geoprobe® Direct Push Technology (DPT) into 19 points (Figure 8 below, Injection Points IP-1 through IP-19), between approximately eight (8) and twenty (20) feet below ground surface. As described above IP-12 hit refusal at 5 feet below ground surface and was abandoned, IP-10 was also abandoned due to the appearance of PlumeStop in the downgradient wells during the injection. The injections generally followed the downgradient edges of the parking lot for the former plating facility, forming a bioremediation barrier approximately 90 feet long and eight to 20 feet below the ground surface. Note, depth to the static water level at the site ranges from eight (8) to thirteen (13) feet below ground surface. Approximately 24 gallons (gal) of PlumeStop solution were injected per vertical foot. In addition to PlumeStop, 18 liters of bioaugmentation culture (Bio-Dechlor Inoculum® Plus, BDI Plus: *Dehalococcoides* dechlorinating bacteria) and 540 lbs. of HRC organic carbon electron donor was injected at each interval. Approximately 60 mL of sodium bisulfite was added to every 300 gallons of PlumeStop to deoxygenate the solution prior to injection.

Figure 8: Former Plating Facility Injection Points and Monitoring Wells

Former Plating Facility Post Injection Monitoring

Immediately prior to and following the PlumeStop injection, groundwater samples were collected from each of the wells and analyzed for VOCs. Samples were collected utilizing EPA SOP-001. Sampling is performed for all of the wells onsite on a semi-annual basis. The most recent sampling round was performed in March 2019. During groundwater sampling, a variable speed peristaltic pump was utilized to

control the rate of purging. Dedicated 3/8-inch diameter polyethylene tubing was installed in each of the wells and dedicated pharmaceutical grade (silicone) tubing was utilized as the pump head tubing.

During the sampling, field readings were recorded for pH, temperature, specific conductance, turbidity, Oxidation-Reduction Potential (ORP) and dissolved oxygen (DO) using an YSI Multi-meter® with a flow-through cell and a LaMotte 2020 turbidity meter. Depths to groundwater and purging flow rate measurements were also recorded during sampling. The field readings are utilized to determine if the well has stabilized and is ready for sampling. The samples were placed in laboratory provided, hydrochloric acid-preserved 40 ml glass vials with septa caps for VOC analysis via EPA Method 8260B. The samples were then packed in an ice chest and transported under chain-of-custody protocol to ESS Laboratory in Cranston, RI.

CHAPTER 4

FINDINGS

Central Landfill Facility

During the operation of the HSHCS pump and treat system, monthly samples were collected from ML-11 and quarterly samples were collected from ML-12. The results of the sampling for ML-11 and ML-12 from 2015 to present are provided in the **Tables 2 through 8**. Due to fluctuations in the concentration of contaminants, the **Figures** depict a 12-month moving average of the sampling results for ML-11 and ML-12. Generally, the concentration of contaminants increases during periods with a low groundwater table and decreases during periods with a high groundwater table due to dilution. The concentrations of contaminants are also impacted by the degradation of 1,2-dichlorobenzene to chlorobenzene. Generally, the concentrations of 1,2-dichlorobenzene and chlorobenzene tend to correlate based on fluctuations in the groundwater table.

ML-11 Results

The HSHCS ceased operation in April 2016. ML-11 was an open borehole from elevation 344.2 feet to 238.2 feet (i.e., 83 feet to 189 feet bgs). Prior to the injection, the concentration of 1,2-dichlorobenzene in samples from ML-11 ranged from approximately 9,000 µg/L to 17,000 µg/L. The concentration of chlorobenzene in ML-11 ranged from 1,700 to 7,200 µg/L prior to the injection.

Figures 9 and 10, show the sampling results for 1,2-DCBZ and CBZ in ML-11 from January 2015 to February 2018. This well was decommissioned shortly after the

third injection in order to accommodate additional landfilling activities in the area.

Figures 9 and 10 show that the 12-month moving average concentration of chlorobenzene and 1,2-dichlorobenzene in ML-11 have decreased since the first injection. The addition of the injections can dilute contaminant concentrations temporarily. Refer to Appendix B for calculations of potential contaminant reduction due to dilution.

Figure 9: Chlorobenzene Results in ML-11

Figure 10: 1,2-Dichlorobenzene Results in ML-11

As shown in Table 2, after the first injection, the concentrations of 1,2-dichlorobenzene in ML-11 decreased from 14,000 µg/L to less than 2,000 µg/L during the August and September sampling rounds. The concentration of 1,2-dichlorobenzene then rebounded to 13,000 µg/L during the October sampling round. This rebound suggests that the PlumeStop migrated downgradient of ML-11 as intended. The concentration of chlorobenzene decreased from 6,400 µg/L in April to 1,500 µg/L in August and 2,100 µg/L in September. The chlorobenzene concentration in October rebounded to 10,000 µg/L. The rebound observed in October is considerably higher than the concentration of chlorobenzene prior to the injection, which may be the result of mobilizing contaminants due to the injection.

Due to the different formulation of PlumeStop used for the second injection, the impacts of the second injection are expected to be more localized around ML-11.

Rebound is not observed in ML-11 after the second injection, as expected because the formulation of the second injection was designed to fall out of suspension faster and would therefore provide treatment closer to the injection well.

ML-12 Results

As depicted in Figures 11 through 20 below, the 12-month average concentration of chlorobenzene and 1,2-dichlorobenzene in downgradient well ML-12 also appear to be trending downward since the first injection. However, the downward trend observed in ML-12 is less pronounced than the trend for ML-11. Note, this well is approximately 230 feet downgradient of ML-11, and there is a delay of approximately 3-9 months (depending on groundwater table fluctuations) before any changes in ML-11 appear in ML-12.

The well screen for ML-12A is installed from elevation 317.6 to 328.6 (i.e., 136 feet to 125 feet bgs). During the operation of the HSHCS, ML-12A experienced less drawdown than the lower well screen sections, which indicates that ML-12A is not as hydraulically connected to ML-11 as the other well screens in ML-12. Therefore, the reduction in contaminant concentrations in ML-12A is not observed. Prior to the injection, the concentrations of 1,2-dichlorobenzene in ML-12A ranged from approximately 800 µg/L to 3,900 µg/L and the concentrations of chlorobenzene ranged from approximately 500 µg/L to 3,600 µg/L. Since the third injection the concentration of 1,2-dichlorobenzene ranged from 730 µg/L to 2,500 µg/L, and the concentration of chlorobenzene ranged from 500 µg/L to 1,800 µg/L. The shape of the 12-month moving averages depicted in Figures 11 and 12 are similar because the

concentration of both 1,2-dichlorobenzene and chlorobenzene are affected the same way by fluctuations in the groundwater table.

Figure 11: Chlorobenzene Results in ML-12A

Figure 12: 1,2-Dichlorobenzene Results in ML-12A

ML-12B is screened at elevation 279.6 to 300.6 (i.e. 174 feet to 153 feet bgs). This well screen is considered to be hydraulically connected to the borehole in ML-11. Prior to the injection, the concentration of 1,2-dichlorobenzene in ML-12B ranged from approximately 20 $\mu\text{g/L}$ to 400 $\mu\text{g/L}$. The concentration of Chlorobenzene ranged from approximately 800 $\mu\text{g/L}$ to 6,000 $\mu\text{g/L}$. The concentrations of 1,2-dichlorobenzene and Chlorobenzene appear to decrease relative to pre-injection levels in October 2016 four (4) months after the first injection, and then appear to rebound in August and November 2017. Since the completion of the third injection the concentration of 1,2-dichlorobenzene in ML-12B has ranged from 22 $\mu\text{g/L}$ to 110 $\mu\text{g/L}$, and the concentration of chlorobenzene has ranged from 130 $\mu\text{g/L}$ to 3,100 $\mu\text{g/L}$.

Figure 13: Chlorobenzene Results in ML-12B

Figure 14: 1,2-Dichlorobenzene Results in ML-12B

ML-12C is screened from elevation 235.6 to 245.6 (i.e. 218 feet to 208 feet bgs). This well screen is considered to be hydraulically connected to the borehole in ML-11. The concentration of 1,2-dichlorobenzene ranged from approximately 20 µg/L to 60 µg/L, prior to the injection. The concentration of Chlorobenzene ranged from approximately 20 µg/L to 1,110 µg/L, prior to the injection. Similar to ML-12B the concentrations of 1,2-dichlorobenzene and chlorobenzene appear to decrease relative to pre-injection levels in October 2016 and rebound in November 2017. The results for 1,2-dichlorobenzene and chlorobenzene in ML-12C have been below the action levels since November 2018.

Figure 15: Chlorobenzene Results in ML-12C

Figure 16: 1,2-Dichlorobenzene Results in ML-12C

ML-12D is screened from elevation 209.6 to 222.6 (i.e. 244 feet to 213 feet bgs). This well screen is considered to be hydraulically connected to the borehole in ML-11. The concentration of 1,2-dichlorobenzene prior to the injection ranged from approximately 40 µg/L to 160 µg/L. The concentration of chlorobenzene prior to the injection ranged from approximately 500 µg/L to 1,000 µg/L. The concentration of 1,2-dichlorobenzene and chlorobenzene appear to decrease relative to pre-injection levels in March 2017, seven (7) months after the first injection and have stayed consistently lower until the February 2019 sampling round. The increase in the concentration of contaminants in ML-12C since the February 2019 sampling round may indicate that the portion of the PlumeStop barrier that is hydraulically connected to ML-12C is saturated with contaminants and break through is occurring.

Figure 17: Chlorobenzene Results in ML-12D

Figure 18: 1,2-Dichlorobenzene Results in ML-12D

ML-12E is screened from 148.6 to 158.6 (i.e. 305 feet to 295 feet bgs). The decrease in contaminant levels was not observed in samples from ML-12E (the deepest well screen). As depicted in Figure 4, this section of well screen is located at a deeper elevation than the bottom of ML-11. It is likely that the PlumeStop injected into ML-11 did not reach the deeper bedrock fractures, therefore, treatment of the deeper bedrock contamination did not occur.

Figure 19: Chlorobenzene Results in ML-12E

Figure 20: 1,2-Dichlorobenzene Results in ML-12E

Central Landfill Statistical Analysis

A t-test analysis was performed to compare pre and post injection data for 1,2-dichlorobenzene and chlorobenzene in ML-11 and ML-12. For ML-11 the pre and post injection data was separated based on the date of the first injection. For ML-12 pre and post injection data was separated based on a 6-month delay (assumed 6 months due to the 3 to 9-month range of the expected delay) from the date of the first injection.

Eight (8) samples have been collected from ML-11 since the first injection, so the t-test compared the eight (8) sample results pre and post the injection. Accounting for a 6-month delay there have been ten (10) post injection sampling events and nine (9) pre-injection sampling events. The p-values from the t-test are presented in **Table 1**.

Table 1: Central Landfill t-test p-values for Pre and Post Injection Data Comparison

	ML-11	ML-12A	ML-12B	ML-12C	ML-12D	ML-12E
1,2-DCBZ	2.99E-05	6.01E-01	1.72E-02	1.01E-01	1.81E-02	3.63E-01
CBZ	7.77E-02	8.76E-01	6.65E-02	2.26E-01	1.97E-05	9.26E-01

Based on t-test using 90% confidence ($p = 0.1$), there is a statistically significant difference between the pre and post injection results for 1,2-dichlorobenzene in ML-11, ML-12B, ML-12C, and ML-12D, but not ML-12A or ML-12E. There is a statistically significant difference between the pre and post injection results for chlorobenzene in ML-11, ML-12B, and ML-12D but not for ML-12A, ML-12C, or ML-12E.

Former Plating Facility

A comparison of the August 2011 baseline to the March 2019 field-screening parameters and laboratory results show that there have been changes in the distribution and character of contaminant concentrations and aquifer conditions within the identified zone of contamination, refer to attached Tables 7 through 16. As described above, the site source area was treated with an injection of a ZVI-organic carbon emulsion. The wells downgradient of the source area began to show signs of rebound beginning in late 2013/early 2014. Generally, the concentration of contaminants downgradient of the injections appear to have decreased since the injection. The initial reduction in contaminant concentrations may be the result of dilution, refer to **Appendix B** for an evaluation of dilution as a result of the injections.

GZ-3 Results

During the first sampling event after the injection, activated carbon particles were observed in GZ-3. The appearance of PlumeStop in GZ-3 after the injection may be an indication that the PlumeStop has migrated past GZ-3. The concentration of contaminants in GZ-3 decreased initially, but appears to show signs of rebound. This rebound may be occurring because the injectate has migrated downgradient of GZ-3, therefore the results are reflective of the source area without treatment. Alternatively, the increase may be because the PlumeStop in the vicinity of GZ-3 is saturated with contaminants. Note, that GZ-3 has historically shown contaminant concentrations reflective of the source area at the Site. As shown in Figure 21, the TCE is the predominant contaminant in GZ-3. The results for PCE, TCE, DCE, and VC in GZ-3 are still in exceedance of action levels.

Figure 21: Downgradient Well GZ-3 TVOC and TCE Results

The results for PCE in GZ-3 shown in Figure 22 also show an initial reduction in contaminant concentrations and then possible rebound. As described earlier it is unclear whether this rebound is the result of saturation of the PlumeStop, or because the PlumeStop has migrated downgradient of GZ-3.

Figure 22: Downgradient Well GZ-3 PCE Results

As shown in Figure 23, DCE increases immediately after the injection. TCE is the predominant contaminant in GZ-3. TCE degrades into DCE as a result of reductive dechlorination. The increase in DCE therefore, may be the result of degradation of TCE. As described earlier, the TCE and PCE concentrations appear to rebound which may be the result of the PlumeStop migrating past GZ-3. The increase in TCE and PCE appears to correspond with a decrease in DCE concentrations, further indicating that GZ-3 may not be benefitting from the injections because the PlumeStop is downgradient of the well. If the PlumeStop is downgradient of GZ-3, then the decrease in DCE cannot be the result of the PlumeStop treatment, but rather a lack of biodegradation.

Figure 23: Downgradient Well GZ-3 DCE Results

The results for VC shown in Figure 24 appear to be decreasing. As indicated above this decrease may be indicating that biodegradation is not occurring because the

PlumeStop is downgradient of GZ-3.

Figure 24: Downgradient Well GZ-3 VC Results

GZ-4 Results

VC results for GZ-4 are not presented because all of the results for VC to date have been below the method detection limit (i.e. non-detect). As shown in Figure 25 TCE is the predominant contaminant found in GZ-4. As shown on Figures 25 to 27, the concentrations of TVOCs, PCE, TCE and DCE all appear to have decreased since the injection. The results for PCE, TCE, DCE, and VC have all been below the action levels for the last five sampling rounds with the exception of the TCE result in September 2017. There is no evidence that biodegradation of contaminants is occurring because there is no increase in degradation products corresponding to a decrease in parent compounds. This lack of degradation products may be because biodegradation is not occurring, alternatively this may be because the degradation products remain adsorbed to the PlumeStop surface.

Figure 25: Downgradient Well GZ-4 TVOC and TCE Results

The PCE results in GZ-4 appear to have decreased since the injection. The results for PCE have been below action levels since the February 2012 sampling round (before the injection).

Figure 26: Downgradient Well GZ-4 PCE Results

The DCE results in GZ-4 also appear to have decreased since the injection.

Figure 27: Downgradient Well GZ-4 DCE Results

GZ-5 Results

TCE is also the predominant contaminant in GZ-5. As shown in Figure 28, the concentrations of TVOCs and TCE have decreased since the injection. The results for TVOCs, PCE, TCE and DCE have all been below actions levels for the last five sample rounds. VC has also been below action levels since the injection with the exception of the September 2018 sampling round.

Figure 28: Downgradient Well GZ-5 TVOC and TCE Results

Figure 29 depicts the results for PCE in downgradient well GZ-5. The results for PCE appear to have decreased since the injection.

Figure 29: Downgradient Well GZ-5 PCE Results

As shown in Figure 30, the results for DCE in GZ-5 also appear to have decreased since the injection. DCE degrades to VC. Figure 31 shows a sharp increase in VC concentration after the injection, which may be the result of DCE degradation. However, as previously described it is unclear whether degradation products remain adsorbed to the PlumeStop surface.

Figure 30: Downgradient Well GZ-5 DCE Results

Figure 31: Downgradient well GZ-5 VC Results

MW-2D Results

As shown in Figure 32, DCE is the predominant contaminant found in MW-2D. VC results for MW-2D are not presented because all of the results for VC to date have been below the method detection limit (i.e. non-detect). The concentration of DCE and TVOCs initially increases after the injections. There is not enough TCE observed in MW-2D to account for the increase in DCE as a result of degradation. The increase may be the result of mobilizing a pocket of contamination as a result of the injections. After the initial spike in DCE and TVOC concentrations, the concentration of both DCE and TVOCs appear to decrease.

Figure 32: Downgradient Well MW-2D TVOC and DCE Results

The results for PCE and TCE in MW-2D (shown in Figures 33 and 34, respectively) appear to have decreased since the injection. The results for PCE, TCE, and DCE have all been below action levels for the last five sampling rounds.

Figure 33: Downgradient Well MW-2D PCE Results

Figure 34: Downgradient Well MW-2D TCE Results

GZ-6 Results

Downgradient well GZ-6 is the furthest from the injection points. We expect to see a delay of approximately 12 to 14 months for groundwater to travel from the PRB injection area to GZ-6. As shown in Figure 35, TCE is the predominant contaminant observed in GZ-6. Based on the results thusfar, it appears as though the concentrations of PCE, TCE, DCE, and VC in GZ-6 are beginning to decrease. As shown in Figure 36, the results for PCE have been decreasing since 2011, which may be a result of the ZVI treatment in addition to the PlumeStop treatment. Figure 37, depicts a sharp decrease in DCE concentrations during the latest sampling round. As shown in Figure 38, the VC was beginning to increase and then decreased, due to the delay it appears that this increase and decrease is related to the ZVI treatment and not the PlumeStop treatment. Long-term monitoring will be required to determine if the PlumeStop injections effectively reduce offsite migration of contaminants.

Figure 35: Downgradient Well GZ-6 TVOC and TCE Results

Figure 36: Downgradient Well GZ-6 PCE Results

Figure 37: Downgradient Well GZ-6 DCE Results

Figure 38: Downgradient Well GZ-6 VC Results

Former Plating Facility Statistical Analysis

A t-test was performed for the sampling results from GZ-3, GZ-4, GZ-5 and MW-2D. A t-test was not performed for GZ-6. As described previously there is a delay of 12-14 months between the time of the injection, and when the impacts of the injection

are expected to appear in GZ-6. As a result of that delay only three (3) samples have been collected that reflect the impact of the treatment in GZ-6. With only three (3) data points the results of a t-test would not be valid.

For GZ-3, GZ-4, GZ-5, and MW-2D six (6) samples have been collected since the injection. The t-test was performed with the six (6) data points pre and post injection for the TVOC, PCE, TCE, DCE, and VC results.. The resulting p-values are presented in Table X. The results for VC were non-detect for GZ-4 and MW-2D, therefore, a t-test was not performed for these results.

Table 2: Former Plating Facility t-test p-values for Pre and Post Injection Data Comparison

	GZ-3	GZ-4	GZ-5	MW-2D
TVOC	2.24E-04	8.78E-02	7.73E-03	7.32E-01
PCE	1.37E-04	1.08E-04	1.79E-02	8.69E-01
TCE	3.25E-04	9.03E-02	1.54E-01	1.86E-01
DCE	3.29E-01	1.16E-01	1.58E-02	6.65E-01
VC	1.88E-03	NA	3.37E-01	NA

Based on t-test using 90% confidence ($p = 0.1$), there is a statistically significant difference between the pre and post injection results for TVOC, PCE, TCE, and VC in GZ-3. There is a statistically significant difference between the pre and post injection results for TVOC, PCE, and TCE in GZ-4. There is a statistically significant difference between the pre and post injection results for TVOC, PCE, and DCE in GZ-5. There was not a statistically significant difference between the pre and post injection results for MW-2D.

CHAPTER 5

CONCLUSION

The results indicate that PlumeStop injection at the Central Landfill successfully reduced contaminant levels in the source area well and provided some reduction of contaminants in the downgradient well. Additionally, the two formulations of PlumeStop appear to have behaved as expected and fall out of suspension at different times and flow longer and shorter distances based on the different formulations. It is still unclear why the submersible pumps used during the injection in ML-11 failed. There appears to be some interference from the PlumeStop that affects the submersible pumps. As described above, the injection into upgradient well MW56 failed to infiltrate into the bedrock. This well was not developed prior to the injection which may have contributed to the injectate not infiltrating. Additionally, MW56 only extends into the shallow bedrock which may have contributed to the low infiltration rate.

The groundwater at Central Landfill contains many more contaminants of concern than those discussed in this paper. Some of these contaminants may interfere with the performance of PlumeStop.

The injection at the former plating facility also appears to have successfully reduced contaminant levels in the wells downgradient of the PRB. Some of the results are still in exceedance of regulatory limits. During the injection, the injectate appeared in two of the downgradient wells. The placement of the injection points should be

from enough from the wells that the PlumeStop does not appear in the wells. Most of the injection points for the Former Plating Facility were placed far enough away to not impact nearby wells, with the exception of IP-10. After the injection, PlumeStop appeared in monitoring well GZ-3. The PlumeStop observed in GZ-3 was agglomerating together, therefore, it appears that the coating on the PlumeStop particles degraded at the same time the injectate was flowing into the vicinity of GZ-3 and fell out of suspension in the well. Planning the injection points to avoid issues with the PlumeStop appearing in monitoring wells is clearly an important part of designing the PRB.

The long-term effectiveness of the injectate remains to be seen. GZA will continue to monitor the groundwater quality downgradient of the injections to evaluate breakthrough of the PRB.

CHAPTER 6

RECOMMENDATIONS

Prior to performing future injections with PlumeStop it is recommended to perform bench scale tests of the product using the actual groundwater and soils from the site of interest. The bench scale testing will evaluate the performance of the product in an environment that is easily monitored. This would help define the quantity of PlumeStop required to achieve the project specific goals

Understanding the hydraulic conductivity of the site is also important to planning the injections. Tracer tests may also be helpful in evaluating/anticipating the flow paths that the PlumeStop will follow.

APPENDICES

Appendix A – Tables 3 through 18

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11											
			1/7/15	2/13/15	3/5/15	4/2/15	5/12/15	6/16/15	7/9/15					
			RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS					
1,1,1,1-Trichloroethane	200	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
1,1,1,2-Tetrachloroethane	5	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
2,4 ⁶	1,1,1-Dichloroethane	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100			
7	1,1,1-Dichloroethene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
70	1,1,2,4-Trichlorobenzene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
0.2	1,1,2-Dibromo-3-Chloropropane (DBCP)	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
0.05	1,1,2-Dibromoethane	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
600	1,1,2-Dichlorobenzene	ug/l	16,000	15,000	12,000	12,000	9,300	13,000	10,000					
5	1,1,2-Dichloroethane	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
5	1,1,2-Dichloropropane	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
600	1,1,3-Dichlorobenzene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
75	1,1,4-Dichlorobenzene	ug/l	520	510	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
-	1,4-Dioxane	ug/l	880	< 500	< 500	< 500	< 500	850	< 500	< 500	< 500			
4,000 ⁶	2-Butanone (MEK)	ug/l	NT	NT	NT	NT	NT	NT	NT	NT	NT			
5	Benzene	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100			
5	Carbon Tetrachloride	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
100	Chlorobenzene	ug/l	5,800	6,000	5,900	6,100	6,100	6,300	2,000					
70	cis-1,2-Dichloroethene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
700	Ethylbenzene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
100 ⁶	Naphthalene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
5	Tetrachloroethene	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100			
100	trans-1,2-Dichloroethene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
5	Trichloroethene	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500			
2	Vinyl chloride	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100			

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11													
			8/3/15		9/1/15		10/5/15		11/2/15		12/2/15		1/6/16		2/3/16	
			RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS	RESULTS
1,1,1-Trichloroethane	200	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,1,1,2-Tetrachloroethane	5	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,1-Dichloroethane	2.4 ⁶	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100		
1,1-Dichloroethene	7	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,1,2,4-Trichlorobenzene	70	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,2-Dibromoethane	0.05	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,2-Dichlorobenzene	600	ug/l	12,000	17,000	16,000	10,000	12,000	12,000	12,000	12,000	12,000	12,000	14,000			
1,2-Dichloroethane	5	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,2-Dichloropropane	5	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,3-Dichlorobenzene	600	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,4-Dichlorobenzene	75	ug/l	300	< 500	550	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
1,4-Dioxane	-	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	1,400	1,600			
2-Butanone (MEK)	4,000 ⁶	ug/l	NT	NT	NT	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Benzene	5	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100		
Carbon Tetrachloride	5	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Chlorobenzene	100	ug/l	5,700	5,200	7,200	1,700	2,700	4,600	2,700	4,600	2,700	4,600	6,600			
cis-1,2-Dichloroethene	70	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Ethylbenzene	700	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Naphthalene	100 ⁶	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Tetrachloroethene	5	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100		
trans-1,2-Dichloroethene	100	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Trichloroethene	5	ug/l	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500		
Vinyl chloride	2	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100		

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11													
			3/4/16		4/1/16		8/17/16		9/16/16		10/31/16		3/3/17		5/10/17	
			RESULT		RESULT		RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1,1-Trichloroethane	200	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,1,1,2-Tetrachloroethane	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,1,1-Dichloroethane	2.4 ⁶	ug/l	<	100	<	100		17		21	<	80	<	40		13.3
1,1,1-Dichloroethene	7	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,1,2,4-Trichlorobenzene	70	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dibromoethane	0.05	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dichlorobenzene	600	ug/l		11,000		14,000		1,100		1,900		13,000		2,830		2,190
1,2-Dichloroethane	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dichloropropane	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,3-Dichlorobenzene	600	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,4-Dichlorobenzene	75	ug/l	<	500	<	500	<	50	<	100		480	<	200		87.1
- 1,4-Dioxane	-	ug/l	<	500	<	500	<	3000		3100	<	400		2,520		2,660
2-Butanone (MEK)	4,000 ⁶	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Benzene	5	ug/l	<	100	<	100		43		59	<	80		70.8		54.4
Carbon Tetrachloride	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Chlorobenzene	100	ug/l		3,800		6,400		1,500		2,100		10,000		2,150		1,660
cis-1,2-Dichloroethene	70	ug/l	<	500	<	500	<	50	<	100	<	470	<	200	<	50
Ethylbenzene	700	ug/l	<	500	<	500	<	50	<	100		840	<	200	<	50
Naphthalene	100 ⁶	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Tetrachloroethene	5	ug/l	<	100	<	100	<	10	<	20	<	80	<	40	<	10
trans-1,2-Dichloroethene	100	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Trichloroethene	5	ug/l	<	500	<	500	<	10	<	20		160	<	40	<	10
Vinyl chloride	2	ug/l	<	100	<	100	<	10	<	20	<	150	<	40	<	10

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11			
			8/21/17	11/14/17	2/6/18	RESULT
1,1,1-Trichloroethane	200	ug/l	<	<	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	<	<	1
1,1-Dichloroethane	2.4 ⁶	ug/l	<	40	1.4	<
1,1-Dichloroethene	7	ug/l	<	<	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	<	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	<	<	2
1,2-Dibromoethane	0.05	ug/l	<	<	<	1
1,2-Dichlorobenzene	600	ug/l	<	<	9.4	3.8
1,2-Dichloroethane	5	ug/l	<	<	<	1
1,2-Dichloropropane	5	ug/l	<	<	<	1
1,3-Dichlorobenzene	600	ug/l	<	<	<	1
1,4-Dichlorobenzene	75	ug/l	<	<	<	1
1,4-Dioxane	-	ug/l	<	993	79	64
2-Butanone (MEK)	4,000 ⁶	ug/l	<	<	<	5
Benzene	5	ug/l	<	40	5.9	1.2
Carbon Tetrachloride	5	ug/l	<	<	<	1
Chlorobenzene	100	ug/l	<	<	48	5
cis-1,2-Dichloroethene	70	ug/l	<	<	<	0.4
Ethylbenzene	700	ug/l	<	<	<	1
Naphthalene	100 ⁶	ug/l	<	<	<	1
Tetrachloroethene	5	ug/l	<	40	<	1
trans-1,2-Dichloroethene	100	ug/l	<	<	<	1
Trichloroethene	5	ug/l	<	40	<	1
Vinyl chloride	2	ug/l	<	40	R	0.5

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A									
			3/17/2015		5/5/2015		8/6/2015		11/17/2015			
			RESULTS		RESULTS		RESULTS		RESULTS			
1,1,1-Trichloroethane	200	ug/l	<	50	<	120	<	100	<	100	<	40
1,1,2-Tetrachloroethane	5	ug/l	<	50	<	120	<	100	<	100	<	40
1,1-Dichloroethane	2.4 ⁶	ug/l	<	10	<	25	<	20	<	20	<	8
1,1-Dichloroethene	7	ug/l	<	50	<	120	<	100	<	100	<	40
1,2,4-Trichlorobenzene	70	ug/l	<	50	<	5	<	100	<	100	<	40
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	50	<	120	<	100	<	100	<	40
1,2-Dibromoethane	0.05	ug/l	<	50	<	120	<	100	<	100	<	40
1,2-Dichlorobenzene	600	ug/l		1,900		3,800	J	3,400		3,400		800
1,2-Dichloroethane	5	ug/l	<	50	<	120	<	100	<	100	<	40
1,2-Dichloropropane	5	ug/l	<	50	<	120	<	100	<	100	<	40
1,3-Dichlorobenzene	600	ug/l	<	50		8.4	<	100	<	100	<	40
1,4-Dichlorobenzene	75	ug/l		110		210		180		150		40
1,4-Dioxane	-	ug/l		470		1,300		790		580		660
2-Butanone (MEK)	4,000 ⁶	ug/l	<	50	<	120	<	100	<	100	<	40
Benzene	5	ug/l		10	<	25	<	20	<	20	<	8
Carbon Tetrachloride	5	ug/l	<	50	<	120	<	100	<	100	<	40
Chlorobenzene	100	ug/l		2,000		3,100		2,200		1,500		510
cis-1,2-Dichloroethene	70	ug/l	<	50	<	120	<	100	<	100	<	40
Ethylbenzene	700	ug/l	<	50	<	120	<	100	<	100	<	40
Methylbenzene (toluene)	1,000	ug/l	<	50	<	120	<	100	<	100	<	40
Naphthalene	100 ⁶	ug/l	<	20		4	<	20	<	100	<	40
Styrene	100	ug/l	<	50	<	120	<	100	<	100	<	40
Tetrachloroethene	5	ug/l	<	10	<	25	<	20	<	20	<	8
trans-1,2-Dichloroethene	100	ug/l	<	50	<	120	<	100	<	100	<	40
Trichloroethene	5	ug/l	<	10	<	25	<	20	<	20	<	8
Vinyl chloride	2	ug/l	<	10	<	25	<	20	<	20	<	8

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A									
			5/17/2016		8/17/2016		9/14/2016		10/31/2016		3/1/2017	
			RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1,1-Trichloroethane	200	ug/l	<	100	<	100	<	200	<	50	<	200
1,1,1,2-Tetrachloroethane	5	ug/l	<	100	<	100	<	200	<	50	<	200
1,1-Dichloroethane	2.4 ⁶	ug/l	<	20	<	20	<	40	<	10	<	40
1,1,1-Dichloroethene	7	ug/l	<	100	<	100	<	200	<	50	<	200
1,1,2,4-Trichlorobenzene	70	ug/l	<	100	<	100	<	200	<	50	<	200
1,1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	100	<	100	<	200	<	50	<	200
1,1,2-Dibromoethane	0.05	ug/l	<	100	<	100	<	200	<	50	<	200
1,1,2-Dichlorobenzene	600	ug/l		2,300		3,900		1,200		1,100		3,290
1,2-Dichloroethane	5	ug/l	<	100	<	100	<	200	<	50	<	200
1,2-Dichloropropane	5	ug/l	<	100	<	100	<	200	<	50	<	200
1,3-Dichlorobenzene	600	ug/l	<	100	<	100	<	200	<	50	<	200
1,4-Dichlorobenzene	75	ug/l		100		230		200	<	50	<	200
1,4-Dioxane	-	ug/l		200		340		400		390		447
2-Butanone (MEK)	4,000 ⁶	ug/l	<	100	<	100	<	200	<	50	<	200
Benzene	5	ug/l	<	20		44	<	40	<	10		42
Carbon Tetrachloride	5	ug/l	<	100	<	100	<	200	<	50	<	200
Chlorobenzene	100	ug/l		910		3,600		830		460		3,590
cis-1,2-Dichloroethene	70	ug/l	<	100	<	100	<	200	<	50	<	200
Ethylbenzene	700	ug/l	<	100	<	100	<	200	<	50	<	200
Methylbenzene (toluene)	1,000	ug/l	<	100	<	100	<	200	<	50	<	200
Naphthalene	100 ⁶	ug/l	<	100	<	100	<	200	<	50	<	200
Styrene	100	ug/l	<	100	<	100	<	200	<	50	<	200
Tetrachloroethene	5	ug/l	<	20	<	20	<	40	<	10	<	40
trans-1,2-Dichloroethene	100	ug/l	<	100	<	100	<	200	<	50	<	200
Trichloroethene	5	ug/l	<	20	<	20	<	40	<	10	<	40
Vinyl chloride	2	ug/l	<	20	<	20	<	40	<	10	<	40

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A							
			5/1/2017	8/21/2017	11/15/2017	2/6/2018	5/7/2018			
			RESULT	RESULT*	RESULT	RESULT	RESULT			
1,1,1-Trichloroethane	200	ug/l	< 100	< 50	< 1	< 1	< 1			
1,1,2-Tetrachloroethane	5	ug/l	< 100	< 50	< 1	< 1	< 1			
1,1-Dichloroethane	2.4 ⁶	ug/l	< 20	< 10	1.3	< 1	< 1			
1,1,1-Dichloroethene	7	ug/l	< 100	< 50	< 1	< 1	< 1			
1,1,2,4-Trichlorobenzene	70	ug/l	< 100	< 50	1.4	< 1	< 1			
1,1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	< 100	< 50	< 2	< 2	< 2			
1,2-Dibromoethane	0.05	ug/l	< 200	< 50	< 1	< 1	< 1			
1,2-Dichlorobenzene	600	ug/l	1,520	1,820	3,700	E 3,000	1,700			
1,2-Dichloroethane	5	ug/l	< 100	< 50	< 1	< 1	< 1			
1,2-Dichloropropane	5	ug/l	< 100	< 50	< 1	< 1	< 1			
1,3-Dichlorobenzene	600	ug/l	< 100	< 50	27	9.5	11			
1,4-Dichlorobenzene	75	ug/l	< 100	116	210	78	83			
1,4-Dioxane	-	ug/l	561	396	350	370	J+ 590			
2-Butanone (MEK)	4,000 ⁶	ug/l	< 100	< 50	< 5	< 85	< 5			
Benzene	5	ug/l	< 20	13.2	33	7.9	11			
Carbon Tetrachloride	5	ug/l	< 100	< 50	< 1	< 1	< 1			
Chlorobenzene	100	ug/l	827	1,520	3,700	E 1,700	1,340			
cis-1,2-Dichloroethene	70	ug/l	< 100	< 50	< 1	< 0.4	< 1			
Ethylbenzene	700	ug/l	< 100	< 50	1.2	< 1	< 1			
Methylbenzene (toluene)	1,000	ug/l	< 100	< 50	1.3	< 1	< 1			
Naphthalene	100 ⁶	ug/l	< 100	< 50	NT	2.1	2.6			
Styrene	100	ug/l	< 100	< 50	< 1	< 1	< 1			
Tetrachloroethene	5	ug/l	< 20	< 50	< 1	< 1	< 1			
trans-1,2-Dichloroethene	100	ug/l	< 100	< 10	< 1	< 1	< 1			
Trichloroethene	5	ug/l	< 20	< 50	< 1	< 1	< 1			
Vinyl chloride	2	ug/l	< 20	< 50	< 0.5	< 0.5	< 0.5			

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A					
			8/16/2018	11/8/2018	2/5/2019	5/7/2019	RESULT	RESULT
			RESULT	RESULT	RESULT	RESULT		
1,1,1-Trichloroethane	200	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,1,2-Tetrachloroethane	5	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethane	2.4 ⁶	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethene	7	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	70	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	< 80	< 2	< 2	< 2	< 2	< 2
1,2-Dibromoethane	0.05	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,2-Dichlorobenzene	600	ug/l	1,900	1,400	730	2,500		
1,2-Dichloroethane	5	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane	5	ug/l	< 40	< 1	< 1	< 1	< 1	< 1
1,3-Dichlorobenzene	600	ug/l	< 40	14	6.2	9.6		
1,4-Dichlorobenzene	75	ug/l	< 40	110	48	84		
1,4-Dioxane	-	ug/l	< 4,000	1,100	2,100	J+		
2-Butanone (MEK)	4,000 ⁶	ug/l	< 200	< 10	48	< 10		
Benzene	5	ug/l	< 40	15	8.1	7		
Carbon Tetrachloride	5	ug/l	< 40	< 1	< 1	< 1		
Chlorobenzene	100	ug/l	1,800	1,700	500	920		
cis-1,2-Dichloroethene	70	ug/l	< 40	< 1	< 0.4	< 1		
Ethylbenzene	700	ug/l	< 40	< 1	< 1	< 1		
Methylbenzene (toluene)	1,000	ug/l	< 40	< 1	< 1	< 1		
Naphthalene	100 ⁶	ug/l	< 40	< 1	1.1			
Styrene	100	ug/l	< 40	< 1	< 1	< 1		
Tetrachloroethene	5	ug/l	< 40	< 1	< 1	< 1		
trans-1,2-Dichloroethene	100	ug/l	< 40	< 1	< 1	< 1		
Trichloroethene	5	ug/l	< 40	< 1	< 1	< 1		
Vinyl chloride	2	ug/l	< 20	< 0.5	< 0.5	< 0.5		

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03ML12B							
			3/17/2015	5/5/2015	8/6/2015	12/16/2015	2/1/2016	RESULTS	RESULTS	RESULT
1,1,1-Trichloroethane	200	ug/l	<	100	<	120	<	100	<	25
1,1,2-Tetrachloroethane	5	ug/l	<	100	<	120	<	100	<	25
1,1-Dichloroethane	2.4 ⁶	ug/l	<	20	<	25	<	20	<	5
1,1-Dichloroethene	7	ug/l	<	100	<	120	<	100	<	25
1,2,4-Trichlorobenzene	70	ug/l	<	10	<	5	<	22	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	100	<	120	<	100	<	25
1,2-Dibromooethane	0.05	ug/l	<	100	<	120	<	100	<	25
1,2-Dichlorobenzene	600	ug/l	<	260	<	410	<	220	<	45
1,2-Dichloroethane	5	ug/l	<	100	<	120	<	100	<	25
1,2-Dichloropropane	5	ug/l	<	100	<	120	<	100	<	25
1,3-Dichlorobenzene	600	ug/l	<	10	<	5	<	22	<	25
1,4-Dichlorobenzene	75	ug/l	<	24	<	34	<	22	<	25
1,4-Dioxane	-	ug/l	<	320	<	830	<	470	<	400
2-Butanone (MEK)	4,000 ⁶	ug/l	<	100	<	120	<	100	<	25
Benzene	5	ug/l	<	20	<	27	<	24	<	10
Carbon Tetrachloride	5	ug/l	<	100	<	120	<	100	<	25
Chlorobenzene	100	ug/l	<	2,400	<	4,000	<	3,500	<	810
cis-1,2-Dichloroethene	70	ug/l	<	100	<	120	<	100	<	25
Ethylbenzene	700	ug/l	<	100	<	120	<	100	<	25
Methylbenzene (toluene)	1,000	ug/l	<	100	<	120	<	100	<	25
Naphthalene	100 ⁶	ug/l	<	2	<	1	<	4.4	<	25
Styrene	100	ug/l	<	100	<	120	<	100	<	25
Tetrachloroethene	5	ug/l	<	20	<	25	<	20	<	5
trans-1,2-Dichloroethene	100	ug/l	<	100	<	120	<	100	<	25
Trichloroethene	5	ug/l	<	20	<	25	<	20	<	5
Vinyl chloride	2	ug/l	<	20	<	25	<	20	<	5

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03-ML12B									
			5/17/2016		8/17/2016		9/14/2016		10/31/2016		3/1/2017	
			RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
1,1,1-Trichloroethane	200	ug/l	< 200	< 200	< 200	< 200	< 200	< 50	< 25			
1,1,2-Tetrachloroethane	5	ug/l	< 200	< 200	< 200	< 200	< 200	< 50	< 25			
1,1-Dichloroethane	2.4 ⁶	ug/l	< 40	< 40	< 40	< 40	< 10	< 5				
1,1-Dichloroethene	7	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,2,4-Trichlorobenzene	70	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,2-Dibromoethane	0.05	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,2-Dichlorobenzene	600	ug/l	< 200	< 200	< 200	< 290	< 31	< 67.5				
1,2-Dichloroethane	5	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,2-Dichloropropane	5	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,3-Dichlorobenzene	600	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,4-Dichlorobenzene	75	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
1,4-Dioxane	-	ug/l	560	< 400	< 400	< 400	< 350	< 330				
2-Butanone (MEK)	4,000 ⁶	ug/l	< 200	< 200	< 200	< 200	< 50	< 25				
Benzene	5	ug/l	48	< 44	< 61	< 10	< 8.3					
Carbon Tetrachloride	5	ug/l	< 200	< 200	< 200	< 50	< 25					
Chlorobenzene	100	ug/l	< 4,800	< 4,600	< 6,200	< 1,300	< 586					
cis-1,2-Dichloroethene	70	ug/l	< 200	< 200	< 200	< 50	< 25					
Ethylbenzene	700	ug/l	< 200	< 200	< 200	< 50	< 25					
Methylbenzene (toluene)	1,000	ug/l	< 200	< 200	< 200	< 50	< 25					
Naphthalene	100 ⁶	ug/l	< 200	< 200	< 200	< 1	< 25					
Styrene	100	ug/l	< 200	< 200	< 200	< 50	< 25					
Tetrachloroethene	5	ug/l	< 40	< 40	< 40	< 10	< 5					
trans-1,2-Dichloroethene	100	ug/l	< 200	< 200	< 200	< 50	< 25					
Trichloroethene	5	ug/l	< 40	< 40	< 40	< 10	< 5					
Vinyl chloride	2	ug/l	< 40	< 40	< 40	< 10	< 5					

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03ML12B							
			5/1/2017		8/21/2017		11/15/2017		2/6/2018	
			RESULT		RESULT*		RESULT		RESULT	RESULT
1,1,1-Trichloroethane	200	ug/l	<	25	<	5	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	5	<	1	<	1
1,1-Dichloroethane	2.4 ⁶	ug/l	<	5	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	25	<	5	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	5	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	5	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	25	<	5	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		103		155		69	J	54
1,2-Dichloroethane	5	ug/l	<	25	<	5	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	25	<	5	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	25		5.05		1.6	<	1
1,4-Dichlorobenzene	75	ug/l	<	25		63		21		6.4
1,4-Dioxane	-	ug/l		407		349		350		320
2-Butanone (MEK)	4,000 ⁶	ug/l	<	25	<	5	<	5	<	5
Benzene	5	ug/l	<	10		58.7		13		9.4
Carbon Tetrachloride	5	ug/l	<	25	<	5	<	1	<	1
Chlorobenzene	100	ug/l		1,110		4,200		3,300	E	970
cis-1,2-Dichloroethene	70	ug/l	<	25	<	5	<	1	<	0.4
Ethylbenzene	700	ug/l	<	25	<	5	<	1		1.1
Methylbenzene (toluene)	1,000	ug/l	<	25	<	5	<	1		2.6
Naphthalene	100 ⁶	ug/l	<	25	<	5	<	1.1	<	1
Styrene	100	ug/l	<	25	<	5	<	1	<	1
Tetrachloroethene	5	ug/l	<	5	<	5	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	25	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	5	<	5	<	1	<	1
Vinyl chloride	2	ug/l	<	5	<	5	<	0.5	<	0.5

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03-ML12B					
			8/16/2018		11/8/2018		2/5/2019	
			RESULT		RESULT		RESULT	RESULT
1,1,1-Trichloroethane	200	ug/l	<	40	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	40	<	1	<	1
1,1-Dichloroethane	2.4 ⁶	ug/l	<	40	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	40	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	40	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	80	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	40	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		110		62		22
1,2-Dichloroethane	5	ug/l	<	40	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	40	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	40	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	40		6.4		2.1
1,4-Dioxane	-	ug/l	<	4,000		290		1,000
2-Butanone (MEK)	4,000 ⁶	ug/l	<	200	<	10		35
Benzene	5	ug/l		43		13		5.2
Carbon Tetrachloride	5	ug/l	<	40	<	1	<	1
Chlorobenzene	100	ug/l		3,100		1,000		130
cis-1,2-Dichloroethene	70	ug/l	<	40	<	1	<	0.4
Ethylbenzene	700	ug/l	<	40	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	<	40		2		1.3
Naphthalene	100 ⁶	ug/l	<	40	<	1	<	1
Styrene	100	ug/l	<	40	<	1	<	1
Tetrachloroethene	5	ug/l	<	40	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	40	<	1	<	1
Trichloroethene	5	ug/l	<	40	<	1	<	1
Vinyl chloride	2	ug/l	<	20	<	0.5	<	0.5
								1.3

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C									
			3/18/2015		5/5/2015		12/16/2015		2/25/2016		5/17/2016	
			RESULTS		RESULTS		RESULTS		RESULTS		RESULTS	
1,1,1-Trichloroethane	200	ug/l	U	25	<	5	<	25	<	25	<	25
1,1,2-Tetrachloroethane	5	ug/l	U	25	<	5	<	25	<	25	<	25
1,1-Dichloroethane	2.4 ⁶	ug/l	U	5	<	1	<	5	<	5	<	5
1,1-Dichloroethene	7	ug/l	U	25	<	5	<	25	<	25	<	25
1,2,4-Trichlorobenzene	70	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dibromoethane	0.05	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dichlorobenzene	600	ug/l	U	25		16	<	25		30		46
1,2-Dichloroethane	5	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dichloropropane	5	ug/l	U	25	<	5	<	25	<	25	<	25
1,3-Dichlorobenzene	600	ug/l	U	25	<	5	<	25	<	25	<	25
1,4-Dichlorobenzene	75	ug/l	U	25	<	5	<	25	<	25	<	25
1,4-Dioxane	-	ug/l	U	25	<	5		30	<	50	<	25
2-Butanone (MEK)	4,000 ⁶	ug/l	U	25	<	5	<	25	<	25	<	25
Benzene	5	ug/l	U	5	<	1	<	5		5.2	<	5
Carbon Tetrachloride	5	ug/l	U	25	<	5	<	25	<	25	<	25
Chlorobenzene	100	ug/l		110		18		280		480		660
cis-1,2-Dichloroethene	70	ug/l	U	25	<	5	<	25	<	25	<	25
Dichloromethane	5	ug/l	U	5	<	1	<	5	<	5	<	5
Ethylbenzene	700	ug/l	U	25	<	5	<	25	<	25	<	25
Methylbenzene (toluene)	1,000	ug/l		NT	<	5	<	25	<	25	<	25
Naphthalene	100	ug/l	U	25	<	1.1	<	25	<	25	<	25
Styrene	100	ug/l	U	25	<	5	<	25	<	25	<	25
Tetrachloroethene	5	ug/l	U	5	<	1	<	5	<	5	<	5
trans-1,2-Dichloroethene	100	ug/l	U	25	<	5	<	25	<	25	<	25
Trichloroethene	5	ug/l	U	5	<	1	<	5	<	5	<	5
Vinyl chloride	2	ug/l	U	5	<	1	<	5	<	5	<	5

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C							
			8/17/2016		9/14/2016		10/31/2016		5/1/2017	
			RESULT		RESULT		RESULT		RESULT	RESULT-DUP
1,1,1-Trichloroethane	200	ug/l	<	25	<	25	<	25	<	50
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	25	<	25	<	50
1,1-Dichloroethane	2.4 ⁶	ug/l	<	5	<	5	<	5	<	10
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	25	<	50
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	25	<	25	<	50
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	25	<	50
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	25	<	50
1,2-Dichlorobenzene	600	ug/l		35		64	<	25	<	50
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	25	<	50
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	25	<	50
1,3-Dichlorobenzene	600	ug/l	<	25	<	25	<	25	<	50
1,4-Dichlorobenzene	75	ug/l	<	25	<	25	<	25	<	50
1,4-Dioxane	-	ug/l	<	50	<	50	<	25	<	50
2-Butanone (MEK)	4,000 ⁶	ug/l	<	25	<	25	<	25	<	50
Benzene	5	ug/l		5.6	<	5	<	5	<	10
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	25	<	50
Chlorobenzene	100	ug/l		540		1,100		150		71.5
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	25	<	50
Dichloromethane	5	ug/l	<	5	<	5	<	5	<	10
Ethylbenzene	700	ug/l	<	25	<	25	<	25	<	50
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25	<	25	<	50
Naphthalene	100	ug/l	<	25	<	25	<	25	<	50
Styrene	100	ug/l	<	25	<	25	<	25	<	50
Tetrachloroethene	5	ug/l	<	5	<	5	<	5	<	50
trans-1,2-Dichloroethene	100	ug/l	<	25	<	25	<	25	<	10
Trichloroethene	5	ug/l	<	5	<	5	<	5	<	50
Vinyl chloride	2	ug/l	<	5	<	5	<	5	<	50

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C									
			8/21/2017		11/15/2017		2/6/2018		5/7/2018		8/16/2018	
			RESULT*		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	5	<	1	<	1	<	1	<	10
1,1,2-Tetrachloroethane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,1-Dichloroethane	2.4 ⁶	ug/l	<	1	<	1	<	1	<	1	<	10
1,1-Dichloroethene	7	ug/l	<	5	<	1	<	1	<	1	<	10
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	5	<	2	<	2	<	2	<	20
1,2-Dibromoethane	0.05	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dichlorobenzene	600	ug/l		8.75		39		39		11		15
1,2-Dichloroethane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dichloropropane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,3-Dichlorobenzene	600	ug/l	<	5	<	1	<	1	<	1	<	10
1,4-Dichlorobenzene	75	ug/l	<	5		8.6		4.3	<	1	<	10
1,4-Dioxane	-	ug/l		20.2		25		45	<	100	<	1,000
2-Butanone (MEK)	4,000 ⁶	ug/l		73		29		56		110	<	50
Benzene	5	ug/l		1.18	<	1		6.2		1.6	<	10
Carbon Tetrachloride	5	ug/l	<	5	<	1	<	1	<	1	<	10
Chlorobenzene	100	ug/l		55.6		440	E	700		69		140
cis-1,2-Dichloroethene	70	ug/l	<	5	<	1	<	0.4	<	1	<	10
Dichloromethane	5	ug/l	<	1	<	1	<	1	<	1	<	10
Ethylbenzene	700	ug/l	<	5	<	1		1.1	<	1	<	10
Methylbenzene (toluene)	1,000	ug/l	<	5		4.8		3.8		1.1	<	10
Naphthalene	100	ug/l	<	5	<	2.4	<	1	<	1	<	10
Styrene	100	ug/l	<	5	<	1	<	1	<	1	<	10
Tetrachloroethene	5	ug/l	<	5	<	1	<	1	<	1	<	10
trans-1,2-Dichloroethene	100	ug/l	<	1	<	1	<	1	<	1	<	10
Trichloroethene	5	ug/l	<	5	<	1	<	1	<	1	<	10
Vinyl chloride	2	ug/l	<	5	<	0.5	<	0.5	<	0.5	<	5

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedance of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C			
			11/8/2018	2/5/2019	5/7/2019	RESULT
1,1,1-Trichloroethane	200	ug/l	<	<	<	<
1,1,2-Tetrachloroethane	5	ug/l	<	<	<	<
1,1-Dichloroethane	2.4 ⁶	ug/l	<	<	<	<
1,1-Dichloroethene	7	ug/l	<	<	<	<
1,2,4-Trichlorobenzene	70	ug/l	<	<	<	<
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	2	<	<
1,2-Dibromoethane	0.05	ug/l	<	<	<	<
1,2-Dichlorobenzene	600	ug/l	13	8.4	<	33
1,2-Dichloroethane	5	ug/l	<	<	<	<
1,2-Dichloropropane	5	ug/l	<	<	<	<
1,3-Dichlorobenzene	600	ug/l	<	<	<	<
1,4-Dichlorobenzene	75	ug/l	<	<	<	4.4
1,4-Dioxane	-	ug/l	38	<	100	222
2-Butanone (MEK)	4,000 ⁶	ug/l	180	120	<	27
Benzene	5	ug/l	1.4	<	1.3	6.6
Carbon Tetrachloride	5	ug/l	<	<	<	<
Chlorobenzene	100	ug/l	67	57	<	438
cis-1,2-Dichloroethene	70	ug/l	<	<	0.4	<
Dichloromethane	5	ug/l	<	<	<	<
Ethylbenzene	700	ug/l	<	1.1	<	<
Methylbenzene (toluene)	1,000	ug/l	<	<	<	2.7
Naphthalene	100	ug/l	<	<	<	<
Styrene	100	ug/l	<	<	<	<
Tetrachloroethene	5	ug/l	<	<	<	<
trans-1,2-Dichloroethene	100	ug/l	<	<	<	<
Trichloroethene	5	ug/l	<	<	<	<
Vinyl chloride	2	ug/l	<	0.5	<	<

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03ML12D							
			3/17/2015		5/5/2015		8/6/2015		11/17/2015	
			RESULTS		RESULTS		RESULTS		RESULTS	
1,1,1-Trichloroethane	200	ug/l	<	25	<	25	<	25	<	25
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	25	<	25	<	25
1,1-Dichloroethane	2.4 ⁶	ug/l	<	5	<	5	<	5	<	5
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	25	<	25
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	5	<	5	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	25	<	25
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	25	<	25
1,2-Dichlorobenzene	600	ug/l	48		60		37		44	41
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	25	<	25
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	25	<	25
1,3-Dichlorobenzene	600	ug/l	<	5	<	5	<	5	<	25
1,4-Dichlorobenzene	75	ug/l		6.6		5.6		5.3	<	25
1,4-Dioxane	-	ug/l	J	58	<	25		71	<	53
2-Butanone (MEK)	4,000 ⁶	ug/l	<	25	<	25	<	25	<	25
Benzene	5	ug/l	<	5	<	5		6	<	5
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	25	<	25
Chlorobenzene	100	ug/l		760		600		990		510
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	25	<	25
Dichloromethane	5	ug/l	<	5	<	5	<	5	<	5
Ethylbenzene	700	ug/l	<	25	<	25	<	25	<	25
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25	<	25	<	25
Naphthalene	100 ⁶	ug/l	<	1	<	1	<	1	<	25
Styrene	100	ug/l	<	25	<	25	<	25	<	25
Tetrachloroethene	5	ug/l	<	5	<	5	<	5	<	5
trans-1,2-Dichloroethene	100	ug/l	<	25	<	25	<	25	<	25
Trichloroethene	5	ug/l	<	5	<	5	<	5	<	5
Vinyl chloride	2	ug/l	<	5	<	5	<	5	<	5

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03ML12D									
			5/17/2016	8/17/2016	9/14/2016	10/31/2016	3/1/2017	5/1/2017				
			RESULT	RESULT	RESULT	RESULT	RESULT	RESULT				
1,1,1-Trichloroethane	200	ug/l	<	20	<	25	<	5	<	5	<	5
1,1,2-Tetrachloroethane	5	ug/l	<	20	<	25	<	5	<	5	<	5
1,1-Dichloroethane	2.4 ⁶	ug/l	<	4	<	5	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	20	<	25	<	5	<	5	<	5
1,2,4-Trichlorobenzene	70	ug/l	<	20	<	25	<	5	<	5	<	5
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	20	<	25	<	5	<	5	<	5
1,2-Dibromooethane	0.05	ug/l	<	20	<	25	<	5	<	5	<	5
1,2-Dichlorobenzene	600	ug/l	110	110	160	48	24.9	20.4				
1,2-Dichloroethane	5	ug/l	<	20	<	25	<	5	<	5	<	5
1,2-Dichloropropane	5	ug/l	<	20	<	25	<	5	<	5	<	5
1,3-Dichlorobenzene	600	ug/l	<	20	<	25	<	5	<	5	<	5
1,4-Dichlorobenzene	75	ug/l	<	20	<	25	<	5	<	5	<	5
1,4-Dioxane	-	ug/l	<	20	<	25	<	5	<	5	<	5
2-Butanone (MEK)	4,000 ⁶	ug/l	<	20	<	25	<	5	<	5	<	5
Benzene	5	ug/l	<	4	<	5	<	6.5	<	1	<	1
Carbon Tetrachloride	5	ug/l	<	20	<	25	<	5	<	5	<	5
Chlorobenzene	100	ug/l	640	720	740	650	69.4	82.1				
cis-1,2-Dichloroethene	70	ug/l	<	20	<	25	<	5	<	5	<	5
Dichloromethane	5	ug/l	<	4	<	5	<	1	<	1	<	1
Ethylbenzene	700	ug/l	<	20	<	25	<	5	<	5	<	5
Methylbenzene (toluene)	1,000	ug/l	<	20	<	25	<	5	<	5	<	5
Naphthalene	100 ⁶	ug/l	<	20	<	25	<	5	<	5	<	5
Styrene	100	ug/l	<	20	<	25	<	5	<	5	<	5
Tetrachloroethene	5	ug/l	<	4	<	5	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	20	<	25	<	5	<	5	<	5
Trichloroethene	5	ug/l	<	4	<	5	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	4	<	5	<	1	<	1	<	1

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03-ML12D							
			8/21/2017	11/15/2017	2/6/2018	5/7/2018	8/16/2018			
			RESULT*	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
1,1,1-Trichloroethane	200	ug/l	<	<	<	<	<	<	<	<
1,1,2-Tetrachloroethane	5	ug/l	<	<	<	<	<	<	<	<
1,1-Dichloroethane	2.4 ⁶	ug/l	<	<	<	<	<	<	<	<
1,1-Dichloroethene	7	ug/l	<	<	<	<	<	<	<	<
1,2,4-Trichlorobenzene	70	ug/l	<	<	<	<	<	<	<	<
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	<	<	<	<	<	<	<
1,2-Dibromoethane	0.05	ug/l	<	<	<	<	<	<	<	<
1,2-Dichlorobenzene	600	ug/l	<	<	<	<	<	<	<	<
1,2-Dichloroethane	5	ug/l	<	<	<	<	<	<	<	<
1,2-Dichloropropane	5	ug/l	<	<	<	<	<	<	<	<
1,3-Dichlorobenzene	600	ug/l	<	<	<	<	<	<	<	<
1,4-Dichlorobenzene	75	ug/l	<	<	<	<	<	<	<	<
1,4-Dioxane	-	ug/l	<	<	<	<	<	<	<	<
2-Butanone (MEK)	4,000 ⁶	ug/l	<	<	<	<	<	<	<	<
Benzene	5	ug/l	<	<	<	<	<	<	<	<
Carbon Tetrachloride	5	ug/l	<	<	<	<	<	<	<	<
Chlorobenzene	100	ug/l	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	70	ug/l	<	<	<	<	<	<	<	<
Dichloromethane	5	ug/l	<	<	<	<	<	<	<	<
Ethylbenzene	700	ug/l	<	<	<	<	<	<	<	<
Methylbenzene (toluene)	1,000	ug/l	<	<	<	<	<	<	<	<
Naphthalene	100 ⁶	ug/l	<	<	<	<	<	<	<	<
Styrene	100	ug/l	<	<	<	<	<	<	<	<
Tetrachloroethene	5	ug/l	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	100	ug/l	<	<	<	<	<	<	<	<
Trichloroethene	5	ug/l	<	<	<	<	<	<	<	<
Vinyl chloride	2	ug/l	<	<	<	<	<	<	<	<

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03-ML12D			
			11/8/2018 RESULT	2/5/2019 RESULT	5/7/2019 RESULT	
1,1,1-Trichloroethane	200	ug/l	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	1	<	1
1,1-Dichloroethane	2.4 ⁶	ug/l	<	1	<	1.3
1,1-Dichloroethene	7	ug/l	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	1	<	1
1,2-Dichlorobenzene	600	ug/l	14	51		98
1,2-Dichloroethane	5	ug/l	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	1	<	4.3
1,4-Dioxane	-	ug/l	25	110		147
2-Butanone (MEK)	4,000 ⁶	ug/l	<	10	<	5.6
Benzene	5	ug/l	<	7.1		9.7
Carbon Tetrachloride	5	ug/l	<	1	<	1
Chlorobenzene	100	ug/l	100	510		402
cis-1,2-Dichloroethene	70	ug/l	<	1	<	1
Dichloromethane	5	ug/l	<	5	<	1
Ethylbenzene	700	ug/l	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	1.2	5.1		5.1
Naphthalene	100 ⁶	ug/l	<	1	<	1
Styrene	100	ug/l	<	1	<	1
Tetrachloroethene	5	ug/l	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	1	<	1
Trichloroethene	5	ug/l	<	1	<	1
Vinyl chloride	2	ug/l	<	0.5	<	1.4

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML12E							
			3/17/2015	5/5/2015	8/6/2015	11/17/2015	12/16/2015	RESULTS	RESULTS	RESULTS
1,1,1-Trichloroethane	200	ug/l	<	10	<	5	<	25	<	5
1,1,2-Tetrachloroethane	5	ug/l	<	10	<	5	<	25	<	5
1,1-Dichloroethane	2.4 ⁶	ug/l	<	2	<	1	<	5	<	1
1,1-Dichloroethene	7	ug/l	<	10	<	5	<	25	<	5
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	5	<	25	<	100
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	10	<	5	<	25	<	5
1,2-Dibromoethane	0.05	ug/l	<	10	<	5	<	25	<	5
1,2-Dichlorobenzene	600	ug/l	<	14	<	32	<	33	<	11
1,2-Dichloroethane	5	ug/l	<	10	<	5	<	25	<	5
1,2-Dichloropropane	5	ug/l	<	10	<	5	<	25	<	5
1,3-Dichlorobenzene	600	ug/l	<	5	<	5	<	25	<	5
1,4-Dichlorobenzene	75	ug/l	<	5	<	5	<	25	<	5
1,4-Dioxane	-	ug/l	<	10	<	24	<	25	<	20
2-Butanone (MEK)	4,000 ⁶	ug/l	<	10	<	13	<	25	<	7.2
Benzene	5	ug/l	<	2	<	4.2	<	5	<	2
Carbon Tetrachloride	5	ug/l	<	10	<	5	<	25	<	5
Chlorobenzene	100	ug/l	<	190	<	500	<	530	<	140
cis-1,2-Dichloroethene	70	ug/l	<	10	<	5	<	25	<	5
Dichloromethane	5	ug/l	<	2	<	1	<	5	<	1
Ethylbenzene	700	ug/l	<	10	<	5	<	25	<	5
Methylbenzene (toluene)	1,000	ug/l	<	10	<	8.1	<	25	<	5
Naphthalene	100 ⁶	ug/l	<	1	<	1.1	<	25	<	5
Styrene	100	ug/l	<	10	<	5	<	25	<	5
Tetrachloroethene	5	ug/l	<	2	<	1	<	5	<	1
trans-1,2-Dichloroethene	100	ug/l	<	10	<	5	<	25	<	5
Trichloroethene	5	ug/l	<	2	<	1	<	5	<	1
Vinyl chloride	2	ug/l	<	2	<	1	<	5	<	1

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML-12E

Parameter	Action Level	UNIT	MW03-ML-12E									
			2/1/2016	5/17/2016	8/17/2016	9/14/2016	10/31/2016	3/1/2017				
			RESULT	RESULT	RESULT	RESULT	RESULT	RESULT				
1,1,1-Trichloroethane	200	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,1,2-Tetrachloroethane	5	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,1-Dichloroethane	2,4 ⁶	ug/l	< 5	< 5	< 1	< 1	< 1	< 4				
1,1-Dichloroethene	7	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,2,4-Trichlorobenzene	70	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,2-Dibromoethane	0.05	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,2-Dichlorobenzene	600	ug/l	40	31	10	46	32	21.3				
1,2-Dichloroethane	5	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,2-Dichloropropane	5	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,3-Dichlorobenzene	600	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,4-Dichlorobenzene	75	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
1,4-Dioxane	-	ug/l	< 25	< 25	< 10	< 12	< 5	< 20				
2-Butanone (MEK)	4,000 ⁶	ug/l	< 25	< 25	< 5	< 5	< 10	< 20				
Benzene	5	ug/l	< 5	< 5	1.6	5.8	5.6	4.24				
Carbon Tetrachloride	5	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
Chlorobenzene	100	ug/l	530	460	120	590	160	340				
cis-1,2-Dichloroethene	70	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
Dichloromethane	5	ug/l	< 5	< 5	< 1	1.1	< 1	< 4				
Ethylbenzene	700	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
Methylbenzene (toluene)	1,000	ug/l	< 25	< 25	< 5	8.2	< 5	< 20				
Naphthalene	100 ⁶	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
Styrene	100	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
Tetrachloroethene	5	ug/l	< 5	< 5	< 1	< 1	< 1	< 4				
trans-1,2-Dichloroethene	100	ug/l	< 25	< 25	< 5	< 5	< 5	< 20				
Trichloroethene	5	ug/l	< 5	< 5	< 1	< 1	< 1	< 4				
Vinyl chloride	2	ug/l	< 5	< 5	< 1	< 1	< 1	< 4				

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedance of action levels

Bold indicates compound detected above method detection limit

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML12E							
			5/1/2017		8/21/2017		11/15/2017		2/6/2018	
			RESULT	RESULT*	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
1,1,1-Trichloroethane	200	ug/l	<	5	<	25	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	5	<	25	<	1	<	1
1,1-Dichloroethane	2.4 ⁶	ug/l	<	25	<	5	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	25	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	1	<	1
1,2-Dichlorobenzene	600	ug/l	<	25	<	25	<	28	<	36
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	25	<	25	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	25	<	25	<	3	<	4.1
1,4-Dioxane	-	ug/l	<	25	<	25	<	22	<	28
2-Butanone (MEK)	4,000 ⁶	ug/l	<	25	<	25	<	13	<	10
Benzene	5	ug/l	<	5	<	5	<	5.9	<	7.3
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	1	<	1
Chlorobenzene	100	ug/l	<	150	<	224	<	620	E	790
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	1	<	0.4
Dichloromethane	5	ug/l	<	5	<	5	<	1	<	1
Ethylbenzene	700	ug/l	<	25	<	25	<	1	<	1.1
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25	<	2.8	<	4.7
Naphthalene	100 ⁶	ug/l	<	25	<	25	<	1	<	1
Styrene	100	ug/l	<	25	<	25	<	1	<	1
Tetrachloroethene	5	ug/l	<	25	<	25	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	5	<	5	<	1	<	1
Trichloroethene	5	ug/l	<	25	<	25	<	1	<	1
Vinyl chloride	2	ug/l	<	25	<	25	<	0.5	<	0.5

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML12E							
			8/16/2018		11/8/2018		2/5/2019		5/7/2019	
			RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	10	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	10	<	1	<	1	<	1
1,1-Dichloroethane	2.4 ⁶	ug/l	<	10	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	10	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	10	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	20	<	2	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	10	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		31		12		33		12.5
1,2-Dichloroethane	5	ug/l	<	10	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	10	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	10	<	1	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	10	<	1		4.3	<	1
1,4-Dioxane	-	ug/l	<	1,000		33	<	100		122
2-Butanone (MEK)	4,000 ⁶	ug/l	<	50		78		34		43.5
Benzene	5	ug/l	<	10		2.5		6.6		3
Carbon Tetrachloride	5	ug/l	<	10	<	1	<	1	<	1
Chlorobenzene	100	ug/l		500		110		250		125
cis-1,2-Dichloroethene	70	ug/l	<	10	<	1	<	0.4	<	1
Dichloromethane	5	ug/l	<	10	<	5	<	1	<	1
Ethylbenzene	700	ug/l	<	10	<	1	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	<	10		1.9		2.8		1.7
Naphthalene	100 ⁶	ug/l	<	10	<	1	<	1	<	1
Styrene	100	ug/l	<	10	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	10	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	10	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	10	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	5	<	0.5	<	0.5	<	1

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection l:

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDE M GB Groundwater Objectives	Units	Date		Date		Date		Date			
				08/24/2011		12/02/2011		02/23/2012		06/04/2012			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	7	1	6	1	8	1	12	1	30	1
	Methyl tert-Butyl Ether	5,000	µg/L	1	1	1	1	2	1	4	1	7	1
	cis-1,2-Dichloroethene	2,400	µg/L	15	1	16	1	16	1	16	1	17	1
	Trichloroethene	540	µg/L	114	10	102	10	99	10	94	1	50	1
	Tetrachloroethene	150	µg/L	2	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	139		126		124		125		104	
	% Parent Products	NS	%	84%		81%		80%		75%		48%	
FIELD PARAMETERS													
	pH	NS	SU	6.5	6.3	6.2		6.2		NT		6.2	
	CONDUCTIVITY	NS	mS/cm	0.580	0.650	0.688		0.650		NT		0.650	
	TURBIDITY	NS	NTU	5	4	NT		NT		NT		5	
	DISSOLVED OXYGEN	NS	mg/L	0.7	1.1	0.9		0.9		NT		0.5	
	TEMPERATURE	NS	°C	18.2	15.7	12.9		12.9		NT		20.6	
	ORP	NS	mV	104	155	177		177		NT		72	

Notes:

RIDE M GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT TESTED

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date			
				12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit		
VOLATILE ORGANICS															
EPA 8260	Vinyl Chloride	2	µg/L	50	1	44	1	23	1	17	1	20	1	19	1
	Methyl tert-Butyl Ether	5,000	µg/L	13	1	9	1	6	1	3	1	2	1	2	1
	cis-1,2-Dichloroethene	2,400	µg/L	27	1	20	1	15	1	7	1	10	1	8	1
	Trichloroethene	540	µg/L	1	1	57	1	37	1	23	1	36	1	57	1
	Tetrachloroethene	150	µg/L	85	1	<	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	179		131		76		48		69		86	
	% Parent Products	NS	%	47%		43%		48%		49%		52%		66%	
FIELD PARAMETERS															
	pH	NS	SU	6.5	6.3		6.4		6.3		6.2		6.1		
	CONDUCTIVITY	NS	mS/cm	0.980	0.848		0.760		0.070		0.833		0.830		
	TURBIDITY	NS	NTU	4	7		18		5		8		10		
	DISSOLVED OXYGEN	NS	mg/L	3.3	NT		0.9		0.7		0.5		0.9		
	TEMPERATURE	NS	°C	16.8	12.1		15.2		19.6		11.4		19.1		
	ORP	NS	mV	113	82		87		150		32		-26		

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND F

< = NOT DETECTED

NS = NO STANDARD

NT = NOT

BGS = BELOW GROUND SURFACE

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient)		RIDE M GB	Units	Date		Date		Date		Date		Date	
				04/08/2015		09/17/2015		03/31/2016		10/13/2016		03/29/2017	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
Screen From 10'-20' BGS													
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	13	1	8	1	16	1	17	1	8	1
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	4	1	4	1	4	1	15	1	4	1
	Trichloroethene	540	µg/L	12	1	14	1	11	1	352	1	14	1
	Tetrachloroethene	150	µg/L	<	1	<	1	<	1	2	1	<	1
	Total VOCs	NS	µg/L	29		26		32		386		26	
	% Parent Products	NS	%	42%		54%		34%		92%		54%	
FIELD PARAMETERS													
pH	NS	SU	6.4		6.7		6.1		6.6		6.2		
CONDUCTIVITY	NS	mS/cm	0.581		0.920		1.030		0.419		1.270		
TURBIDITY	NS	NTU	10		12		3		5		3		
DISSOLVED OXYGEN	NS	mg/L	2.0		4.5		2.4		9.5		0.4		
TEMPERATURE	NS	°C	9.7		19.5		12.8		16.4		12.3		
ORP	NS	mV	141		-46		128		147		145		

Notes:

RIDE M GB EXCEEDANCES ARE IN BOLD AND F

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		
				09/21/2017		03/29/2018		09/27/2018		03/20/2019		
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	
VOLATILE ORGANICS												
EPA 8260		Vinyl Chloride	2	µg/L	3	1	5	1	3	1	1	1
		Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1
		cis-1,2-Dichloroethene	2,400	µg/L	82	1	5	1	2	1	3	1
		Trichloroethene	540	µg/L	40	1	30	1	10	1	28	1
		Tetrachloroethene	150	µg/L	<	1	<	1	<	1	<	1
		Total VOCs	NS	µg/L	125		39		16		32	
		% Parent Products	NS	%	32%		76%		65%		86%	
FIELD PARAMETERS												
pH		NS	SU	6.1		NT		6.0		6.1		
CONDUCTIVITY		NS	mS/cm	0.511		NT		0.549		1.020		
TURBIDITY		NS	NTU	2		NT		13		5		
DISSOLVED OXYGEN		NS	mg/L	2.2		NT		1.3		0.5		
TEMPERATURE		NS	°C	18.9		NT		19.3		12.5		
ORP		NS	mV	198		NT		181		165		

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND F

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date			
				Baseline		12/02/2011		02/23/2012		06/04/2012			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	2	1	7	1	2	1	5	1
	1,1,1-Trichloroethane	NS	µg/L	6	1	2	1	2	1	2	1	4	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1	1
	1,1-Dichloroethene	7	µg/L	3	1	2	1	4	1	4	1	5	1
	1,2-Dichloroethane	110	µg/L	6	1	5	1	5	1	5	1	7	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	2	1	<	1	3	1	3	1
	cis-1,2-Dichloroethene	2,400	µg/L	80	1	174	1	294	1	237	20	630	20
	Toluene	1,700	µg/L	2	1	2	1	2	1	1	1	2	1
	Trichloroethene	540	µg/L	1,550	50	1,050	50	843	50	1,420	20	1,290	20
	Tetrachloroethene	150	µg/L	503	50	356	50	347	50	445	20	432	20
	Total VOCs	NS	µg/L	2,174		1,748		1,651		2,278		2,481	
	% Parent Products	NS	%	94%		80%		72%		82%		69%	
FIELD PARAMETERS													
pH	NS	SU	5.8		6.1		6.3		NT		6.2		
CONDUCTIVITY	NS	mS/cm	2,280		5,820		5,866		NT		3,780		
TURBIDITY	NS	NTU	691		29		NT		NT		7		
DISSOLVED OXYGEN	NS	mg/L	5.6		1.4		2.3		NT		2.1		
TEMPERATURE	NS	°C	20.2		15.6		13.6		NT		21.8		
ORP	NS	mV	191		33		28		NT		71		

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

NT = NOT TESTED

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date	
				12/07/2012		03/06/2013		06/06/2013		09/05/2013	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS											
EPA 8260	Vinyl Chloride	2	µg/L	3	1	<	1	<	1	1	1
	1,1,1-Trichloroethane	NS	µg/L	4	1	3	1	5	1	5	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	2	1	2	1
	1,1-Dichloroethane	NS	µg/L	2	1	1	1	2	1	3	1
	1,1-Dichloroethene	7	µg/L	7	1	4	1	7	1	8	1
	1,2-Dichloroethane	110	µg/L	11	1	8	1	13	1	18	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	3	1	6	1	8	1
	cis-1,2-Dichloroethene	2,400	µg/L	634	20	279	50	436	50	529	50
	Toluene	1,700	µg/L	3	1	3	1	7	1	12	1
	Trichloroethene	540	µg/L	1,980	20	2,680	50	4,390	50	7,230	50
	Tetrachloroethene	150	µg/L	422	20	720	50	801	50	686	50
	Total VOCs	NS	µg/L	3,159		3,766		5,747		8,596	
	% Parent Products	NS	%	76%		90%		90%		92%	
FIELD PARAMETERS											
pH	NS	SU	6.6	6.6	6.4	6.2	6.2	6.3	6.3	6.4	
CONDUCTIVITY	NS	mS/cm	4.180	4.180	2.670	2.750	2.750	3.440	3.440	1.861	
TURBIDITY	NS	NTU	22	22	12	26	26	24	24	11	
DISSOLVED OXYGEN	NS	mg/L	1.5	1.5	NT	2.1	2.1	2.8	2.8	7.6	
TEMPERATURE	NS	°C	15.2	15.2	10.5	16.1	16.1	19.7	19.7	12.0	
ORP	NS	mV	77	77	162	50	50	214	214	155	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIG

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				09/10/2014		04/08/2015		09/17/2015		03/31/2016		08/12/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	100	1	1	<	1	17	1	<	10
	1,1,1-Trichloroethane	NS	µg/L	<	100	3	1	3	1	2	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	100	2	1	2	1	15	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	100	2	1	2	1	2	1	<	1
	1,1-Dichloroethene	7	µg/L	<	100	8	1	6	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	<	100	2	1	7	1	352	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	100	8	1	5	1	16	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	518	100	456	200	504	200	147	200	390	200
	Toluene	1,700	µg/L	123	100	70	1	53	1	62	1	39	
	Trichloroethene	540	µg/L	17,800	1,000	11,800	200	16,400	200	9,510	200	11,700	200
	Tetrachloroethene	150	µg/L	587	100	868	200	946	200	599	200	905	200
	Total VOCs	NS	µg/L	19,028		13,314		17,973		11,168		13,034	
	% Parent Products	NS	%	97%		95%		97%		91%		97%	
FIELD PARAMETERS													
	pH	NS	SU	6.2		6.5		6.6		6.4		6.4	
	CONDUCTIVITY	NS	mS/cm	2,740		3,690		3,810		4,110		3,949	
	TURBIDITY	NS	NTU	15		5		59		28		35	
	DISSOLVED OXYGEN	NS	mg/L	1.4		0.9		0.9		5.5		1.4	
	TEMPERATURE	NS	°C	19.2		10.0		22.0		14.6		20.9	
	ORP	NS	mV	8		79		49		185		205	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIG

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDE M GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	333	10	40.3	1	45.1	1	21.9	1	7.4	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	1	1	1	1	1	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	6	1	2	1	3	1	2	1	2	1
	1,2-Dichloroethane	110	µg/L	3	1	1	1	1	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	2	1	2	1	<	1	2	1
	cis-1,2-Dichloroethene	2,400	µg/L	2,540	200	910	100	533	100	203	100	143	100
	Toluene	1,700	µg/L	4	1	2	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	3,120	200	2,170	100	3,290	100	4,740	100	4,710	100
	Tetrachloroethene	150	µg/L	75	200	84	1	157	1	224	1	313	1
	Total VOCs	NS	µg/L	6,101		3,296		4,048		5,195		5,181	
	% Parent Products	NS	%	52%		68%		85%		96%		97%	
FIELD PARAMETERS													
	pH	NS	SU	6.8	7.3	6.3	7.2	6.9					
	CONDUCTIVITY	NS	mS/cm	2,840	2,860	2,701	4,320	3,400					
	TURBIDITY	NS	NTU	33	NT	5	36	25					
	DISSOLVED OXYGEN	NS	mg/L	0.3	6.2	2.8	0.3	0.4					
	TEMPERATURE	NS	°C	12.3	21.5	10.3	20.1	12.8					
	ORP	NS	mV	-81	-73	-7	-42	-66					

Notes:

RIDE M GB EXCEEDANCES ARE IN BOLD AND HIG

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date (Blind Duplicate)		
				8/24/2011		12/02/2011		02/23/2012			06/04/2012	
				Result	Limit	Result	Limit	Result	Limit		Result	Limit
VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	
	1,1,1-Trichloroethane	NS	µg/L	10	1	2	1	<	1	<	1	
	1,1,2-Trichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	
	1,1-Dichloroethane	NS	µg/L	1	1	4	1	3	1	<	1	
	1,1-Dichloroethene	7	µg/L	4	1	<	1	3	1	4	1	
	1,2-Dichloroethane	110	µg/L	9	1	6	1	<	1	1	1	
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	3	1	3	1	3	1	
	cis-1,2-Dichloroethene	2,400	µg/L	146	50	106	1	129	1	107	10	
	Trichloroethene	540	µg/L	3,210	50	1,400	50	636	50	434	10	
	Tetrachloroethene	150	µg/L	1,180	50	366	50	127	50	91	10	
	Total VOCs	NS	µg/L	4,624		2,026		997		691	733	
	% Parent Products	NS	%	95%		87%		76%		76%	79%	
FIELD PARAMETERS												
	pH	NS	SU	5.8		5.7		6.2		NT	6.2	
	CONDUCTIVITY	NS	mS/cm	0.376		6.260		4.070		NT	2.110	
	TURBIDITY	NS	NTU	1649		25		NT		NT	17	
	DISSOLVED OXYGEN	NS	mg/L	4.3		3.3		8.5		NT	0.9	
	TEMPERATURE	NS	°C	22.2		16.2		13.1		NT	21.3	
	ORP	NS	mV	334		93		168		NT	81	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

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NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient)		RIDEM GB	Units	Date		Date		Date		Date			
				08/29/2012		12/07/2012		03/06/2013		06/06/2013			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
Screen From 8'-18' BGS		Groundwater Objectives											
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	<	1	3	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	2	1	<	1	1	1	2	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	2	1	8	1
	1,1-Dichloroethene	7	µg/L	3	1	2	1	<	1	2	1	3	1
	1,2-Dichloroethane	110	µg/L	2	1	1	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	2	1	<	1	2	1	4	1
	cis-1,2-Dichloroethene	2,400	µg/L	130	10	142	10	20	1	239	1	454	1
	Trichloroethene	540	µg/L	406	10	547	10	171	10	1,110	10	3,680	10
	Tetrachloroethene	150	µg/L	63	10	48	10	23	1	64	1	70	1
	Total VOCs	NS	µg/L	691		823		227		1,421		4,244	
	% Parent Products	NS	%	68%		72%		86%		83%		88%	
FIELD PARAMETERS													
	pH	NS	SU	NT		6.5		7.0		6.7		6.8	
	CONDUCTIVITY	NS	mS/cm	NT		2,070		1,274		1,810		2,370	
	TURBIDITY	NS	NTU	NT		12		18		15		230	
	DISSOLVED OXYGEN	NS	mg/L	NT		1.0		NT		5.0		1.4	
	TEMPERATURE	NS	°C	NT		16.3		10.5		14.8		20.8	
	ORP	NS	mV	NT		91		0.8		15		245	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

NT = NOT

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient)	RIDEM GB	Units	Date		Date		Date		Date		Date	
			03/18/2014		09/10/2014		04/08/2015		03/31/2016		10/13/2016	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
			VOLATILE ORGANICS									
Screen From 8'-18' BGS	2	µg/L	2	1	11	1	5	1	1	50	2	50
	NS	µg/L	2	1	4	1	<	1	<	50	<	50
	NS	µg/L	<	1	3	1	<	1	<	50	2	50
	NS	µg/L	7	1	23	1	10	1	5	50	11	50
	7	µg/L	2	1	4	1	2	1	<	50	2	50
	110	µg/L	2	1	5	1	2	1	1	50	3	50
	2,800	µg/L	2	1	5	1	2	1	1	50	1	50
	2,400	µg/L	351	100	1,220	200	285	100	127	50	437	50
	540	µg/L	3,750	100	15,500	200	4,710	100	2,560	500	3,540	500
	150	µg/L	81	1	52	1	47	1	33	50	22	50
	NS	µg/L	4,242		16,881		5,073		2,732		4,042	
% Parent Products	NS	%	90%		92%		94%		95%		88%	
FIELD PARAMETERS												
	NS	SU	6.6		6.6		6.8		6.7		7.5	
CONDUCTIVITY	NS	mS/cm	1.094		2.160		9.57		10.49		0.68	
TURBIDITY	NS	NTU	10		11		<5		48		6	
DISSOLVED OXYGEN	NS	mg/L	3.8		2.2		3.9		10.4		7.3	
TEMPERATURE	NS	°C	10.9		19.1		10.1		13.9		21.4	
ORP	NS	mV	170		121		247.8		179		71	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient)		RIDEM GB	Units	Date		Date		Date		Date		Date		
				03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019		
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
Screen From 8'-18' BGS		Groundwater Objectives												
		VOLATILE ORGANICS												
		Vinyl Chloride	2	µg/L	<	1	2	1	<	1	<	1	<	1
		1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
		1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
		1,1-Dichloroethane	NS	µg/L	<	1	4	1	<	1	<	1	<	1
		1,1-Dichloroethene	7	µg/L	<	1	1	1	<	1	<	1	<	1
		1,2-Dichloroethane	110	µg/L	<	1	1	1	<	1	<	1	<	1
		trans-1,2-Dichloroethene	2,800	µg/L	<	1	1	1	<	1	<	1	<	1
		cis-1,2-Dichloroethene	2,400	µg/L	33	1	279	1	70	1	31	1	2	1
		Trichloroethene	540	µg/L	234	10	2,020	1	417	10	416	10	38	10
		Tetrachloroethene	150	µg/L	3	1	17	1	4	1	6	1	1	1
		Total VOCs	NS	µg/L	271		2,331		491		453	41		
		% Parent Products	NS	%	88%		87%		86%		93%	95%		
		FIELD PARAMETERS												
		pH	NS	SU	6.9	7.7		6.8		6.9		6.8		
		CONDUCTIVITY	NS	mS/cm	5.71	3.56		5.58		4.21		5.10		
		TURBIDITY	NS	NTU	11	NT		4		>5		>5		
		DISSOLVED OXYGEN	NS	mg/L	0.5	6.8		3.6		1.4		0.8		
		TEMPERATURE	NS	°C	10.3	21.2		8.6		20.3		11.6		
		ORP	NS	mV	131	180		297		157		144		

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND

< = NOT DETECTED

NS = NO STANDARD

NT = NOT

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date			
				8/24/2011		12/02/2011		02/23/2012		06/04/2012			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	1.4	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	32	1	5	1	<	1	6	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	1	1	2	1	<	1	1	1	1	1
	1,1-Dichloroethane	NS	µg/L	3	1	2	1	<	1	3	1	4	1
	1,1-Dichloroethene	7	µg/L	133	1	13	1	<	1	4	1	<	1
	1,2-Dichloroethane	110	µg/L	2	1	3	1	1	1	3	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	2	1	<	1	4	1	2	1
	cis-1,2-Dichloroethene	2,400	µg/L	833	50	597	1	215	1	722	50	693	50
	Trichloroethene	540	µg/L	1,840	50	1,700	1	511	1	1,700	50	909	50
	Tetrachloroethene	150	µg/L	49	1	44	1	15	1	54	1	15	1
	Total VOCs	NS	µg/L	2,906		2,651		938		2,714		2,006	
	% Parent Products	NS	%	65%		66%		56%		65%		46%	
FIELD PARAMETERS													
	pH	NS	SU	5.7	5.6		5.2		NT		6.0		
	CONDUCTIVITY	NS	mS/cm	0.971	2,900		2,455		NT		2,360		
	TURBIDITY	NS	NTU	522	>500		NT		NT		NT		
	DISSOLVED OXYGEN	NS	mg/L	2.3	8.6		9.3		NT		4.9		
	TEMPERATURE	NS	°C	20.2	16.0		17.1		NT		21.3		
	ORP	NS	mV	168	91		57		NT		-30		

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

NT = NOT TESTED

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date			
				12/07/2012		03/06/2013		06/06/2013		09/05/2013			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	2	1	<	1	<	1	3	1	6	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	6	1	5	1	<	1	<	1	6	1
	1,1-Dichloroethene	7	µg/L	6	1	5	1	<	1	12	1	12	1
	1,2-Dichloroethane	110	µg/L	2	1	2	1	<	1	<	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	5	1	5	1	6	1	2	1	5	1
	cis-1,2-Dichloroethene	2,400	µg/L	2,560	50	2,060	50	3,140	50	1,320	50	1,980	100
	Trichloroethene	540	µg/L	77	50	163	50	27	50	4	50	460	100
	Tetrachloroethene	150	µg/L	6	1	11	1	<	1	<	1	11	1
	Total VOCs	NS	µg/L	2,951		2,319		3,210		1,433		2,577	
	% Parent Products	NS	%	3%		7%		1%		0.3%		18%	
FIELD PARAMETERS													
pH	NS	SU	6.0	7.0	6.6	6.4	6.7						
CONDUCTIVITY	NS	mS/cm	1,990	1,460	1,320	0.450	1,001						
TURBIDITY	NS	NTU	>500	16	55	>500	450						
DISSOLVED OXYGEN	NS	mg/L	2.7	NT	1.5	5.9	0.8						
TEMPERATURE	NS	°C	17.1	13.8	16.1	20.8	12.8						
ORP	NS	mV	-80	-43	-8	-34	-34						

Notes:

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

NT = NO'

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				09/10/2014		04/08/2015		09/17/2015		03/31/2016		10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	3	1	<	1	1	1	<	1	36	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	1	1	2	1	2	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	5	1	3	1	7	1	6	1	6	1
	1,1-Dichloroethene	7	µg/L	8	1	<	1	12	1	2	1	4	1
	1,2-Dichloroethane	110	µg/L	2	1	<	1	1	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	<	1	2	1	1	1	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	3,500	100	194	50	2,020	50	433	50	507	50
	Trichloroethene	540	µg/L	397	100	776	50	2,710	50	1,440	50	1,090	50
	Tetrachloroethene	150	µg/L	10	1	10	1	11	1	17	1	10	1
	Total VOCs	NS	µg/L	3,975		999		4,775		1,918		1,655	
	% Parent Products	NS	%	10%		79%		57%		76%		66%	
FIELD PARAMETERS													
pH	NS	SU	6.3	6.2	7.4	6.4	6.8						
CONDUCTIVITY	NS	mS/cm	0.880	8.62	0.59	2.39	0.93						
TURBIDITY	NS	NTU	>500	5	NT	>500	650						
DISSOLVED OXYGEN	NS	mg/L	1.1	1.6	3.0	11.5	10.5						
TEMPERATURE	NS	°C	19.5	11.3	23.6	13.6	14.2						
ORP	NS	mV	-95	196	-14	95	130						

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

NT = NO

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	10	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	2	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	25	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	39	50	49	1	26	1	100	1	2	1
	Trichloroethene	540	µg/L	196	50	104	10	72	10	309	10	7	10
	Tetrachloroethene	150	µg/L	2	1	<	1	1	1	3	1	<	1
	Total VOCs	NS	µg/L	237		155		98		448		9	
	% Parent Products	NS	%	84%		67%		74%		70%		78%	
FIELD PARAMETERS													
	pH	NS	SU	6.7		7.5		6.8		6.1		6.3	
	CONDUCTIVITY	NS	mS/cm	2.87		3.21		2.70		4.03		3.05	
	TURBIDITY	NS	NTU	20		NT		68		67		52	
	DISSOLVED OXYGEN	NS	mg/L	0.5		8.2		6.4		1.5		0.9	
	TEMPERATURE	NS	°C	11.4		26.0		8.7		20.1		12.8	
	ORP	NS	mV	126		120		155		143		130	

Notes:

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

NT = NO

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date	
				8/24/2011		12/05/2011		02/24/2012		06/04/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS											
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	5	1	2	1	<	1	2	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	1	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	1	1	<	1	4	1	1	<
	1,1-Dichloroethene	7	µg/L	7	1	<	1	<	1	<	2
	1,2-Dichloroethane	110	µg/L	8	1	6	1	<	1	5	1
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	1.1	1	<	1	1.4	<
	cis-1,2-Dichloroethene	2,400	µg/L	134	50	102	50	52.0	50	113	20
	Trichloroethene	540	µg/L	1,720	50	998	50	529	50	1,390	20
	Tetrachloroethene	150	µg/L	500	50	204	50	182	50	453	20
	Total VOCs	NS	µg/L	2,400		1,316		767		1,969	
% Parent Products		NS	%	93%		91%		93%		94%	
FIELD PARAMETERS											
pH		NS	SU	6.6		6.4		6.9		NT	6.1
CONDUCTIVITY		NS	mS/cm	2,681		4,910		5,011		NT	2,550
TURBIDITY		NS	NTU	934		5		NT		NT	6
DISSOLVED OXYGEN		NS	mg/L	7.4		8.3		6.8		NT	8.0
TEMPERATURE		NS	°C	22.7		18.4		7.8		NT	22.7
ORP		NS	mV	171		110		146		NT	167

Notes:

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and allowed to recover prior to sampling.

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient)		RIDEM GB	Units	Date		Date		Date		Date		Date	
				12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
Screen From 7'-17' BGS													
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	3	1	<	1	2	1	1	<	1	
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	4	2	<	2	2	2	2	<	1	
	1,2-Dichloroethane	110	µg/L	9	1	<	1	<	1	5	1	1	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	<	1	2	1	1	<	1	
	cis-1,2-Dichloroethene	2,400	µg/L	120	20	34	1	102	1	81	1	68	1
	Trichloroethene	540	µg/L	1,620	20	322	20	1,480	20	1,360	20	518	10
	Tetrachloroethene	150	µg/L	396	20	180	20	415	20	325	20	210	10
	Total VOCs	NS	µg/L	2,161		549		2,007		1,774		805	
% Parent Products	NS	%	93%		91%		94%		95%		90%		
FIELD PARAMETERS													
pH	NS	SU	5.7		6.4		7.1		6.1		6.2		
CONDUCTIVITY	NS	mS/cm	2,410		1,640		1,530		3,450		0.837		
TURBIDITY	NS	NTU	19		3		28		>500		8		
DISSOLVED OXYGEN	NS	mg/L	3.8		NT		7.1		7.2		0.8		
TEMPERATURE	NS	°C	15.7		14.0		18.6		22.1		14.5		
ORP	NS	mV	237		150		95		184		157		

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and

NT = NOT TESTED

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient)		RIDEM GB	Units	Date		Date		Date		Date		Date	
				09/10/2014		04/08/2015		09/16/2015		03/31/2016		10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
Screen From 7'-17' BGS													
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	4	1	2	1	10	1	5	1
	1,1,1-Trichloroethane	NS	µg/L	2	1	<	1	1	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	1	1	3	1	5	1
	1,1-Dichloroethene	7	µg/L	3	1	<	1	2	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	5	1	<	1	3	1	<	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	<	1	1	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	87	50	119	10	160	10	208	10	294	50
	Trichloroethene	540	µg/L	950	50	266	10	1,260	10	798	10	1,390	50
	Tetrachloroethene	150	µg/L	118	50	52	1	174	1	81	1	84	1
	Total VOCs	NS	µg/L	1,172		440		1,610		1,104		1,795	
% Parent Products	NS	%	91%		72%		89%		80%		82%		
FIELD PARAMETERS													
pH	NS	SU	5.6		6.0		6.1		5.9		5.8		
CONDUCTIVITY	NS	mS/cm	1,360		1.70		2.15		4.56		NT		
TURBIDITY	NS	NTU	52		8		62		13		9		
DISSOLVED OXYGEN	NS	mg/L	1.9		3.0		5.5		8.3		8.4		
TEMPERATURE	NS	°C	20.5		12.5		26.6		16.6		17.9		
ORP	NS	mV	67		118		177		199		188		

Notes:

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

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BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	3	1	5	1	1	1	4	1	1.5	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	3	1	2	1	2	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	2	1	<	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	1	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	246	20	268	50	247	20	233	20	114	20
	Trichloroethene	540	µg/L	895	20	1,320	50	475	20	914	20	316	20
	Tetrachloroethene	150	µg/L	38	1	89	50	6	1	23	1	7	1
	Total VOCs	NS	µg/L	1,191		1,710		735		1,178		438	
% Parent Products		NS	%	78%		82%		65%		80%		74%	
FIELD PARAMETERS													
pH		NS	SU	5.6		NT		5.4		5.5		5.6	
CONDUCTIVITY		NS	mS/cm	4.31		NT		4.38		3.59		4.12	
TURBIDITY		NS	NTU	36		NT		12		0		2	
DISSOLVED OXYGEN		NS	mg/L	0.3		NT		7.8		1.8		0.6	
TEMPERATURE		NS	°C	14.3		NT		12.2		21.2		13.0	
ORP		NS	mV	169		NT		227		190		202	

Notes:

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient)	RIDE M GB	Units	Date		Date (Blind Duplicate)		Date		Date (Blind Duplicate)		Date	
			Baseline		12/05/2011		02/24/2012		02/24/2012		06/04/2012	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
Screen From 8'-18' BGS	Groundwater Objectives											
VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<
	1,1,1-Trichloroethane	NS	µg/L	106	20	10	1	11	1	2	1	2
	1,1-Dichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<
	1,1-Dichloroethene	7	µg/L	61	1	6	1	7	1	<	1	2
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<
	cis-1,2-Dichloroethene	2,400	µg/L	7	1	3	1	3	1	3	1	6
	Trichloroethene	540	µg/L	797	20	203	10	198	10	82	10	156
	Tetrachloroethene	150	µg/L	39	1	7	1	7	1	5	1	10
	Total VOCs	NS	µg/L	1,017		230		226		92		175
	% Parent Products	NS	%	82%		91%		91%		94%		95%
FIELD PARAMETERS												
pH	NS	SU	6.6	5.8	NA	6.6	NA	6.6	NA	NA	NT	
CONDUCTIVITY	NS	ms/cm	0.599	1.195	NA	1.015	NA	1.015	NA	NA	NT	
TURBIDITY	NS	NTU	>1000	>1000	NA	NT	NA	NT	NA	NA	NT	
DISSOLVED OXYGEN	NS	mg/L	2.2	2.4	NA	6.2	NA	6.2	NA	NA	NT	
TEMPERATURE	NS	°C	21.2	17.3	NA	9.2	NA	9.2	NA	NA	NT	
ORP	NS	mV	126	136	NA	67	NA	67	NA	NA	NT	

Notes:

**RIDE GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

NT = NOT TESTED

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient)	RIDEM GB	Units	Date		Date		Date		Date (Blind Duplicate)		Date		Date		
	Groundwater Objectives		08/29/2012		12/07/2012		03/06/2013		03/06/2013		06/06/2013		09/05/2013		
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
VOLATILE ORGANICS															
EPA 8260	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	1	1	1	1	<	1	<	1	<	1	1	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	1	1	1	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	8	1	10	1	3	1	3	1	10	1	9	1
	Trichloroethene	540	µg/L	127	10	205	10	44	1	43	1	136	1	214	1
	Tetrachloroethene	150	µg/L	6	1	12	1	4	1	4	1	7	1	7	1
	Total VOCs	NS	µg/L	145		231		51		49		153		231	
	% Parent Products	NS	%	92%		94%		95%		95%		93%		96%	
FIELD PARAMETERS															
pH	NS	SU	5.8	5.8	7.890	6.6	NA	6.5	6.0						
	CONDUCTIVITY	NS	mS/cm	7.680	7.890	8.060	8.060	NA	5.880	6.800					
	TURBIDITY	NS	NTU	NT	NT	NT	NT	NA	>1000	>500					
	DISSOLVED OXYGEN	NS	mg/L	3.0	6.9	NT	NT	NA	7.2	6.6					
	TEMPERATURE	NS	°C	20.8	17.4	12.5	12.5	NA	16.9	21.7					
	ORP	NS	mV	147	159	84.9	84.9	NA	91	225					

Notes:

**RIDE GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

NT = NOT TESTED

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB	Units	Date (Blind Duplicate)		Date		Date		Date		Date									
				09/05/2013	Limit	Result	Limit	10/13/2016	Result	Limit	03/29/2017	Result	Limit	04/08/2015	Result	Limit	09/16/2015	Result	Limit	03/31/2016	Result
VOLATILE ORGANICS																					
EPA 8260	Vinyl Chloride	2	µg/L	<	1	17	1	8	1	<	1	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	10	1	386	1	26	1	3	1	16	1	63	1	139	1	175	1	175	1
	Trichloroethene	540	µg/L	207	1	1	10	1	10	63	1	139	1	139	1	139	1	175	1	175	1
	Tetrachloroethene	150	µg/L	7	1	0	1	0	1	0	1	16	1	4	1	4	1	24	1	24	1
	Total VOCs	NS	µg/L	225		2		1		81		159		217		217		217		217	
	% Parent Products	NS	%	95%		80%		49%		97%		90%		92%		92%		92%		92%	
FIELD PARAMETERS																					
pH	NS	SU	NA		9.5				6.0		6.3				5.4						
CONDUCTIVITY	NS	mS/cm	NA		16,400				13.61		6.02				11.34						
TURBIDITY	NS	NTU	NA		147.0				high		78.0				3.0						
DISSOLVED OXYGEN	NS	mg/L	NA		3.65			3.65	4.89		5.53				1.25						
TEMPERATURE	NS	°C	NA		14.6			14.6	12.6		24.5				15.9						
ORP	NS	mV	NA		121			121	59.1		91				179						

Notes:

**RIDE GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

NT = NOT TESTED

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				10/19/2016		03/19/2017		09/26/2017		03/29/2018		09/27/2018	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	2	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	19	1	4	1	12	1	1	1	<	1
	Trichloroethene	540	µg/L	6	1	41	1	63	1	16	1	13	4
	Tetrachloroethene	150	µg/L	124	10	3	1	2	1	1	1	1	<
	Total VOCs	NS	µg/L	150		49		77		18		14	4
	% Parent Products	NS	%	87%		89%		85%		94%		#####	#####
FIELD PARAMETERS													
pH	NS	SU	6.0		NT		6.6		6.7		6.3		6.4
CONDUCTIVITY	NS	mS/cm	0.83		NT		7.01		9.13		9.10		8.61
TURBIDITY	NS	NTU	156.0		NT		NT		88.2		<5		15
DISSOLVED OXYGEN	NS	mg/L	7.64		NT		7.03		6.74		4.4		5.2
TEMPERATURE	NS	°C	20.7		NT		23		14.8		20.8		13.1
ORP	NS	mV	267		NT		160		188		171		193

Notes:

**RIDE GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area) Screen From 8'-18' BGS	RIDE M GB Groundwater Objectives	Units	Date		Date		Date		Date	
			8/24/2011		12/02/2011		02/23/2012		06/04/2012	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	VOLATILE ORGANICS									
	Vinyl Chloride	µg/L	<	1	10	1	4	1	6	1
	1,1,1-Trichloroethane	µg/L	<	1	7	1	4	1	3	1
	1,1,2-Trichloroethane	µg/L	<	1	1	1	<	1	<	1
	1,1-Dichloroethane	µg/L	<	1	4	1	2	1	2	1
	1,1-Dichloroethene	µg/L	<	1	9	1	<	1	6	1
	1,2-Dichloroethane	µg/L	<	1	4	1	1	1	1	1
	cis-1,2-Dichloroethene	µg/L	112	100	3,240	100	1,500	100	3,720	50
	trans-1,2-Dichloroethene	µg/L	<	1	3	1	1	1	5	1
	Ethylbenzene	µg/L	<	1	2	1	<	1	1	1
	Trichloroethene	µg/L	7,960	100	1,150	100	204	100	206	50
	Tetrachloroethene	µg/L	9,180	1,000	1,520	100	642	100	572	50
	Toluene	µg/L	<	1	4	1	1	1	2	1
	Total VOCs	µg/L	17,252		6,090		2,442		4,569	
	% Parent Products	%	99%		44%		35%		17%	
FIELD PARAMETERS										
	pH	SU	4.5		6.9		7.0		7.1	8.1
	CONDUCTIVITY	mS/cm	1,221		2,100		1,639		0,860	1,100
	TURBIDITY	NTU	43		7		NT		NT	NT
	DISSOLVED OXYGEN	mg/L	2.1		1.1		6.2		1.0	5.6
	TEMPERATURE	°C	19.5		15.5		14.4		15.7	29.0
	ORP	mV	240		-111		-141		-151	0

Notes:

**RIDE M GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT TESTED

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area)		RIDE M GB	Units	Date		Date		Date		Date	
				12/07/2012		03/06/2013		06/06/2013		09/05/2013	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit
Screen From 8'-18' BGS											
VOLATILE ORGANICS											
EPA 8260	Vinyl Chloride	2	µg/L	1.7	1	<	1	<	1	1	1
	1,1,1-Trichloroethane	3,100	µg/L	1	1	4	1	2	1	1	3
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	1	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	2	1	1	1	<	1	<	3
	1,2-Dichloroethane	110	µg/L	<	1	1	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	1,850	50	788	200	243	200	464	50
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	<	1	<	1	<	1
	Ethylbenzene	1,600	µg/L	<	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	247	50	1,190	200	762	100	327	50
	Tetrachloroethene	150	µg/L	268	50	1,600	200	1,130	100	986	50
	Toluene	1,700	µg/L	1	1	2	1	<	1	1	1
	Total VOCs	NS	µg/L	2,393		3,592		2,138		1,825	
	% Parent Products	NS	%	22%		78%		88%		72%	
FIELD PARAMETERS											
	pH	NS	SU	7.3		6.9		8.6		6.6	
	CONDUCTIVITY	NS	mS/cm	0.890		0.980		1.080		1.460	
	TURBIDITY	NS	NTU	7		35		22		58	
	DISSOLVED OXYGEN	NS	mg/L	2.1		NT		2.0		1.0	
	TEMPERATURE	NS	°C	17.0		14.0		17.3		22.3	
	ORP	NS	mV	-85		-39		78		-12	

Notes:

**RIDE M GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT TESTED

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area)		RIDE M GB	Units	Date		Date		Date		Date			
				09/10/2014		04/08/2015		09/17/2015		03/31/2016			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
Screen From 8'-18' BGS		Groundwater	Objectives										
		VOLATILE ORGANICS											
		Vinyl Chloride		2	µg/L	<	1	<	1	<	1	<	1
		1,1,1-Trichloroethane		3,100	µg/L	<	1	<	1	<	1	<	3
		1,1,2-Trichloroethane		NS	µg/L	<	1	<	1	<	1	<	1
		1,1-Dichloroethane		NS	µg/L	<	1	<	1	<	1	<	1
		1,1-Dichloroethene		7	µg/L	2	1	<	1	<	1	1	1
		1,2-Dichloroethane		110	µg/L	<	1	<	1	<	1	<	1
		cis-1,2-Dichloroethene		2,400	µg/L	92	1	49	1	23	1	202	1
		trans-1,2-Dichloroethene		2,800	µg/L	<	1	<	1	<	1	<	1
		Ethylbenzene		1,600	µg/L	<	1	<	1	2	1	<	3
		Trichloroethene		540	µg/L	546	20	552	100	971	100	536	100
		Tetrachloroethene		150	µg/L	977	20	2,000	100	4,150	100	1,910	100
		Toluene		1,700	µg/L	2	1	1	1	2	1	2	1
Total VOCs		NS	µg/L	1,618		2,625		5,195		8,778			
% Parent Products		NS	%	94%		97%		99%		99%			

Notes:

**RIDE M GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT TESTED

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area)	RIDEM GB	Units	Date		Date		Date		Date				
			03/29/2017		09/21/2017		03/29/2018		09/27/2018				
			Result	Limit	Result	Limit	Result	Limit	Result	Limit			
Screen From 8'-18' BGS	Groundwater Objectives												
	VOLATILE ORGANICS												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1		
	1,1,1-Trichloroethane	3,100	µg/L	<	1	<	1	<	1	<	1		
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1		
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1		
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	<	1		
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1		
	cis-1,2-Dichloroethene	2,400	µg/L	9	1	12	1	153	20	11	20	5	20
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	Ethylbenzene	1,600	µg/L	<	1	<	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	151	100	56	1	15	1	19	1	16	1
	Tetrachloroethene	150	µg/L	2,000	100	801	100	394	20	102	10	109	10
	Toluene	1,700	µg/L	<	1	<	1	<	1	<	1	<	1
Total VOCs	NS	µg/L	2,181		885		562		133		129		
% Parent Products	NS	%	99%		97%		73%		92%		96%		
FIELD PARAMETERS													
	pH	NS	SU	6.5		NT		8.2		8.7		7.4	
	CONDUCTIVITY	NS	mS/cm	7.8		NT		17.9		7.0		7.1	
	TURBIDITY	NS	NTU	39		NT		NT		<5		<5	
	DISSOLVED OXYGEN	NS	mg/L	0.5		NT		8.4		0.4		1.2	
	TEMPERATURE	NS	°C	12.5		NT		8.2		19.7		12.4	
	ORP	NS	mV	143		NT		143.2		16		126	

Notes:

**RIDEM GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO STANDARD

BGS = BELOW GROUND SURFACE

NT = NOT TESTED

Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area)	RIDE M GB	Units	Date		Date		Date		Date		Date		
			8/24/2011		12/02/2011		02/23/2012		06/04/2012		08/29/2012		
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
Screen From 8'-18" BGS	VOLATILE ORGANICS												
	Vinyl Chloride	2	µg/L	<	1	2	1	<	1	14	1	13	1
	1,1,1-Trichloroethane	NS	µg/L	10	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	2	1	<	1	2	1	5	1
	1,1-Dichloroethene	7	µg/L	2	1	<	1	<	1	5	1	8	1
	1,2-Dichloroethane	110	µg/L	4	1	2	1	<	1	3	1	3	1
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	1	1	<	1	2	1	3	1
	cis-1,2-Dichloroethene	2,400	µg/L	705	50	989	1	390	1	1,650	50	2,430	50
	Trichloroethene	540	µg/L	2,290	50	167	1	23	1	1	1	1	1
	Tetrachloroethene	150	µg/L	63	1	9	1	2	1	<	1	<	1
	Total VOCs	NS	µg/L	3,090		1,951		752		1,999		2,501	
	% Parent Products	NS	%	76%		9%		3%		0.1%		0.1%	
	FIELD PARAMETERS												
	pH	NS	SU	7.1		7.1		7.6		NT		6.7	
CONDUCTIVITY	NS	mS/cm	0.800		3.330		2.480		NT		1.980		
TURBIDITY	NS	NTU	>1000		>1000		NT		NT		NT		
DISSOLVED OXYGEN	NS	mg/L	7.8		4.5		7.1		NT		0.8		
TEMPERATURE	NS	°C	21.6		14.9		15.8		NT		23.1		
ORP	NS	mV	172		-129		-151		NT		-61		

Notes:

RIDE M GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO S' NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area)	RIDE M GB	Units	Date		Date		Date		Date		Date			
			12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014			
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit		
Screen From 8'-18' BGS	Groundwater Objectives	VOLATILE ORGANICS												
		Vinyl Chloride	2	µg/L	29	1	75	1	<	1	113	1	103	100
		1,1,1-Trichloroethane	NS	µg/L	1	1	3	1	<	1	<	1	<	100
		1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	100
		1,1-Dichloroethane	NS	µg/L	<	1	12	1	<	1	53	1	<	100
		1,1-Dichloroethene	7	µg/L	14	1	16	1	<	1	26	1	<	100
		1,2-Dichloroethane	110	µg/L	4	1	6	1	<	1	14	1	<	100
		trans-1,2-Dichloroethene	2,800	µg/L	4	1	10	1	<	1	<	1	<	100
		cis-1,2-Dichloroethene	2,400	µg/L	1,850	50	5,000	500	11,600	500	10,000	50	29,300	1,000
		Trichloroethene	540	µg/L	9	1	41	1	<	1	13	50	680	100
		Tetrachloroethene	150	µg/L	1	1	2	1	<	1	<	10	<	100
		Total VOCs	NS	µg/L	1,938		5,210		11,600		10,218		30,083	
% Parent Products	NS	%	1%		1%				0.1%		2%			
FIELD PARAMETERS														
	pH	NS	SU	6.6		6.4		6.8		6.4		6.5		
	CONDUCTIVITY	NS	mS/cm	1,830		1,400		1,670		1,790		1,060		
	TURBIDITY	NS	NTU	>500		99		50		140		24		
	DISSOLVED OXYGEN	NS	mg/L	0.8		NT		1.9		0.9		1.2		
	TEMPERATURE	NS	°C	18.1		12.2		16.3		22.7		12.4		
ORP	NS	mV	-80		-68		-46		-70		-49			

Notes:

**RIDE M GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO S' NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area)	RIDE M GB	Units	Date		Date		Date		Date		Date			
			09/10/2014		04/08/2015		09/17/2015		03/31/2016		10/19/2016			
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit		
Screen From 8'-18' BGS	Groundwater Objectives	VOLATILE ORGANICS												
		Vinyl Chloride	2	µg/L	18	1	<	1	12	1	10	1	6	1
		1,1,1-Trichloroethane	NS	µg/L	<	1	<	100	<	1	<	1	1	1
		1,1,2-Trichloroethane	NS	µg/L	<	1	<	100	<	1	1	1	2	1
		1,1-Dichloroethane	NS	µg/L	42	1	142	100	39	1	54	1	73	1
		1,1-Dichloroethene	7	µg/L	19	1	<	100	15	1	16	1	27	1
		1,2-Dichloroethane	110	µg/L	5	1	<	100	5	1	8	1	6	1
		trans-1,2-Dichloroethene	2,800	µg/L	74	1	<	100	72	1	553	1	65	1
		cis-1,2-Dichloroethene	2,400	µg/L	11,100	200	34,900	1,000	10,500	200	16,500	200	17,300	1,000
		Trichloroethene	540	µg/L	1,890	200	7,220	100	1,000	1	3,550	1	4,760	1,000
EPA 8260	Tetrachloroethene	150	µg/L	9	1	<	100	4	1	39	1	18	1	
	Total VOCs	NS	µg/L	13,248		42,262		11,676		20,769		22,281		
	% Parent Products	NS	%	14%		17%		9%		17%		21%		
	FIELD PARAMETERS													
	pH	NS	SU	6.5		6.7		6.6		6.5		7.2		
	CONDUCTIVITY	NS	mS/cm	1,060		1.59		1.12		2.23		2.41		
	TURBIDITY	NS	NTU	>500		high		>500		2		14		
	DISSOLVED OXYGEN	NS	mg/L	1.6		5.3		4.4		14.2		0.9		
	TEMPERATURE	NS	°C	20.5		11.5		22.3		13.6		22.7		
ORP	NS	mV	-124		134		-101		19		-27			

Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area)	RIDE M GB	Units	Date		Date		Date		Date		Date		
			03/29/2017		09/21/2017		03/29/2018		10/30/2018		03/20/2019		
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
Screen From 8'-18' BGS	VOLATILE ORGANICS												
	Vinyl Chloride	2	µg/L	12	1	4	1	3	1	3	1	4	1
	1,1,1-Trichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	47	1	20	1	9	1	3	1	1	1
	1,1-Dichloroethene	7	µg/L	31	1	17	1	12	1	9	1	6	1
	1,2-Dichloroethane	110	µg/L	5	1	2	1	1	1	1	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	130	1	96	1	44	1	22	1	6	1
	cis-1,2-Dichloroethene	2,400	µg/L	17,300	500	11,800	1,000	6,260	100	5,800	100	3,540	100
	Trichloroethene	540	µg/L	9,040	1,000	3,650	1,000	3,410	100	2,420	100	1,950	100
	Tetrachloroethene	150	µg/L	27	1	11	1	15	1	9	1	9	1
	Total VOCs	NS	µg/L	26,613		15,609		9,755		8,266		5,516	
	% Parent Products	NS	%	34%		23%		35%		29%		36%	
	FIELD PARAMETERS												
	pH	NS	SU	NT	NT	NT	NT	6.5	6.5	6.8	6.8	6.6	6.6
	CONDUCTIVITY	NS	mS/cm	NT	NT	NT	NT	4.5	4.5	3.3	3.3	2.8	2.8
	TURBIDITY	NS	NTU	NT	NT	NT	NT	292	292	<5	<5	<5	<5
	DISSOLVED OXYGEN	NS	mg/L	NT	NT	NT	NT	3.5	3.5	4.6	4.6	2.4	2.4
	TEMPERATURE	NS	°C	NT	NT	NT	NT	12.1	12.1	19.8	19.8	12.7	12.7
ORP	NS	mV	NT	NT	NT	NT	NT	129	129	44	44	-30	-30

Notes:

**RIDE M GB EXCEEDANCES ARE IN BOLD AND
HIGHLIGHTED GREEN**

< = NOT DETECTED

NS = NO S' NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		
				8/24/2011		12/02/2011		02/23/2012		06/04/2012		
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	
VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	1	1	<	1	<	1	1	3	1
	1,1,1-Trichloroethane	NS	µg/L	6	1	<	1	<	1	<	1	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1
	1,1-Dichloroethene	7	µg/L	8	1	<	1	<	1	2	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	20	1	14	1	82	1	320	10	229
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1	<
	Trichloroethene	540	µg/L	719	20	112	10	35	10	32	1	5
	Tetrachloroethene	150	µg/L	11	1	2	1	2	1	5	1	<
	Total VOCs	NS	µg/L	765		1,340		185		415		287
% Parent Products		NS	%	95%		9%	20%		9%		2%	
FIELD PARAMETERS												
pH		NS	SU	5.2	6.4	7.0	NT	NT	6.3			
CONDUCTIVITY		NS	mS/cm	0.743	2.510	1.672	NT	NT	1.070			
TURBIDITY		NS	NTU	699	>500	NT	NT	NT	NT			
DISSOLVED OXYGEN		NS	mg/L	0.8	8.1	9.8	NT	NT	1.7			
TEMPERATURE		NS	°C	18.2	14.8	15.2	NT	NT	21.7			
ORP		NS	mV	204	-9	-133	NT	NT	-53			

Notes:

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HIGHLIGHTED GREEN**

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NT = NOT TESTED

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date			
				12/07/2012		03/06/2013		06/06/2013		09/05/2013			
				Result	Limit	Result	Limit	Result	Limit	Result	Limit		
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	3	1	2	1	1	1	4	1	3	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	2	1	<	1	1	1	2	1	1	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	265	10	224	10	252	10	321	10	251	10
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	1	1	1	1
	Trichloroethene	540	µg/L	2	1	3	1	4	1	5	1	34	1
	Tetrachloroethene	150	µg/L	1	1	<	1	<	1	<	1	5	1
	Total VOCs	NS	µg/L	314		253		321		333		311	
% Parent Products	NS	%	1%		1%		1%		1%		13%		
FIELD PARAMETERS													
	pH	NS	SU	6.4		6.8		6.7		6.9		6.2	
	CONDUCTIVITY	NS	mS/cm	1.010		0.810		0.820		0.880		0.562	
	TURBIDITY	NS	NTU	>500		1352		500		>500		640	
	DISSOLVED OXYGEN	NS	mg/L	2.6		NT		3.3		7.1		0.4	
	TEMPERATURE	NS	°C	17.2		13.8		16.9		20.2		12.7	
	ORP	NS	mV	-86		-22		70		-25		-25	

Notes:

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Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				09/10/2014		04/08/2015		09/17/2015		03/31/2016		10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	5	1	3	1	10	1	3	1	7	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	2	1	1	1	<	1
	1,1-Dichloroethene	7	µg/L	3	1	<	1	3	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	281	10	79	1	330	1	240	1	150	1
	Methyl tert-Butyl Ether	5,000	µg/L	2	1	1	1	3	1	1	1	2	1
	Trichloroethene	540	µg/L	28	1	51	1	57	1	89	1	77	1
	Tetrachloroethene	150	µg/L	<	1	13	1	2	1	61	1	2	1
	Total VOCs	NS	µg/L	332		147		417		395		237	
	% Parent Products	NS	%	9%		35%		14%		23%		33%	
	FIELD PARAMETERS												
	pH	NS	SU	6.0		6.1		6.3		5.6		5.8	
	CONDUCTIVITY	NS	mS/cm	0.060		0.790		0.860		0.780		0.234	
	TURBIDITY	NS	NTU	>500		5		>500		>500		5	
	DISSOLVED OXYGEN	NS	mg/L	0.6		2.3		0.3		7.8		0.7	
	TEMPERATURE	NS	°C	19.7		11.5		19.6		13.1		16.5	
	ORP	NS	mV	-90		46		-144		102		73	

Notes:

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NT = NOT

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS	RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
			03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	VOLATILE ORGANICS											
	Vinyl Chloride	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	µg/L	49	1	96	1	64	1	34	1	19	1
	Methyl tert-Butyl Ether	µg/L	<	1	<	1	<	1	<	1	<	1
	Trichloroethene	µg/L	46	1	31	1	56	1	41	1	43	1
	Tetrachloroethene	µg/L	3	1	<	1	2	1	2	1	2	1
	Total VOC's	µg/L	98		126		122		77		63	
	% Parent Products	%	50%		24%		48%		56%		70%	
	FIELD PARAMETERS											
	pH	NS	NT		7.3		6.0		5.2		6.1	
	CONDUCTIVITY	NS	NT		0.910		2.44		3.19		2.64	
	TURBIDITY	NS	NT		NT		96		>5		>5	
	DISSOLVED OXYGEN	NS	NT		8.6		7.9		1.0		1.3	
	TEMPERATURE	NS	NT		23.1		12.8		20.2		13.1	
	ORP	NS	NT		-32		185		210		166	

Notes:

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Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)	RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date		
			8/24/2011		12/05/2011		02/24/2012		06/04/2012		08/29/2012		
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
VOLATILE ORGANICS													
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	12	1	4	1	2	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	7	1	10	1	11	1	7	1	3	1
	1,1-Dichloroethene	7	µg/L	85	1	42	1	32	1	13	1	4	1
	1,2-Dichloroethane	110	µg/L	4	1	3	1	2	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	58	1	40	1	43	1	120	10	147	10
	Trichloroethene	540	µg/L	670	20	331	20	266	20	27	1	6	1
	Tetrachloroethene	150	µg/L	34	1	12	1	105	1	5	1	2	1
	Total VOCs	NS	µg/L	874		982		1,027		425		394	
	% Parent Products	NS	%	81%		35%		36%		8%		2%	
FIELD PARAMETERS													
	pH	NS	SU	6.7		4.9		5.8		NT		NT	
	CONDUCTIVITY	NS	mS/cm	1,293		3,770		4,111		NT		NT	
	TURBIDITY	NS	NTU	1691		<100		NT		NT		NT	
	DISSOLVED OXYGEN	NS	mg/L	1.3		0.9		0.6		NT		NT	
	TEMPERATURE	NS	°C	27.3		15.2		12.9		NT		NT	
	ORP	NS	mV	276		99		-72		NT		NT	

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Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)	RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date		
			12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014		
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
			VOLATILE ORGANICS										
EPA 8260	Vinyl Chloride	2	µg/L	1	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	4	1	5	1	3	1
	1,1-Dichloroethene	7	µg/L	12	1	8	1	17	1	23	1	13	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	270	10	130	10	197	10	230	10	152	10
	Trichloroethene	540	µg/L	29	1	2	1	3	1	3	1	4	1
	Tetrachloroethene	150	µg/L	1	1	<	1	<	1	<	1	2	1
	Total VOCs	NS	µg/L	302		160		222		261		174	
% Parent Products	NS	%	10%		1%		1%		1%		4%		
FIELD PARAMETERS													
	pH	NS	SU	7.0	7.0	7.2	7.0	7.0	6.9	6.9	6.9	6.9	6.9
	CONDUCTIVITY	NS	mS/cm	1.890	1.890	1.380	1.110	1.110	1.180	1.180	0.710	0.710	0.710
	TURBIDITY	NS	NTU	>500		NT	900	900	>500	>500	7	7	7
	DISSOLVED OXYGEN	NS	mg/L	1.4		NT	0.4	0.4	1.3	1.3	3.2	3.2	3.2
	TEMPERATURE	NS	°C	15.0		10.8	16.7	16.7	20.0	20.0	14.1	14.1	14.1
	ORP	NS	mV	-129		-103	-95	-95	-110	-110	-36	-36	-36

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Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)	RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
			09/10/2014		04/08/2015		09/16/2015		03/31/2016		10/13/2016	
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	<	1	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1
	1,1-Dichloroethane	NS	µg/L	3	1	3	1	2	1	1	1	6
	1,1-Dichloroethene	7	µg/L	35	1	26	1	18	1	14	1	16
	1,2-Dichloroethane	110	µg/L	1	1	<	1	1	1	<	1	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	748	20	686	10	706	10	486	10	4,360
	Trichloroethene	540	µg/L	209	20	109	10	27	10	57	10	48
	Tetrachloroethene	150	µg/L	5	1	3	1	<	1	15	1	19
	Total VOCs	NS	µg/L	1,004		827		755		573		4,449
% Parent Products	NS	%	21%		14%		4%		10%		1%	
FIELD PARAMETERS												
	pH	NS	SU	6.7	6.9	6.9	6.9	6.9	6.9	6.9	6.9	NT
	CONDUCTIVITY	NS	mS/cm	0.080	1.41	1.41	1.41	1.41	1.41	1.75	1.75	NT
	TURBIDITY	NS	NTU	>1000	<5	<5	11	11	23	23	23	NT
	DISSOLVED OXYGEN	NS	mg/L	0.5	3.3	3.3	3.3	3.3	7.0	7.0	7.0	NT
	TEMPERATURE	NS	°C	18.8	13.5	13.5	22.5	22.5	15.4	15.4	15.4	NT
	ORP	NS	mV	-131	42	42	45	45	67	67	67	NT

Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)	RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date		
			03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019		
			Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	
			VOLATILE ORGANICS										
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	1.8	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	5	1	2	1	3	1	2	1
	1,1-Dichloroethene	7	µg/L	8	1	5	1	3	1	3	1	3	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	247	100	101	100	81	1	65	1	73	1
	Trichloroethene	540	µg/L	25	10	15	1	18	1	12	1	11	1
	Tetrachloroethene	150	µg/L	<	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	288		126		104		84		89	
% Parent Products	NS	%	9%		12%		17%		14%		12%		
FIELD PARAMETERS													
	pH	NS	SU	6.9	7.3	7.3	NT	NT	6.8				
	CONDUCTIVITY	NS	mS/cm	1.15	0.91	1.08	NT	NT	1.02				
	TURBIDITY	NS	NTU	10	NT	217	NT	NT	44.0				
	DISSOLVED OXYGEN	NS	mg/L	0.3	0.9	3.4	NT	NT	1.1				
	TEMPERATURE	NS	°C	14.8	18.1	15.0	NT	NT	13.0				
	ORP	NS	mV	123	-66	149	NT	NT	-35.0				

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APPENDICES

Appendix B – Dilution Evaluation

Appendix B - Dilution calculations

Central Landfill

The total volume of the first injection was approximately 1,250 gallons. The total volume of the second injection was approximately 800 gallons. The total volume of the third injection was approximately 2,000 gallons. The groundwater hydraulic conductivity is expected to range from 0.85 to 2.5 feet per day (based on the 3-9 months for changes in ML-11 to appear in ML-12 which is 230 feet downgradient). Based on literature from Regenesis, PlumeStop is expected to migrate at least 2 meters (6.5 feet) from the injection point. Meaning the radius of influence (ROI) would be at least 6.5 feet. Using an interconnected matrix porosity for gneiss of 0.01 (INTERA Environmental Consultants, Inc. 1983), the total flow of groundwater through the radius of influence can be estimated using the following equation. Note, the equation below assumes that the flow is perpendicular to an area that is equivalent to the depth of water in the borehole by twice the ROI.

$$\begin{aligned} \text{Volume} &= \text{Depth of Water} * 2 * \text{ROI} * \text{Porosity} \\ &\quad * \text{Hydraulic Conductivity} \end{aligned}$$

$$\text{Volume} = (189 \text{ ft} - 83 \text{ ft}) * 13 \text{ ft} * 0.01 * 0.85 \text{ ft/day} = 11.7 \text{ ft}^3/\text{day}$$

The first injection was performed over five weeks, and the first sample after the injection was collected 77 days after the start of the first injection. The total volume of groundwater that passed through the ROI during that time period is estimated below.

$$\begin{aligned}
 \text{Volume} &= \frac{\text{volume}}{\text{day}} * \text{No. of days} = 11.7 \frac{\text{ft}^3}{\text{day}} * 77 \text{ days} \\
 &= 900.9 \text{ ft}^3 \text{ or } 6,738.7 \text{ gallons}
 \end{aligned}$$

The estimated dilution due to the addition of the injectate is below

$$\frac{\text{Volume Injectate}}{\text{Volume of flow through ROI}} = \frac{1,250 \text{ gallons}}{6,738.7 \text{ gallons}} = 0.185$$

Therefore, the percent reduction in contaminant concentrations due to dilution alone for the first injection is estimated to be at most 18.5%. Note, the radius of influence may be larger which would lower the percent reduction in contaminant concentrations due to dilution alone. It is not possible to determine the actual ROI of the injections without performing soil borings. Additionally, the lowest value of hydraulic conductivity was used to determine the flow through the ROI as a conservative estimate. If the 2.5 feet per day hydraulic conductivity was used, then the percent reduction in contaminant concentrations due to dilution would be lower.

The concentration of 1,2-DCBz prior to the injection was 14,000 µg/L and the concentration after the first injection was 1,100 µg/L. The concentration of CBz prior to the first injection was 6,400 µg/L and the concentration after the first injection was 1,500 µg/L. The percent reduction in contaminant concentrations can be calculated as follows

$$\frac{C_1 - C_2}{C_1} * 100 = \% \text{ Reduction}$$

$$\frac{14,000 - 1,100}{14,000} * 100 = 92.1\%$$

$$\frac{6,400 - 1,500}{6,400} * 100 = 76.5\%$$

Given that the percent reductions for 1,2-DCBz and CBz are more than 18.5%, it is unlikely that the reduction in contaminant concentrations is due to dilution alone, although dilution may be a contributing factor.

Calculations for the second injection

$$\begin{aligned} \text{Volume} &= \frac{\text{volume}}{\text{day}} * \text{No. of days} = 11.7 \frac{\text{ft}^3}{\text{day}} * 51 \text{ days} \\ &= 596.7 \text{ ft}^3 \text{ or } 4,463 \text{ gallons} \end{aligned}$$

$$\frac{\text{Volume Injectate}}{\text{Volume of flow through ROI}} = \frac{800 \text{ gallons}}{4,463 \text{ gallons}} = 0.179 \text{ or } 17.9\%$$

The concentration of 1,2-DCBz prior to the injection was 2,190 µg/L and the concentration after the first injection was below the method detection limit of 200 µg/L. The concentration of CBz prior to the first injection was 1,660 µg/L and the concentration after the first injection was below the method detection limit of 200 µg/L.

$$\frac{2,190 - 200}{2190} * 100 = 90.8\%$$

$$\frac{1,660 - 200}{1,660} * 100 = 87.9\%$$

Again, the reduction in contaminant concentrations cannot be contributed to dilution alone. These calculations cannot be completed for the third injection because there is no sampling data after the third injection.

Former Plating Facility

The total volume of injectate at the Former Plating Facility was approximately 5,300 gallons. The groundwater hydraulic conductivity is expected to range from 0.12 to 0.14 feet per day (based on the 12-14 months for groundwater to reach GZ-6, 50 feet downgradient). The injections were performed along the corner of the Site. The length of the injections perpendicular to groundwater flow direction is approximately 90 feet, and the injections were completed to 20 feet below grade. The depth to groundwater at the site is typically 9 to feet below grade. The soil at the site consists of silty sand, the porosity of silty sand is 0.25.

$$\begin{aligned} \text{Volume} &= \text{Depth of Water} * 90 \text{ feet} * \text{Porosity} \\ &\quad * \text{Hydraulic Conductivity} \end{aligned}$$

$$\text{Volume} = (20 \text{ ft} - 10 \text{ ft}) * 90 \text{ ft} * 0.25 * 0.12 = 27 \text{ ft}^3/\text{day}$$

The first samples were collected 58 days after the injection. The total volume of groundwater that passed through the area of the injectate during that time period is estimated below.

$$\begin{aligned} \text{Volume} &= \frac{\text{volume}}{\text{day}} * \text{No. of days} = 27 \frac{\text{ft}^3}{\text{day}} * 58 \text{ days} \\ &= 1,566 \text{ ft}^3 \text{ or } 11,713.7 \text{ gallons} \end{aligned}$$

The estimated dilution due to the addition of the injectate is below

$$\frac{\textit{Volume Injectate}}{\textit{Volume of flow through ROI}} = \frac{5,300 \textit{ gallons}}{11,713.7 \textit{ gallons}} = 0.452$$

Therefore, the percent reduction in contaminant concentrations due to dilution alone for the first injection is estimated to be at most 45.2%. Dilution could be influencing the results however, the concentration of some contaminants increased after the injection, therefore it is unlikely that dilution is occurring.

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