HESS CORPORATION

CORRECTIVE ACTION PLAN ADDENDUM

OIL CONTROL PROGRAM CASE 1991-2100BA
FORMER HESS STATION #20204
1613 EAST JOPPA ROAD, TOWSON, MARYLAND

SEPTEMBER 17, 2020

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PROJECT NO. 31400408
DATE: SEPTEMBER 17, 2020

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1 INTRODUCTION

On behalf of Hess Corporation, WSP USA Inc. (WSP) has developed this addendum to the corrective action plan (CAP) for the former Hess filling station located at 1613 Joppa Road in Towson, Maryland. The proposed corrective action will include activities in Ridgely Manor Park, located south of the former Hess filling station on Yakona Road (Figure 1).

In September 2017, a site investigation was performed to define the vertical and horizontal location of maximum concentration of remaining total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylene (BTEX) compounds and gather data needed to evaluate in situ treatment options. WSP also completed an in situ chemical oxidation (ISCO) bench scale study (WSP 2017) to evaluate its efficacy at reducing site contaminants. Based on the investigation and bench scale results, this CAP addendum proposes in situ application of unactivated persulfate in the area of significant contaminated mass located in the southern portion of the former Hess filing station and the northeastern portion of Ridgely Manor Park.

This CAP addendum, prepared in accordance with Maryland Environmental Assessment Technology (MEAT) Guidance for Leaking Underground Storage Tanks (LUSTs), revised February 2003, serves to:

— Evaluate the achievement of remedial goals in accordance with the MEAT Guidance
— Evaluate the site status with respect to the seven risk factors in the MEAT Guidance
— Evaluate compliance with previous directives for the site from the Maryland Department of the Environment (MDE)
— Identify a corrective action (ISCO treatment) to address any remaining risk factors and outstanding obligations

The focused ISCO treatment in areas of significant contaminant mass is designed to (1) reduce BTEX and TPH concentrations in groundwater collected by the management system, thereby allowing removal of the activated carbon treatment prior to discharge, (2) shorten the time to reach closure at the site, and (3) demonstrate Hess' continued commitment to addressing impacted groundwater.

1.1 CORRECTIVE ACTION OBJECTIVES

The corrective action objectives are based on the remedial goals from the MEAT Guidance and the site-specific directives issued by MDE. The objectives for the former Hess filling station include:

— Remove all risks posed by the release in accordance with the MEAT guidance including:
  — Prevent contamination migration
  — Reduce potential human health risks via all appropriate pathways for the contaminants originating from the former Hess filling station
— Demonstrate an asymptotic or declining trend in dissolved-phase contamination including benzene, total BTEX, and Methyl Tertiary-butyl ether (MTBE)
— Demonstrate consistent site conditions including absence of iron staining at groundwater discharge locations
— Ensure soils remaining in-place do not pose a risk to human health or environment

1.1.1 SEVEN RISK FACTORS

This section evaluates the status of the site with respect to the following seven risk factors listed in the MEAT guidance:

1. Liquid Phase Hydrocarbons (LPH)
2. Current and Future Use of Impacted Groundwater
3. Migration of Contamination
4. Human Exposure
5. Environmental Ecological Exposure
6. Impact to Utilities and Other Buried Services
7. Other Sensitive Receptors

The definition of each risk factor in the MEAT guidance is provided below in *italics,* followed by the lines of evidence from the site.

LIQUID PHASE HYDROCARBONS

The site must demonstrate the presence of LPH has been removed to the maximum extent possible- generally indicated when measurable product can no longer be detected over an extended period of time in site monitoring points used to observe the subsurface and/or groundwater beneath the site.

Existing monitoring wells are monitored for LPH every quarter. LPH has not been detected in any onsite or offsite groundwater monitoring well since July 1995. Therefore, LPH is not present at the site.

CURRENT AND FUTURE USE OF IMPACTED GROUNDWATER

If the groundwater impacted by the release is used for direct consumption within a half mile of the site or the site is located within an approved wellhead protection zone, a site assessment and corrective action plan must be designed. Other uses of groundwater that would warrant remediation include industrial, agricultural, and surface water augmentation. If known, future use of the groundwater must be taken into consideration. If site-specific future use is unsure, regional trends must be considered. Generally, if future use is not clear a more conservative approach to cleanup is applied.

There is no current direct consumption or use of groundwater impacted by the release, and there are no drinking water receptors in the area. Baltimore County provides municipal water and sanitary sewer services to both the former Hess filling station and the surrounding commercial and residential areas.

The development of Ridgely Manor Park has eliminated any potential future risk associated with residual amounts of hydrocarbons in groundwater. The park is zoned for residential properties, but Baltimore County has labeled the property as unbuildable because it is identified as “environmentally constrained.” Due to these restrictions, there is no potential future use of groundwater at the filling station site or the park.

As discussed in the sections below, the groundwater management system completed in Ridgely Manor Park is preventing offsite migration of groundwater contamination to other properties. The wells maintained in the monitoring program (YMW-1 through YMW-4 and YP-5) proposed in September 2018 *Groundwater Monitoring Program Modifications* Letter will monitor the potential for offsite migration.

MIGRATION OF CONTAMINATION

The ability of contamination to migrate off site or to migrate to a receptor is a critical measure. If it can be demonstrated that the contamination is stationary and site conditions restrict the potential for migration, the need for cleanup may be reduced.

Four of the wells at the Site have had non-detectable concentrations for all compounds analyzed in the most recent eight or more consecutive quarters, and 11 wells had non-detect concentrations for TPH-gasoline range organics (GRO), TPH-diesel range organics (DRO), Naphthalene, and at least three BTEX constituents in the June 2018 sampling event. Monitoring locations such as OW-1, YMW-1 and YMW-2 have been monitored before and after installation of the groundwater management system, and provide clear evidence of decreasing concentrations due to natural attenuation of petroleum compounds and the groundwater management system operations.

Wells near the downgradient property boundary will continue to be monitored, as stated above, to confirm that the extent of affected groundwater has been defined at the downgradient edge of Ridgely Manor Park. Offsite migration of groundwater contamination is unlikely due to the operation of the groundwater management system which prevents groundwater surface discharge and significantly reduces offsite groundwater migration.

HUMAN EXPOSURE

Any exposure to the public warrants site corrective action. There are several exposure pathways that must be considered and include but not limited to inhalation, ingestion, and dermal contact.

The exposure pathways evaluated are ingestion and dermal contact of groundwater for visitors to the site. While groundwater on the property is considered shallow, the wells have locked plugs and a bolted steel well cover to prevent access to wells. By lowering the water table, the groundwater management system prevents groundwater from discharging to the ground surface and has eliminated associated exposure pathways.

ENVIRONMENTAL ECOLOGICAL EXPOSURE

The need to protect the natural resources of the state mandated by Maryland Law. If there is exposure to animal or plant life from the petroleum release or the degradation of a natural resource, correct action is warranted.

The groundwater management system collects any groundwater migrating offsite or groundwater discharging to the surface. Treated groundwater has never exceeded the National Pollutant Discharge Elimination System (NPDES) discharge limits and is discharged to the public storm sewer. No natural resources have been impacted since the installation of the groundwater management system.

IMPACT TO UTILITIES AND OTHER BURIED STRUCTURES

The responsible party must correct adverse effects to utilities. Utility materials have been known to degrade from contact with petroleum products. Utilities may also act as conduits that lead to the migration of contamination. Migration along utilities may cause vapor impacts or other issues at nearby structures.

Groundwater affected by the release is treated by filtration and liquid phase granular activated carbon to meet the NPDES discharge limits prior to being discharged to the public storm sewer system. The treated groundwater effluent sample results demonstrate that benzene, BTEX, and TPH concentrations have never exceeded the NPDES permit limits. Beginning in January 2015, the breathing zone in and above the five onsite storm sewer manholes and the Yakona Road curb inlet have been screened weekly with a photoionization detector (PID) to monitor organic vapor concentrations (Appendix A – Figure 1). No organic vapors have ever been detected in the breathing zone at any location. While the PID readings indicate that volatile organic compounds (VOCs) are present in the below grade air space of the collection system manholes, the PID readings for the curb inlet have been non-detectable or near non-detectable. It is anticipated that the organic vapor concentrations in the below grade airspace would decrease after the injection remedy has degraded BTEX and other volatiles.

There are utilities along the southern portion of the property, including underground gas and underground electric lines running along Yakona Road. The groundwater concentrations along the southern boundary of the site (i.e. monitoring wells YMW-1 and YMW-2 through YMW-5) indicate that contamination will not impact the buried utilities.

OTHER SENSITIVE RECEPTORS

Sensitive receptors such as surface water, historic structures, and subways are an indication that a site may warrant further corrective action.

There are no sensitive receptors on the site. The end of Herring Run, a tributary of the Back River, is located approximately 3,080 feet east-southeast of the site. The groundwater management system collects and treats groundwater before it is discharged to the storm sewer system.

There are no historic structures, subway systems or other sensitive receptors on or near the site.

1.1.2 ASYMPTOTIC OR DECLINING CONCENTRATION TRENDS

Groundwater monitoring has been performed for the release since 1991. Groundwater monitoring has been performed on a quarterly basis, and MDE approved a change to semi-annual groundwater monitoring in November 2018 (MDE, 2018). Therefore, the groundwater data set is sufficient to evaluate concentration trends. The quarterly groundwater quality results do not suggest seasonal variability.

The quarterly groundwater samples are analyzed for VOCs and fuel oxygenates by U.S. Environmental Protection Agency (EPA) Method 8260C, TPH–GRO by U.S. EPA Method 8015C, and TPH–DRO by U.S. EPA Method 8015C. An evaluation of the groundwater quality results and concentration trends indicate non-detect, consistent, or decreasing concentrations at most location/analyte pairs. Many analyte detections in recent sampling events are below the MEAT criteria for groundwater for the respective constituent, or below the laboratory reporting limits.

Monitoring locations such as OW-1, YMW-1 and YMW-2 have been monitored before and after installation of the groundwater management system and provide clear evidence of decreasing concentrations due to natural attenuation of petroleum compounds and the groundwater management system operations. The proposed corrective action will further reduce the BTEX, TPH-GRO and TPH-DRO concentrations in groundwater.

1.1.3 OBSERVABLE SITE CONDITIONS

MDE requested reporting of notable observations about the site in the letter mailed in February 2016 (MDE 2016). Since installation of the groundwater management system, there has been no evidence of surface discharge of groundwater, odors, iron staining, or any other observations indicating contaminant impacts at the site.

1.1.4 SOIL CONDITIONS

The last corrective action objective is to ensure soils remaining in-place do not pose a risk to human health or environment.

In 2017, WSP conducted the site investigation using a membrane interface probe (MIP)/ hydraulic profiling tool (HPT) to identify areas of the site with significant contaminant mass (Appendix B). Soil sample collection was biased towards the areas with the highest contaminant concentrations. The maximum BTEX and TPH concentrations in soil were measured at MIP-02 (25-30 feet below ground surface [bgs]) in soil (Figure 2). All soil concentrations were below the MEAT standards except for the TPH-GRO and TPH-DRO concentrations at MIP-02 (1,220 milligrams per kilogram [mg/kg] and 803 mg/kg, respectively). There is no potential exposure to soil at the depths of the exceedances nor are there buried structures at that depth that could be impacted or a conduit for the contamination to migrate. Therefore, the soils remaining in place do not pose a risk to human health or the environment. The proposed corrective action will further reduce the TPH-GRO and TPH-DRO concentrations in soil in this area of the site.

2 SITE DESCRIPTION

The site includes former Hess filling station No. 20204, located at 1613 East Joppa Road in Baltimore County, Baltimore, Maryland, and Ridgely Manor Park to the south (Figure 1). Ridgely Manor Park is located on 16 contiguous parcels formerly occupied by 8 duplex residences at 1612 through 1642 Yakona Road. The park is topographically lower and hydraulically downgradient of several commercial properties along East Joppa Road including the former Hess Station. The park property slopes from a high of 454 feet above mean sea level (MSL) in the northern corner near the former Hess filling station to a low point of 430 feet above MSL in the southern portion of the park along the sidewalk at Yakona Road. Releases of gasoline constituents from the former Hess filling station were a potential source of petroleum contamination in groundwater beneath the former residences (MDE 2005). The Site Number associated with the releases is MDE Oil Control Program (OCP) Case No. 1991-2100BA.

There are no drinking water receptors in the area. Baltimore County provides municipal water and sanitary sewer services to both the former Hess filling station property and the surrounding commercial and residential areas.

2.1 SITE GEOLOGY/HYDROGEOLOGY

The geologic conditions in the area consist of a surficial unit comprised of layered clayey and sandy deposits believed to represent the Cretaceous-age Potomac Group, which are underlain by saprolite formed by the weathering of the local metamorphic rocks (Baltimore Gneiss). Geologic cross sections that include the former station and park areas are shown in Figure 2. The texture of the saprolitic materials varies from clayey to silty sand to sandy clay and is governed by the lithologic characteristics of the parent (i.e., unweathered) rock. Regional geologic studies in the Baltimore area and Harford County, Maryland indicate the saprolite thickness ranges from approximately 30 to 50 feet (Otton et al. 1964; SRBC 2008).

Saturated portions of the unconsolidated Potomac Group deposits and underlying saprolite are interpreted to comprise a coupled, unconfined hydrogeologic unit of variable permeability. The water table occurs within the surficial Potomac Group deposits, with the depth to the groundwater surface greater than 10 feet bgs in the northern-most portion of the area and less than 10 feet bgs moving south. Water level elevations indicate the historical fluctuation in the groundwater surface at the site has been less than 4 feet bgs. Groundwater flow within this water-bearing unit is in a generally southward direction and appears to mimic the local surface topography. Overall, the groundwater surface contours indicate a lower Site-wide hydraulic gradient in the northern-most area under both high and low water table conditions.

The hydraulic conductivity (K) of the unconsolidated surficial sand (Potomac Group) deposits and saprolite was estimated from slug tests conducted at site monitoring wells. (Detailed information on the test performance and data analysis, and the calculated K values determined from test data, are provided in the WSP 2013 CAP.) The hydraulic conductivity of the aquifer materials exhibits some degree of spatial variability over Ridgely Manor Park. The representative K values for the tested wells range from 0.71 feet per day (ft/day) to 7.8 ft/day, with a geometric mean value of 2.0 ft/day. Further examination of the K estimates indicates a slightly higher permeability for the surficial sand deposits (range: 0.71 to 7.8 ft/day; median: 2.3 ft/day) compared to the saprolitic materials (range: 1.1 to 2.8 ft/day; median: 1.4 ft/day). Additionally, the conductivities for aquifer materials are higher in the northern portion of Ridgely Manor Park (geometric mean = 3.1 ft/day) compared to the south along Yakona Road (geometric mean = 1.1 ft/day). This spatial variability in K values may reflect the increased abundance of fine-grained silt and clay deposits in the upper-most portion of the saturated zone.

2.2 HISTORIC SITE INVESTIGATIONS AND REMEDIAL ACTIONS

Hess designed and implemented corrective actions to treat the impacted groundwater on the gas station property and the former residential properties downgradient of the gas station property, located on Yakona Road. These corrective measures have included the installation of a groundwater treatment system, a soil vapor extraction system, enhanced fluid recovery events, and air-sparging. By-pass drains, interceptor sumps, and vapor abatement systems were also installed in several residences between 1612 and 1640 Yakona Road.

In 2013, Hess purchased the properties from 1610 through 1642 Yakona Road (even numbered properties only) and implemented a corrective action approach that involved groundwater collection, site monitoring, and site development as a green space. The approach is described in WSP's CAP dated August 14, 2013, and the CAP Addendum (detailing design modifications) dated October 11, 2013. The MDE OCP conditionally approved the corrective action in a letter dated November 22, 2013 (MDE 2013).

During the installation of the groundwater management system in 2014, samples of the collected groundwater did not meet the discharge criterion of 100 parts per billion total BTEX in the General Permit for the Discharge of Treated Ground Water from Oil Contaminated Ground Water Sources to Surface or Ground Waters of the State (NPDES Permit No. MDG915958). A treatment system consisting of granular activated carbon was installed to treat the groundwater prior to discharge from the groundwater management system. Ridgely Manor Park was opened to the public on August 30, 2014, and the groundwater management system began operating in December 2014. Monitoring of the manholes and Yakona road curb inlet began in January 2015.

In September 2017, WSP completed a site investigation to identify areas of maximum concentrations of site contaminants, collect additional groundwater data needed to evaluate in situ treatment options, and perform an ISCO bench scale study. The investigation identified the southern portion of the former Hess filling station and the northeastern portion of Ridgely Manor Park as the area of maximum contaminant concentrations. The groundwater data provided information on the present groundwater contaminant concentrations, as well as geochemical conditions demonstrating that anaerobic (reducing) conditions are present in wells with contamination. The bench scale ISCO treatability study was performed by Terra Systems of Claymont, Delaware, to evaluate the effectiveness of both unactivated and pH-activated Klozur® SP, a persulfate formulation distributed by PeroxyChem, on site soil and groundwater samples collected during the September 2017 investigation. Three concentrations of unactivated and pH-activated persulfate (10 grams per liter [g/l], 20 g/l and 40 g/l) were tested to determine the most suitable concentration for site application. The study compared contaminant concentrations from the baseline samples to the treated samples collected in the study and evaluated the longevity of persulfate at the end of the study. The bench scale study demonstrated that activated and unactivated persulfate were both effective at reducing contaminant concentrations, with complete to near complete destruction of BTEX and TPH-GRO. Although the TPH-DRO concentrations in the bench scale results were not reduced to levels below the MEAT standard, the persulfate treatment created favorable conditions for continued biodegradation of TPH. The study also determined more favorable results with the unactivated persulfate, including improved persulfate longevity and absence of metals mobilization (which occurred in the activated persulfate test samples). Of the three persulfate concentrations evaluated in the bench scale study, a concentration of 20 g/l was most effective at contaminant mass reduction. Further details and results of the 2017 investigation can be found in the May 2018 *Site Investigation Summary* letter (Appendix B).

2.3 CURRENT CONDITIONS

The groundwater management system and treatment equipment remain in operation. EMS Environmental, Inc. (EMS) is responsible for the operation, maintenance, and monitoring of the system and collects bi-monthly system samples in accordance with the discharge permit. EMS also conducts the groundwater monitoring program. The 2019 Fourth Quarter Site Status Report submitted to MDE by EMS is provided as Appendix A. Historical groundwater monitoring results are tabulated in Table 1 of Appendix A, and the November 2019 groundwater quality results are shown on Figure 1 in Appendix A. The maximum concentrations of TPH-DRO, TPH-GRO, and BTEX compounds detected in groundwater samples were detected at monitoring wells MW-7, YMW-8 and YP-1 located in Ridgely Manor Park. Contaminant concentrations at these locations are consistent across quarters and have not decreased significantly since installation of the groundwater management system. Given that the groundwater management system controls downgradient migration but does not directly affect residual contamination in the area around these wells, additional corrective action would be needed to reduce the TPH and BTEX concentrations in these areas, the duration of groundwater treatment and groundwater monitoring, and the time required to reach site closure.

As required by MDE's letter Request for Comprehensive Well Sampling letter dated June 7, 2010, dissolved concentrations of benzene, total BTEX, and MTBE are monitored (MDE 2010). A summary of the site conditions for each constituent is described below.

BENZENE

During the semi-annual sampling events in 2019, benzene was detected at concentrations above the MEAT Standard (5.0 micrograms per liter [µg/L]) at six of ten monitoring well locations. The benzene concentrations in samples from these wells have been relatively constant or decreasing. Benzene concentrations in the other four locations are below the MEAT

Standards or additionally below the laboratory reporting limits. The proposed ISCO remedy will further reduce benzene concentrations, and monitoring will continue at select well locations.

TOTAL BTEX

There is no MEAT Standard for Total BTEX. The concentrations of the individual BTEX constituents varied over time in most of the monitoring locations, and benzene exceeds the MEAT Standard at six out of ten locations sampled in 2019. It is anticipated that the proposed ISCO remedy will reduce concentrations of all BTEX constituents in the groundwater.

MTBE

The MTBE concentrations in the groundwater samples collected in November 2019 were less than the MEAT criteria. Groundwater samples collected from YMW-2 and YMW-4 in July 2019 contained MTBE at concentrations greater than the MEAT criteria of 20 µg/L. MTBE concentrations in groundwater samples from the other eight locations in the current monitoring program were less than the MEAT criteria and have been below the criteria for three years or longer. The detected MTBE concentrations appear to be stable or decreasing over time.

The remaining discussion in this CAP will not address MTBE, tertiary butyl alcohol (TBA) or other oxygenates in further detail for the following reasons:

- MTBE concentrations in groundwater samples appear to be stable or decreasing over time (Appendix A).
- TBA has no established MEAT criteria. In 2019, TBA concentrations greater than the method detection limits were detected in samples from five of the ten current sampling locations. The TBA concentrations detected at these sampling locations appear to be stable or decreasing over time.
- The ISCO bench scale study showed that chemical oxidation primarily reduced BTEX concentrations, and reduced TPH concentrations to a lesser extent compared to BTEX. The locations for injection wells have been selected based on BTEX and TPH concentrations rather than oxygenate concentrations (Section 3.1).

2.3.1 GROUNDWATER

Groundwater flows generally southward before being collected by the groundwater management system for treatment and discharge to the storm sewer system. The distribution of the impacted groundwater is primarily contained between MW-4 (source area) and the southern property boundary of Ridgely Manor Park between YMW-1 and YMW-2. Wells with concentrations of TPH-GRO, TPH-DRO or benzene that exceed MEAT Standards include: MW-4, OW-1, MW-7, YMW-7, YMW-8, YP-1, YP-1, YMW-4 and YMW-2. BTEX compounds and TPH were not detected in samples from wells on the southwestern portion of the site or were detected at very low concentrations.

WSP compiled the quarterly site-wide monitoring data in the 2019 Fourth Quarter Site Status Report (EMS, 2020) and prepared trend graphs depicting the groundwater elevations and concentrations over time for BTEX, TPH-DRO, and TPH-GRO (Appendix C). Trend graphs were only generated for location/analyte pairings with 3 or more detections; therefore, no trend graphs were generated for YMW-3, YMW-6, and YMW-9. The newest monitoring wells on site have been sampled quarterly for four years, providing sufficient data to identify general trends. The groundwater management system has now been operating for over 5 years, and the start of system operation is also marked on each trend graph. Multiple years of monitoring data collected since installing the groundwater management system also provide a sufficient quantity of data to identify trends such as the noticeable decrease in contaminant concentrations at wells OW-1, YMW-1 and YMW-2.

An evaluation of the groundwater results and graphical trends indicated non-detect, consistent, or decreasing concentrations at most of the location/analyte pairs. Overall, groundwater concentrations of BTEX, TPH-DRO, TPH-GRO, and Naphthalene at wells across the site have been stable or decreasing.

2.3.2 GROUNDWATER MANAGEMENT SYSTEM

The groundwater management system collects groundwater through four underground parallel drains consisting of slotted polyvinyl chloride (PVC) pipe. The groundwater drains by gravity to a manhole, from which it is pumped through bag filters and liquid phase granular activated carbon prior to being discharged to the storm sewer system. The groundwater management system lowers the water table, thereby eliminating surface discharge of groundwater. The system influent and effluent are sampled by EMS twice each month to ensure compliance with the NPDES permit discharge limits. Influent concentrations of total BTEX are typically greater than the NPDES BTEX discharge limit of 100 µg/L but there is seasonal variation. During 2019, the total BTEX concentrations in the influent samples were greater than 500 µg/L from April through June (maximum concentration 669 µg/L) but less than 100 µg/L during September and October (minimum concentration 44 µg/L). Influent concentrations of TPH-DRO and TPH-GRO have fluctuated over time but remain below the NPDES discharge limit of 15,000 µg/L total TPH. To date, there have been no exceedances of the NPDES discharge limits in the treatment system effluent samples. The historical influent and effluent sample results are provided in the EMS quarterly report (Appendix A).

Based on sampling data, the groundwater management system is operating as designed and fulfilling the Site's corrective action objectives. Based on the influent concentrations of BTEX, treatment of the groundwater is expected to continue for the foreseeable future, unless BTEX concentrations are reduced. The proposed ISCO remedy is anticipated to reduce BTEX concentrations in the collected groundwater to the extent that the groundwater would no longer require treatment before discharge. The groundwater collection system would remain in place to continue to lower the groundwater elevation and prevent groundwater discharge to the ground surface.

3 *IN SITU* DESIGN RATIONALE

The ISCO injection design, treatment area, treatment chemical selection, and dosage calculations are presented below. Detailed information about the bench scale treatability study are included in the May 2018 *Site Investigation Summary* letter (Appendix B).

3.1 INJECTION TREATMENT AREA

The proposed injection locations have been selected to effectively treat the area of maximum concentrations ("hot spots") remaining and achieve the objectives described in Section 1.1. The proposed injection locations are designed to treat the area of the maximum probe responses from the MIP/HPT investigation: the southern portion of the former Hess filling station and the northeastern portion of Ridgely Manor Park (Figure 3). The design includes installing 3 permanent injection wells (IP-1 through IP-3) to maximum depths of approximately 33 feet bgs. These wells will be screened in the most conductive groundwater flow zone (approximately 10 feet thick) based on the HPT data. The injections are designed to treat a 25-foot radius of influence around each well. The estimated total area of treatment is approximately 5,900 square feet. Permanent injection wells were selected over direct push injection points because of their versatility (monitoring or injection use), ability to be used for additional injections if needed, and greater potential radius of influence for the injection.

3.2 CHEMICAL SELECTION AND DOSAGE

The treatability study results determined that unactivated Klozur® SP (Klozur®) sodium persulfate would provide the most effective treatment. The proposed remedy will inject the following amendments in the "hot spot" areas:

- Klozur® SP (Klozur®) sodium persulfate (unactivated), applied at a concentration of 20 g/l (20% solution)
- Micro nutrients (nitrogen and phosphorous source)

The safety data sheets for Klozur® and a typical nitrogen and phosphorus source are provided in Appendix D. The amendment formula (Klozur® and nutrients) will be diluted with potable water and applied through the injection wells at a pressure of less than 40 pounds per square inch (psi). Assuming an average saturated soil mobile porosity value of 0.34, there are 20,026 cubic feet (approximately 567,000 liters or 150,000 gallons) of mobile groundwater are present within the treatment volume for each injection well. The volume of amendment needed to achieve the design amendment distribution was calculated to be equivalent to 9% of the estimated mobile porosity. Therefore, a total volume of 13,085 gallons of Klozur® amendment solution will be distributed equally to each injection well resulting in 4,362 gallons of injection fluid per well. Assuming a delivery flow rate of 5 gallons per minute, the application is estimated to take 7 days to complete.

The estimated amount of each component to be injected in each well (in gallons) is summarized in the table below.

Injection Point	**Units**	**IP-1**	**IP-2**	**IP-3**	**Total**
Klozur®	Pounds	8,340	8,340	8,340	**25,020**
Potable Water	Gallons	4,011	4,011	4,011	**12,033**
Nutrient – Nitrogen	Pounds	38	38	38	**114**
Nutrient - Phosphorous	Pounds	5.5	5.5	5.5	**16.5**

4 *IN SITU* TREATMENT PROCEDURES

4.1 ACCESS AGREEMENT AND COMMUNITY OUTREACH

Access agreements have been executed with Petroleum Marketing Group, the current owners of the former Hess filling station property, and NeighborSpace, the organization that operates Ridgely Manor Park. The agreements will be reviewed and extended or expanded to include the proposed ISCO injections if necessary.

Prior to conducting any field work activities, Hess will notify Petroleum Marketing Group and NeighborSpace. In addition, Hess will contact members of the board of Ridgely Manor Community Association to describe the focused investigation on Ridgely Manor Park and to discuss the planned work. Communication will be performed directly between a Hess representative and members of the Ridgely Manor Community Association. Details such as the planned dates of the work, the areas of the park to be temporarily closed to public access during the work, and other safety measures that will be implemented to protect public safety will be presented, as further described in Section 4.2.1.

4.2 PERMITS

The drilling contractor will obtain soil boring permits from Baltimore County in advance of the injection well installation.

WSP contacted the MDE Water Management Administration for underground injection applications to treat affected groundwater. According to Ms. Tracy Rocca-Weikart of MDE in a call on November 1, 2018, an underground injection control permit is not required for this environmental remediation application.

4.2.1 HEALTH AND SAFETY PLANNING

Health and safety planning will include protection for the general public, including residents, Ridgely Manor Park patrons, and employees and customers at the current filling station. As mentioned previously, discussions with members of the Ridgely Manor Community Association in advance of the work will be used to alert residents regarding the injection activities and schedule, as well as any temporary access restrictions in the park for public safety. WSP will order and install temporary barriers to restrict access to the work areas and restricted access signs to alert patrons of the hazards and access restrictions during the planning stage. The temporary barriers may include concrete or plastic jersey barriers, cones, or a temporary fence supported by movable footings. The ground surface conditions will also be restored following completion of the work.

Worker safety planning involves updating the Site-Specific Health and Safety Plan (HASP) to include the activities being conducted under this CAP Addendum. The updated HASP will detail the objectives, project organization, and specific procedures required for all activities conducted during the field work, including the type and location of temporary barriers installed around the work area. WSP's subcontractors are required to prepare their own HASP and will be required to restrict site access as described in the HASP prepared by WSP.

4.2.2 UTILITY LOCATE

A ground penetrating radar survey will be conducted by a private utility locator prior to any intrusive activities at the site to identify potential underground utilities in or near the injection well locations. The locations of the groundwater management system laterals will be marked based on the cleanout and manhole locations. A public utility mark out will also be made a minimum of 72 hours before intrusive work begins.

4.3 GENERAL PROCEDURES

All activities will be conducted in accordance with WSP Standard Operating Procedures (SOPs; Appendix E) and the MDE MEAT Guidance. All field activities will be conducted using cleaned equipment; decontamination of non-disposable equipment will be conducted in accordance with WSP's SOPs and manufacturer's specifications.

Before any intrusive work is conducted, the location of each proposed injection well (Figure 3) will be determined in the field during a site reconnaissance; locations may be adjusted in the field based on underground and overhead utilities and site access considerations. Each location will be marked using white marking paint and given a unique identifier that will be written directly on the ground surface.

Standard efforts will be taken to prevent cross contamination and contamination of the environment when installing the injection wells, conducting the injections and collecting samples. Equipment, sample containers and supplies will be protected from accidental contamination. In accordance with WSP's SOPs, a new pair of disposable gloves will be donned immediately before each sample is collected to limit the possibility of cross-contamination from accidental contact. The gloves will not come in contact with the sample and will be changed any time during sample collection that their cleanliness is compromised.

4.4 MONITORING EQUIPMENT

Monitoring equipment used for sample collection and health and safety will be inspected before use to assess the operating condition of the equipment. The condition of the monitoring equipment will be documented in the field log book, and necessary maintenance will be performed on the equipment prior to sampling. WSP will follow the manufacturer's operation manuals for calibration, use, and decontamination procedures.

Manufacturer's guidelines will be consulted before beginning the calibration process and the manufacturer's technical support will be contacted if problems or questions arise. Air and water quality monitoring equipment will be tested and calibrated daily before use and will be recalibrated every twenty samples. All calibration procedures performed will be documented in the field book and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which the readings were taken, and the calibration readings.

- Before calibrating and using air and water quality monitoring equipment in the field, the sensors will be inspected to ensure that they are clean, installed properly and are not damaged.
- Field calibration will be conducted in an area sheltered from wind, dust, and temperature/sunlight fluctuations, such as inside a room or vehicle. The standards will be maintained at a temperature >40 degrees Fahrenheit (°F) and < 100°F.
- The air and water quality monitoring equipment will be allowed to warm up for at least 10 minutes after being turned on and the display will be set to read the appropriate measurement units.
- The standard solutions will be handled in a manner that prevents their dilution or contamination. Standard solutions will not be reused or poured back into the bottle. Expired standard solutions will not be used. Proper chain-of-custody will be followed for standard solutions.

Following calibration, the air and water quality monitoring equipment will be used to collect field parameters and the field measurements will be recorded on sampling forms and in the field book; conditions that may affect data quality (e.g., changes in weather) will also be noted.

4.5 DECONTAMINATION

Non-dedicated equipment must be adequately decontaminated between locations. Where possible, each individual piece will be individually decontaminated in accordance with the manufacturer's specifications. Specifically, the decontamination process will include the following steps:

- Physical removal of debris
- Bucket wash with non-phosphate soap such as Liquinox®, or equivalent and scrub brush

— Tap water rinse
— Deionized (DI) water rinse (distilled water can be used as a substitute)

Equipment will be allowed to dry thoroughly after decontamination. Water used for decontamination will be processed through a 5-gallon bucket of granulated carbon and then discharged onto the natural ground surface.

4.6 INJECTION WELL INSTALLATION PROCEDURES

The injection wells will be installed by a licensed Maryland driller. The drilling firm will also be responsible for obtaining Baltimore County boring permits before drilling work is initiated. The final well locations will be surveyed following installation by a licensed Maryland surveyor. Horizontal locations will be determined to +0.1 feet using the Maryland Coordinate System and North American Datum (NAD 83). The surveyed coordinates for the injection wells locations will be added on the existing site plan.

The borings will be installed using track- or cart-mounted direct-push drilling equipment to approximately 33 feet bgs, where the MIP investigation identified the highest concentration of contamination. Soil samples will be collected as necessary to confirm the anticipated stratigraphy. WSP's onsite geologist will determine the final boring depth and screen interval based on observed conditions.

Soil samples will be collected using 2-foot split spoon or Macro-Core® samplers equipped with a disposable acetate liner. Upon recovery, the soils will be visually screened for evidence of contamination and logged using the Unified Soil Classification System. The headspace of each sample will be screened for organic vapors at approximately 2.5-foot intervals using a PID equipped with a 10.6 electron-volt lamp. Soil observations, such as odors, presence of fill, staining, and moisture content will be recorded in the field logbook along with the PID readings.

The wells will be constructed using 10 feet of 2-inch inner diameter (ID), flush-threaded 0.020-inch continuous wrap Schedule 40 (SCH40) PVC well screen fitted with enough blank SCH40 PVC riser to reach the ground surface. The top of casing will be completed with an appropriate, and removable, connection to the amendment delivery system. A 10-foot section of 2-inch continuous wrap 20 slotted screen will be installed at the intervals shown in the table below.

Injection Well ID	Screen Interval (feet bgs)
IP-1	22-32
IP-2	20-30
IP-3	18-28

At each well, the well screen will be surrounded with a high silica content, washed and rounded sand filter pack from the bottom of the screen to approximately 2 feet above the top of the screens. The filter pack will be placed in the annulus of the well in such a manner that bridging of the filter pack material will not occur. A 3-foot bentonite seal will be placed on top of the sand filter pack, delivered to the annular space in one-foot lifts. At each lift, the bentonite will be tamped and charged with potable water. Once the bentonite has been fully hydrated, the remaining annular space will be backfilled with bentonite-cement grout to approximately 1-foot bgs. Grout will be placed in the borehole using a tremie pipe.

The wells will be developed by surging the screened interval to loosen any fine-grained sediment in the sand filter pack and adjacent aquifer material. Groundwater from each well will then be removed by pumping or bailing for a minimum of 1 hour, until the groundwater is sediment free. Well development documentation, including development method(s), time spent on development, volume of water removed, well depth, depth to top of the screen, well diameter, visual appearance (clarity), and discharge water stability parameters (turbidity, pH, temperature, oxidation-reduction potential, specific conductance, and dissolved oxygen) at various stages of pumping, as possible, will be recorded in the field book. Water quality parameters will be collected by monitoring equipment with procedures as described in Section 4.4. The water level and total well depth will be periodically checked during the mechanical surging and pumping process to assess changes in the well condition. The monitoring well will be developed for a minimum of 1 hour or as directed by WSP's onsite geologist. The wells will be equipped with lockable watertight caps and 12-inch diameter flush mount completion.

4.7 BASELINE GROUNDWATER SAMPLING PROCEDURES

Table 1 presents the monitoring program for the persulfate injection. The monitoring is designed to evaluate effectiveness at contaminant treatment and the persulfate distribution. This section describes monitoring to be conducted before injection to establish pre-treatment conditions (baseline monitoring). Section 4.8 describes monitoring during the injection, and Section 4.9 describes post-injection monitoring.

Baseline groundwater samples will be collected from the existing wells MW-4, OW-1, MW-7, YMW-7, MDE-4, YP-1, and YMW-8 (Figure 4). The samples will be collected within 30 days of the injection so that the analytical results are representative of conditions at the time of treatment application. Before initiating any sampling activities, depth to water measurements will be collected at the sampling locations. Purging and sampling will be performed using low-flow techniques with bladder pumps connected to in-line water quality meters. Temperature, pH, specific conductivity, turbidity, dissolved oxygen, and oxidation-reduction potential (ORP) will be measured at equal time intervals during the purging activities using a multi-parameter water quality meter with a flow-through cell to minimize atmospheric interference. These readings, along with observations on groundwater quality, will be recorded on groundwater purge forms. At MW-1, the water level will be measured, and grab sample of purge water from MW-1 will be collected for field analysis of pH and ORP only.

Groundwater will be removed until parameters stabilize, thereby confirming that formation water is present in the well. After the well has been adequately purged, groundwater samples will be collected using the bladder pump. Filtered (0.45 micron filter) and unfiltered samples will be collected for metals analysis.

- VOCs by US EPA Method 8260C (including BTEX constituents)
- TPH-DRO by US EPA Method 8015C
- TPH-GRO by US EPA Method 8015C
- Total and dissolved chromium and selenium by US EPA Method 6020
- Total and dissolved hexavalent chromium by US EPA Method 7196
- Total and dissolved iron by Hach Colorimeter Test Kit or equivalent

The samples will then be labeled with the appropriate identification, stored in a cooler with ice, and submitted to Phase Separation Science of Catonsville, Maryland for analysis of the following, except for persulfate and total iron, which will be analyzed in the field using the text kits specified above. Chromium and selenium were selected for analysis because they are the only metals detected in the bench scale test for the 20 g/L unactivated persulfate dose.

The pH, ORP and total iron concentration of water in groundwater collection system manholes MH-21 and MH-23 will be measured bi-monthly for at least one month before the injections to establish pre-treatment conditions. This data will be collected by EMS during their bi-monthly sampling of treatment system influent and effluent.

4.8 AMENDMENT PREPARATION, INJECTION PROCEDURE, AND MONITORING DURING TREATMENT

The Klozur® and nutrients will be delivered as solids in bulk containers (e.g., totes, drums, or sacks). The Klozur®, nutrients, and dilution water solution will be prepared in a mixing area set up in the fenced area at the rear of the former Hess filling station before being pumped to the injection point. The amendment will be prepared in batches for each well as specified in Section 3.2. The nutrients and Klozur® will be mixed into potable water until the soluble materials dissolve and any remaining insoluble materials are in a uniform suspension. The persulfate concentration will be measured in the first batch mixed each day using the persulfate field test kit and the solution pH will be measured using a field test. The amendment solution will then be pumped to the injection well or transported to the injection areas on a mobile platform (e.g., trailer or lift), which will also be used for staging equipment during treatment.

The wellhead of each injection well (IP-1 through IP-3) will be sealed during the injection as necessary to withstand injection pressures. Additionally, a ball valve will be installed near the well head to minimize spillage when disconnecting the injection hose. Gravity feed of the amendment is preferred, however, if necessary the amendment may be delivered to the well under pressure. A pressure gauge on the application pump or the amendment conveyance line will be used to ensure that the applied injection pressure does not exceed 40 psi. The amendment will be fed or pumped into the screened interval of the injection well at an expected flow rate of approximately 5 gallons per minute. The flow rate will be monitored using an inline flow meter or visual observations of the fluid level decrease in the amendment holding tank over time.

The injections will begin with IP-1, followed by IP-2, and then IP-3. WSP will attempt to evenly distribute the amendment volume between the three injection wells. If delivery to any injection well is unsuccessful, the volume of amendment that was not delivered will be injected into the adjacent injection well. If all other injections have been completed and residual amendment remains, the residual amendment volume will be delivered into a previous location where delivery was successful.

The injection volumes, pressures, and flow rates of the amendment application at each injection well will be recorded. WSP will also regularly monitor water levels, field parameters, and iron concentrations in nearby monitoring wells, such as MW-4, OW-1, MW-7, MW-1, and YMW-7. When injections are performed within 25 feet of an existing monitoring well, a packer or other device will be used to seal the top of the monitoring well(s) to prevent amendment from reaching the ground surface. No existing monitoring wells are within 25 feet of IP-1 (Figure 3). Wells MW-4 and OW-1 will be capped during injections into IP-2. MW-7 will be capped during injections into IP-3.

WSP will place a pressure transducer into each capped well to measure influence (i.e., changes in water pressure) during the injection at the nearby injection point. The pressure transducer will be installed at least 1 hour prior to initiating injections at the nearby injection point and remain in place for at least 2 hours after completing injection.

4.8.1 PERSULFATE MONITORING AND RELEASE PREVENTION

It is possible that diluted amendment solution may migrate into one or more collection laterals of the groundwater management system. Any amendment would be further diluted by the groundwater in the management system. The procedures that will be used to monitor for a release and respond to a release (if necessary) are present in Appendix F.

WSP will monitor the water quality in a manhole of the collection system, MH-23 (Figure 1), at least 1 hour prior to treatment (baseline) and at regular intervals during treatment to check for persulfate discharge to the groundwater management system. MH-23 was selected as the monitoring point due to accessibility and because it receives groundwater from the two collection laterals that straddle the treatment area. The water quality monitoring will include field parameters (e.g., pH, ORP), persulfate, and total iron concentrations in MH-23. The persulfate concentration will be monitored in the field using the Persulfate by Klozur® Field Test Kit "K". WSP will also visually observe the water flow rate in the manhole to identify any changes. If a change from baseline conditions is observed in MH-23, the parameters will then be monitored in MH-21. MH-21 receives groundwater from all four collection laterals and represents the overall water quality in water discharging from the groundwater management system.

If monitoring indicates that any of the action levels in Appendix F have been triggered, the injection delivery pressure will be reduced. If the injection pressure is unable to be reduced (such as in the case where the amendment is flowing under gravity feed) then the injection will be stopped at the injection point. Any remaining amendment will be added to a previous injection point. WSP will continue to monitor water quality in MH-23 at regular intervals over the course of the injection. Appendix F contains more information regarding the monitoring conducted to detect any impact to the groundwater management system, action levels and countermeasures that will be implement in the event that any action levels are exceeded.

The potential countermeasures include recovering persulfate solution or low pH groundwater from manholes MH-21 and MW-23. An emergency response contractor will be on call during the injections in case it becomes necessary to recover fluid from the manholes.

The stormwater/groundwater discharge from Ridgely Manor Park flows underground in the Baltimore County storm sewer system for approximately 0.6 miles before discharging into a concrete lined drainage ditch. Water flows in this concrete-lined ditch for approximately ½ mile before discharging into Herring Run. The procedures in Appendix F identify two locations in the downstream stormwater system where water quality would be monitored if there was a persulfate release from manhole MH-21.

4.9 POST-TREATMENT GROUNDWATER SAMPLING AND INJECTION MONITORING

The initial post-treatment monitoring will begin the day after the injection ends. Water samples will be collected from MH-21 and MH-23 daily for one week, and the pH, ORP and persulfate concentration will be measured in the field (Table 1). If the first week of post-injection measurements are consistent with the baseline, then the monitoring frequency will be reduced to bi-monthly for three months (in conjunction with bi-monthly EMS sampling of the treatment system). If the post-treatment measurements indicate a significant change from baseline, MDE will be contacted and daily measurements will continue until MDE approves an alternate sampling frequency.

Long-term post-treatment monitoring will consist of quarterly groundwater samples collected from existing monitoring wells MW-4, MW-7, YMW-7, MDE-4, OW-1, YP-1, and YMW-8 for 1 year following the injections. The groundwater samples will be analyzed for the following parameters, as shown in Table 1:

— VOCs by US EPA Method 8260C
— TPH-DRO by US EPA Method 8015C
— TPH-GRO by US EPA Method 8015C
— Total and dissolved chromium and selenium by US EPA Method 6020
— Total and dissolved hexavalent chromium by US EPA Method 7196
— Total and dissolved iron by Hach Colorimeter test kit or equivalent

WSP will review the results from the first two quarterly post-treatments sampling events and, if appropriate, recommend adjustments to the list of parameter analysis for the next two quarterly sampling events. Continuation of iron and metals testing after the first quarter will be contingent on detected metals concentrations above the 2008 MDE Generic Cleanup Standards for Type I/II Aquifers and/or detected iron concentrations above baseline from the initial pre-treatment monitoring event (MDE 2008). The wells will be sampled with procedures described in Section 4.7 and in accordance with WSP SOPs. Concurrently with the quarterly post-treatment monitoring events, the water level in MW-1 will be measured and a grab sample will be collected for pH and ORP. After 1 year, the wells will be sampled semi-annually as per the MDE-approved groundwater monitoring program (MDE 2018).

4.10 SAMPLE CONTAINERS AND LABELS

Laboratory supplied containers will be used for sample collection. Preservation by pH adjustment will be achieved using appropriate preservatives. Preservatives will be added to the sample containers in the laboratory prior to being shipped to WSP for use. While collecting samples, care must be taken to prevent washing out the preservative by sample container overfilling.

Temperature control will be achieved by placing the samples in a cooler immediately after collection. The cooler will be packed with enough ice to cool the samples to 4° Celsius (C) and maintain the temperature at 4°C until arrival at the laboratory. Field personnel will record the sample temperature on the chain-of-custody form prior to sample shipment. The temperature will be measured upon receipt at the laboratory.

Adhesive, waterproof labels will be used to identify the samples. Each label will provide the following information:

— Sample identification number
— Name of sample collector
— Date
— Time
— Place of collection
— Parameters requested for analysis
— Type of preservative added (if applicable)

This information will be written on the label with an indelible, waterproof marker and be repeated on the chain-of-custody forms.

4.11 CHAIN OF CUSTODY RECORDS

Sample custody will be controlled and maintained through the chain-of-custody procedures. Chain-of-custody procedures will allow for the tracing of possession and handling of samples from the field to the laboratory. A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it up to prevent tampering. Items to be used to document the possession and handling of samples and protect their integrity include sample labels, custody seals, a logbook, and chain-of-custody forms.

In accordance with WSP's SOPs, the chain-of-custody form will be used to trace sample possession from the time of collection to receipt at the laboratory. Dated and signed adhesive seals will be affixed to the shipping containers to demonstrate that they have not been opened during shipment. The seals will be affixed so that the shipping containers cannot be opened without breaking the seal.

4.12 QUALITY CONTROL AND ANALYTICAL PROCEDURES

The Quality Control and Analytical Procedures are provided to ensure that controls are initiated and maintained throughout sample collection and analysis. Field quality assurance and quality control (QC) procedures, such as the use of proper sampling technique and decontamination procedures, were discussed in earlier sections of this plan. Additional QC measures include the use of control samples.

Control samples are introduced into the train of actual samples as a monitor on the sampling procedures and the analytical system performance. Control samples for this monitoring plan include field duplicates, equipment blanks, trip blanks, and temperature blanks. Each type provides a different form of quality control for the analytical system. The collection of each QC sample will be recorded in the field book and will be limited to VOCs.

4.12.1 FIELD DUPLICATES

Field duplicates are used to assess sampling process precision. One field duplicate will be collected during each sampling event. The duplicate sample will be collected at the same time from the same sample aliquot and in the same order as the corresponding field sample. The field duplicate identity will not be provided to the laboratory. Trip blanks will not be used for field duplicates. The unique sample identification will be chosen from the range of MW-100 through MW-999.

4.12.2 EQUIPMENT BLANKS

Equipment blanks are useful in documenting adequate decontamination of sampling equipment. One equipment blank will be collected per each type of non-dedicated, reused equipment (bladder pumps). Each equipment blank will consist of collecting a rinsate sample from non-dedicated equipment after the equipment has been decontaminated. Laboratory-provided deionized (DI) water will be used for the rinsing the equipment. The equipment blank will be analyzed for all analytes of interest (VOCs, TPH-DRO and TPH-GRO). The unique sample identification will indicate that the sample is an equipment blank and will include the sampling date (e.g., WSP-EB-MMDDYY).

4.12.3 TRIP BLANKS

Trip blanks are used to document contamination attributable to shipping and field handling procedures. One trip blank will be provided in each cooler with VOC samples and trip blank(s) will only be analyzed for VOCs. Trip blank(s) will be prepared at the laboratory by filling two 40-milliliter vials with Teflon-lined septum caps with DI water. The trip blank(s) will be labeled in the field and returned to the laboratory in the cooler(s) along with sample containers that contain samples for VOC analysis. The unique sample identification will indicate that the sample is a trip blank and will include the sampling date (e.g., TB-MMDDYY).

4.12.4 TEMPERATURE BLANKS

Temperature blanks are used to determine if proper sample thermal preservation has been maintained by measuring the sample container temperature upon arrival at the laboratory. Laboratory-provided temperature blank(s) will be returned to the laboratory in each cooler.

4.12.5 ANALYTICAL PROCEDURES

All analyses will be performed by Phase Separation Science in Catonsville, Maryland.

A “standard turn-around time” will be requested for the samples with results anticipated within 10 business days of sample receipt by the laboratory. The analytical method used, extraction date, and date of actual analysis will be recorded by the laboratory.

Laboratory QC checks such as lab blanks, spikes, calibration standards, duplicates, and reference samples will be used to provide a measure of accuracy and precision. Laboratory reference QC samples and spikes will be integrated into the analytical scheme in accordance with the Phase Separation Science Quality Control Plan. Laboratory duplicates will be analyzed at the same frequency to assess precision.

4.13 INVESTIGATION DERIVED WASTE

Investigation-derived waste (IDW) such as drill cuttings and drilling fluids will be contained in U.S. Department of Transportation-compliant 55-gallon steel drums. The drums will be labeled as “Non-Hazardous Pending Analysis” and moved to a temporary storage area on the filling station property for subsequent management and disposal. IDW will be promptly characterized and disposed of in accordance with state and federal requirements. Purge water from the well installation and sampling events will be processed through a 5-gallon bucket of granulated carbon and then discharged onto the natural ground surface.

Personal protective equipment will be disposed of as general trash.

4.14 SURVEYING

Following the injection well installation, the elevations of the new wells will be surveyed by a Maryland-licensed surveyor to the nearest +/- 0.01-foot, and the horizontal locations will be measured to the nearest +/ 0.1 foot.

5 SCHEDULE AND REPORTING

The ISCO remedy will commence after receiving MDE's approval of the injection application described in this CAP Addendum. The approximate schedule shown below is contingent on MDE's approval of this CAP. The injection well installation is expected to take 3 days and will be scheduled a minimum of 2 weeks prior to the baseline groundwater sampling and no more than 30 days prior to the injection event. The amendment application is anticipated to take approximately 1 week, with quarterly groundwater monitoring to continue for 1 year after the injection.

Results will be reported to the MDE OCP in a completion report following the final round of post-injection groundwater monitoring (to occur 1 year following the injections). The completion report will summarize the treatment intervals per injection boring, volume of materials injected, general observations from the injections (e.g., flow rates, pressures), monitoring well construction details, and groundwater monitoring results. Successful treatment will be demonstrated through the groundwater quality samples exhibiting decreasing BTEX concentration trends.

CAP Addendum Remediation Schedule

Task	Schedule
CAP Addendum Submitted to MDE Oil Control Program	September 2020
Field Preparations (HASP Modification, Driller Procurement, Permitting, Site Access Agreements, Miss Utility One Call)	October 2020
Injection Well Installation	November 2020
Baseline Groundwater Monitoring	November 2020
ISCO Injection Implementation	December 2020
Post-Injection Groundwater Monitoring Round #1	March 2020
Post-Injection Groundwater Monitoring Round #2	June 2021
Post-Injection Groundwater Monitoring Round #3	September 2021
Post-Injection Groundwater Monitoring Round #4	December 2021
ISCO Injection Completion Report	February 2022

6 REFERENCES

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- WSP. 2018. Site Investigation Summary. May 30.

FIGURES

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B

Drawn By: EGC
Checked: 4/9/2020
Approved: 4/9/2020
DWG Name: 314V1965-002

RIDGELY MANOR PARK
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PREPARED FOR
HESS CORPORATION
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Figure 1
SITE PLAN

WSP USA Inc.
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TEL: +1 703.709.6500

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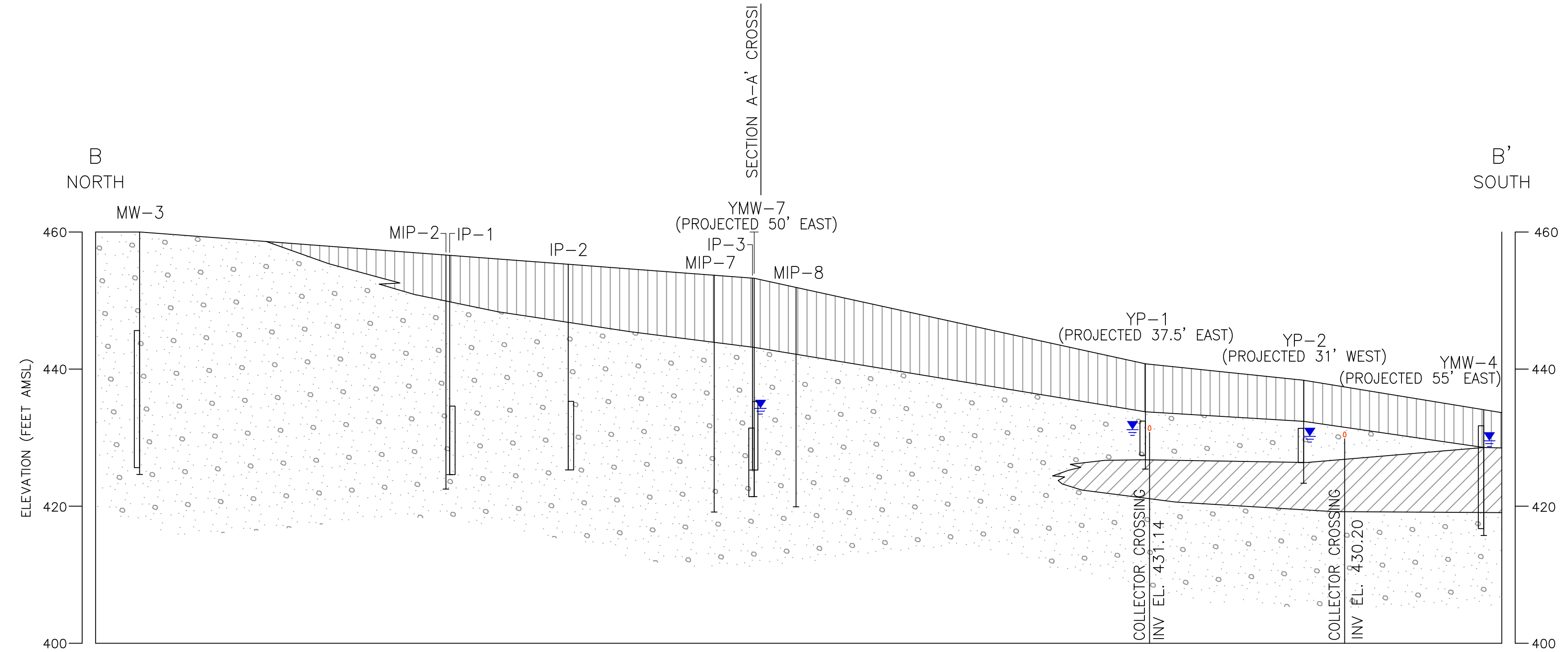

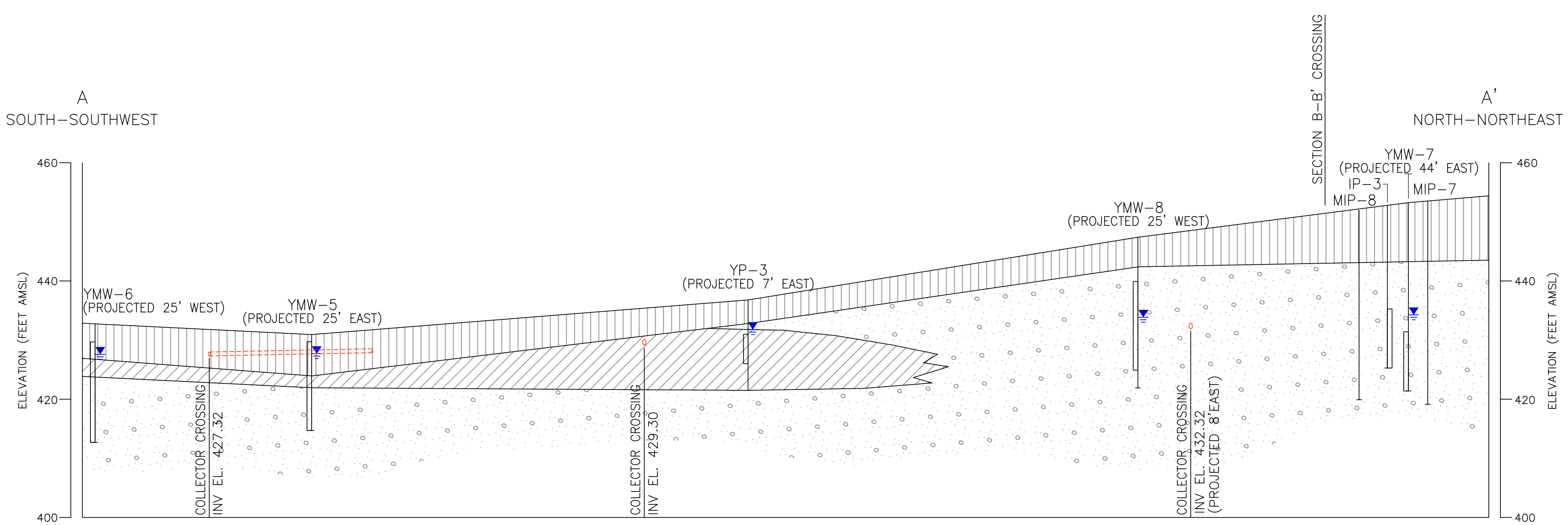

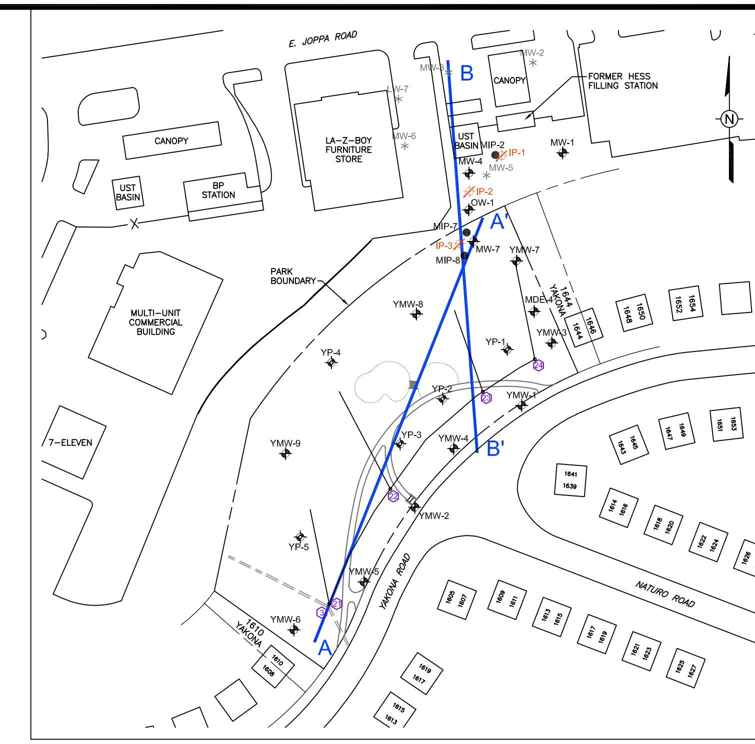

CROSS-SECTION LOCATION
SCALE: 1"=200'

LEGEND

YP-2 — WELL ID
WATER LEVEL, SEE NOTE
SCREENED INTERVAL
COLLECTOR OF GROUNDWATER MANAGEMENT SYSTEM
SILT
CLAY
SAND, SILTY SAND, GRAVEL

NOTE:
DEPTH TO WATER MEASUREMENTS COLLECTED BY EMS ENVIRONMENTAL IN MARCH 2016.

0 25 50
VERTICAL SCALE IN FEET

0 50 100
HORIZONTAL SCALE IN FEET

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Approved: 4/9/2020
DWG Name: 314V1965-003

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Figure 2
GEOLOGICAL CROSS-SECTIONS

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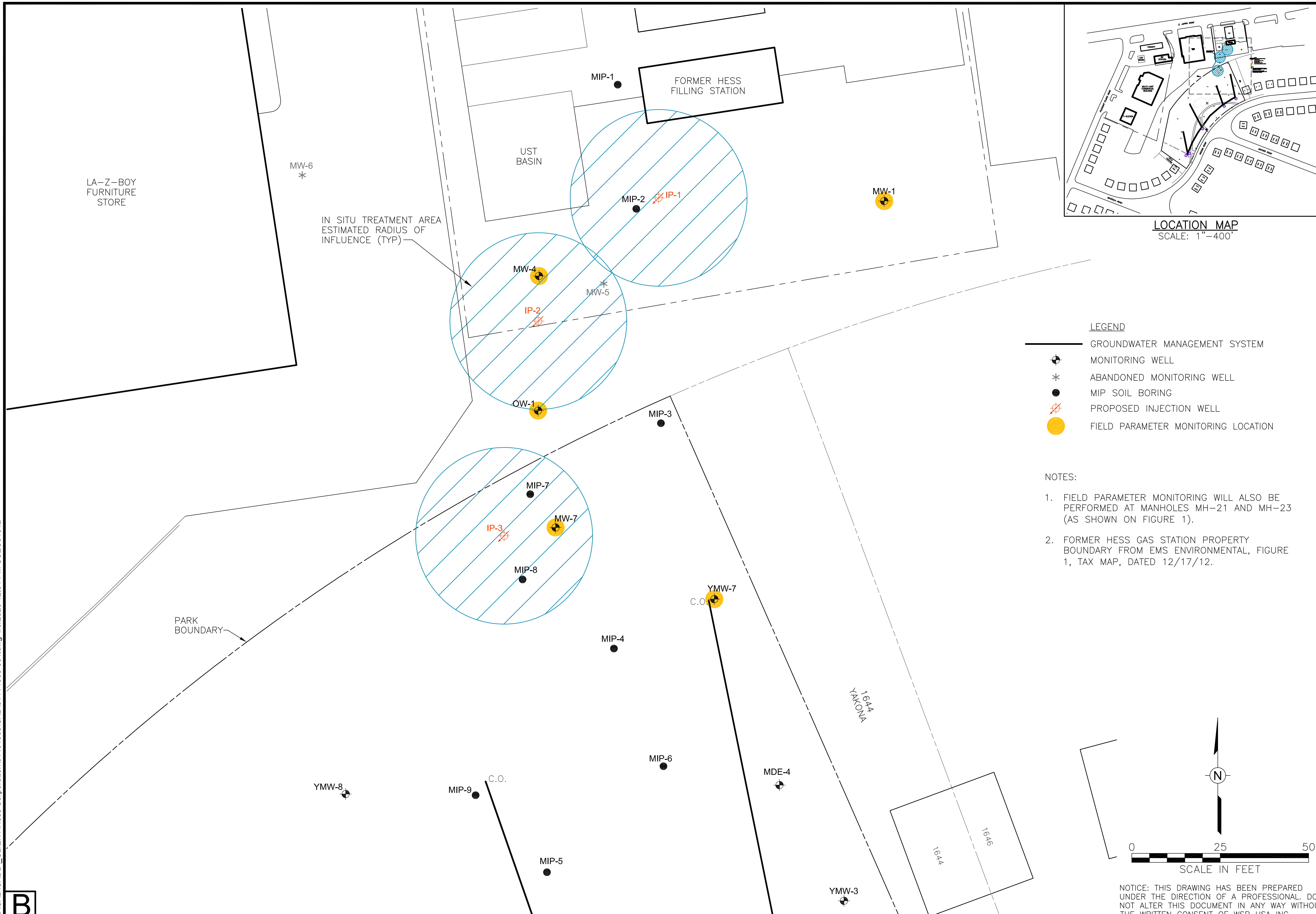

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Figure 3

PROPOSED INJECTION TREATMENT AREAS AND FIELD PARAMETER MONITORING LOCATIONS

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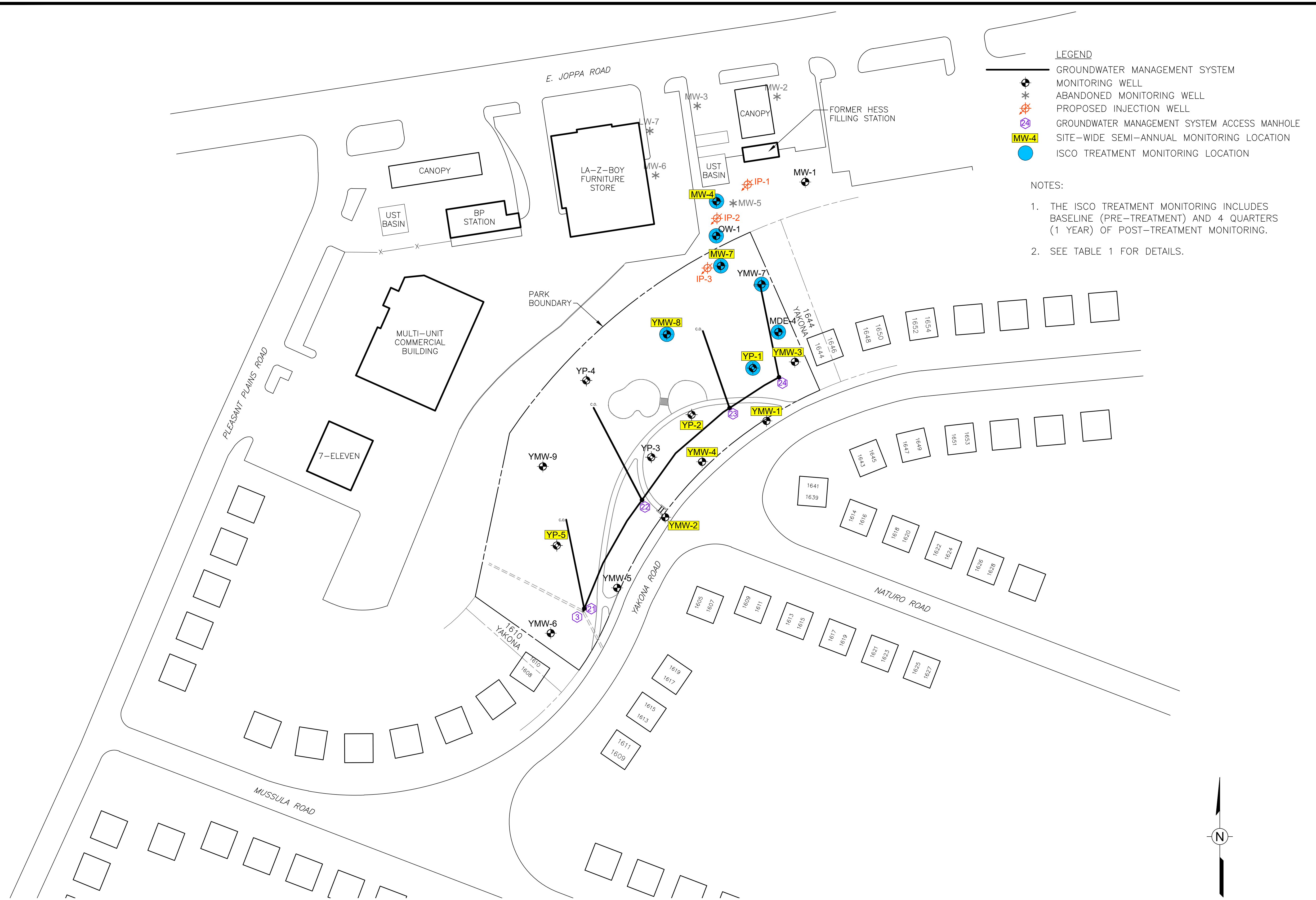

NOTES:

1. THE ISCO TREATMENT MONITORING INCLUDES BASELINE (PRE-TREATMENT) AND 4 QUARTERS (1 YEAR) OF POST-TREATMENT MONITORING.
2. SEE TABLE 1 FOR DETAILS.

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Figure 4

SITE-WIDE SEMIANNUAL MONITORING LOCATIONS AND ISCO TREATMENT MONITOING LOCATIONS

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TABLE

Table 1

Monitoring Program for Persulfate Injection
Oil Control Program Case 1991-2100BA
1613 East Joppa Road, Towson MD (a)

Location ID	Total Depth (ft BTOC)	Screen Length (ft)	Screen Interval Depth (ft BTOC)	Baseline (Pre-Treatment) (b)					During Treatment (g)				Initial Post-Treatment (h)		Long-Term Post-Treatment (i)						Included In Semi-annual Monitoring Program
				Water Level	Field Parameters (c)	VOCs (d)	TPH (e)	Metals (f)	Persulfate	Water Level	Field Parameters	Metals	Persulfate	Field Parameters	Persulfate	Water Level	Field Parameters	VOCs	TPH	Metals	
			Method:	--	--	US EPA 8260C	US EPA 8015C	US EPA 6020; Iron Field Test Kit	Persulfate Field Test Kit	--	--	US EPA 6020; Iron Field Test Kit	Persulfate Field Test Kit	--	Persulfate Field Test Kit	--	--	US EPA 8260C	US EPA 8015C	US EPA 6020; Iron Field Test Kit	
MDE-4	15.00	10.00	3.00 - 13.00	X	X	X	X	X								X		X	X	X	
MW-1	NA	NA	NA - NA	X	pH, ORP					X	pH, ORP					X	pH, ORP				
MW-4	25.00	15.00	10.00 - 25.00	X	X	X	X	X		X	X	X				X		X	X	X	X
MW-7	34.00	25.00	8.00 - 33.00	X	X	X	X	X		X	X	X				X		X	X	X	X
OW-1	34	25	9.00 - 34.00	X	X	X	X	X		X	X	X				X		X	X	X	
YMW-1	15.00	12.00	2.00 - 14.00																		X
YMW-2	15.00	12.00	2.00 - 14.00																		X
YMW-3	20.00	15.00	4.50 - 19.50																		X
YMW-4	18.00	15.00	2.00 - 17.00																		X
YMW-5	16.00	15.00	1.00 - 16.00																		
YMW-6	20.00	15.00	3.00 - 18.00																		
YMW-7	28.00	10.00	18.00 - 28.00	X	X	X	X	X		X	X	X				X		X	X	X	
YMW-8	25.00	15.00	7.00 - 22.00	X	X	X	X	X								X		X	X	X	X
YMW-9	18.00	15.00	2.50 - 17.50																		
YP-1	15.00	5.00	8.00 - 13.00	X	X	X	X	X								X		X	X	X	X
YP-2	15.00	5.00	7.00 - 12.00																		X
YP-3	15.00	5.00	5.50 - 10.50																		
YP-4	15.00	5.00	8.00 - 13.00																		
YP-5	11.00	5.00	5.00 - 10.00																		X
MH-21	5.80	NA	NA		pH, ORP (j)			Iron	X		pH, ORP	Iron	X	pH, ORP							
MH-23	7.40	NA	NA		pH, ORP (j)			Iron	X		pH, ORP	Iron	X	pH, ORP							
			Total	***8***	***9***	***7***	***7***	***9***	***2***	***5***	***6***	***6***	***2***	***2***	***0***	***8***	***0***	***7***	***7***	***7***	***10***

Notes:

a/ ft = feet; BTOC = below top of casing; NA = Not available or not applicable; US EPA = United States Environmental Protection Agency; VOCs = volatile organic compounds; TPH = total petroleum hydrocarbons; BTEX = benzene, toluene, ethylbenzene, xylene; MH = manhole.
b/ Samples will be collected a minimum of 2 weeks after injection point development, and within 30 days prior to the pilot test so that the analytical results are representative of conditions at the time of treatment application.
c/ Field parameters include temperature, pH, specific conductivity, turbidity, dissolved oxygen, and oxidation-reduction potential.
During treatment, the field parameters will be monitored hourly beginning 1 hour prior to treatment and ending 1 hour post treatment. MW-1, MH-21, and MH-23 will be monitored for pH and ORP only.
d/ VOCs are analyzed by US EPA Method 8260C. BTEX constituents and total BTEX will be determined through the VOC suite analysis.
e/ TPH are analyzed by US EPA Method 8015C and include diesel range organics and gasoline range organics.

f/ Collect filtered (0.45 micron) and unfiltered samples for analysis of total and dissolved chromium and selenium by US EPA Method 6020 and hexavalent chromium by USEPA Method 7196. Iron will be the only parameter monitored during treatment and will be monitored at the same frequency as the field parameters using a field method such as a Hach Colorimeter or equivalent. Metals will be monitored quarterly for two quarters after treatment; continuation of iron and metals testing after the first quarter will be contingent on detected metals concentrations above the 2008 Maryland Department of the Environment (MDE) Generic Cleanup Standards for Type I/II Aquifers and/or detected iron concentrations above baseline from the initial pre-treatment monitoring event.
g/ Existing monitoring wells within the anticipated radius of influence of an injection point (25 feet) will be capped during treatment and field parameters will not be collected from the capped wells. A pressure transducer will be deployed in each capped well. The groundwater collection piping downstream of MH-23 will be capped and the water in MH-23 monitored. See the Persulfate Release Prevention Plan in Appendix F for more information.

h/ Initial post-treatment monitoring will be initiated the day after the injection ends. Assuming the post-treatment measurements remain consistent with the baseline, then frequency of monitoring will be performed daily for the first week, then biweekly for three months (in conjunction with biweekly EMS site visits). If the post-treatment measurements indicate a significant change from baseline, MDE will be contacted and the frequency will be increased to daily until conditions stabilize.
i/ Long-term post-treatment monitoring will occur on a quarterly basis for one year following treatment and is in addition to the semi-annual monitoring program. For more information, please see the September 10, 2018 *Proposed Groundwater Monitoring Program Modifications Letter* submitted to MDE.
j/ Biweekly for one month (in conjunction with biweekly EMS site visits).

APPENDIX

A

EMS QUARTERLY REPORT

January 6, 2020

Ms. Ellen Jackson, Central Region Section Head
Maryland Department of the Environment
Remediation Division
Oil Control Program
1800 Washington Boulevard, Suite 620
Baltimore, Maryland 21230-1719

Via: FedEx

Re: 2019 Fourth Quarter Status Report
Former Hess Station #20204
1613 East Joppa Road
Towson, Maryland
Case Number 1991-2100 BA

Dear Ms. Jackson:

Enclosed please find the above-referenced report. This report includes results from the November 13, 2019 groundwater monitoring and sampling event. This report also summarizes the results of the groundwater management system (System) vapor screening, operations and maintenance (O&M), and discharge sampling events conducted during the Fourth Quarter of 2019.

Should you have any questions or require any additional information, please feel free to contact me by telephone at (610) 866-7799 or via email at jfox@emsenv.com. If you have any questions relating to the project, please contact John Schenkewitz of Hess Corporation at (609) 406-3969.

Sincerely,
EMS Environmental, Inc.

Jeremy L. Fox
Regional Manager

Enclosure
cc: J. Schenkewitz, Hess Corporation
T. Jackson, Baker Botts
G. Helfrick, PMG
B. Hopkins, NeighborSpace
P. Groff Robertson, WSP

January 6, 2020

2019 FOURTH QUARTER STATUS REPORT
FORMER HESS STATION #20204
1613 East Joppa Road
Towson, Maryland
Case Number 1991-2100 BA

Prepared For: Hess Corporation
Trenton-Mercer Airport
601 Jack Stephan Way
West Trenton, NJ 08628

Prepared By: EMS Environmental, Inc.
4550 Bath Pike
Bethlehem, PA 18017

INTRODUCTION

The following is the 2019 Fourth Quarter Site Status Report for Former Hess Station #20204, located at 1613 East Joppa Road in Towson, Maryland. This report includes results from the November 13, 2019 groundwater monitoring and sampling event. Also included in this report are summaries of the groundwater management system vapor screening, operations and maintenance (O&M), and discharge sampling events. **Figure 1** is included as a Site Plan depicting the subject site layout, adjacent properties, the site's below-grade system, as well as all monitoring wells, piezometers, storm drain outlets, and vapor monitoring points bounded by the area known as Ridgely Manor Park. Refer to **Tables 1** and **2** for a summary of the groundwater data collected during the monitoring and sampling event. Refer to the **Appendix** for copies of the corresponding laboratory analytical reports.

During the Fourth Quarter of 2019, continued monthly system vapor screening events, using a photoionization detector (PID), were conducted at the designated vapor monitoring points depicted in **Figure 1**. Additionally, system O&M events were performed on a bi-monthly basis. Post-treatment discharge samples were collected twice monthly from the system's groundwater collection vault. Besides routine system maintenance (e.g. filter bag and carbon changeouts, pump and hose checks, electrical component maintenance, system throughput monitoring, etc.), noteworthy or unusual conditions, such as surficial dissolved iron staining, were not observed. **Tables 3** through **5** summarize the system vapor screening and discharge data.

GENERAL INFORMATION

Site:	Former Hess Station #20204 – Towson, MD (See **Figure 1**)
Sampling Frequency:	Semi-Annual
Reporting Frequency:	Quarterly
Monitoring Wells/Piezometers Sampled:	MW-4, MW-7, YMW-1 through YMW-4, YMW-8, YP-1, YP-2 and YP-5
Monitoring Wells/Piezometers Not Sampled:	MDE-4, MW-1, OW-1, YMW-5, YMW-6, YMW-7, YMW-9, YP-3 and YP-4
Monitoring Wells/Piezometers Gauged:	MDE-4, MW-1, MW-4, MW-7, OW-1, YMW-1 through YMW-9 and YP-1 through YP-5
Monitoring Wells/Piezometers Not Gauged:	None
Required Analysis:	Full Scan Volatile Organic Compounds (VOCs) + Fuel Oxygenates by EPA Method 8260C, and Total Petroleum Hydrocarbons-Gasoline Range Organics (TPH-GRO) and Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO) by EPA Method 8015C

SAMPLING DATA

Groundwater Sampling Event:	November 13, 2019
Depth to Groundwater:	2.61 feet (YMW-2) to 20.66 feet (OW-1)
Groundwater Elevation:	427.19 feet (YMW-6) to 435.48 feet (MW-1) (See **Table 1**, **Table 2**, and **Figure 2**)
Groundwater Flow:	Predominantly south (See **Figure 2**)
Liquid Phase Hydrocarbons (LPH) Identified:	None
Dissolved Phase Concentrations Reported:	See **Table 1** and **Figure 3**

REMEDIATION DATA

Technology:	Groundwater Collection System
System Start:	May 22, 2014
Waste Stream Treatment:	Groundwater collected within the site's groundwater collection system vault is treated via the use of both liquid phase carbon adsorbers and filter bags prior to being discharged to the adjacent public storm sewer system.
Vapor Screening Frequency:	Monthly
O&M Frequency:	Weekly
Discharge Sampling Frequency:	Twice monthly
System Performance Data:	See **Tables 4** and **5**

SCHEDULED/PROPOSED WORK

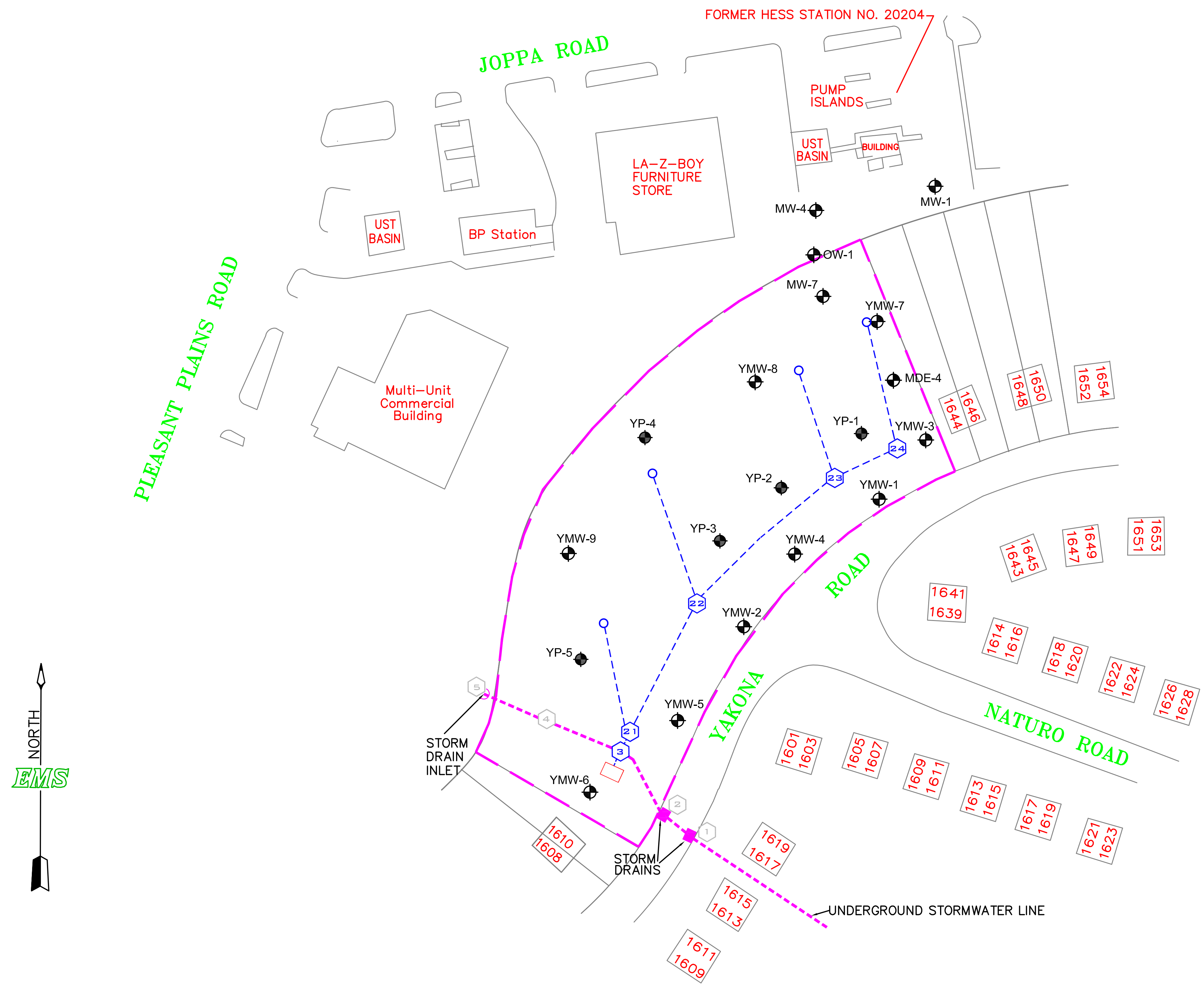
System vapor screening events are scheduled to continue on a monthly basis during the First Quarter of 2020. System O&M events and discharge sampling events are scheduled to continue weekly and twice monthly, respectively, during the First Quarter of 2020. Groundwater monitoring and sampling will continue on a semi-annual basis.

ATTACHMENTS

Figure 1:	Site Plan
Figure 2:	Groundwater Elevation & Hydraulic Contour Map (November 13, 2019)
Figure 3:	Hydrocarbon Distribution Map (November 13, 2019)

Table 1:	Historical Groundwater Monitoring Data Summary
Table 2:	Groundwater Gauging Results Summary
Table 3:	Monthly PID Screening Results Summary
Table 4:	Groundwater Treatment System Discharge Summary
Table 5:	Groundwater Treatment System Sampling Results Summary

Appendix:	Laboratory Analytical Report (November 13, 2019)



LEGEND

- Ridgely Manor Park Boundary
- Groundwater Monitoring Well
- Piezometer
- Groundwater Management System Access Manhole (Vapor Screening Point)
- Stormwater Inlet Callout
- Drainage Piping Cleanout
- Below Grade Groundwater Management System Vault
- Underground Groundwater Management System Drainage Piping

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)

FIGURE 1

SITE PLAN

FORMER HESS STATION #20204
1613 East Joppa Road
Towson, Maryland

Drawn By: YSN

Date: 4/5/16

EMS ENVIRONMENTAL

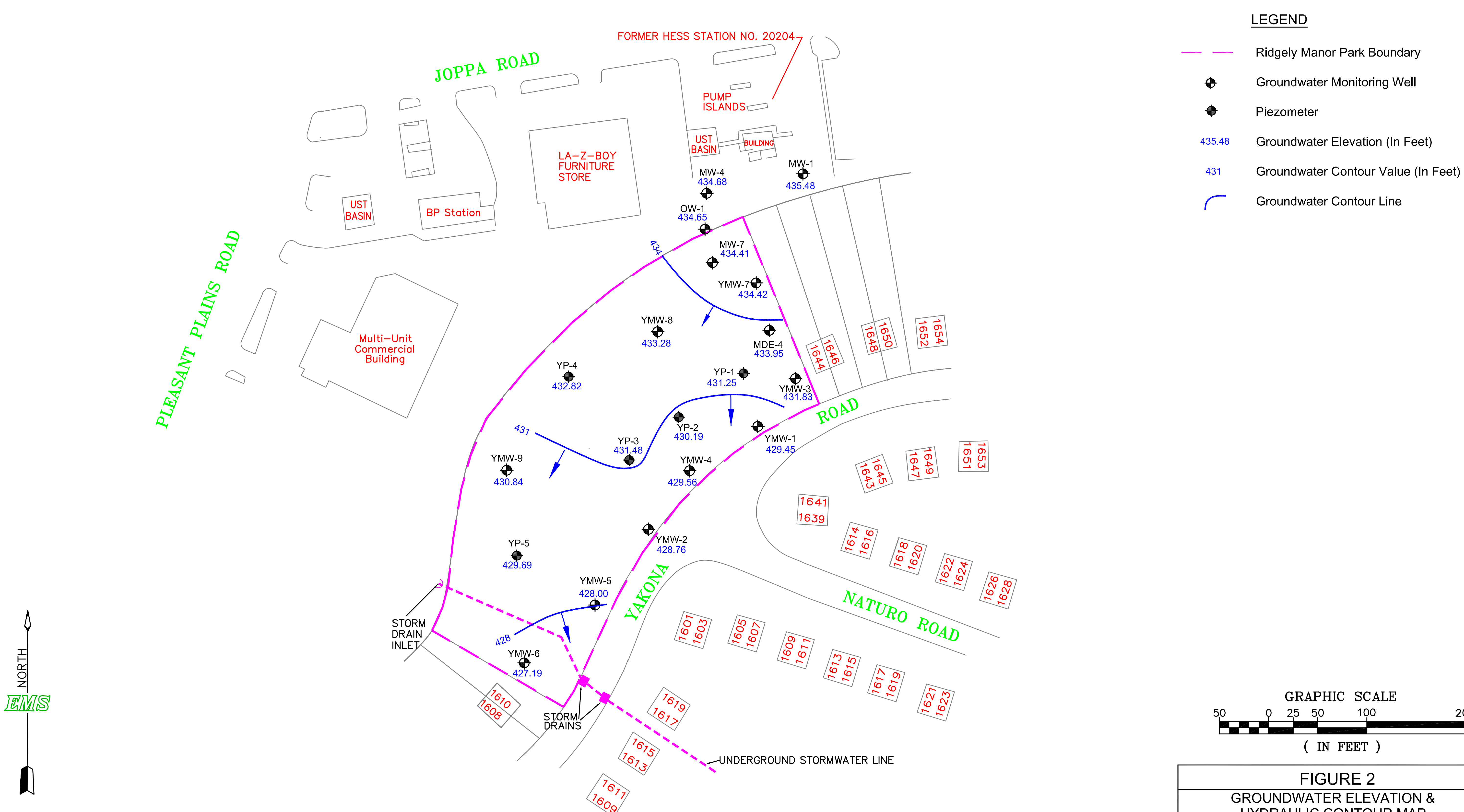


FIGURE 2

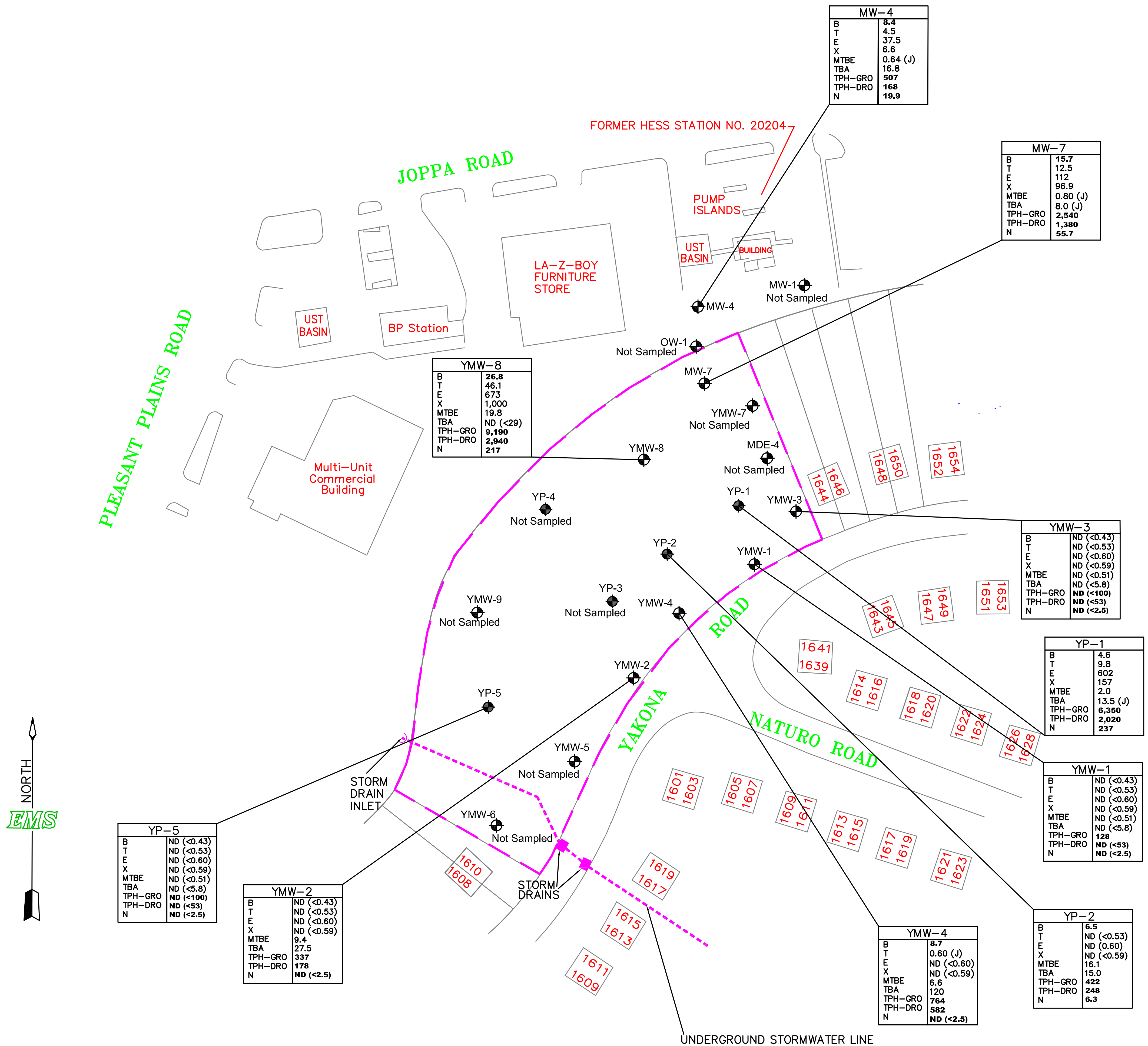
GROUNDWATER ELEVATION & HYDRAULIC CONTOUR MAP
(Gauged: 11/13/19)

FORMER HESS STATION #20204
1613 East Joppa Road
Towson, Maryland

Drawn By: RAL

Date: 1/3/20

EMS ENVIRONMENTAL



MW-4	
B	**8.4**
T	4.5
E	37.5
X	6.6
MTBE	0.64 (J)
TBA	16.8
TPH-GRO	**507**
TPH-DRO	**168**
N	**19.9**

MW-7	
B	**15.7**
T	12.5
E	112
X	96.9
MTBE	0.80 (J)
TBA	8.0 (J)
TPH-GRO	**2,540**
TPH-DRO	**1,380**
N	**55.7**

YMW-8	
B	**26.8**
T	46.1
E	673
X	1,000
MTBE	**19.8**
TBA	ND (<29)
TPH-GRO	**9,190**
TPH-DRO	**2,940**
N	**217**

YMW-3	
B	ND (<0.43)
T	ND (<0.53)
E	ND (<0.60)
X	ND (<0.59)
MTBE	ND (<0.51)
TBA	ND (<5.8)
TPH-GRO	**ND (<100)**
TPH-DRO	**ND (<53)**
N	**ND (<2.5)**

YP-1	
B	4.6
T	9.8
E	602
X	157
MTBE	2.0
TBA	13.5 (J)
TPH-GRO	**6,350**
TPH-DRO	**2,020**
N	**237**

YMW-1	
B	ND (<0.43)
T	ND (<0.53)
E	ND (<0.60)
X	ND (<0.59)
MTBE	ND (<0.51)
TBA	ND (<5.8)
TPH-GRO	**128**
TPH-DRO	**ND (<53)**
N	**ND (<2.5)**

YP-5	
B	ND (<0.43)
T	ND (<0.53)
E	ND (<0.60)
X	ND (<0.59)
MTBE	ND (<0.51)
TBA	ND (<5.8)
TPH-GRO	**ND (<100)**
TPH-DRO	**ND (<53)**
N	**ND (<2.5)**

YMW-2	
B	ND (<0.43)
T	ND (<0.53)
E	ND (<0.60)
X	ND (<0.59)
MTBE	**9.4**
TBA	27.5
TPH-GRO	**337**
TPH-DRO	**178**
N	**ND (<2.5)**

YMW-4	
B	**8.7**
T	0.60 (J)
E	ND (<0.60)
X	ND (<0.59)
MTBE	6.6
TBA	120
TPH-GRO	**764**
TPH-DRO	**582**
N	**ND (<2.5)**

YP-2	
B	**6.5**
T	ND (<0.53)
E	ND (0.60)
X	ND (<0.59)
MTBE	16.1
TBA	15.0
TPH-GRO	**422**
TPH-DRO	**248**
N	**6.3**

LEGEND

— —	Ridgely Manor Park Boundary
⊕	Groundwater Monitoring Well
◆	Piezometer
ND	Constituent Compound Not Detected
J	Laboratory-Estimated Value
B	Benzene
T	Toluene
E	Ethylbenzene
X	Total Xylenes
MTBE	Methyl Tertiary Butyl Ether
TBA	Tertiary Butyl Alcohol
TPH-GRO	Total Petroleum Hydrocarbons-Gasoline Range Organics
TPH-DRO	Total Petroleum Hydrocarbons-Diesel Range Organics
N	Naphthalene

All Concentrations Expressed In Micrograms/Liter (µg/L)

Values Shown In Boldface Type Exceed The Applicable MDE Statewide Health Standard

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)

FIGURE 3

HYDROCARBON DISTRIBUTION MAP

(Sampled: 11/13/19)

FORMER HESS STATION #20204
1613 East Joppa Road
Towson, Maryland

Drawn By: RAL

Date: 1/3/20

EMS ENVIRONMENTAL

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
MDE-4	7/17/1996	NSVD	NM	NM	NM	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	11/26/1996	NSVD	NM	NM	NM	3	3	ND	ND	6	ND	NS	NS	NS	NS
Casing:	2/27/1997	444.03	5.78	0.00	438.25	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
0 to 3 feet	5/30/1997	444.03	6.20	0.00	437.83	ND	ND	ND	2	2	ND	NS	NS	NS	NS
	8/21/1997	444.03	7.37	0.00	436.66	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
Screen:	11/25/1997	444.03	7.42	0.00	436.61	**11**	642	**892**	3,050	4,595	**69**	NS	NS	NS	NS
3 to 13 feet	2/19/1998	444.03	6.01	0.00	438.02	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/28/1998	444.03	5.60	0.00	438.43	4	5	4	8	21	ND	NS	NS	NS	NS
	8/18/1998	444.03	6.68	0.00	437.35	**13**	10	57	92	172	**31**	NS	NS	NS	NS
	11/21/1998	444.03	7.64	0.00	436.39	1	8	31	176	216	**57**	NS	NS	NS	NS
	2/17/1999	444.03	7.70	0.00	436.33	3.7	107	193	605	909	**39**	NS	NS	NS	NS
	5/24/1999	444.03	7.02	0.00	437.01	2	ND	ND	ND	2	ND	NS	NS	NS	NS
	8/26/1999	444.03	7.87	0.00	436.16	**24**	140	390	750	1,304	**44**	NS	NS	NS	NS
	11/18/1999	444.03	6.90	0.00	437.13	ND	500	**920**	2,850	4,270	ND	NS	NS	NS	NS
	2/23/2000	444.03	6.50	0.00	437.53	ND	ND	ND	ND	ND	3.9	NS	NS	NS	NS
	5/17/2000	444.03	6.00	0.00	438.03	ND	ND	2.4	11.7	14.1	**30**	NS	NS	NS	NS
	8/3/2000	444.03	6.48	0.00	437.55	**7.7**	9	59	101	177	**54**	NS	NS	NS	NS
	11/20/2000	444.03	7.15	0.00	436.88	ND	ND	120	242	362	ND	NS	NS	NS	NS
	2/20/2001	444.03	6.87	0.00	437.16	**7.3**	7.5	19	81	115	**22**	NS	NS	NS	NS
	5/25/2001	444.03	6.66	0.00	437.37	**15**	8.8	ND	20.3	44	**34**	NS	NS	NS	NS
	8/6/2001	444.03	7.26	0.00	436.77	**9.7**	33	380	1,220	1,643	**87**	NS	NS	NS	NS
	11/7/2001	444.03	8.39	0.00	435.64	ND	41	220	760	1,021	**120**	NS	NS	NS	NS
	2/22/2002	444.03	8.83	0.00	435.20	**12**	91	220	1,380	1,703	ND	NS	NS	NS	NS
	5/16/2002	444.03	6.52	0.00	437.51	ND	27	120	268	415	15	NS	NS	NS	NS
	8/6/2002	444.03	8.72	0.00	435.31	ND	360	**1,100**	3,630	5,090	**150**	NS	NS	NS	NS
	11/13/2002	444.03	8.23	0.00	435.80	ND	610	**1,300**	5,900	7,810	ND	NS	NS	NS	NS
	3/5/2003	444.03	5.43	0.00	438.60	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/13/2003	444.03	5.36	0.00	438.67	2.0	ND	ND	2.6	4.6	11	NS	NS	NS	NS
	8/27/2003	444.03	5.72	0.00	438.31	1.0	ND	1.8	ND	2.8	ND	NS	NS	NS	NS
	11/12/2003	444.03	6.66	0.00	437.37	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	2/2/2004	444.03	5.39	0.00	438.64	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/14/2004	444.03	5.24	0.00	438.79	ND	ND	ND	ND	ND	1.7	NS	NS	NS	NS
	8/19/2004	444.03	5.97	0.00	438.06	ND	ND	ND	ND	ND	**26.8**	NS	NS	NS	NS
	5/19/2005	444.03	5.94	0.00	438.09	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	8/24/2007	444.03	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/27/2007	444.03	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/27/2008	444.03	6.91	0.00	437.12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/25/2008	444.03	6.56	0.00	437.47	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/24/2008	444.03	7.14	0.00	436.89	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/17/2008	444.03	6.53	0.00	437.50	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/31/2009	444.03	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/22/2009	444.03	6.36	0.00	437.67	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/25/2009	444.03	6.60	0.00	437.43	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/14/2009	444.03	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	444.03	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/17/2010	444.03	4.51	0.00	439.52	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	444.03	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	8/24/2010	443.68	6.69	0.00	436.99	1.3	0.87 (J)	2.8	1.3	6.27 (J)	ND	ND	**858**	**216**	**1.6 (J)**
	1/11/2011	443.68	7.17	0.00	436.51	ND	ND	0.42 (J)	ND	0.42 (J)	ND	ND	**ND (<200)**	**ND (<100)**	ND
	6/23/2011	443.68	6.26	0.00	437.42	1.3	0.46 (J)	4.4	3.6	9.76 (J)	ND	ND	**982**	**464**	**3.3 (J)**
	9/28/2011	443.68	6.02	0.00	437.66	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<100)**	ND
	12/21/2012	443.68	5.90	0.00	437.78	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<100)**	ND
	3/21/2012	443.68	6.18	0.00	437.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	5/16/2012	443.68	6.48	0.00	437.20	0.50 (J)	ND	0.46 (J)	0.73 (J)	1.69 (J)	ND	ND	**340**	**104**	ND
	8/29/2012	443.68	7.67	0.00	436.01	0.50 (J)	ND	0.30 (J)	0.43 (J)	1.23 (J)	ND	ND	**407**	ND	ND
	12/19/2012	443.68	6.94	0.00	436.74	0.40 (J)	0.44 (J)	2.5	19.2	22.54 (J)	ND	ND	**390**	**372**	**1.1 (J)**
	3/20/2013	443.68	6.57	0.00	437.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/19/2013	443.68	6.47	0.00	437.21	0.45 (J)	0.56 (J)	7.0	8.4	16.41 (J)	ND	ND	**328**	ND	**2.0 (J)**
	9/19/2013	443.68	7.31	0.00	436.37	0.71 (J)	ND	1.3	0.60 (J)	2.61 (J)	ND	ND	**580**	**221**	**2.0 (J)**
	11/22/2013	443.68	7.25	0.00	436.43	1.9	3.2	427	1,420	1,852.10	ND	ND	**13,300**	**2,310**	**110**
	3/20/2014	443.68	5.56	0.00	438.12	ND	ND	0.99	5.8	6.79	ND	ND	ND	ND	ND
***	6/18/2014	443.68	8.33	0.00	435.35	ND	1.2	ND	17.5	18.7	ND	ND	**762**	***	**6.9**
***	6/30/2014	443.68	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS
	9/23/2014	443.18	9.54	0.00	433.64	ND	0.53 (J)	0.99 (J)	1.1	2.62 (J)	ND	ND	ND	**ND (<80)**	**0.93 (J)**
	12/23/2014	443.18	9.94	0.00	433.24	ND	ND	0.62 (J)	0.53 (J)	1.15 (J)	ND	ND	ND	**ND (<80)**	0.37 (J)
	3/24/2015	443.18	9.58	0.00	433.60	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<77)**	ND
	6/22/2015	443.18	9.25	0.00	433.93	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/21/2015	443.18	9.28	0.00	433.90	ND	ND	ND	ND	ND	ND	ND	ND	**125**	ND
	12/9/2015	443.18	9.58	0.00	433.60	ND	ND	ND	ND	ND	ND	ND	ND	**98.4**	ND
	3/8/2016	443.18	8.98	0.00	434.20	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	443.18	9.03	0.00	434.15	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<58)**	ND
	9/13/2016	443.18	9.48	0.00	433.70	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**94.6**	ND
	11/21/2016	443.18	9.90	0.00	433.28	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**469**	ND
	3/9/2017	443.18	10.42	0.00	432.76	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
ǂ	6/7/2017	443.18	9.72	0.00	433.46	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/6/2017	443.18	9.77	0.00	433.41	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	11/1/2017	443.18	9.97	0.00	433.21	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**154**	**ND (<1.1)**
	3/6/2018	443.18	9.84	0.00	433.34	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	6/20/2018	443.18	8.72	0.00	434.46	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	443.18	8.64	0.00	434.54	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	443.18	8.11	0.00	435.07	Not sampled									
	11/13/2019	443.18	9.23	0.00	433.95	Not sampled									
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
MW-1	3/28/1991	455.93	15.86	0.00	440.07	**17**	ND	ND	35	52	5	NS	NS	NS	NS
	6/26/1991	455.93	29.40	0.00	426.53	2	ND	ND	2	4	8	NS	NS	NS	NS
Casing:	9/1/1992	455.93	26.35	0.00	429.58	**25**	18	10	41	94	ND	NS	NS	NS	NS
Unknown	1/7/1993	455.93	24.70	0.00	431.23	3	4	ND	10	17	**142**	NS	NS	NS	NS
	4/12/1993	455.93	NM	NM	NM	**29**	5	7	51	92	**30**	NS	NS	NS	NS
Screen:	7/15/1993	455.93	NM	NM	NM	**12**	3	3	66	84	ND	NS	NS	NS	NS
Unknown	10/19/1993	455.93	NM	NM	NM	**11**	ND	ND	37	48	ND	NS	NS	NS	NS
	1/26/1994	455.93	NM	NM	NM	**10**	ND	3	22	35	ND	NS	NS	NS	NS
	4/20/1994	455.93	NM	NM	NM	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	8/2/1994	455.93	NM	NM	NM	**23**	ND	4	38	65	ND	NS	NS	NS	NS
	11/22/1994	455.93	NM	NM	NM	**14**	ND	3	16	33	11	NS	NS	NS	NS
	3/3/1995	455.93	NM	NM	NM	**12**	2	3	13	30	6	NS	NS	NS	NS
	5/9/1995	455.93	NM	NM	NM	**10**	ND	ND	11	21	16	NS	NS	NS	NS
	8/15/1995	455.93	NM	NM	NM	**12**	ND	2	23	37	ND	NS	NS	NS	NS
	11/28/1995	455.93	NM	NM	NM	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	2/13/1996	455.93	16.20	0.00	439.73	ND	ND	ND	4	4	ND	NS	NS	NS	NS
	5/15/1996	455.93	18.06	0.00	437.87	4	ND	ND	6	10	**24.3**	NS	NS	NS	NS
	8/28/1996	455.93	16.95	0.00	438.98	ND	6	3	12	21	5.6	NS	NS	NS	NS
	11/26/1996	455.93	26.21	0.00	429.72	3	ND	ND	2	5	ND	NS	NS	NS	NS
	2/27/1997	455.93	15.73	0.00	440.20	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/30/1997	455.93	16.00	0.00	439.93	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	8/21/1997	455.93	18.66	0.00	437.27	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	11/25/1997	455.93	17.97	0.00	437.96	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	2/19/1998	455.93	15.47	0.00	440.46	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/28/1998	455.93	15.06	0.00	440.87	ND	ND	3	9	12	ND	NS	NS	NS	NS
	8/18/1998	455.93	16.42	0.00	439.51	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/19/2005	455.93	16.83	0.00	439.10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	8/24/2007	455.93	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/27/2007	455.93	17.58	0.00	438.35	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/27/2008	455.93	17.39	0.00	438.54	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/25/2008	455.93	16.41	0.00	439.52	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/24/2008	455.93	16.57	0.00	439.36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/17/2008	455.93	16.26	0.00	439.67	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/31/2009	455.93	17.87	0.00	438.06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/22/2009	455.93	16.07	0.00	439.86	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/25/2009	455.93	16.48	0.00	439.45	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/14/2009	455.93	15.94	0.00	439.99	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	455.93	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/17/2010	455.93	0.01	0.00	455.92	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	455.93	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	8/26/2010	454.42	16.61	0.00	437.81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/10/2011	454.42	17.64	0.00	436.78	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<100)**	ND
	6/22/2011	454.42	16.05	0.00	438.37	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<110)**	ND
	9/28/2011	454.42	6.68	0.00	447.74	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<110)**	ND
	12/20/2012	454.42	15.90	0.00	438.52	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<100)**	ND
	3/21/2012	454.42	16.41	0.00	438.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	5/15/2012	454.42	14.43	0.00	439.99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	8/28/2012	454.42	15.84	0.00	438.58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/18/2012	454.42	17.16	0.00	437.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	3/19/2013	454.42	16.57	0.00	437.85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	6/18/2013	454.42	17.45	0.00	436.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/19/2013	454.42	17.54	0.00	436.88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	11/22/2013	454.42	17.87	0.00	436.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	3/20/2014	454.42	15.89	0.00	438.53	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.59 (J)
***	6/18/2014	454.42	18.43	0.00	435.99	ND	ND	ND	ND	ND	ND	ND	ND	***	ND
***	6/30/2014	454.42	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS
	9/23/2014	453.92	18.73	0.00	435.19	ND	ND	ND	ND	ND	ND	18.4	ND	**243**	ND
	12/23/2014	453.92	19.67	0.00	434.25	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<80)**	ND
	3/24/2015	453.92	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/22/2015	453.92	18.24	0.00	435.68	ND	ND	ND	ND	ND	ND	ND	ND	**102**	ND
	9/21/2015	453.92	18.49	0.00	435.43	ND	ND	ND	ND	ND	ND	ND	ND	**233**	ND
	12/9/2015	453.92	19.24	0.00	434.68	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<64)**	ND
	3/8/2016	453.92	18.28	0.00	435.64	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	453.92	18.21	0.00	435.71	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<58)**	ND
	9/13/2016	453.92	18.92	0.00	435.00	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**108**	ND
	11/21/2016	453.92	19.83	0.00	434.09	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	ND
	3/9/2017	453.92	20.49	0.00	433.43	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	6/7/2017	453.92	19.38	0.00	434.54	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/6/2017	453.92	19.04	0.00	434.88	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	11/1/2017	453.92	19.67	0.00	434.25	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	3/6/2018	453.92	20.16	0.00	433.76	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**91.9**	**ND (<1.1)**
	6/20/2018	453.92	17.45	0.00	436.47	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	453.92	16.71	0.00	437.21	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	453.92	16.52	0.00	437.40	Not sampled									
	11/13/2019	453.92	18.44	0.00	435.48	Not sampled									
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

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Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (μg/L)	Toluene (μg/L)	Ethyl-benzene (μg/L)	Xylenes (μg/L)	Total BTEX (μg/L)	MTBE (μg/L)	TBA (μg/L)	TPH-GRO (μg/L)	TPH-DRO (μg/L)	Naphthalene (μg/L)
MW-4	3/28/1991	457.11	16.98	0.00	440.13	**600**	**1,300**	380	1,500	3,780	**40**	NS	NS	NS	NS
	6/26/1991	457.11	23.80	0.00	433.31	**3,775**	**4,825**	**925**	4,075	13,600	**1,125**	NS	NS	NS	NS
Casing:	9/1/1992	457.11	22.00	0.00	435.11	**3,500**	**9,300**	**1,625**	5,225	19,650	**1,100**	NS	NS	NS	NS
0 to 10 feet	9/4/1992	457.11	22.79	0.01	434.33	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/15/1992	457.11	22.98	sheen	434.13	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Screen:	11/9/1992	457.11	23.20	2.50	435.79	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
10 to 25 feet	12/9/1992	457.11	21.58	1.36	436.55	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1/7/1993	457.11	21.68	0.02	435.45	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2/1/1993	457.11	23.15	0.85	434.60	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/8/1993	457.11	20.10	sheen	437.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4/12/1993	457.11	18.20	0.05	438.95	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	5/11/1993	457.11	18.10	0.15	439.12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/3/1993	457.11	18.96	0.38	438.44	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	7/7/1993	457.11	19.65	0.30	437.69	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	8/2/1993	457.11	18.95	0.00	438.16	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/15/1993	457.11	19.34	0.00	437.77	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/19/1993	457.11	19.75	0.00	437.36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	11/18/1993	457.11	20.75	sheen	436.36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/14/1993	457.11	19.85	0.00	437.26	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1/25/1994	457.11	17.84	0.00	439.27	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/11/1994	457.11	17.13	0.00	439.98	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4/20/1994	457.11	17.68	0.00	439.43	**1,650**	**6,130**	678	3,950	12,408	**223**	NS	NS	NS	NS
	8/2/1994	457.11	18.35	0.00	438.76	**2,630**	**12,200**	**1,430**	9,070	25,330	ND	NS	NS	NS	NS
	11/22/1994	457.11	18.52	0.00	438.59	**2,950**	**7,040**	**1,430**	8,700	20,120	**340**	NS	NS	NS	NS
	3/3/1995	457.11	20.31	0.00	436.80	**1,560**	**12,400**	**1,690**	9,050	24,700	**775**	NS	NS	NS	NS
	5/9/1995	457.11	20.25	0.00	436.86	**1,600**	**12,800**	**1,840**	**10,400**	26,640	**499**	NS	NS	NS	NS
	8/15/1995	457.11	21.10	0.00	436.01	**<200**	<200	<200	726	726	**<200**	NS	NS	NS	NS
	7/24/1995	457.11	19.29	0.02	437.84	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	11/28/1995	457.11	22.00	0.00	435.11	ND	10	ND	58	68	**47**	NS	NS	NS	NS
	2/13/1996	457.11	20.20	0.00	436.91	3	11	2	21	37	14	NS	NS	NS	NS
	5/15/1996	457.11	17.60	0.00	439.51	ND	53	18	133	204	6	NS	NS	NS	NS
	8/28/1996	457.11	16.98	0.00	440.13	ND	3	3	10	16	6	NS	NS	NS	NS
	11/26/1996	457.11	15.85	0.00	441.26	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	2/27/1997	457.11	14.19	0.00	442.92	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/30/1997	457.11	15.77	0.00	441.34	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	8/21/1997	457.11	19.01	0.00	438.10	**15**	24	4	27	70	ND	NS	NS	NS	NS
	11/25/1997	457.11	19.15	0.00	437.96	**89**	75	143	240	547	3	NS	NS	NS	NS
	2/19/1998	457.11	17.68	0.00	439.43	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	5/28/1998	457.11	16.64	0.00	440.47	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	8/18/1998	457.11	18.21	0.00	438.90	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	11/21/1998	457.11	19.65	0.00	437.46	**71**	**1,600**	183	731	2,585	19	NS	NS	NS	NS
	2/17/1999	457.11	19.70	0.00	437.41	ND	780	252	460	1,492	**<100**	NS	NS	NS	NS
	5/24/1999	457.11	18.90	0.00	438.21	ND	14	8.7	21.9	44.6	**77.7**	NS	NS	NS	NS
	8/26/1999	457.11	20.60	0.00	436.51	ND	ND	35	123	158	**220**	NS	NS	NS	NS
	11/18/1999	457.11	18.52	0.00	438.59	ND	ND	ND	3.8	3.8	**2,000**	NS	NS	NS	NS
	12/29/1999	457.11	NM	NM	NM	ND	ND	ND	ND	ND	**2,100**	NS	NS	NS	NS
	2/23/2000	457.11	19.21	0.00	437.90	**120**	4.5	32	106	263	**730**	NS	NS	NS	NS
	5/17/2000	457.11	16.90	0.00	440.21	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	8/3/2000	457.11	17.28	0.00	439.83	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	11/20/2000	457.11	19.69	0.00	437.42	**87**	ND	ND	ND	87	**3,000**	NS	NS	NS	NS
	2/20/2001	457.11	18.60	0.00	438.51	ND	ND	ND	ND	ND	6.8	NS	NS	NS	NS
	5/25/2001	457.11	17.30	0.00	439.81	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	8/6/2001	457.11	19.17	0.00	437.94	ND	ND	ND	ND	ND	2.0	NS	NS	NS	NS
	11/7/2001	457.11	21.17	0.00	435.94	**330**	62	370	800	1,562	**110**	NS	NS	NS	NS
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

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Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
MW-4 (continued)	2/22/2002	457.11	20.80	0.00	436.31	**81**	120	200	510	911	**33**	NS	NS	NS	NS
	5/16/2002	457.11	18.12	0.00	438.99	ND	15	12	223	250	2.2	NS	NS	NS	NS
	8/6/2002	457.11	21.61	0.00	435.50	3.5	3.2	7.0	22.8	36.5	3.9	NS	NS	NS	NS
	11/13/2002	457.11	18.81	0.00	438.30	ND	4.9	14	141	159.9	ND	NS	NS	NS	NS
	3/5/2003	457.11	18.41	0.00	438.70	ND	ND	ND	ND	ND	2.0	NS	NS	NS	NS
	5/13/2003	457.11	16.96	0.00	440.15	3.9	ND	ND	ND	3.9	**110**	NS	NS	NS	NS
	9/25/2003	457.11	NM	NM	NM	ND	ND	ND	ND	ND	1.5	NS	NS	NS	NS
	11/12/2003	457.11	18.32	0.00	438.79	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS
	2/2/2004	457.11	14.70	0.00	442.41	ND	ND	ND	ND	ND	**666**	NS	NS	NS	NS
	5/14/2004	457.11	18.09	0.00	439.02	ND	ND	ND	ND	ND	**24.8**	NS	NS	NS	NS
	8/19/2004	457.11	16.55	0.00	440.56	1.6	2.1	36.5	92.4	132.6	1.6	NS	NS	NS	NS
	11/22/2004	457.11	19.43	0.00	437.68	ND	ND	0.31 (J)	0.57 (J)	0.88 (J)	0.29 (J)	NS	NS	NS	NS
	2/23/2005	457.11	18.93	0.00	438.18	ND	ND	ND	ND	ND	0.65 (J)	NS	NS	NS	NS
	5/19/2005	457.11	16.67	0.00	440.44	ND	ND	ND	ND	ND	0.91 (J)	ND	ND	ND	NS
	8/24/2007	457.11	19.06	0.00	438.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/27/2007	457.11	18.72	0.00	438.39	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/27/2008	457.11	18.63	0.00	438.48	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/25/2008	457.11	17.57	0.00	439.54	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/24/2008	457.11	19.28	0.00	437.83	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/17/2008	457.11	19.10	0.00	438.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/31/2009	457.11	19.12	0.00	437.99	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/22/2009	457.11	15.07	0.00	442.04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/25/2009	457.11	17.63	0.00	439.48	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/14/2009	457.11	16.56	0.00	440.55	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	457.11	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/17/2010	457.11	14.98	0.00	442.13	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	457.11	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	8/23/2010	455.60	18.10	0.00	437.50	0.52 (J)	22.3	41.1	84.2	148.12 (J)	ND	ND	**449**	**244**	**7.2**
	1/10/2011	455.60	18.94	0.00	436.66	**16.4**	16.9	151	235	419.30	2.7	112	**1,940**	**1,930**	**84.1**
	6/22/2011	455.60	17.57	0.00	438.03	**8.7**	10.6	5.7	8.6	33.60	1.9	128	**306**	**304**	ND
	9/28/2011	455.60	17.08	0.00	438.52	ND	ND	ND	ND	ND	ND	ND	**ND (<200)**	**ND (<100)**	ND
	12/20/2012	455.60	17.30	0.00	438.30	ND	ND	0.29 (J)	ND	0.29 (J)	ND	ND	**ND (<200)**	**ND (<100)**	ND
	3/21/2012	455.60	17.78	0.00	437.82	0.24 (J)	ND	1.5	ND	1.74 (J)	ND	ND	ND	ND	ND
	5/15/2012	455.60	11.49	0.00	444.11	ND	ND	ND	ND	ND	ND	ND	ND	**283**	ND
	8/28/2012	455.60	18.91	0.00	436.69	ND	ND	ND	ND	ND	ND	ND	ND	**924**	ND
	12/18/2012	455.60	18.58	0.00	437.02	**6.5**	37.2	419	108	570.7	ND	18.5 (J)	**2,510**	**1,120**	**154**
	3/19/2013	455.60	17.99	0.00	437.61	ND	ND	ND	ND	ND	ND	ND	ND	**350**	ND
	6/18/2013	455.60	17.77	0.00	437.83	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/19/2013	455.60	19.01	0.00	436.59	3.0	16.1	85.9	16.2	121.2	ND	55.8	**2,420**	**367**	**34.3**
	11/22/2013	455.60	19.21	0.00	436.39	**9.9**	32.3	38.4	23.7	104.3	1.3	52.9	**4,110**	**1,400**	**7.0**
	3/20/2014	455.60	15.71	0.00	439.89	2.0	5.2	ND	5.8	13.0	1.2	71.3	**1,870**	**408**	ND
***	6/18/2014	455.60	18.24	0.00	437.36	**87.4**	59.2	9.4	24.8	180.8	**106**	1,770	**3,850**	***	**1.5 (J)**
***	6/30/2014	455.60	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	**2,160**	NS
	9/23/2014	455.10	20.69	0.00	434.41	**7.3**	212	541	567	1,327.3	**269**	1,150	**5,740**	**2,560**	**159**
	12/23/2014	455.10	21.37	0.00	433.73	**88.0**	83.0	**1,290**	1,480	2,941.0	**50.6**	771	**12,200**	**3,090**	**490**
	3/24/2015	455.10	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	6/22/2015	455.10	20.38	0.00	434.72	**178**	34.1	661	409	1,282.1	17.3	3,200	**6,130**	**4,540**	**392**
	9/21/2015	455.10	20.57	0.00	434.53	**153**	44.3	623	394	1,214.3	16.9	1,730	**10,300**	**3,740**	**430**
	12/9/2015	455.10	21.08	0.00	434.02	**7.8**	1.4	34.8	10.1	54.1	ND	250	**650**	**684**	**28.3**
	3/8/2016	455.10	20.29	0.00	434.81	**103**	9.4	223	49.0	384.4	7.5	553	**2,130**	**874**	**143**
	6/7/2016	455.10	20.28	0.00	434.82	**155**	27.1	**744**	139	1,065.1	6.2	3,030	**6,540**	**3,150**	**436**
	9/13/2016	455.10	20.87	0.00	434.23	**131**	23.1	**763**	150	1,067.1	5.8	2,320	**6,520**	**2,750**	**422**
	11/21/2016	455.10	21.56	0.00	433.54	**108**	25.9	**727**	192	1,052.9	12.9	2,480	**6,730**	**3,520**	**439**
	3/9/2017	455.10	22.05	0.00	433.05	**23.7**	5.5	142	42.8	214.0	3.4	ND	**2,450**	**1,090**	**144**
	6/7/2017	455.10	21.18	0.00	433.92	**14.6**	2.8	50.7	7.8	75.9	2.3	174	**1,590**	**1,050**	**34.3**
	9/6/2017	455.10	20.94	0.00	434.16	**44.1**	5.8	141	24.5	215.4	ND	1,230	**1,980**	**1,570**	**107**
	11/1/2017	455.10	21.41	0.00	433.69	**69.8**	7.6	146	42.1	266	6.1	1,380	**3,050**	**1,900**	**118**
	3/6/2018	455.10	21.75	0.00	433.35	**11.3**	0.71 (J)	12.3	4.4	28.7 (J)	ND	9.4 (J)	**1,090**	**1,070**	**20.6**
	6/20/2018	455.10	19.73	0.00	435.37	**18.2**	ND	0.77 (J)	ND	18.97 (J)	2.5	83.4	**124 (J)**	**112**	**ND (<1.1)**
	9/5/2018	455.10	19.34	0.00	435.76	**7.3**	ND	2.7	ND	10.0	ND	40.3	**226**	**110**	**2.8 (J)**
	7/18/2019	455.10	18.82	0.00	436.28	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	ND (<42)	**ND (<53)**	**ND (<0.98)**
	11/13/2019	455.10	20.42	0.00	434.68	**8.4**	4.5	37.5	6.6	57.0	0.64 (J)	16.8	**507**	**168**	**19.9**
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
MW-7	3/28/1991	452.69	15.10	0.00	437.59	**7,950**	**6,100**	**2,700**	8,550	25,300	**650**	NS	NS	NS	NS
	6/26/1991	452.69	16.12	0.00	436.57	**2,100**	**2,400**	**800**	2,300	7,600	**1,000**	NS	NS	NS	NS
Casing:	9/1/1992	452.69	17.22	0.00	435.47	**1,470**	**3,670**	**1,350**	5,350	11,840	**1,200**	NS	NS	NS	NS
0 to 8 feet	1/7/1993	452.69	26.25	0.00	426.44	**1,550**	**5,750**	**1,100**	6,250	14,650	**600**	NS	NS	NS	NS
	4/12/1993	452.69	NM	NM	NM	**200**	**2,550**	350	3,600	6,700	ND	NS	NS	NS	NS
Screen:	7/15/1993	452.69	NM	NM	NM	**2,150**	**8,550**	**1,200**	8,950	20,850	**1,000**	NS	NS	NS	NS
8 to 33 feet	10/19/1993	452.69	NM	NM	NM	**2,400**	**15,700**	**1,300**	9,000	28,400	**870**	NS	NS	NS	NS
	1/26/1994	452.69	NM	NM	NM	**1,100**	**6,200**	**950**	5,650	13,900	ND	NS	NS	NS	NS
	4/19/1994	452.69	NM	NM	NM	**11**	68	11	86	176	**64.4**	NS	NS	NS	NS
	8/2/1994	452.69	NM	NM	NM	**280**	**1,160**	260	2,280	3,980	**180**	NS	NS	NS	NS
	11/22/1994	452.69	NM	NM	NM	**1,530**	**1,780**	**1,380**	5,400	10,090	**338**	NS	NS	NS	NS
	3/3/1995	452.69	NM	NM	NM	**1,690**	**9,600**	**1,930**	**11,000**	24,220	**913**	NS	NS	NS	NS
	5/9/1995	452.69	NM	NM	NM	**448**	**2,330**	294	3,560	6,632	**<200**	NS	NS	NS	NS
	8/15/1995	452.69	NM	NM	NM	**370**	**1,790**	420	3,430	6,010	**<200**	NS	NS	NS	NS
	11/28/1995	452.69	NM	NM	NM	**394**	**3,440**	646	4,230	8,710	ND	NS	NS	NS	NS
	2/13/1996	452.69	14.75	0.00	437.94	**104**	164	106	259	633	ND	NS	NS	NS	NS
	5/15/1996	452.69	15.40	0.00	437.29	**132**	429	101	436	1,098	**33**	NS	NS	NS	NS
	8/28/1996	452.69	15.27	0.00	437.42	**422**	**3,460**	480	5,540	9,902	**78**	NS	NS	NS	NS
	11/26/1996	452.69	15.61	0.00	437.08	**96**	340	ND	875	1,311	ND	NS	NS	NS	NS
	2/27/1997	452.69	14.69	0.00	438.00	**56**	225	**1,420**	3,830	5,531	**109**	NS	NS	NS	NS
	5/30/1997	452.69	15.10	0.00	437.59	**69**	293	**1,600**	4,900	6,862	**149**	NS	NS	NS	NS
	8/21/1997	452.69	16.53	0.00	436.16	ND	349	**1,280**	5,730	7,359	ND	NS	NS	NS	NS
	11/25/1997	452.69	16.63	0.00	436.06	ND	175	**913**	4,160	5,248	**57**	NS	NS	NS	NS
	2/19/1998	452.69	15.23	0.00	437.46	ND	165	381	2,360	2,906	ND	NS	NS	NS	NS
	5/28/1998	452.69	14.36	0.00	438.33	**100**	364	**1,270**	5,070	6,804	**147**	NS	NS	NS	NS
	8/18/1998	452.69	15.61	0.00	437.08	**120**	313	**1,300**	5,540	7,273	ND	NS	NS	NS	NS
	11/21/1998	452.69	16.86	0.00	435.83	**<100**	195	**1,280**	6,340	7,815	**129**	NS	NS	NS	NS
	2/17/1999	452.69	17.02	0.00	435.67	**<50**	409	**1,510**	6,230	8,149	**136**	NS	NS	NS	NS
	5/24/1999	452.69	16.20	0.00	436.49	**37**	229	**1,010**	3,230	4,506	**211**	NS	NS	NS	NS
	8/26/1999	452.69	17.18	0.00	435.51	**<50**	110	**920**	3,900	4,930	**170**	NS	NS	NS	NS
	11/18/1999	452.69	16.02	0.00	436.67	**<20**	130	**870**	3,300	4,300	**1,400**	NS	NS	NS	NS
	12/29/1999	452.69	NM	NM	NM	**9**	140	**780**	3,200	4,129	**240**	NS	NS	NS	NS
	2/23/2000	452.69	15.43	0.00	437.26	**<20**	320	**990**	3,800	5,110	**370**	NS	NS	NS	NS
	5/17/2000	452.69	14.47	0.00	438.22	ND	180	**1,100**	3,900	5,180	**1,300**	NS	NS	NS	NS
	8/3/2000	452.69	14.92	0.00	437.77	**84**	260	**1,000**	4,200	5,544	**2,100**	NS	NS	NS	NS
	11/20/2000	452.69	16.65	0.00	436.04	ND	140	**830**	3,180	4,150	**150**	NS	NS	NS	NS
	2/20/2001	452.69	17.86	0.00	434.83	**70**	240	**850**	2,540	3,700	**130**	NS	NS	NS	NS
	5/25/2001	452.69	15.05	0.00	437.64	ND	250	**1,300**	3,600	5,150	ND	NS	NS	NS	NS
	8/6/2001	452.69	16.70	0.00	435.99	**11**	280	**1,400**	4,900	6,591	**210**	NS	NS	NS	NS
	11/7/2001	452.69	17.64	0.00	435.05	ND	64	**810**	2,284	3,158	**98**	NS	NS	NS	NS
	2/22/2002	452.69	17.92	0.00	434.77	**11**	75	660	2,080	2,826	**54**	NS	NS	NS	NS
	5/16/2002	452.69	15.80	0.00	436.89	ND	140	690	2,110	2,940	**51**	NS	NS	NS	NS
	8/6/2002	452.69	18.05	0.00	434.64	**60**	93	**800**	2,180	3,133	**140**	NS	NS	NS	NS
	11/13/2002	452.69	17.23	0.00	435.46	ND	ND	**760**	1,746	2,506	ND	NS	NS	NS	NS
	3/5/2003	452.69	13.94	0.00	438.75	ND	16	100	301	417	5.1	NS	NS	NS	NS
	5/13/2003	452.69	15.10	0.00	437.59	**10**	10	110	198	328	**22**	NS	NS	NS	NS
	9/25/2003	452.69	NM	NM	NM	**25.6**	24.9	343	273	667	16.1	NS	NS	NS	NS
	11/12/2003	452.69	15.36	0.00	437.33	**24.5**	91.7	**907**	1,400	2,423	10	NS	NS	NS	NS
	2/2/2004	452.69	14.40	0.00	438.29	**22.6**	76.4	605	1,390	2,094	7.0	NS	NS	NS	NS
	5/14/2004	452.69	13.97	0.00	438.72	**10.3**	28.8	499	595	1,133	5.8	NS	NS	NS	NS
	8/19/2004	452.69	14.67	0.00	438.02	**18.8**	82.8	**763**	2,720	3,585	11.3	NS	NS	NS	NS
	2/23/2005	452.69	16.39	0.00	436.30	3.5 (J)	80	**1,080**	4,320	5,484 (J)	7.6 (J)	NS	NS	NS	NS
	5/19/2005	452.69	16.25	0.00	436.44	2.1 (J)	61.9	**740**	2,580	3,384 (J)	3.7 (J)	NS	NS	NS	NS
	8/24/2005	452.69	15.89	0.00	436.80	**<10**	56.9	**1,020**	3,770	4,847	8.4 (J)	NS	NS	NS	NS
	11/8/2005	452.69	15.54	0.00	437.15	1.6 (J)	18.1	472	913	1,405 (J)	9.1	NS	NS	NS	NS
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

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Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
MW-7	2/10/2006	452.69	14.54	0.00	438.15	1.2 (J)	22	413	1,390	1,826	5.2	NS	NS	NS	NS
(continued)	5/15/2006	452.69	15.50	0.00	437.19	**<10**	34.4	**880**	2,690	3,604	**22.2**	NS	NS	NS	NS
	8/9/2006	452.69	15.41	0.00	437.28	ND	40	**911**	3,140	4,091	6.1	NS	NS	NS	NS
	10/17/2006	452.69	17.28	0.00	435.41	**<10**	42.3	**1,170**	4,340	5,552	10	NS	NS	NS	NS
	4/11/2007	452.69	NG	NG	NG	ND	1.9	57	92	150.9	ND	ND	**1,900**	ND	NS
	8/24/2007	452.69	16.38	0.00	436.31	1.5	7.2	200	150	359	4.3	ND	**1,900**	**1,300**	NS
	12/27/2007	452.69	16.02	0.00	436.67	ND	ND	1.2	2.2	3.4	ND	ND	ND	**4,900**	NS
	3/27/2008	452.69	16.11	0.00	436.58	ND	ND	14	12.9	26.9	1.0	ND	ND	ND	NS
	6/25/2008	452.69	15.56	0.00	437.13	0.42 (J)	3.1	17.4	39	59.9	ND	ND	**1,400**	**700**	NS
	9/24/2008	452.69	16.20	0.00	436.49	1.7	9.7	278	323	612.4	3.4	ND	**4,340**	**976**	NS
	12/17/2008	452.69	9.65	0.00	443.04	2.0	17.3	495	911	1,425.3	3.4	ND	**8,250**	**1,160**	NS
	3/31/2009	452.69	16.77	0.00	435.92	1.0	ND	ND	ND	1.0	**59.8**	ND (<25)	ND	**1,160**	NS
	6/22/2009	452.69	15.50	0.00	437.19	1.2 (J)	7.9	257	285	551.1 (J)	1.6 (J)	ND (<63)	**4,810**	**1,870**	NS
	9/25/2009	452.69	15.64	0.00	437.05	1.2 (J)	9.1	528	549	1,087.3 (J)	ND	ND (<50)	**9,450**	**2,330**	NS
	12/14/2009	452.69	13.57	0.00	439.12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	452.69	NM	NM	NM	0.51 (J)	3.4	98.9	53.7	156.51 (J)	ND	ND (<25)	**1,490**	**531**	NS
	3/17/2010	452.69	13.17	0.00	439.52	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	452.69	NM	NM	NM	ND	ND	43.3	7.4	50.7	ND	ND (<25)	**1,160**	**516**	NS
19 ft. sample	8/24/2010	453.52	15.73	0.00	437.79	1.8	3	238	58.4	301.2	ND	ND	**3,000**	**567**	NS
27 ft. sample	8/24/2010	453.52	15.73	0.00	437.79	**13**	2	127	31.3	173.3	**53.1**	47.6	**2,080**	**655**	**7.3**
	1/11/2011	453.52	16.36	0.00	437.16	1.8	8.7	492	294	796.5	1.8	ND	**7,180**	**2,360**	**75.4**
	6/23/2011	453.52	15.20	0.00	438.32	0.76 (J)	3.8	114	19.9	138.46 (J)	0.75 (J)	ND	**1,640**	**772**	**12.6**
	9/29/2011	453.52	14.99	0.00	438.53	1.5	6.7	330	200	538.2	1.7	18.8 (J)	**3,060**	**2,620**	**48.0**
	12/21/2012	453.52	14.86	0.00	438.66	3.7	2.8	13.6	3.0	23.1	6.7	276	**452**	**422**	**32.9**
	3/21/2012	453.52	15.26	0.00	438.26	4.0	3.4	128	10.1	145.5	4.5	198	**1,820**	**1,390**	**11.9**
	5/16/2012	453.52	15.60	0.00	437.92	2.3	3.5	138	55.7	199.5	2.9	126	**2,270**	**1,330**	**20.5**
	8/29/2012	453.52	15.84	0.00	437.68	3.5	9.3	392	354	758.8	3.5	96.3	**6,070**	**1,530**	**85.7**
	12/19/2012	453.52	16.06	0.00	437.46	3.2	8.9	464	424	900.1	9.7	44.3 (J)	**8,770**	**1,760**	**153**
	3/20/2013	453.52	14.45	0.00	439.07	1.8	7.8	208	289	506.6	3.7	ND	**4,880**	**1,400**	**171**
	6/19/2013	453.52	15.46	0.00	438.06	1.6	6.1	193	150	350.7	2.4	5.4 (J)	**3,980**	**1,690**	**80.0**
	9/19/2013	453.52	16.49	0.00	437.03	2.4	8.0	386	259	647.4	2.8	ND	**6,250**	**1,520**	**162**
	11/22/2013	453.52	16.56	0.00	436.96	2.1	9.0	481	295	787.1	3.8	10.1 (J)	**8,920**	**1,230**	**197**
	3/20/2014	453.52	14.60	0.00	438.92	2.1	3.2	147	20.3	172.6	1.5	ND	**2,830**	**1,560**	**29.2**
	6/18/2014	453.52	Inaccessible - Sampled on 6/24/2014												
***	6/24/2014	453.52	16.89	0.00	436.63	4.8	10.5	396	284	695.3	**32.1**	256	**8,400**	***	**34.1**
***	6/30/2014	453.52	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	**1,840**	NS
	9/23/2014	452.69	18.44	0.00	434.25	1.3	5.5	350	389	745.8	**28.3**	125	**8,640**	**232**	**159**
	12/23/2014	452.69	19.02	0.00	433.67	1.4	4.3	200	177	382.7	**29.6**	90.1	**5,990**	**1,030**	**91.8**
	3/24/2015	452.69	18.67	0.00	434.02	3.6	1.9	97.4	53.4	156.3	**80.0**	130	**3,540**	**463**	**56.2**
	6/22/2015	452.69	18.29	0.00	434.40	5.0	3.6	117	117	242.6	**51.0**	145	**2,980**	**1,580**	**45.7**
	9/21/2015	452.69	18.42	0.00	434.27	**5.9**	2.6	77.0	73.2	158.7	18.0	89.7	**3,460**	**902**	**27.3**
	12/9/2015	452.69	18.81	0.00	433.88	**7.3**	2.5	63.3	40.4	113.5	18.1	93.2	**2,080**	**714**	**6.4**
	3/8/2016	452.69	18.16	0.00	434.53	**8.9**	1.6	36.9	11.6	59.0	**81.5**	138	**1,990**	**785**	**2.8 (J)**
	6/7/2016	452.69	18.19	0.00	434.50	**8.3**	1.5	32.0	14.4	56.2	**25.3**	73.8	**1,390**	**904**	**5.5**
	9/13/2016	452.69	18.62	0.00	434.07	**8.5**	1.5	31.6	15.6	57.2	10.7	73.5	**2,600**	**925**	**5.0**
	11/21/2016	452.69	19.14	0.00	433.55	**7.6**	1.8	39.0	21.8	70.2	7.4	77.1	**2,240**	**564**	**7.7**
	3/9/2017	452.69	19.63	0.00	433.06	**6.9**	1.1	27.8	14.0	49.8	9.7	ND	**1,720**	**434**	**4.5**
ǂ	6/7/2017	452.69	18.89	0.00	433.80	**6.2**	0.81(J)	8.5	7.8	23.31 (J)	**43.2**	94.7	**1,130**	**585**	**ND (<1.0)**
	9/6/2017	452.69	18.78	0.00	433.91	**6.6**	2.2	42.6	35.4	86.8	8.2	64.6	**1,630**	**665**	**6.7**
	11/1/2017	452.69	19.07	0.00	433.62	**8.3**	3.3	63.2	56.2	131.0	9.2	96.2	**1,560**	**893**	**10.5**
	3/6/2018	452.69	19.31	0.00	433.38	3.3	0.56 (J)	3.3	2.2	9.36 (J)	**21.0**	72.8	**826**	**517**	**ND (<1.1)**
	6/20/2018	452.69	17.74	0.00	434.95	**18.4**	3.4	59.1	47.2	128.1	**52.7**	187	**1,810**	**866**	**12.0**
	9/5/2018	452.69	17.38	0.00	435.31	**12.9**	2.1	27.8	20.6	63.4	14.2	100	**1,410**	**715**	**4.6 (J)**
	7/18/2019	452.69	16.97	0.00	435.72	**5.1**	3.6	31.0	19.0	58.7	1.5	ND (<5.8)	**1,640**	**537**	**9.0**
	11/13/2019	452.69	18.28	0.00	434.41	**15.7**	12.5	112	96.9	237	0.80 (J)	8.0 (J)	**2,540**	**1,380**	**55.7**
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
OW-1	11/22/2004	NSVD	18.36	0.00	NSVD	**74.8**	169	**919**	5,220	6,383	**25**	NS	NS	NS	NS
	2/23/2005	NSVD	17.93	0.00	NSVD	4.4	9.4	168	621	803	19.9	NS	NS	NS	NS
Casing:	5/19/2005	NSVD	17.44	0.00	NSVD	**14.5**	46	343	1,130	1,534	14.3	NS	NS	NS	NS
0 to 9 feet	8/24/2005	NSVD	18.44	0.00	NSVD	**43.1**	163	**831**	3,890	4,927	5.9	NS	NS	NS	NS
	11/8/2005	NSVD	18.57	0.00	NSVD	4.0	17.8	344	1,050	1,416	7.7	NS	NS	NS	NS
Screen:	2/10/2006	NSVD	17.35	0.00	NSVD	1.8	11.2	77.3	328	418	2.2	NS	NS	NS	NS
9 to 34 feet	5/15/2006	NSVD	17.99	0.00	NSVD	4.0 (J)	53.4	414	1,690	2,161	6.4	NS	NS	NS	NS
	8/9/2006	NSVD	18.15	0.00	NSVD	**5.8**	68.4	432	1,550	2,056	10.8	NS	NS	NS	NS
	10/17/2006	NSVD	18.50	0.00	NSVD	1.2 (J)	18.6	268	712	1,000	10.2	NS	NS	NS	NS
	4/11/2007	NSVD	17.68	0.00	NSVD	ND	26	320	1,400	1,746	8.7	ND	**14,000**	**3,000**	NS
	8/24/2007	NSVD	19.14	0.00	NSVD	ND	11	210	440	661	4.2	ND	**6,900**	**2,400**	NS
	12/27/2007	NSVD	18.98	0.00	NSVD	ND	5.8	120	3.1	128.9	3.3	13	**9,600**	**2,400**	NS
	3/27/2008	NSVD	18.24	0.00	NSVD	ND	4.2	69	382.5	455.7	5.0	7.6	**9,200**	**2,000**	NS
	6/25/2008	NSVD	NM	NM	NSVD	ND	8.7	163	347	518.7	ND	ND	**8,900**	**1,400**	NS
	9/24/2008	NSVD	16.30	0.00	NSVD	0.67 (J)	11.6	170	372	554.3	1.2	13.3 (J)	**8,400**	**1,550**	NS
	12/17/2008	NSVD	15.95	0.00	NSVD	0.46 (J)	6.2	96.3	248	351.0	ND	ND	**6,020**	**1,490**	NS
	3/31/2009	NSVD	19.19	0.00	NSVD	ND	3.4	31.2	157	191.6	1.9	ND (<25)	**8,110**	**1,820**	NS
	6/22/2009	NSVD	17.74	0.00	NSVD	0.60 (J)	7.5	111	352	471.1 (J)	1.0	ND (<25)	**7,200**	**1,710**	NS
	9/25/2009	NSVD	18.10	0.00	NSVD	ND	3.0	73.0	168	244.0	ND	ND (<50)	**5,920**	**2,960**	NS
	12/14/2009	NSVD	16.51	0.00	NSVD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	NSVD	NM	NM	NM	0.30 (J)	6.3	209	934	1,149.6 (J)	0.44 (J)	ND (<25)	**8,690**	**1,440**	NS
	3/17/2010	NSVD	15.70	0.00	NSVD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	NSVD	NM	NM	NM	ND	22.1	98.5	378	498.6	ND	ND (<25)	**6,880**	**2,030**	NS
23 ft. sample	8/25/2010	455.81	18.27	0.00	437.54	0.71 (J)	14.7	267	376	658.41 (J)	ND	ND	**8,780**	**2,290**	NS
28 ft.sample	8/25/2010	455.81	18.27	0.00	437.54	0.88 (J)	13.4	239	384	637.28 (J)	ND	ND	**8,290**	**2,500**	ND
	1/10/2011	455.81	18.99	0.00	436.82	0.81 (J)	13.1	143	376	532.91 (J)	ND	ND	**7,960**	**2,800**	**138**
	6/22/2011	455.81	18.73	0.00	437.08	ND	0.20 (J)	4.3	9.1	13.6 (J)	ND	ND	**353**	**1,110**	**4.1 (J)**
	9/28/2011	455.81	17.56	0.00	438.25	ND	2.0	41.0	110	153.0	ND	ND	**3,920**	**268**	**53.9**
	12/20/2012	455.81	15.49	0.00	440.32	0.53 (J)	2.2	33.9	124	160.63 (J)	ND	ND	**4,430**	**465**	**61.8**
	3/20/2012	455.81	17.84	0.00	437.97	0.41 (J)	2.5	24.2	107	134.11 (J)	0.87 (J)	ND	**6,030**	**1,760**	**74.4**
	5/15/2012	455.81	20.16	0.00	435.65	0.65 (J)	1.1	11.8	57.4	70.95 (J)	ND	ND	**2,630**	**514**	**29.4**
	8/28/2012	455.81	18.31	0.00	437.50	0.54 (J)	2.8	54.3	95.0	152.64 (J)	ND	ND	**5,060**	**1,840**	**70.0**
	12/18/2012	455.81	18.64	0.00	437.17	0.90 (J)	3.6	77.8	145	227.30 (J)	0.42 (J)	ND	**4,890**	**1,280**	**58.8**
	3/19/2013	455.81	18.05	0.00	437.76	0.80 (J)	2.0	21.5	84.5	108.80 (J)	0.74 (J)	ND	**3,670**	**1,280**	**41.3**
	6/18/2013	455.81	17.91	0.00	437.90	ND	1.5	21.8	48.1	71.4	ND	ND	**4,330**	**2,190**	**56.7**
	9/19/2013	455.81	19.03	0.00	436.78	ND	2.5	53.7	68.5	124.7	ND	ND	**3,910**	**1,200**	**65.5**
	11/22/2013	455.81	19.13	0.00	436.68	0.38 (J)	5.1	116	92.4	213.88 (J)	ND	ND	**5,810**	**1,620**	**98.6**
	3/20/2014	455.81	17.24	0.00	438.57	0.33 (J)	1.7	27.4	35.5	64.93 (J)	0.52 (J)	ND	**4,100**	**1,240**	**45.3**
***	6/18/2014	455.81	18.82	0.00	436.99	2.2	3.5	47.6	65.1	118.4	7.9	ND	**6,150**	***	**66.4**
***	6/30/2014	455.81	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	**2,020**	NS
	9/23/2014	455.31	20.88	0.00	434.43	0.43 (J)	1.6	53.3	135	190.33 (J)	1.5	56.7	**7,780**	**1,170**	**72.0**
	12/23/2014	455.31	21.28	0.00	434.03	0.81	1.4	13.1	34.2	49.51	1.5	33.9	**4,310**	**1,280**	**23.6**
	3/24/2015	455.31	21.08	0.00	434.23	0.47 (J)	0.64 (J)	2.3	8.9	12.31 (J)	ND	ND	**3,180**	**787**	**14.6**
	6/22/2015	455.31	20.58	0.00	434.73	1.4	0.32 (J)	1.0	1.8	4.52 (J)	6.9	29.5	**1,370**	**918**	**3.4 (J)**
	9/21/2015	455.31	20.73	0.00	434.58	1.7	0.27 (J)	1.4	1.8	5.17 (J)	5.3	24.5	**982**	**515**	**1.3 (J)**
	12/9/2015	455.31	21.23	0.00	434.08	2.3	0.23 (J)	0.93 (J)	1.3	4.76 (J)	6.9	19.5	**1,040**	**459**	**0.76 (J)**
	3/8/2016	455.31	20.54	0.00	434.77	1.9	ND	0.36 (J)	ND	2.26 (J)	6.1	ND	**1,100**	**373**	0.33 (J)
	6/7/2016	455.31	20.58	0.00	434.73	2.5	0.33 (J)	2.5	3.0	8.33 (J)	6.6	14.0	**934**	**370**	ND
	9/13/2016	455.31	21.03	0.00	434.28	0.99	ND	ND	ND	0.99	3.3	10.7	**583**	**209**	ND
	11/21/2016	455.31	21.82	0.00	433.49	1.2	ND	0.56 (J)	ND	1.76 (J)	4.2	11.4	**486**	**344**	ND
	3/9/2017	455.31	22.04	0.00	433.27	1.5	ND	0.34 (J)	0.58 (J)	2.42 (J)	7.9	ND	**845**	**298**	**ND (<1.0)**
‡	6/7/2017	455.31	21.22	0.00	434.09	1.6	ND	0.47 (J)	0.69 (J)	2.76 (J)	7.3	11.5	**572**	**356**	**ND (<1.0)**
	9/6/2017	455.31	21.27	0.00	434.04	1.3	ND	0.37 (J)	0.45 (J)	2.12 (J)	4.7	12.8	**583**	**348**	**ND (<1.1)**
	11/1/2017	455.31	21.53	0.00	433.78	1.4	ND	0.49 (J)	0.32 (J)	2.2 (J)	6.1	11.3	**439**	**336**	**ND (<1.1)**
	3/6/2018	455.31	21.77	0.00	433.54	1.5	ND	1.3	8.6	11.4	7.5	19.7	**962**	**511**	**ND (<1.1)**
	6/20/2018	455.31	20.03	0.00	435.28	1.7	0.45 (J)	2.8	16.1	21.1 (J)	6.2	14.2	**746**	**469**	**ND (<1.1)**
	9/5/2018	455.31	19.61	0.00	435.70	2.2	ND	7.8	8.3	18.3	5.2	21.3	**816**	**441**	**1.2 (J)**
	7/18/2019	455.31	19.23	0.00	436.08	Not sampled									
	11/13/2019	455.31	20.66	0.00	434.65	Not sampled									
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
YMW-1	6/13/2006	433.72	3.00	0.00	430.72	**21.7**	30.1	559	373	984	15.6	NS	NS	NS	NS
	7/17/2006	433.72	3.95	0.00	429.77	**5.3**	61.4	543	1,390	2,000	ND	NS	NS	NS	NS
Casing:	4/11/2007	433.72	4.89	0.00	428.83	**5.5**	140	**1,200**	3,300	4,646	ND	ND	**37,000**	ND	NS
0 to 2 feet	8/24/2007	433.72	5.94	0.00	427.78	4.6	60	660	850	1,574.6	ND	ND	**12,000**	**1,500**	NS
	12/27/2007	433.72	5.29	0.00	428.43	4.8	32	500	30	566.8	ND	ND	**14,000**	**1,500**	NS
Screen:	3/27/2008	433.72	5.19	0.00	428.53	**5.6**	73	610	1,510	2,198.6	1.2	ND	**9,600**	**1,000**	NS
2 to 14 feet	6/25/2008	433.72	1.68	0.00	432.04	4.0	92.7	648	1,700	2,444.7	ND	ND	**14,300**	**1,980**	NS
	9/24/2008	433.72	2.55	0.00	431.17	2.3	38.1	477	912	1,429.4	ND	ND	**11,200**	**1,010**	NS
	12/17/2008	433.72	2.30	0.00	431.42	2.0	38.5	346	1,000	1,386.5	ND	ND	**10,700**	**731**	NS
	3/31/2009	433.72	2.78	0.00	430.94	**7.7**	20.2	112	290	429.9	6.1	ND (<25)	**7,790**	**567**	NS
	6/22/2009	433.72	1.13	0.00	432.59	1.9 (J)	54.4	557	1,470	2,083.3 (J)	ND	(<130)	**11,600**	**1,810**	NS
	9/25/2009	433.72	0.20	0.00	433.52	2.0	28.1	325	701	1,056.1	ND	ND (<50)	**8,540**	**1,540**	NS
	12/14/2009	433.72	0.00	0.00	433.72	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	433.72	NM	NM	NM	ND	40.7	401	1,490	1,931.7	ND	(<130)	**10,700**	**1,760**	NS
	3/17/2010	433.72	0.01	0.00	433.71	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	433.72	NM	NM	NM	ND	60.4	407	1,060	1,527.4	ND	(<130)	**10,500**	**1,080**	NS
	8/25/2010	434.11	1.39	0.00	432.72	2.3 (J)	81.1	635	1,250	1,968.4	ND	131	**5,350**	**796**	**234**
	1/12/2011	434.11	1.51	0.00	432.60	1.8	40.6	464	1,620	2,126.4	ND	ND	**11,500**	**2,080**	**168**
	6/22/2011	434.11	1.34	0.00	432.77	0.74 (J)	18.0	181	392	591.74 (J)	ND	ND	**4,200**	**1,530**	**59.3**
	9/28/2011	434.11	0.03	0.00	434.08	1.6	31.3	463	685	1,180.9	ND	ND	**7,580**	**ND (<110)**	**168**
	12/20/2012	434.11	1.01	0.00	433.10	1.4 (J)	52.0	**792**	1,530	2375.4 (J)	ND	ND	**12,600**	**1,161**	**285**
	3/20/2012	434.11	0.90	0.00	433.21	0.51 (J)	11.4	145	298	454.91 (J)	ND	ND	**1,690**	**1,140**	**58.6**
†	5/15/2012	434.11	0.04	0.00	434.07	3.5	7.3	14.1	73.8	98.7	5.8	21.8 (J)	**2,420**	**1,650**	**83.3**
	8/28/2012	434.11	1.56	0.00	432.55	1.9 (J)	22.0	240	107	370.9 (J)	ND	ND	**5,040**	**1,860**	**156**
	12/18/2012	434.11	0.50	0.00	433.61	2.0	23.4	178	143	346.4	ND	ND	**3,790**	**616**	**15.1**
	3/19/2013	434.11	0.03	0.00	434.08	1.3	54.4	444	645	1,144.7	ND	ND	**6,810**	**807**	**184**
	6/18/2013	434.11	0.89	0.00	433.22	0.90 (J)	21.3	231	164	417.2 (J)	ND	ND	**3,770**	**1,280**	**104**
	9/19/2013	434.11	1.49	0.00	432.62	2.2	27.3	428	173	630.5	ND	ND	**5,960**	**1,560**	**200**
	11/22/2013	434.11	0.50	0.00	433.61	2.2	23.0	377	89.5	491.7	ND	ND	**8,760**	**1,130**	**186**
	3/20/2014	434.11	0.01	0.00	434.10	1.4	18.6	234	69.5	323.5	ND	ND	**3,210**	**659**	**57.4**
***	6/18/2014	434.11	3.62	0.00	430.49	3.3	19.2	96.6	104	223.1	ND	ND	**4,710**	***	**132**
***	6/30/2014	434.11	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	**1,040**	NS
	9/23/2014	433.64	5.33	0.00	428.31	0.72	1.4	0.98 (J)	2.7	5.8 (J)	ND	ND	**775**	**269**	**2.3 (J)**
	12/23/2014	433.64	4.19	0.00	429.45	0.31 (J)	0.33 (J)	2.5	0.61 (J)	3.75 (J)	ND	ND	**277**	**ND (<80)**	ND
	3/24/2015	433.64	3.02	0.00	430.62	ND	ND	2.0	0.57 (J)	2.57 (J)	ND	ND	ND	**ND (<77)**	**0.97 (J)**
	6/22/2015	433.64	3.04	0.00	430.60	ND	ND	0.39 (J)	ND	0.39 (J)	ND	ND	ND	**108**	ND
	9/21/2015	433.64	4.94	0.00	428.70	0.60	ND	0.61 (J)	ND	1.21 (J)	ND	ND	**205**	**144**	**0.81 (J)**
	12/9/2015	433.64	4.37	0.00	429.27	ND	ND	1.7	ND	1.7	ND	ND	ND	**160**	ND
	3/8/2016	433.64	3.31	0.00	430.33	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	433.64	3.90	0.00	429.74	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	9/13/2016	433.64	5.47	0.00	428.17	0.86	ND	ND	ND	0.86	ND	ND	**157 (J)**	**112**	ND
	11/21/2016	433.64	6.21	0.00	427.43	0.35 (J)	ND	ND	ND	0.35 (J)	ND	ND	**ND (<100)**	**ND (<64)**	ND
	3/9/2017	433.64	5.40	0.00	428.24	0.41 (J)	ND	13.1	0.46 (J)	13.97 (J)	ND	ND	**184**	**ND (<64)**	**ND (<1.0)**
ǂ	6/7/2017	433.64	4.25	0.00	429.39	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/6/2017	433.64	4.44	0.00	429.20	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND(<83)**	**ND (<1.1)**
	11/1/2017	433.64	5.37	0.00	428.27	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND(<83)**	**ND (<1.1)**
	3/6/2018	433.64	4.16	0.00	429.48	ND	ND	0.86 (J)	ND	0.86 (J)	ND	ND	**ND (<100)**	**90.6**	**ND (<1.1)**
	6/20/2018	433.64	3.08	0.00	430.56	0.55	ND	ND	ND	0.55	ND	ND	**ND (<100)**	**ND(<83)**	**ND (<1.1)**
	9/5/2018	433.64	3.35	0.00	430.29	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND(<53)**	**ND (<0.90)**
	7/18/2019	433.64	2.73	0.00	430.91	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	ND (<0.42)	**ND(<53)**	**ND (<0.98)**
	11/13/2019	433.64	4.19	0.00	429.45	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	**128**	**ND(<53)**	**ND (<2.5)**
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (μg/L)	Toluene (μg/L)	Ethyl-benzene (μg/L)	Xylenes (μg/L)	Total BTEX (μg/L)	MTBE (μg/L)	TBA (μg/L)	TPH-GRO (μg/L)	TPH-DRO (μg/L)	Naphthalene (μg/L)
YMW-2	6/13/2006	431.42	0.89	0.00	430.53	3.3	47.6	211	656	917.9	2.3	NS	NS	NS	NS
	7/17/2006	431.42	1.25	0.00	430.17	**14.9**	25.6	533	285	858.5	10.7	NS	NS	NS	NS
Casing:	4/11/2007	431.42	1.60	0.00	429.82	**15**	24	630	670	1,339	14	17	**1,400**	**3,000**	NS
0 to 2 feet	8/24/2007	431.42	2.61	0.00	428.81	**16**	59	250	270	595	14	ND	**4,800**	**3,200**	NS
	12/27/2007	431.42	2.48	0.00	428.94	**13**	21	370	14	418	9.9	17	**13,000**	**2,300**	NS
Screen:	3/27/2008	431.42	1.06	0.00	430.36	**8.2**	21	260	395	684.2	7.7	ND	**7,700**	**1,400**	NS
2 to 14 feet	6/25/2008	431.42	1.00	0.00	430.42	**11.5**	38.5	66.3	163	279.3	10.5	ND	**6,010**	**1,550**	NS
	9/24/2008	431.42	1.15	0.00	430.27	**13.5**	45.7	125	215	399.2	9	ND	**7,710**	**2,000**	NS
	12/17/2008	431.42	1.00	0.00	430.42	1.3	2.4	22.7	33.9	60.3	1.1	ND	**920**	ND	NS
	3/31/2009	431.42	1.66	0.00	429.76	**8.1**	23.2	164	357	552.3	5.8	ND (<25)	**7,750**	**1,030**	NS
	6/22/2009	431.42	0.60	0.00	430.82	**6.6**	14.6	43.8	93.8	158.8	4.1	ND (<25)	**3,960**	**977**	NS
	9/25/2009	431.42	0.30	0.00	431.12	**9.1**	25.8	73.0	178	285.9	6.5	ND (<25)	**5,290**	**3,070**	NS
	12/14/2009	431.42	0.10	0.00	431.32	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/28/2009	431.42	NM	NM	NM	4.8	12.0	117	176	309.8	2.7	ND (<25)	**4,560**	**534**	NS
	3/17/2010	431.42	0.74	0.00	430.68	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/18/2010	431.42	NM	NM	NM	4.9	17.0	115	187	323.9	3.8	ND (<25)	**3,670**	**549**	NS
	8/25/2010	431.34	0.90	0.00	430.44	**6.9**	25.4	63.8	118	214.1	5.3	ND	**5,820**	**1,580**	**239**
	1/11/2011	431.34	1.39	0.00	429.95	**7.0**	23.6	199	251	480.6	4.8	ND	**7,190**	**1,950**	**215**
	6/23/2011	431.34	0.87	0.00	430.47	1.8	3.0	2.1	7.8	14.7	5.5	ND	**2,140**	**649**	**17.8**
	9/29/2011	431.34	0.08	0.00	431.26	**6.9**	19.6	29.0	138	193.5	9.4	31.5	**3,010**	**1,140**	**150**
	12/21/2012	431.34	0.92	0.00	430.42	**7.2**	14.9	98.0	194	314.1	8.6	ND	**5,510**	**1,470**	**164**
	3/21/2012	431.34	1.18	0.00	430.16	4.1	8.6	38.1	90.5	141.3	6.5	27.3	**3,800**	**859**	**86.2**
	5/16/2012	431.34	1.47	0.00	429.87	1.0 (J)	28.6	450	551	1,030.6 (J)	ND	ND	**8,100**	**1,820**	**247**
	8/29/2012	431.34	0.59	0.00	430.75	4.7	15.2	25.4	135	180.3	4.7	39.0	**4,490**	**1,990**	**157 (E)**
	12/19/2012	431.34	1.03	0.00	430.31	4.5	19.1	77.9	229	330.5	3.1	ND	**6,000**	**1,300**	**148**
	3/20/2013	431.34	1.00	0.00	430.34	2.9	12.4	55.1	133	203.4	5.0	ND	**3,550**	**582**	**96.5**
	6/19/2013	431.34	0.58	0.00	430.76	2.2	7.9	6.2	85.8	102.1	4.6	ND	**3,190**	**612**	**61.1**
	9/19/2013	431.34	0.08	0.00	431.26	3.2	18.9	23.3	158	203.4	2.7	ND	**3,770**	**1,250**	**102**
	11/22/2013	431.34	0.50	0.00	430.84	0.98 (J)	4.1	12.3	67.9	85.28 (J)	1.4	ND	**2,180**	**747**	**34.3**
	3/20/2014	431.34	0.00	0.00	431.34	4.5	7.6	124	178	314.1	4.7	ND	**4,340**	**934**	**76.6**
***	6/18/2014	431.34	1.23	0.00	430.11	0.89	0.43 (J)	9.4	24.6	35.32 (J)	ND	ND	**729**	***	**2.2 (J)**
***	6/30/2014	431.34	NM	NM	NM	NS	NS	NS	NS	NS	NS	NS	NS	**183**	NS
	9/23/2014	431.37	2.51	0.00	428.86	3.4	ND	ND	ND	3.4	13.4	77.3	**759**	**313**	ND
	12/23/2014	431.37	2.64	0.00	428.73	2.7	ND	ND	ND	2.7	18.7	103	**740**	**310**	ND
	3/24/2015	431.37	2.78	0.00	428.59	3.0	0.27 (J)	ND	ND	3.27 (J)	**22.6**	92.9	**671**	**309**	ND
	6/22/2015	431.37	2.51	0.00	428.86	2.4	ND	ND	ND	2.4	12.7	87.7	**336**	**315**	0.41 (J)
	9/21/2015	431.37	2.58	0.00	428.79	4.0	ND	ND	ND	4.0	18.2	150	**391**	**320**	ND
	12/9/2015	431.37	3.94	0.00	427.43	**6.8**	1.6	0.96 (J)	5.7	15.06 (J)	16.5	202	**671**	**345**	**1.6 (J)**
	3/8/2016	431.37	2.97	0.00	428.40	2.2	ND	ND	ND	2.2	19.6	96.2	**364**	**ND (<64)**	ND
	6/7/2016	431.37	2.84	0.00	428.53	**5.2**	ND	ND	ND	5.2	14.3	99.4	**222**	**ND (<64)**	ND
	9/13/2016	431.37	2.44	0.00	428.93	3.3	ND	ND	ND	3.3	11.6	135	**304**	**489**	ND
	11/21/2016	431.37	2.94	0.00	428.43	**5.8**	ND	ND	ND	5.8	ND	185	**645**	**260**	ND
	3/9/2017	431.37	2.94	0.00	428.43	**5.8**	ND	0.51 (J)	0.45 (J)	6.76 (J)	7.9	185	**727**	**ND (<64)**	**ND (<1.0)**
	6/7/2017	431.37	3.10	0.00	428.27	1.1	ND	ND	ND	1.1	11.5	238	**376**	**318**	**ND (<1.0)**
	9/6/2017	431.37	2.65	0.00	428.72	ND	ND	ND	ND	ND	10.7	280	**334**	**358**	**ND (<1.1)**
	11/1/2017	431.37	2.67	0.00	428.70	ND	ND	ND	ND	ND	ND	338	**374**	**420**	**ND (<1.1)**
	3/6/2018	431.37	2.85	0.00	428.52	0.53	ND	ND	ND	0.53	5.8	200	**514**	**308**	**ND (<1.1)**
	6/20/2018	431.37	2.58	0.00	428.79	ND	ND	ND	ND	ND	**20.6**	189	**150 (J)**	**162**	**ND (<1.1)**
	9/5/2018	431.37	2.51	0.00	428.86	ND	ND	ND	ND	ND	**22.3**	184	**144 (J)**	**151**	**ND (<0.98)**
	7/18/2019	431.37	3.01	0.00	428.36	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	**54.4**	59.0	**158 (J)**	**ND (<53)**	**ND (<0.98)**
	11/13/2019	431.37	2.61	0.00	428.76	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	9.4	27.5	**337**	**178**	**ND (<2.5)**
YMW-3	9/23/2014	440.39	9.41	0.00	430.98	ND	0.39 (J)	9.0	5.1	14.49 (J)	ND	ND	**268**	**327**	**1.1 (J)**
	12/23/2014	440.39	9.86	0.00	430.53	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<80)**	ND
Casing:	3/24/2015	440.39	8.17	0.00	432.22	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<76)**	ND
0 to 4.5 feet	6/22/2015	440.39	8.54	0.00	431.85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/21/2015	440.39	9.21	0.00	431.18	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<58)**	ND
Screen:	12/9/2015	440.39	8.83	0.00	431.56	ND	ND	ND	ND	ND	ND	ND	ND	**231**	ND
4.5 to 19.5 feet	3/8/2016	440.39	8.63	0.00	431.76	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	440.39	8.86	0.00	431.53	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	9/13/2016	440.39	9.54	0.00	430.85	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	ND
	11/21/2016	440.39	10.44	0.00	429.95	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	ND
	3/9/2017	440.39	9.55	0.00	430.84	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
ǂ	6/7/2017	440.39	8.82	0.00	431.57	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/6/2017	440.39	8.84	0.00	431.55	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	11/1/2017	440.39	9.34	0.00	431.05	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	3/6/2018	440.39	7.97	0.00	432.42	ND	ND	ND	ND	ND	ND	13.3	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	6/20/2018	440.39	8.27	0.00	432.12	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	440.39	8.48	0.00	431.91	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	440.39	8.12	0.00	432.27	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	ND (<42)	**ND (<53)**	**ND (<0.98)**
	11/13/2019	440.39	8.56	0.00	431.83	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	**ND (<100)**	**ND (<53)**	**ND (<2.5)**
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
YMW-4	9/23/2014	433.72	4.71	0.00	429.01	**6.1**	9.2	94.0	192	301.3	4.3	ND	**3,780**	**1,050**	**45.0**
	12/23/2014	433.72	4.31	0.00	429.41	**5.7**	14.2	44.7	219	283.6	5.9	16.6	**4,240**	**612**	**57.3**
Casing:	3/24/2015	433.72	4.06	0.00	429.66	4.0	21.6	36.6	434	496.2	10.6	53.8	**4,470**	**1,190**	**73.1**
0 to 2 feet	6/22/2015	433.72	3.96	0.00	429.76	**5.6**	21.6	36.3	376	439.5	**24.5**	114	**4,280**	**2,460**	**124**
	9/21/2015	433.72	4.45	0.00	429.27	**7.8**	17.2	33.2	289	347.2	**38.9**	163	**5,480**	**1,560**	**138**
Screen:	12/9/2015	433.72	4.34	0.00	429.38	**9.2**	13.7	31.9	252	306.8	**38.4**	251	**5,110**	**1,560**	**87.8**
2 to 17 feet	3/8/2016	433.72	4.18	0.00	429.54	2.4	3.1	4.4	39.0	48.9	10	68.8	**828**	**414**	**15.8**
	6/7/2016	433.72	4.18	0.00	429.54	**13.9**	9.5	27.8	116	167.2	**32.3**	280	**4,040**	**1,790**	**98.7**
	9/13/2016	433.72	4.46	0.00	429.26	**18.4**	8.7	25.3	108	160.4	**24.9**	240	**3,500**	**2,490**	**64.3**
	11/21/2016	433.72	4.85	0.00	428.87	**18.8**	5.2	13.6	59.5	97.1	**28.4**	247	**3,520**	**299**	**28.9**
	3/9/2017	433.72	4.30	0.00	429.42	**19.6**	4.8	8.9	47.4	80.7	**50.9**	ND	**2,830**	**925**	**32.4**
	6/7/2017	433.72	4.26	0.00	429.46	**13.4**	3.0	7.6	18.7	42.7	**21.4**	169	**1,940**	**1,300**	**20.8**
	9/6/2017	433.72	4.18	0.00	429.54	0.49 (J)	ND	0.70 (J)	1.6	2.79 (J)	0.46 (J)	7.2 (J)	**262**	**134**	**ND (<1.1)**
	11/1/2017	433.72	4.41	0.00	429.31	**20.9**	12.9	35.9	286	355.7	17.8	345	**3,570**	**1,730**	**50.3**
	3/6/2018	433.72	4.24	0.00	429.48	**6.2**	2.2	3.6	29.6	41.6	10.0	144	**688**	**383**	**4.8 (J)**
	6/20/2018	433.72	3.89	0.00	429.83	5.0	ND	0.63 (J)	ND	5.6 (J)	16.6	361	**591**	**623**	**ND (<1.1)**
	9/5/2018	433.72	4.01	0.00	429.71	**10.4**	0.72 (J)	4.2	5.7	21.0 (J)	14.0	355	**1,010**	**813**	**1.9 (J)**
	7/18/2019	433.72	3.79	0.00	429.93	1.8	ND (<0.53)	ND (<0.60)	ND (<0.59)	<3.5	**181**	384	**625**	**406**	**ND (<0.98)**
	11/13/2019	433.72	4.16	0.00	429.56	**8.7**	0.60 (J)	ND (<0.60)	ND (<0.59)	<10.5	6.6	384	**764**	**582**	**ND (<2.5)**
YMW-5	9/23/2014	430.70	4.42	0.00	426.28	ND	ND	ND	181	0.63 (J)	6.6	ND	**294**	**273**	ND
	12/23/2014	430.70	5.52	0.00	425.18	0.25 (J)	ND	ND	ND	0.25 (J)	5.6	ND	ND	**ND (<80)**	ND
Casing:	3/24/2015	430.70	3.05	0.00	427.65	0.65	ND	ND	ND	0.65	7.7	7.0 (J)	ND	**ND (<80)**	ND
0 to 1 feet	6/22/2015	430.70	3.05	0.00	427.65	0.92	ND	ND	ND	0.92	6.3	10.3	ND	**123**	ND
	9/21/2015	430.70	3.52	0.00	427.18	0.54	ND	ND	ND	0.54	9.2	23.5	ND	**98.0**	ND
Screen:	12/9/2015	430.70	3.16	0.00	427.54	0.35 (J)	ND	ND	ND	0.35 (J)	7.4	27.3	ND	**ND (<64)**	ND
1 to 16 feet	3/8/2016	430.70	2.99	0.00	427.71	0.38 (J)	ND	ND	ND	0.38 (J)	6.8	19.7	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	430.70	3.01	0.00	427.69	0.23 (J)	ND	ND	ND	0.23 (J)	6.8	12.6	**ND (<55)**	**ND (<64)**	ND
	9/13/2016	430.70	3.39	0.00	427.31	0.20 (J)	ND	ND	ND	0.20 (J)	6.6	15.4	**ND (<100)**	**ND (<64)**	ND
	11/21/2016	430.70	3.74	0.00	426.96	ND	ND	ND	ND	ND	6.2	26.2	**ND (<100)**	**565**	ND
	3/9/2017	430.70	3.14	0.00	427.56	0.30 (J)	ND	ND	ND	0.30 (J)	5.7	23.2	**ND (<100)**	**ND (<64)**	**ND (<100)**
	6/7/2017	430.70	3.07	0.00	427.63	0.25 (J)	ND	ND	ND	0.25 (J)	4.5	13.5	**ND (<100)**	**105**	**ND (<100)**
	9/6/2017	430.70	2.98	0.00	427.72	ND	ND	ND	ND	ND	3.6	12.2	**ND (<100)**	**171**	**ND (<1.1)**
	11/1/2017	430.70	3.23	0.00	427.47	ND	ND	ND	ND	ND	5.5	27.9	**ND (<100)**	**109**	**ND (<1.1)**
	3/6/2018	430.70	2.83	0.00	427.87	ND	ND	ND	ND	ND	4.2	27.9	**ND (<100)**	**98.6**	**ND (<1.1)**
	6/20/2018	430.70	2.67	0.00	428.03	ND	ND	ND	ND	ND	3.0	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	430.70	2.74	0.00	427.96	ND	ND	ND	ND	ND	3.3	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	430.70	2.36	0.00	428.34	Not sampled									
	11/13/2019	430.70	2.70	0.00	428.00	Not sampled									
YMW-6	9/23/2014	432.68	6.61	0.00	426.07	ND	ND	ND	ND	ND	1.5	26.9	ND	**ND (<80)**	ND
	12/23/2014	432.68	5.69	0.00	426.99	ND	ND	ND	ND	ND	1.4	24.7	ND	**ND (<80)**	ND
Casing:	3/24/2015	432.68	5.11	0.00	427.57	ND	ND	ND	ND	ND	2.1	44.5	ND	**ND (<80)**	ND
0 to 3 feet	6/22/2015	432.68	5.11	0.00	427.57	ND	ND	ND	ND	ND	2.4	65.6	ND	ND	ND
	9/21/2015	432.68	6.11	0.00	426.57	ND	ND	ND	ND	ND	2.9	73.3	ND	**76.9**	ND
Screen:	12/9/2015	432.68	5.56	0.00	427.12	ND	ND	ND	ND	ND	2.9	80.3	ND	**ND (<64)**	ND
3 to 18 feet	3/8/2016	432.68	5.10	0.00	427.58	ND	ND	ND	ND	ND	3.3	91.0	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	432.68	5.36	0.00	427.32	ND	ND	ND	ND	ND	4.3	109	**ND (<55)**	**ND (<64)**	ND
	9/13/2016	432.68	6.38	0.00	426.30	ND	ND	ND	ND	ND	4.3	98.6	**ND (<100)**	**ND (<64)**	ND
	11/21/2016	432.68	7.05	0.00	425.63	ND	ND	ND	ND	ND	3.8	85.9	**ND (<100)**	**ND (<64)**	ND
	3/9/2017	432.68	6.25	0.00	426.43	ND	ND	ND	ND	ND	4.5	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	6/7/2017	432.68	5.49	0.00	427.19	ND	ND	ND	ND	ND	4.9	97.3	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/6/2017	432.68	6.25	0.00	426.43	ND	ND	ND	ND	ND	4.0	89.6	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	11/1/2017	432.68	6.65	0.00	426.03	ND	ND	ND	ND	ND	4.7	83.7	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	3/6/2018	432.68	5.35	0.00	427.33	ND	ND	ND	ND	ND	5.0	85.6	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	6/20/2018	432.68	4.89	0.00	427.79	ND	ND	ND	ND	ND	5.5	96.8	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	432.68	5.05	0.00	427.63	ND	ND	ND	ND	ND	5.3	98.4	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	432.68	4.74	0.00	427.94	Not sampled									
	11/13/2019	432.68	5.49	0.00	427.19	Not sampled									
YMW-7	9/23/2014	449.40	15.33	0.00	434.07	**173**	141	428	2,240	2,982	10.0	ND	**17,500**	**1,670**	**73.6**
	12/23/2014	449.40	15.16	0.00	434.24	**176**	130	690	2,580	3,576	9.1 (J)	ND	**23,800**	**2,250**	**99.7**
Casing:	3/24/2015	449.40	15.54	0.00	433.86	**142**	78.0	261	2,330	2,811	11.4	ND	**16,300**	**2,560**	**92.8**
0 to 18 feet	6/22/2015	449.40	15.22	0.00	434.18	**134**	37.4	146	828	1,145.4	9.1	ND	**6,820**	**1,680**	**39.8**
	9/21/2015	449.40	15.32	0.00	434.08	**101**	18.9	67.9	286	473.8	8.3	17.0	**4,970**	**736**	**22.1**
Screen:	12/9/2015	449.40	15.68	0.00	433.72	**129**	80.2	301	1,140	1,650.2	7.3	ND	**14,100**	**1,630**	**122**
18 to 28 feet	3/8/2016	449.40	15.13	0.00	434.27	**136**	52.0	140	688	1,016.0	7.3	17.0 (J)	**7,050**	**1,300**	**97.7**
	6/7/2016	449.40	15.09	0.00	434.31	**127**	42.3	166	620	955.3	7.6	15.7	**7,370**	**1,320**	**75.6**
	9/13/2016	449.40	15.47	0.00	433.93	**118**	65.2	296	961	1,440.2	6.9	14.0 (J)	**9,010**	**1,480**	**103**
	11/21/2016	449.40	15.69	0.00	433.71	**97.2**	68.1	313	1,080	1,558.3	ND	ND	**10,300**	**841**	**108**
	3/9/2017	449.40	16.31	0.00	433.09	**45.0**	81.7	342	1,450	1,918.7	1.9	ND	**12,000**	**1,290**	**121**
	6/7/2017	449.40	15.24	0.00	434.16	**60.0**	76.2	303	1,310	1,749.2	2.6 (J)	ND	**13,100**	**2,350**	**124**
	9/6/2017	449.40	15.68	0.00	433.72	**57.3**	92.3	398	1,470	2,017.6	ND	ND	**13,200**	**1,650**	**130**
	11/1/2017	449.40	15.91	0.00	433.49	**48.5**	89.6	374	1,550	2,062	ND	ND	**13,200**	**2,330**	**116**
	3/6/2018	449.40	16.12	0.00	433.28	**37.9**	54.1	267	1,190	1,549	1.4	ND	**13,000**	**2,170**	**91.5**
	6/20/2018	449.40	14.75	0.00	434.65	**57.9**	23.6	195	473	750	2.7	15.9 (J)	**6,530**	**1,100**	**63.4**
	9/5/2018	449.40	14.43	0.00	434.97	**64.9**	10.1	105	207	387	3.5	12.1	**3,810**	**ND (<53)**	**39.8**
	7/18/2019	449.40	13.96	0.00	435.44	Not sampled									
	11/13/2019	449.40	14.98	0.00	434.42	Not sampled									
MDE MEAT GNCSG**						**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
YMW-8	9/23/2014	446.91	13.63	0.00	433.28	**56.4**	46.8	638	2,270	3,011.2	**50.8**	ND	**16,100**	**1,820**	**182**
	12/23/2014	446.91	13.96	0.00	432.95	**61.9**	50.5	**793**	2,570	3,475.4	**40.0**	ND	**17,800**	**2,450**	**216**
Casing:	3/24/2015	446.91	12.91	0.00	434.00	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<80)**	ND
0 to 7 feet	6/22/2015	446.91	13.44	0.00	433.47	**91.5**	18.4	255	395	759.9	**28.4**	17.2	**4,330**	**1,710**	**75.9**
	9/21/2015	446.91	13.85	0.00	433.06	**45.7**	24.9	533	1,150	1,753.6	**31.2**	ND	**16,600**	**1,900**	**145**
Screen:	12/9/2015	446.91	13.94	0.00	432.97	**39.5**	96.9	631	1,500	2,267.4	**24.6**	ND	**18,400**	**2,470**	**169**
7 to 22 feet	3/8/2016	446.91	13.05	0.00	433.86	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	446.91	13.52	0.00	433.39	**72.4**	14.6	341	185	613.0	**29.1**	20.9	**4,260**	**1,020**	**77.1**
	9/13/2016	446.91	14.03	0.00	432.88	**37.0**	117	**806**	1,790	2,750	**26.1**	30.6 (J)	**14,700**	**3,440**	**200**
	11/21/2016	446.91	14.39	0.00	432.52	**22.9**	113	**710**	2,240	3,085.9	18.8	ND	**18,200**	**3,920**	**208**
	3/9/2017	446.91	14.61	0.00	432.30	**31.2**	114	**1,010**	3,070	4,225.2	**21.3**	ND	**20,400**	**2,620**	**297**
	6/7/2017	446.91	14.07	0.00	432.84	**41.9**	70.9	**953**	2,840	3,905.8	**22.4**	47.8 (J)	**19,500**	**3,080**	**251**
	9/6/2017	446.91	14.28	0.00	432.63	**25.1**	155	**1,060**	3,190	4,430.1	18.4	ND	**26,300**	**6,870**	**291**
	11/1/2017	446.91	14.43	0.00	432.48	**23.9**	144	**1,190**	4,250	5,608	19.2	ND	**21,600**	**4,510**	**301**
	3/6/2018	446.91	14.07	0.00	432.84	**36.3**	76.0	**1,240**	4,660	6,012	21.6	102	**26,400**	**4,570**	**325**
	6/20/2018	446.91	12.80	0.00	434.11	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	446.91	12.99	0.00	433.92	**29.3**	10.4	202	267	509	9.4	17.4	**3,000**	**823**	**59.7**
	7/18/2019	446.91	12.57	0.00	434.34	**11.4**	1.1	31.4	34.5	78.4	5.5	ND (<5.8)	**403**	**ND (<53)**	**6.1**
	11/13/2019	446.91	13.63	0.00	433.28	**26.8**	46.1	673	1,000	1,746	19.8	ND (<29)	**9,190**	**2,940**	**217.0**
YMW-9	9/23/2014	436.71	6.16	0.00	430.55	ND	ND	ND	ND	ND	1.8	ND	ND	**ND (<80)**	ND
	12/23/2014	436.71	5.94	0.00	430.77	ND	ND	ND	ND	ND	1.6	ND	ND	**ND (<80)**	ND
Casing:	3/24/2015	436.71	5.41	0.00	431.30	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<80)**	ND
0 to 2.5 feet	6/22/2015	436.71	5.81	0.00	430.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/21/2015	436.71	6.17	0.00	430.54	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<58)**	ND
Screen:	12/9/2015	436.71	5.86	0.00	430.85	ND	ND	ND	ND	ND	ND	ND	ND	**ND (<64)**	ND
2.5 to 17.5 feet	3/8/2016	436.71	5.43	0.00	431.28	ND	ND	ND	ND	ND	ND	ND	**ND (<55)**	**ND (<64)**	ND
	6/7/2016	436.71	5.93	0.00	430.78	ND	ND	ND	ND	ND	0.48 (J)	ND	**ND (<55)**	**ND (<64)**	ND
	9/13/2016	436.71	6.44	0.00	430.27	ND	ND	ND	ND	ND	0.67 (J)	ND	**ND (<100)**	**ND (<64)**	ND
	11/21/2016	436.71	6.50	0.00	430.21	ND	ND	ND	ND	ND	0.62 (J)	ND	**ND (<100)**	**ND (<64)**	ND
	3/9/2017	436.71	6.23	0.00	430.48	ND	ND	ND	ND	ND	0.94 (J)	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	6/7/2017	436.71	6.13	0.00	430.58	ND	ND	ND	ND	ND	0.86 (J)	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/6/2017	436.71	6.42	0.00	430.29	ND	ND	ND	ND	ND	0.92 (J)	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	11/1/2017	436.71	6.34	0.00	430.37	ND	ND	ND	ND	ND	1.2	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	3/6/2018	436.71	5.29	0.00	431.42	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**87.5**	**ND (<1.1)**
	6/20/2018	436.71	5.73	0.00	430.98	ND	ND	ND	ND	ND	1.7	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/5/2018	436.71	5.88	0.00	430.83	ND	ND	ND	ND	ND	1.7	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	436.71	5.65	0.00	431.06	Not sampled									
	11/13/2019	436.71	5.87	0.00	430.84	Not sampled									
YP-1	9/23/2014	440.41	9.11	0.00	431.30	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/23/2014	440.41	9.16	0.00	431.25	0.98	42.1	383	326	752.08	6.3	34.5	**4,370**	**221**	**67.0**
Casing:	3/25/2015	440.41	9.26	0.00	431.15	1.8 (J)	72.6	**762**	2,120	2,956.4 (J)	11.2	70.9	**13,300**	**2,160**	**160**
0 to 8 feet	6/23/2015	440.41	9.18	0.00	431.23	**5.6**	75.6	**714**	1,420	2,215.2	19.3	104	**11,100**	**1,980**	**186**
	9/22/2015	440.41	9.20	0.00	431.21	**7.0**	63.1	**807**	1,460	2,337.1	9.4	120	**9,470**	**2,500**	**280**
Screen:	12/10/2015	440.41	9.17	0.00	431.24	**5.5**	31.0	**723**	872	1,631.5	5.0	113	**13,400**	**1,590**	**181**
8 to 13 feet	3/9/2016	440.41	9.24	0.00	431.17	**6.0**	28.1	**756**	970	1,760.1	5.0	38.4	**10,700**	**1,940**	**166**
	6/8/2016	440.41	9.14	0.00	431.27	**6.4**	20.2	638	773	1,437.6	4.2	53.3	**8,270**	**2,490**	**189**
	9/14/2016	440.41	8.18	0.00	432.23	**6.8**	12.4	516	259	794.2	3.5	25.0	**6,130**	**1,730**	**113**
	11/22/2016	440.41	9.25	0.00	431.16	**7.4**	12.7	652	314	986.1	2.4	24.7	**6,950**	**1,230**	**129**
	3/10/2017	440.41	9.39	0.00	431.02	4.0	22.7	**820**	1,160	2,006.7	ND	ND	**8,680**	**1,710**	**171**
‡	6/8/2017	440.41	9.34	0.00	431.07	4.4	14.4	683	1,020	1,721.8	2.0 (J)	32.4 (J)	**11,500**	**1,780**	**185**
	9/7/2017	440.41	9.29	0.00	431.12	**6.9**	23.4	698	466	1,194.3	ND	ND	**8,770**	**3,130**	**228**
	11/1/2017	440.41	9.32	0.00	431.09	**8.4**	31.3	**785**	398	1,222.7	3.1	ND	**6,930**	**2,230**	**202**
	3/7/2018	440.41	9.41	0.00	431.00	**5.5**	54.7	**952**	2,210	3,222.2	1.9 (J)	52.7	**14,600**	**3,660**	**284**
	6/21/2018	440.41	9.14	0.00	431.27	4.2	22.6	**811**	1,360	2,198	4.1	89.5	**9,620**	**2,000**	**245**
	9/6/2018	440.41	9.01	0.00	431.40	**10.1**	30.6	688	759	1,488	5.3	115	**9,700**	**2,030**	**202**
	7/18/2019	440.41	8.93	0.00	431.48	**5.8**	16.5	**725**	404	1,151	1.9	ND (<5.8)	**11,200**	**1,510**	**268**
	11/13/2019	440.41	9.16	0.00	431.25	4.6	9.8	602	157	773	2.0	13.5 (J)	**6,350**	**2,020**	**237**
YP-2	9/23/2014	438.35	8.25	0.00	430.10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/23/2014	438.35	8.10	0.00	430.25	3.0	ND	ND	ND	3.0	8.5	7.4 (J)	ND	**ND (<80)**	0.43 (J)
Casing:	3/25/2015	438.35	8.05	0.00	430.30	**5.3**	ND	1.7	1	7.0	12.5	ND	ND	**ND (<80)**	0.42 (J)
0 to 7 feet	6/23/2015	438.35	7.98	0.00	430.37	3.9	ND	ND	ND	3.9	12.6	4.7 (J)	ND	**95**	ND
	9/22/2015	438.35	8.13	0.00	430.22	**5.2**	0.20 (J)	ND	0.77 (J)	6.17 (J)	13.2	60.2	**399**	**299**	0.52 (J)
Screen:	12/10/2015	438.35	8.25	0.00	430.10	**9.8**	0.18 (J)	ND	0.44 (J)	10.42 (J)	15.5	76.0	**322**	**254**	**0.81 (J)**
7 to 12 feet	3/9/2016	438.35	8.15	0.00	430.20	**62.4**	0.21 (J)	2.8	0.44 (J)	65.85 (J)	**32.7**	18.9	**324**	**110**	0.66 (J)
	6/8/2016	438.35	8.07	0.00	430.28	**13.9**	ND	ND	ND	13.9	17.7	23.4	**159**	**151**	ND
	9/14/2016	438.35	8.07	0.00	430.28	2.0	ND	ND	ND	2.0	6.1	37.0	**215**	**ND (<64)**	ND
	11/22/2016	438.35	8.11	0.00	430.24	**6.9**	0.46 (J)	15.9	7.4	30.66 (J)	8.6	167	**1,030**	**437**	**7.7**
	3/10/2017	438.35	8.11	0.00	430.24	3.0	ND	ND	ND	3.0	11.6	78.5	**168**	**ND (<64)**	**ND (<1.0)**
	9/7/2017	438.35	8.10	0.00	430.25	1.4	ND	ND	ND	1.4	10.1	26.3	**121 (J)**	**196**	**ND (<1.1)**
‡	6/8/2017	438.35	8.23	0.00	430.12	2.0	ND	ND	ND	2.0	13.1	21.6	**130 (J)**	**192**	**ND (<1.1)**
	9/7/2017	438.35	8.10	0.00	430.25	1.4	ND	ND	ND	1.4	10.1	26.3	**121 (J)**	**196**	**ND (<1.1)**
	11/1/2017	438.35	8.08	0.00	430.27	**6.7**	ND	3.0	0.36 (J)	10.1	10.5	257	**521**	**984**	**4.3 (J)**
	3/7/2018	438.35	8.12	0.00	430.23	0.93	ND	ND	ND	0.93	5.0	44.0	**ND (<100)**	**106**	**ND (<1.1)**
	6/21/2018	438.35	8.13	0.00	430.22	0.92	ND	ND	ND	0.92	7.0	13.6	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/6/2018	438.35	8.16	0.00	430.19	2.9	ND	ND	ND	2.9	9.6	57.7	**181 (J)**	**96.3**	**ND (<0.98)**
	7/18/2019	438.35	8.03	0.00	430.32	0.70	ND (<0.53)	ND (<0.60)	ND (<0.59)	<2.42	12.5	ND (<5.8)	**150 (J)**	**ND (<53)**	**ND (<0.98)**
	11/13/2019	438.35	8.16	0.00	430.19	**6.5**	ND (<0.53)	ND (<0.60)	ND (<0.59)	<8.22	16.1	15.0	**422**	**248**	**6.3**
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table 1
HISTORICAL GROUNDWATER MONITORING DATA SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Well No.	Date	Casing Elevation* (feet)	Depth to Water (feet)	Product Thickness (feet)	Water Table Elevation* (feet)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TBA (µg/L)	TPH-GRO (µg/L)	TPH-DRO (µg/L)	Naphthalene (µg/L)
YP-3	9/23/2014	436.51	5.21	0.00	431.30	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/23/2014	436.51	5.21	0.00	431.30	ND	ND	ND	ND	ND	1.9	ND	ND	**ND (<80)**	ND
Casing:	3/25/2015	436.51	4.85	0.00	431.66	0.30 (J)	ND	ND	ND	0.30 (J)	6.0	ND	ND	**ND (<80)**	ND
0 to 5.5 feet	6/23/2015	436.51	4.75	0.00	431.76	0.91	ND	ND	ND	0.91	6.9	4.8 (J)	ND	**199**	ND
	9/22/2015	436.51	5.19	0.00	431.32	1.0	ND	ND	ND	1.0	6.6	ND	ND	**122**	ND
Screen:	12/10/2015	436.51	5.27	0.00	431.24	0.98	ND	ND	ND	0.98	5.9	5.3 (J)	ND	**146**	ND
5.5 to 10.5 feet	3/9/2016	436.51	4.74	0.00	431.77	0.25 (J)	ND	ND	ND	0.25 (J)	2.6	ND	**ND (<55)**	**122**	ND
	6/8/2016	436.51	5.02	0.00	431.49	0.84	ND	ND	ND	0.84	4.3	ND	**ND (<55)**	**216**	ND
	9/14/2016	436.51	5.32	0.00	431.19	0.61	ND	ND	ND	0.61	4.9	ND	**ND (<100)**	**ND (<64)**	ND
	11/22/2016	436.51	6.65	0.00	429.86	1.0	ND	ND	ND	1.0	6.7	ND	**ND (<100)**	NS	ND
	3/10/2017	436.51	5.62	0.00	430.89	0.88	ND	ND	ND	0.88	5.0	3.3 (J)	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	ł 6/8/2017	436.51	5.21	0.00	431.30	0.69	ND	ND	ND	0.69	4.0	4.0 (J)	**ND (<100)**	**89.6**	**ND (<1.0)**
	9/7/2017	436.51	5.16	0.00	431.35	0.67	ND	ND	ND	0.67	3.6	ND	**ND (<100)**	**197**	**ND (<1.1)**
	11/1/2017	436.51	5.94	0.00	430.57	0.96	ND	ND	ND	0.96	5.7	ND	**ND (<100)**	**413**	**ND (<1.1)**
	3/7/2018	436.51	4.95	0.00	431.56	0.25 (J)	ND	ND	ND	0.25 (J)	2.0	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	6/21/2018	436.51	4.62	0.00	431.89	0.39 (J)	ND	ND	ND	0.39 (J)	2.5	ND	**ND (<100)**	**102**	**ND (<1.1)**
	9/6/2018	436.51	4.76	0.00	431.75	ND	ND	ND	ND	ND	2.2	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	436.51	4.49	0.00	432.02	Not sampled									
	11/13/2019	436.51	5.03	0.00	431.48	Not sampled									
YP-4	9/23/2014	441.83	9.01	0.00	432.82	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/23/2014	441.83	9.24	0.00	432.59	0.44 (J)	ND	ND	ND	0.44 (J)	**36.5**	19.7	**386**	**ND (<80)**	ND
Casing:	3/25/2015	441.83	8.25	0.00	433.58	ND	ND	ND	ND	ND	5.5	ND	ND	**ND (<80)**	ND
0 to 8 feet	6/23/2015	441.83	8.96	0.00	432.87	ND	ND	ND	ND	ND	3.1	ND	ND	**ND (<64)**	ND
	9/22/2015	441.83	9.31	0.00	432.52	ND	ND	ND	ND	ND	12.2	ND	ND	**199**	0.26 (J)
Screen:	12/10/2015	441.83	9.28	0.00	432.55	0.41 (J)	ND	ND	ND	0.41 (J)	19.5	13.7	ND	**ND (<64)**	ND
8 to 13 feet	3/9/2016	441.83	8.54	0.00	433.29	ND	ND	ND	ND	ND	2.7	ND	**ND (<55)**	**ND (<64)**	ND
	6/8/2016	441.83	9.02	0.00	432.81	ND	ND	ND	ND	ND	4.2	ND	**ND (<55)**	**ND (<64)**	ND
	9/14/2016	441.83	9.53	0.00	432.30	0.23 (J)	ND	ND	ND	0.23 (J)	14.1	9.3 (J)	**118 (J)**	**ND (<64)**	ND
	11/22/2016	441.83	9.74	0.00	432.09	0.29 (J)	ND	ND	ND	0.29 (J)	19.8	18.4	**140 (J)**	**122**	ND
	3/10/2017	441.83	9.91	0.00	431.92	ND	ND	ND	ND	ND	19.9	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	ł 6/8/2017	441.83	9.31	0.00	432.52	ND	ND	ND	ND	ND	5.0	ND	**ND (<100)**	**115**	**ND (<1.0)**
	9/7/2017	441.83	9.72	0.00	432.11	ND	ND	ND	ND	ND	11.0	ND	**ND (<100)**	**199**	**ND (<1.1)**
	11/1/2017	441.83	9.82	0.00	432.01	ND	ND	ND	ND	ND	14.2	ND	**ND (<100)**	**107**	**ND (<1.1)**
	3/7/2018	441.83	9.23	0.00	432.60	ND	ND	ND	ND	ND	8.5	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	6/21/2018	441.83	8.48	0.00	433.35	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/6/2018	441.83	8.61	0.00	433.22	ND	ND	ND	ND	ND	4.7	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	441.83	8.18	0.00	433.65	Not sampled									
	11/13/2019	441.83	9.01	0.00	432.82	Not sampled									
YP-5	9/23/2014	433.65	4.01	0.00	429.64	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	12/23/2014	433.65	4.33	0.00	429.32	ND	ND	ND	ND	ND	0.66 (J)	ND	ND	**137**	ND
Casing:	3/25/2015	433.65	3.90	0.00	429.75	ND	ND	ND	ND	ND	17.7	51.2	ND	**ND (<80)**	ND
0 to 5 feet	6/23/2015	433.65	4.49	0.00	429.16	0.28 (J)	ND	ND	ND	0.28 (J)	**32.3**	106	ND	**117**	ND
	9/22/2015	433.65	4.12	0.00	429.53	1.2	ND	ND	ND	1.2	**45.7**	139	ND	**236**	ND
Screen:	12/10/2015	433.65	3.88	0.00	429.77	ND	ND	ND	ND	ND	**33.2**	8.7 (J)	ND	**ND (<64)**	ND
5 to 10 feet	3/9/2016	433.65	3.97	0.00	429.68	ND	ND	ND	ND	ND	1.6	ND	**ND (<55)**	**ND (<64)**	ND
	6/8/2016	433.65	4.31	0.00	429.34	ND	ND	ND	ND	ND	2.2	7.5 (J)	**ND (<55)**	**232**	ND
	9/14/2016	433.65	4.33	0.00	429.32	ND	ND	ND	ND	ND	10.4	32.6	**ND (<100)**	**ND (<64)**	ND
	11/22/2016	433.65	4.37	0.00	429.28	ND	ND	ND	ND	ND	**29.7**	34.5	**ND (<100)**	**ND (<64)**	ND
	3/10/2017	433.65	4.18	0.00	429.47	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	6/8/2017	433.65	4.31	0.00	429.34	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<64)**	**ND (<1.0)**
	9/7/2017	433.65	3.31	0.00	430.34	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**140**	**ND (<1.1)**
	11/1/2017	433.65	4.33	0.00	429.32	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**299**	**ND (<1.1)**
	3/7/2018	433.65	3.84	0.00	429.81	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**105**	**ND (<1.1)**
	6/21/2018	433.65	3.93	0.00	429.72	ND	ND	ND	ND	ND	ND	ND	**ND (<100)**	**ND (<83)**	**ND (<1.1)**
	9/6/2018	433.65	4.01	0.00	429.64	ND	ND	ND	ND	ND	0.62 (J)	ND	**ND (<100)**	**ND (<53)**	**ND (<0.98)**
	7/18/2019	433.65	3.83	0.00	429.82	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	ND (<42)	**ND (<53)**	**ND (<0.98)**
	11/13/2019	433.65	3.96	0.00	429.69	ND (<0.43)	ND (<0.53)	ND (<0.60)	ND (<0.59)	ND (<2.15)	ND (<0.51)	ND (<5.8)	**ND (<100)**	**ND (<53)**	**ND (<2.5)**
					MDE MEAT GNCSG**	**5**	**1,000**	**700**	**10,000**	**NA**	**20**	**NA**	**47**	**47**	**0.7**

Table Notes:

*Elevation is relative to a designated benchmark
(Current Casing elevations surveyed on August 25, 2010.)
**Generic Numeric Cleanup Standards for Groundwater (GNCSG) from Appendix F of the Maryland Department of the Environments (MDE) Maryland Environmental Assessment Technology (MEAT) for Leaking Undergound Storage Tanks
***The June 18, 2014 TPH-DRO parameters were analyzed out of laboratory holding times; Follow-up samples were collected on June 30, 2014, for analysis of TPH-DRO only
ł-The June 8, 2017 TPH-DRO sample was lost in transit. Follow-up sample was collected on June 21, 2017, for analysis of TPH-DRO only
ND (<MDL) = Not Detected above Method Detection Limit. (As of 2012 this changed to mean "Not Detected above Method Dection Limit".)
Groundwater elevations corrected for the presence of LPH using the following formula: Water Table Elevation = Water Elevation+(0.75*LPH Thickness)

Values in boldface type exceed applicable MDE MEAT GNCSG
ND = Not Detected
NA = Not Applicable
Total BTEX = sum of Benzene, Toluene, Ethylbenzene, and Xylenes
MTBE = Methyl-tertiary-Butyl Ether
NS = Not Sampled for indicated analyte

LPH = Liquid Phase Hydrocarbons
¥ = Bottleware broken in shipment.
J = Laboratory Estimated Value
µg/L = micrograms per liter
† = Samples damaged in shipment, resampled for TPH-DRO on 5/24/12
E= Value Exceeded Laboratory Calibration Range

NM = Not Measured
NSVD - Not Surveyed

TABLE 2
GROUNDWATER GAUGING
RESULTS SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
MDE-4	1/19/2015	443.18	0.00	9.89	433.29
	2/25/2015	443.18	0.00	9.99	433.19
Casing:	3/24/2015	443.18	0.00	9.58	433.60
0 to 3 feet	4/20/2015	443.18	0.00	9.41	433.77
	5/27/2015	443.18	0.00	9.51	433.67
Screen:	6/22/2015	443.18	0.00	9.25	433.93
3 to 13 feet	7/28/2015	443.18	0.00	8.94	434.24
	8/24/2015	443.18	0.00	9.14	434.04
	9/21/2015	443.18	0.00	9.28	433.90
	10/29/2015	443.18	0.00	9.03	434.15
	11/18/2015	443.18	0.00	9.73	433.45
	12/9/2015	443.18	0.00	9.58	433.60
	1/12/2016	443.18	0.00	9.31	433.87
	3/8/2016	443.18	0.00	8.98	434.20
	6/7/2016	443.18	0.00	9.03	434.15
	9/13/2016	443.18	0.00	9.48	433.70
	11/21/2016	443.18	0.00	9.90	433.28
	3/9/2017	443.18	0.00	10.42	432.76
	6/7/2017	443.18	0.00	9.72	433.46
	9/6/2017	443.18	0.00	9.77	433.41
	11/1/2017	443.18	0.00	9.97	433.21
	3/6/2018	443.18	0.00	9.84	433.34
	6/20/2018	443.18	0.00	8.72	434.46
	9/5/2018	443.18	0.00	8.64	434.54
	7/18/2019	443.18	0.00	8.11	435.07
	11/13/2019	443.18	0.00	9.23	433.95
MW-1	1/19/2015	453.92	NM	NM	NM
	2/25/2015	453.92	NM	NM	NM
Casing:	3/24/2015	453.92	NM	NM	NM
Unknown	4/20/2015	453.92	0.00	16.71	437.21
	5/27/2015	453.92	0.00	18.75	435.17
Screen:	6/22/2015	453.92	0.00	18.24	435.68
Unknown	7/28/2015	453.92	0.00	17.20	436.72
	8/24/2015	453.92	0.00	17.42	436.50
	9/21/2015	453.92	0.00	18.49	435.43
	10/29/2015	453.92	0.00	18.36	435.56
	11/18/2015	453.92	0.00	19.40	434.52
	12/9/2015	453.92	0.00	19.24	434.68
	1/12/2016	453.92	0.00	18.45	435.47
	3/8/2016	453.92	0.00	18.28	435.64
	6/7/2016	453.92	0.00	18.21	435.71
	9/13/2016	453.92	0.00	18.92	435.00
	11/21/2016	453.92	0.00	19.83	434.09
	3/9/2017	453.92	0.00	20.49	433.43
	6/7/2017	453.92	0.00	19.38	434.54
	9/6/2017	453.92	0.00	19.04	434.88
	11/1/2017	453.92	0.00	19.67	434.25
	3/6/2018	453.92	0.00	20.16	433.76
	6/20/2018	453.92	0.00	17.45	436.47
	9/5/2018	453.92	0.00	16.71	437.21
	7/18/2019	453.92	0.00	16.52	437.40
	11/13/2019	453.92	0.00	18.44	435.48

TABLE 2
GROUNDWATER GAUGING
RESULTS SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
MW-4	1/19/2015	455.10	NM	NM	NM
	2/25/2015	455.10	NM	NM	NM
Casing:	3/24/2015	455.10	NM	NM	NM
0 to 10 feet	4/20/2015	455.10	0.00	20.72	434.38
	5/27/2015	455.10	0.00	20.68	434.42
Screen:	6/22/2015	455.10	0.00	20.38	434.72
10 to 25 feet	7/28/2015	455.10	0.00	19.86	435.24
	8/24/2015	455.10	0.00	20.08	435.02
	9/21/2015	455.10	0.00	20.57	434.53
	10/29/2015	455.10	0.00	20.26	434.84
	11/18/2015	455.10	0.00	21.29	433.81
	12/9/2015	455.10	0.00	21.08	434.02
	1/12/2016	455.10	0.00	20.54	434.56
	3/8/2016	455.10	0.00	20.29	434.81
	6/7/2016	455.10	0.00	20.28	434.82
	9/13/2016	455.10	0.00	20.87	434.23
	11/21/2016	455.10	0.00	21.56	433.54
	3/9/2017	455.10	0.00	22.05	433.05
	9/6/2017	455.10	0.00	20.94	434.16
	6/7/2017	455.10	0.00	21.18	433.92
	11/1/2017	455.10	0.00	21.41	433.69
	3/6/2018	455.10	0.00	21.75	433.35
	6/20/2018	455.10	0.00	19.73	435.37
	9/5/2018	455.10	0.00	19.34	435.76
	7/18/2019	455.10	0.00	18.82	436.28
	11/13/2019	455.10	0.00	20.42	434.68
MW-7	1/19/2015	452.69	0.00	19.21	433.48
	2/25/2015	452.69	0.00	19.06	433.63
Casing:	3/24/2015	452.69	0.00	18.67	434.02
0 to 8 feet	4/20/2015	452.69	0.00	18.47	434.22
	5/27/2015	452.69	0.00	15.60	437.09
Screen:	6/22/2015	452.69	0.00	18.29	434.40
8 to 33 feet	7/28/2015	452.69	0.00	17.90	434.79
	8/24/2015	452.69	0.00	18.11	434.58
	9/21/2015	452.69	0.00	18.42	434.27
	10/29/2015	452.69	0.00	18.20	434.49
	11/18/2015	452.69	0.00	18.99	433.70
	12/9/2015	452.69	0.00	18.81	433.88
	1/12/2016	452.69	0.00	18.71	433.98
	3/8/2016	452.69	0.00	18.16	434.53
	6/7/2016	452.69	0.00	18.19	434.50
	9/13/2016	452.69	0.00	18.62	434.07
	11/21/2016	452.69	0.00	19.14	433.55
	3/9/2017	452.69	0.00	19.63	433.06
	6/7/2017	452.69	0.00	18.89	433.80
	9/6/2017	452.69	0.00	18.78	433.91
	11/1/2017	452.69	0.00	19.07	433.62
	3/6/2018	452.69	0.00	19.31	433.38
	6/20/2018	452.69	0.00	17.74	434.95
	9/5/2018	452.69	0.00	17.38	435.31
	7/18/2019	452.69	0.00	16.97	435.72
	11/13/2019	452.69	0.00	18.28	434.41

TABLE 2
GROUNDWATER GAUGING
RESULTS SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
OW-1	1/19/2015	455.31	0.00	19.33	435.98
	2/25/2015	455.31	0.00	21.66	433.65
Casing:	3/24/2015	455.31	0.00	21.08	434.23
0 to 9 feet	4/20/2015	455.31	0.00	20.66	434.65
	5/27/2015	455.31	0.00	20.59	434.72
Screen:	6/22/2015	455.31	0.00	20.58	434.73
9 to 34 feet	7/28/2015	455.31	0.00	20.18	435.13
	8/24/2015	455.31	0.00	20.40	434.91
	9/21/2015	455.31	0.00	20.73	434.58
	10/29/2015	455.31	0.00	20.55	434.76
	11/18/2015	455.31	0.00	21.38	433.93
	12/9/2015	455.31	0.00	21.23	434.08
	1/12/2016	455.31	0.00	21.06	434.25
	3/8/2016	455.31	0.00	20.54	434.77
	6/7/2016	455.31	0.00	20.58	434.73
	9/13/2016	455.31	0.00	21.03	434.28
	11/21/2016	455.31	0.00	21.82	433.49
	3/9/2017	455.31	0.00	22.04	433.27
	9/6/2017	455.31	0.00	21.27	434.04
	6/7/2017	455.31	0.00	21.22	434.09
	11/1/2017	455.31	0.00	21.53	433.78
	3/6/2018	455.31	0.00	21.77	433.54
	6/20/2018	455.31	0.00	20.03	435.28
	9/5/2018	455.31	0.00	19.61	435.70
	7/18/2019	455.31	0.00	19.23	436.08
	11/13/2019	455.31	0.00	20.66	434.65
YMW-1	1/19/2015	433.64	0.00	3.66	429.98
	2/25/2015	433.64	0.00	4.01	429.63
Casing:	3/24/2015	433.64	0.00	3.02	430.62
0 to 2 feet	4/20/2015	433.64	0.00	3.34	430.30
	5/27/2015	433.64	0.00	4.08	429.56
Screen:	6/22/2015	433.64	0.00	3.04	430.60
2 to 14 feet	7/28/2015	433.64	0.00	3.04	430.60
	8/24/2015	433.64	0.00	1.51	432.13
	9/21/2015	433.64	0.00	4.94	428.70
	10/29/2015	433.64	0.00	4.63	429.01
	11/18/2015	433.64	0.00	4.45	429.19
	12/9/2015	433.64	0.00	4.37	429.27
	1/12/2016	433.64	0.00	3.31	430.33
	3/8/2016	433.64	0.00	3.31	430.33
	6/7/2016	433.64	0.00	3.90	429.74
	9/13/2016	433.64	0.00	5.47	428.17
	11/21/2016	433.64	0.00	6.21	427.43
	3/9/2017	433.64	0.00	5.40	428.24
	6/7/2017	433.64	0.00	4.25	429.39
	9/6/2017	433.64	0.00	4.44	429.20
	11/1/2017	433.64	0.00	5.37	428.27
	3/6/2018	433.64	0.00	4.16	429.48
	6/20/2018	433.64	0.00	3.08	430.56
	9/5/2018	433.64	0.00	3.35	430.29
	7/18/2019	433.64	0.00	2.73	430.91
	11/13/2019	433.64	0.00	4.19	429.45

TABLE 2
GROUNDWATER GAUGING
RESULTS SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
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Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YMW-2	1/19/2015	431.37	0.00	2.86	428.51
	2/25/2015	431.37	0.00	2.84	428.53
Casing:	3/24/2015	431.37	0.00	2.78	428.59
0 to 2 feet	4/20/2015	431.37	0.00	2.71	428.66
	5/27/2015	431.37	0.00	2.78	428.59
Screen:	6/22/2015	431.37	0.00	2.51	428.86
2 to 14 feet	7/28/2015	431.37	0.00	2.41	428.96
	8/24/2015	431.37	0.00	0.61	430.76
	9/21/2015	431.37	0.00	2.58	428.79
	10/29/2015	431.37	0.00	2.31	429.06
	11/18/2015	431.37	0.00	4.02	427.35
	12/9/2015	431.37	0.00	3.94	427.43
	1/12/2016	431.37	0.00	2.90	428.47
	3/8/2016	431.37	0.00	2.97	428.40
	6/7/2016	431.37	0.00	2.84	428.53
	9/13/2016	431.37	0.00	2.44	428.93
	11/21/2016	431.37	0.00	2.94	428.43
	3/9/2017	431.37	0.00	2.94	428.43
	6/7/2017	431.37	0.00	3.10	428.27
	9/6/2017	431.37	0.00	2.65	428.72
	11/1/2017	431.37	0.00	2.67	428.70
	3/6/2018	431.37	0.00	2.85	428.52
	6/20/2018	431.37	0.00	2.58	428.79
	9/5/2018	431.37	0.00	2.51	428.86
	7/18/2019	431.37	0.00	3.01	428.36
	11/13/2019	431.37	0.00	2.61	428.76
YMW-3	1/19/2015	440.39	0.00	8.63	431.76
	2/25/2015	440.39	0.00	8.87	431.52
Casing:	3/24/2015	440.39	0.00	8.17	432.22
0 to 4.5 feet	4/20/2015	440.39	0.00	8.19	432.20
	5/27/2015	440.39	0.00	8.54	431.85
Screen:	6/22/2015	440.39	0.00	8.54	431.85
4.5 to 19.5 feet	7/28/2015	440.39	0.00	7.76	432.63
	8/24/2015	440.39	0.00	7.97	432.42
	9/21/2015	440.39	0.00	9.21	431.18
	10/29/2015	440.39	0.00	9.00	431.39
	11/18/2015	440.39	0.00	9.09	431.30
	12/9/2015	440.39	0.00	8.83	431.56
	1/12/2016	440.39	0.00	7.97	432.42
	3/8/2016	440.39	0.00	8.63	431.76
	6/7/2016	440.39	0.00	8.86	431.53
	9/13/2016	440.39	0.00	9.54	430.85
	11/21/2016	440.39	0.00	10.44	429.95
	3/9/2017	440.39	0.00	9.55	430.84
	6/7/2017	440.39	0.00	8.82	431.57
	9/6/2017	440.39	0.00	8.84	431.55
	11/1/2017	440.39	0.00	9.34	431.05
	3/6/2018	440.39	0.00	7.97	432.42
	6/20/2018	440.39	0.00	8.27	432.12
	9/5/2018	440.39	0.00	8.48	431.91
	7/18/2019	440.39	0.00	8.12	432.27
	11/13/2019	440.39	0.00	8.56	431.83

TABLE 2
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Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YMW-4	1/19/2015	433.72	0.00	4.29	429.43
	2/25/2015	433.72	0.00	4.02	429.70
Casing:	3/24/2015	433.72	0.00	4.06	429.66
0 to 2 feet	4/20/2015	433.72	0.00	4.09	429.63
	5/27/2015	433.72	0.00	4.33	429.39
Screen:	6/22/2015	433.72	0.00	3.96	429.76
2 to 17 feet	7/28/2015	433.72	0.00	4.13	429.59
	8/24/2015	433.72	0.00	2.34	431.38
	9/21/2015	433.72	0.00	4.45	429.27
	10/29/2015	433.72	0.00	4.24	429.48
	11/18/2015	433.72	0.00	4.55	429.17
	12/9/2015	433.72	0.00	4.34	429.38
	1/12/2016	433.72	0.00	4.71	429.01
	3/8/2016	433.72	0.00	4.18	429.54
	6/7/2016	433.72	0.00	4.18	429.54
	9/13/2016	433.72	0.00	4.46	429.26
	11/21/2016	433.72	0.00	4.85	428.87
	3/9/2017	433.72	0.00	4.30	429.42
	6/7/2017	433.72	0.00	4.26	429.46
	9/6/2017	433.72	0.00	4.18	429.54
	11/1/2017	433.72	0.00	4.41	429.31
	3/6/2018	433.72	0.00	4.24	429.48
	6/20/2018	433.72	0.00	3.89	429.83
	9/5/2018	433.72	0.00	4.01	429.71
	7/18/2019	433.72	0.00	3.79	429.93
	11/13/2019	433.72	0.00	4.16	429.56
YMW-5	1/19/2015	430.70	0.00	3.26	427.44
	2/25/2015	430.70	0.00	3.15	427.55
Casing:	3/24/2015	430.70	0.00	3.05	427.65
0 to 1 feet	4/20/2015	430.70	0.00	3.19	427.51
	5/27/2015	430.70	0.00	3.25	427.45
Screen:	6/22/2015	430.70	0.00	3.05	427.65
1 to 16 feet	7/28/2015	430.70	0.00	3.23	427.47
	8/24/2015	430.70	0.00	1.43	429.27
	9/21/2015	430.70	0.00	3.52	427.18
	10/29/2015	430.70	0.00	3.23	427.47
	11/18/2015	430.70	0.00	3.32	427.38
	12/9/2015	430.70	0.00	3.16	427.54
	1/12/2016	430.70	0.00	2.91	427.79
	3/8/2016	430.70	0.00	2.99	427.71
	6/7/2016	430.70	0.00	3.01	427.69
	9/13/2016	430.70	0.00	3.39	427.31
	11/21/2016	430.70	0.00	3.74	426.96
	3/9/2017	430.70	0.00	3.14	427.56
	6/7/2017	430.70	0.00	3.07	427.63
	9/6/2017	430.70	0.00	2.98	427.72
	11/1/2017	430.70	0.00	3.23	427.47
	3/6/2018	430.70	0.00	2.83	427.87
	6/20/2018	430.70	0.00	2.67	428.03
	9/5/2018	430.70	0.00	2.74	427.96
	7/18/2019	430.70	0.00	2.36	428.34
	11/13/2019	430.70	0.00	2.70	428.00

TABLE 2
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Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YMW-6	1/19/2015	432.68	0.00	5.42	427.26
	2/25/2015	432.68	0.00	5.59	427.09
Casing:	3/24/2015	432.68	0.00	5.11	427.57
0 to 3 feet	4/20/2015	432.68	0.00	5.08	427.60
	5/27/2015	432.68	0.00	5.87	426.81
Screen:	6/22/2015	432.68	0.00	5.11	427.57
3 to 18 feet	7/28/2015	432.68	0.00	5.38	427.30
	8/24/2015	432.68	0.00	3.58	429.10
	9/21/2015	432.68	0.00	6.11	426.57
	10/29/2015	432.68	0.00	6.01	426.67
	11/18/2015	432.68	0.00	5.79	426.89
	12/9/2015	432.68	0.00	5.56	427.12
	1/12/2016	432.68	0.00	5.11	427.57
	3/8/2016	432.68	0.00	5.10	427.58
	6/7/2016	432.68	0.00	5.36	427.32
	9/13/2016	432.68	0.00	6.38	426.30
	11/21/2016	432.68	0.00	7.05	425.63
	3/9/2017	432.68	0.00	6.25	426.43
	6/7/2017	432.68	0.00	5.49	427.19
	9/6/2017	432.68	0.00	6.25	426.43
	11/1/2017	432.68	0.00	6.65	426.03
	3/6/2018	432.68	0.00	5.35	427.33
	6/20/2018	432.68	0.00	4.89	427.79
	9/5/2018	432.68	0.00	5.05	427.63
	7/18/2019	432.68	0.00	4.74	427.94
	11/13/2019	432.68	0.00	5.49	427.19
YMW-7	1/19/2015	449.40	0.00	15.91	433.49
	2/25/2015	449.40	0.00	15.98	433.42
Casing:	3/24/2015	449.40	0.00	15.54	433.86
0 to 18 feet	4/20/2015	449.40	0.00	15.47	433.93
	5/27/2015	449.40	0.00	15.51	433.89
Screen:	6/22/2015	449.40	0.00	15.22	434.18
18 to 28 feet	7/28/2015	449.40	0.00	14.89	434.51
	8/24/2015	449.40	0.00	15.10	434.30
	9/21/2015	449.40	0.00	15.32	434.08
	10/29/2015	449.40	0.00	14.97	434.43
	11/18/2015	449.40	0.00	15.83	433.57
	12/9/2015	449.40	0.00	15.68	433.72
	1/12/2016	449.40	0.00	15.29	434.11
	3/8/2016	449.40	0.00	15.13	434.27
	6/7/2016	449.40	0.00	15.09	434.31
	9/13/2016	449.40	0.00	15.47	433.93
	11/21/2016	449.40	0.00	15.69	433.71
	3/9/2017	449.40	0.00	16.31	433.09
	6/7/2017	449.40	0.00	15.24	434.16
	9/6/2017	449.40	0.00	15.68	433.72
	11/1/2017	449.40	0.00	15.91	433.49
	3/6/2018	449.40	0.00	16.12	433.28
	6/20/2018	449.40	0.00	14.75	434.65
	9/5/2018	449.40	0.00	14.43	434.97
	7/18/2019	449.40	0.00	13.96	435.44
	11/13/2019	449.40	0.00	14.98	434.42

TABLE 2
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RESULTS SUMMARY
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Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YMW-8	1/19/2015	446.91	0.00	13.86	433.05
	2/25/2015	446.91	0.00	14.52	432.39
Casing:	3/24/2015	446.91	0.00	12.91	434.00
0 to 7 feet	4/20/2015	446.91	0.00	13.34	433.57
	5/27/2015	446.91	0.00	13.61	433.30
Screen:	6/22/2015	446.91	0.00	13.44	433.47
7 to 22 feet	7/28/2015	446.91	0.00	13.34	433.57
	8/24/2015	446.91	0.00	13.55	433.36
	9/21/2015	446.91	0.00	13.85	433.06
	10/29/2015	446.91	0.00	13.56	433.35
	11/18/2015	446.91	0.00	14.11	432.80
	12/9/2015	446.91	0.00	13.94	432.97
	1/12/2016	446.91	0.00	13.57	433.34
	3/8/2016	446.91	0.00	13.05	433.86
	6/7/2016	446.91	0.00	13.52	433.39
	9/13/2016	446.91	0.00	14.03	432.88
	11/21/2016	446.91	0.00	14.39	432.52
	3/9/2017	446.91	0.00	14.61	432.30
	6/7/2017	446.91	0.00	14.07	432.84
	9/6/2017	446.91	0.00	14.28	432.63
	11/1/2017	446.91	0.00	14.43	432.48
	3/6/2018	446.91	0.00	14.07	432.84
	6/20/2018	446.91	0.00	12.80	434.11
	9/5/2018	446.91	0.00	12.99	433.92
	7/18/2019	446.91	0.00	12.57	434.34
	11/13/2019	446.91	0.00	13.63	433.28
YMW-9	1/19/2015	436.71	0.00	5.69	431.02
	2/25/2015	436.71	0.00	5.93	430.78
Casing:	3/24/2015	436.71	0.00	5.41	431.30
0 to 2.5 feet	4/20/2015	436.71	0.00	4.80	431.91
	5/27/2015	436.71	0.00	6.02	430.69
Screen:	6/22/2015	436.71	0.00	5.81	430.90
2.5 to 17.5 feet	7/28/2015	436.71	0.00	5.94	430.77
	8/24/2015	436.71	0.00	4.14	432.57
	9/21/2015	436.71	0.00	6.17	430.54
	10/29/2015	436.71	0.00	5.99	430.72
	11/18/2015	436.71	0.00	6.13	430.58
	12/9/2015	436.71	0.00	5.86	430.85
	1/12/2016	436.71	0.00	5.04	431.67
	3/8/2016	436.71	0.00	5.43	431.28
	6/7/2016	436.71	0.00	5.93	430.78
	9/13/2016	436.71	0.00	6.44	430.27
	11/21/2016	436.71	0.00	6.50	430.21
	3/9/2017	436.71	0.00	6.23	430.48
	6/7/2017	436.71	0.00	6.13	430.58
	9/6/2017	436.71	0.00	6.42	430.29
	11/1/2017	436.71	0.00	6.34	430.37
	3/6/2018	436.71	0.00	5.29	431.42
	6/20/2018	436.71	0.00	5.73	430.98
	9/5/2018	436.71	0.00	5.88	430.83
	7/18/2019	436.71	0.00	5.65	431.06
	11/13/2019	436.71	0.00	5.87	430.84

TABLE 2
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Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YP-1	1/19/2015	440.41	0.00	9.25	431.16
	2/25/2015	440.41	0.00	9.25	431.16
Casing:	3/24/2015	440.41	0.00	9.26	431.15
0 to 8 feet	4/20/2015	440.41	0.00	9.23	431.18
	5/27/2015	440.41	0.00	9.34	431.07
Screen:	6/22/2015	440.41	0.00	9.18	431.23
8 to 13 feet	7/28/2015	440.41	0.00	8.79	431.62
	8/24/2015	440.41	0.00	8.99	431.42
	9/21/2015	440.41	0.00	9.20	431.21
	10/29/2015	440.41	0.00	8.96	431.45
	11/18/2015	440.41	0.00	9.30	431.11
	12/9/2015	440.41	0.00	9.17	431.24
	1/12/2016	440.41	0.00	9.14	431.27
	3/8/2016	440.41	0.00	9.24	431.17
	6/7/2016	440.41	0.00	9.14	431.27
	9/13/2016	440.41	0.00	8.18	432.23
	11/21/2016	440.41	0.00	9.25	431.16
	3/10/2017	440.41	0.00	9.39	431.02
	6/8/2017	440.41	0.00	9.34	431.07
	9/7/2017	440.41	0.00	9.29	431.12
	11/2/2017	440.41	0.00	9.32	431.09
	3/7/2018	440.41	0.00	9.41	431.00
	6/21/2018	440.41	0.00	9.14	431.27
	9/6/2018	440.41	0.00	9.01	431.40
	7/18/2019	440.41	0.00	8.93	431.48
	11/13/2019	440.41	0.00	9.16	431.25
YP-2	1/19/2015	438.35	0.00	8.27	430.08
	2/25/2015	438.35	0.00	8.09	430.26
Casing:	3/24/2015	438.35	0.00	8.05	430.30
0 to 7 feet	4/20/2015	438.35	0.00	8.01	430.34
	5/27/2015	438.35	0.00	8.36	429.99
Screen:	6/22/2015	438.35	0.00	7.98	430.37
7 to 12 feet	7/28/2015	438.35	0.00	8.08	430.27
	8/24/2015	438.35	0.00	8.28	430.07
	9/21/2015	438.35	0.00	8.13	430.22
	10/29/2015	438.35	0.00	7.91	430.44
	11/18/2015	438.35	0.00	8.36	429.99
	12/9/2015	438.35	0.00	8.25	430.10
	1/12/2016	438.35	0.00	8.17	430.18
	3/8/2016	438.35	0.00	8.15	430.20
	6/7/2016	438.35	0.00	8.07	430.28
	9/13/2016	438.35	0.00	8.07	430.28
	11/21/2016	438.35	0.00	8.11	430.24
	3/10/2017	438.35	0.00	8.11	430.24
	6/8/2017	438.35	0.00	8.23	430.12
	9/7/2017	438.35	0.00	8.10	430.25
	11/2/2017	438.35	0.00	8.08	430.27
	3/7/2018	438.35	0.00	8.12	430.23
	6/21/2018	438.35	0.00	8.13	430.22
	9/6/2018	438.35	0.00	8.16	430.19
	7/18/2019	438.35	0.00	8.03	430.32
	11/13/2019	438.35	0.00	8.16	430.19

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Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YP-3	1/19/2015	436.51	0.00	5.09	431.42
	2/25/2015	436.51	0.00	5.01	431.50
Casing:	3/24/2015	436.51	0.00	4.85	431.66
0 to 5.5 feet	4/20/2015	436.51	0.00	5.67	430.84
	5/27/2015	436.51	0.00	5.47	431.04
Screen:	6/22/2015	436.51	0.00	4.75	431.76
5.5 to 10.5 feet	7/28/2015	436.51	0.00	5.08	431.43
	8/24/2015	436.51	0.00	5.11	431.40
	9/21/2015	436.51	0.00	5.19	431.32
	10/29/2015	436.51	0.00	4.88	431.63
	11/18/2015	436.51	0.00	5.40	431.11
	12/9/2015	436.51	0.00	5.27	431.24
	1/12/2016	436.51	0.00	4.93	431.58
	3/8/2016	436.51	0.00	4.74	431.77
	6/7/2016	436.51	0.00	5.02	431.49
	9/13/2016	436.51	0.00	5.32	431.19
	11/21/2016	436.51	0.00	6.65	429.86
	3/10/2017	436.51	0.00	5.62	430.89
	6/8/2017	436.51	0.00	5.21	431.30
	9/7/2017	436.51	0.00	5.16	431.35
	11/2/2017	436.51	0.00	5.94	430.57
	3/7/2018	436.51	0.00	4.95	431.56
	6/21/2018	436.51	0.00	4.62	431.89
	9/6/2018	436.51	0.00	4.76	431.75
	7/18/2019	436.51	0.00	4.49	432.02
	11/13/2019	436.51	0.00	5.03	431.48
YP-4	1/19/2015	441.83	0.00	9.13	432.70
	2/25/2015	441.83	0.00	9.32	432.51
Casing:	3/24/2015	441.83	0.00	8.25	433.58
0 to 8 feet	4/20/2015	441.83	0.00	8.74	433.09
	5/27/2015	441.83	0.00	9.07	432.76
Screen:	6/22/2015	441.83	0.00	8.96	432.87
8 to 13 feet	7/28/2015	441.83	0.00	8.27	433.56
	8/24/2015	441.83	0.00	9.18	432.65
	9/21/2015	441.83	0.00	9.31	432.52
	10/29/2015	441.83	0.00	9.11	432.72
	11/18/2015	441.83	0.00	9.41	432.42
	12/9/2015	441.83	0.00	9.28	432.55
	1/12/2016	441.83	0.00	8.78	433.05
	3/8/2016	441.83	0.00	8.54	433.29
	6/7/2016	441.83	0.00	9.02	432.81
	9/13/2016	441.83	0.00	9.53	432.30
	11/21/2016	441.83	0.00	9.74	432.09
	3/10/2017	441.83	0.00	9.91	431.92
	6/8/2017	441.83	0.00	9.31	432.52
	9/7/2017	441.83	0.00	9.72	432.11
	11/2/2017	441.83	0.00	9.82	432.01
	3/7/2018	441.83	0.00	9.23	432.60
	6/21/2018	441.83	0.00	8.48	433.35
	9/6/2018	441.83	0.00	8.61	433.22
	7/18/2019	441.83	0.00	8.18	433.65
	11/13/2019	441.83	0.00	9.01	432.82

TABLE 2
GROUNDWATER GAUGING
RESULTS SUMMARY
Former Hess Station No. 20204
1613 East Joppa Road
Towson, MD
Case No. 1991-2100-BA

Monitoring Well/Piezometer Identification	Gauging Date	Top of Casing Elevation (ft)	LPH Thickness (ft)	Depth to Groundwater (ft)	Corrected Groundwater Table Elevation (ft)
YP-5	1/19/2015	433.65	0.00	5.50	428.15
	2/25/2015	433.65	0.00	5.79	427.86
Casing:	3/24/2015	433.65	0.00	3.90	429.75
0 to 5 feet	4/20/2015	433.65	0.00	4.05	429.60
	5/27/2015	433.65	0.00	4.21	429.44
Screen:	6/22/2015	433.65	0.00	4.49	429.16
5 to 10 feet	7/28/2015	433.65	0.00	5.48	428.17
	8/24/2015	433.65	0.00	3.68	429.97
	9/21/2015	433.65	0.00	4.12	429.53
	10/29/2015	433.65	0.00	4.02	429.63
	11/18/2015	433.65	0.00	4.02	429.63
	12/9/2015	433.65	0.00	3.88	429.77
	1/12/2016	433.65	0.00	4.69	428.96
	3/8/2016	433.65	0.00	3.97	429.68
	6/7/2016	433.65	0.00	4.31	429.34
	9/13/2016	433.65	0.00	4.33	429.32
	11/21/2016	433.65	0.00	4.37	429.28
	3/10/2017	433.65	0.00	4.18	429.47
	6/8/2017	433.65	0.00	4.31	429.34
	9/7/2017	433.65	0.00	3.31	430.34
	11/2/2017	433.65	0.00	4.33	429.32
	3/7/2018	433.65	0.00	3.84	429.81
	6/21/2018	433.65	0.00	3.93	429.72
	9/6/2018	433.65	0.00	4.01	429.64
	7/18/2019	433.65	0.00	3.83	429.82
	11/13/2019	433.65	0.00	3.96	429.69

Notes:
ft = feet
LPH = Liquid Phase Hydrocarbons
NM = Not Monitored (Well not accessible)

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Yakona Road Curb Inlet	1/11/2017	0.0	0.0
	1/17/2017	0.0	0.0
	1/25/2017	0.0	0.0
	2/7/2017	0.0	0.0
	2/21/2017	0.0	0.0
	3/1/2017	0.0	0.0
	3/10/2017	0.0	0.0
	3/23/2017	0.0	0.0
	4/4/2017	0.0	0.0
	4/19/2017	0.0	0.0
	5/25/2017	0.0	0.0
	6/1/2017	0.0	0.0
	6/8/2017	0.0	0.0
	6/21/2017	0.0	0.0
	6/29/2017	0.0	0.0
	7/11/2017	0.0	0.0
	7/20/2017	0.0	0.0
	7/28/2017	0.0	0.0
	8/10/2017	0.0	0.0
	8/18/2017	0.0	0.0
	9/8/2017	0.0	0.0
	9/18/2017	0.0	0.0
	10/3/2017	0.0	0.0
	10/17/2017	0.0	0.0
	10/27/2017	0.0	0.0
	11/2/2017	0.0	0.0
	11/9/2017	0.0	0.0
	11/20/2017	0.0	0.0
	11/28/2017	0.0	0.0
	12/8/2017	0.0	0.0
	1/4/2018	0.0	0.0
	1/11/2018	0.0	0.0
	1/22/2018	0.0	0.0
	1/30/2018	0.0	0.0
	2/7/2018	0.0	0.0
	2/14/2018	0.0	0.0
	2/21/2018	0.0	0.0
	2/28/2018	0.0	0.0
	3/7/2018	0.0	0.0
	3/14/2018	0.0	0.0
	3/21/2018	0.0	0.0
	3/29/2018	0.0	0.0
	4/3/2018	0.0	0.0
	4/11/2018	0.0	0.0
	4/18/2018	0.0	0.0
	4/26/2018	0.0	0.0
	5/2/2018	0.0	0.0
	5/9/2018	0.0	0.0
	5/15/2018	0.0	0.0
	5/23/2018	0.0	0.0
	5/31/2018	0.0	0.0
	6/6/2018	0.0	0.0
	6/13/2018	0.0	0.0
	6/21/2018	0.0	0.0
	6/28/2018	0.0	0.0
	7/3/2018	0.0	0.0
	7/12/2018	0.0	0.0
	7/18/2018	0.0	0.0
	8/1/2018	0.0	0.0
	8/8/2018	0.0	0.0
	8/15/2018	0.0	0.0
	8/22/2018	0.0	0.0
	8/29/2018	0.0	0.0
	9/6/2018	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Yakona Road Curb Inlet (continued)	9/12/2018	0.0	0.0
	9/19/2018	0.0	0.0
	9/25/2018	0.0	0.0
	10/3/2018	0.0	0.0
	10/10/2018	0.0	0.0
	10/17/2018	0.0	0.0
	10/24/2018	0.0	0.0
	10/31/2018	0.0	0.0
	11/7/2018	0.0	0.0
	11/14/2018	0.0	0.0
	11/27/2018	0.0	0.0
	12/4/2018	0.0	0.0
	12/12/2018	0.0	0.0
	12/26/2018	0.0	0.0
	1/3/2019	0.0	0.0
	1/10/2019	0.0	0.0
	1/16/2019	0.0	0.0
	1/24/2019	0.0	0.0
	1/30/2019	0.0	0.0
	2/6/2019	0.0	0.0
	2/15/2019	0.0	0.0
	2/21/2019	0.0	0.0
	2/27/2019	0.0	0.0
	3/6/2019	0.0	0.0
	3/13/2019	0.0	0.0
	3/20/2019	0.0	0.0
	3/27/2019	0.0	0.0
	4/3/2019	0.0	0.0
	4/9/2019	0.0	0.0
	4/17/2019	0.0	0.0
	4/24/2019	0.0	0.0
	5/1/2019	0.0	0.0
	5/8/2019	0.0	0.0
	5/15/2019	0.0	0.0
	5/22/2019	0.0	0.0
	5/29/2019	0.0	0.0
	6/5/2019	0.0	0.0
	6/12/2019	0.0	0.0
	6/19/2019	0.0	0.0
	6/26/2019	0.0	0.0
	7/2/2019	0.0	0.0
	7/10/2019	0.0	0.0
	7/19/2019	0.0	0.0
	7/24/2019	0.0	0.0
	7/31/2019	0.0	0.0
	8/5/2019	0.0	0.0
	8/13/2019	0.0	0.0
	8/21/2019	0.0	0.0
	8/28/2019	0.0	0.0
	9/4/2019	0.0	0.0
	9/11/2019	0.0	0.0
	9/18/2019	0.0	0.0
	9/24/2019	0.0	0.0
	10/1/2019	0.0	0.0
	10/9/2019	0.0	0.0
	10/16/2019	0.0	0.0
	10/23/2019	0.0	0.0
	11/14/2019	0.0	0.0
	11/19/2019	0.0	0.0
	11/26/2019	0.0	0.0
	12/4/2019	0.0	0.0
	12/11/2019	0.0	0.0
	12/18/2019	0.0	0.0
	12/23/2019	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 3	1/11/2017	0.0	0.0
	1/17/2017	0.0	0.0
	1/25/2017	0.0	0.0
	2/7/2017	0.0	0.0
	2/21/2017	0.0	0.0
	3/1/2017	0.0	0.0
	3/10/2017	0.0	0.0
	3/23/2017	0.0	0.0
	4/4/2017	0.0	0.0
	4/19/2017	0.0	0.0
	5/25/2017	0.0	0.0
	6/1/2017	0.0	0.0
	6/8/2017	0.0	0.0
	6/21/2017	0.0	0.0
	6/29/2017	0.0	0.0
	7/11/2017	0.0	0.0
	7/20/2017	0.0	0.0
	7/28/2017	0.0	0.0
	8/10/2017	0.0	0.0
	8/18/2017	0.0	0.0
	9/8/2017	0.0	0.0
	9/18/2017	0.0	0.0
	10/3/2017	0.0	0.0
	10/17/2017	0.0	0.0
	10/27/2017	0.0	0.0
	11/2/2017	0.0	0.0
	11/9/2017	0.0	0.0
	11/20/2017	0.0	0.0
	11/28/2017	0.0	0.0
	12/8/2017	0.0	0.0
	1/4/2018	0.0	0.0
	1/11/2018	0.0	0.0
	1/22/2018	0.0	0.0
	1/30/2018	0.0	0.0
	2/7/2018	0.0	0.0
	2/14/2018	0.0	0.0
	2/21/2018	0.0	0.0
	2/28/2018	0.0	0.0
	3/7/2018	0.0	0.0
	3/14/2018	0.0	0.0
	3/21/2018	0.0	0.0
	3/29/2018	0.0	0.0
	4/3/2018	0.0	0.0
	4/11/2018	0.0	0.0
	4/18/2018	0.0	0.0
	4/26/2018	0.0	0.0
	5/2/2018	0.0	0.0
	5/9/2018	0.0	0.0
	5/15/2018	0.0	0.0
	5/23/2018	0.0	0.0
	5/31/2018	0.0	0.0
	6/6/2018	0.0	0.0
	6/13/2018	0.0	0.0
	6/21/2018	0.0	0.0
	6/28/2018	0.0	0.0
	7/3/2018	0.0	0.0
	7/12/2018	0.0	0.0
	7/18/2018	0.0	0.0
	8/1/2018	0.0	0.0
	8/8/2018	0.0	0.0
	8/15/2018	0.0	0.0
	8/22/2018	0.0	0.0
	8/29/2018	0.0	0.0
	9/6/2018	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 3 (continued)	9/12/2018	0.0	0.0
	9/19/2018	0.0	0.0
	9/25/2018	0.0	0.0
	10/3/2018	0.0	0.0
	10/10/2018	0.0	0.0
	10/17/2018	0.0	0.0
	10/24/2018	0.0	0.0
	10/31/2018	0.0	0.0
	11/7/2018	0.0	0.0
	11/14/2018	0.0	0.0
	11/27/2018	0.0	0.0
	12/4/2018	0.0	0.0
	12/12/2018	0.0	0.0
	12/26/2018	0.0	0.0
	1/3/2019	0.0	0.0
	1/10/2019	0.0	0.0
	1/16/2019	0.0	0.0
	1/24/2019	0.0	0.0
	1/30/2019	0.0	0.0
	2/6/2019	0.0	0.0
	2/15/2019	0.0	0.0
	2/21/2019	0.0	12.8
	2/27/2019	0.0	74.2
	3/6/2019	0.0	54.9
	3/13/2019	0.0	0.0
	3/20/2019	0.0	0.0
	3/27/2019	0.0	0.0
	4/3/2019	0.0	0.0
	4/9/2019	0.0	0.0
	4/17/2019	0.0	0.0
	4/24/2019	0.0	0.0
	5/1/2019	0.0	0.0
	5/8/2019	0.0	0.0
	5/15/2019	0.0	0.0
	5/22/2019	0.0	0.0
	5/29/2019	0.0	0.0
	6/5/2019	0.0	0.0
	6/12/2019	0.0	0.0
	6/19/2019	0.0	0.0
	6/26/2019	0.0	0.0
	7/2/2019	0.0	0.0
	7/12/2019	0.0	0.0
	7/19/2019	0.0	0.0
	7/24/2019	0.0	0.0
	7/31/2019	0.0	0.0
	8/5/2019	0.0	0.0
	8/13/2019	0.0	0.0
	8/21/2019	0.0	0.0
	8/28/2019	0.0	0.0
	9/4/2019	0.0	0.0
	9/11/2019	0.0	0.0
	9/18/2019	0.0	0.0
	9/24/2019	0.0	0.0
	10/1/2019	0.0	0.0
	10/9/2019	0.0	0.0
	10/16/2019	0.0	0.0
	10/23/2019	0.0	0.0
	11/14/2019	0.0	0.0
	11/19/2019	0.0	0.0
	11/26/2019	0.0	0.0
	12/4/2019	0.0	0.0
	12/11/2019	0.0	0.0
	12/18/2019	0.0	0.0
	12/23/2019	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 21	1/11/2017	0.0	5.8
	1/17/2017	0.0	2.6
	1/25/2017	0.0	1.6
	2/7/2017	0.0	1.1
	2/21/2017	0.0	4.3
	3/1/2017	0.0	20.8
	3/10/2017	0.0	2.4
	3/23/2017	0.0	2.6
	4/4/2017	0.0	270.4
	4/19/2017	0.0	20.1
	5/25/2017	0.0	115.0
	6/1/2017	0.0	71.0
	6/8/2017	0.0	7.0
	6/21/2017	0.0	59.7
	6/29/2017	0.0	83.1
	7/11/2017	0.0	75.2
	7/20/2017	0.0	61.3
	7/28/2017	0.0	1.7
	8/10/2017	0.0	41.6
	8/18/2017	0.0	58.7
	9/8/2017	0.0	36.1
	9/18/2017	0.0	81.9
	10/3/2017	0.0	2.8
	10/17/2017	0.0	0.9
	10/27/2017	0.0	6.8
	11/2/2017	0.0	28.7
	11/9/2017	0.0	0.5
	11/20/2017	0.0	1.8
	11/28/2017	0.0	3.4
	12/8/2017	0.0	3.8
	1/4/2018	0.0	1.1
	1/11/2018	0.0	3.1
	1/22/2018	0.0	9.4
	1/30/2018	0.0	0.2
	2/7/2018	0.0	2.2
	2/14/2018	0.0	7.9
	2/21/2018	0.0	29.6
	2/28/2018	0.0	38.4
	3/7/2018	0.0	1.8
	3/14/2018	0.0	4.1
	3/21/2018	0.0	2.2
	3/29/2018	0.0	14.6
	4/3/2018	0.0	13.2
	4/11/2018	0.0	4.1
	4/18/2018	0.0	31.8
	4/26/2018	0.0	4.6
	5/2/2018	0.0	8.2
	5/9/2018	0.0	29.7
	5/15/2018	0.0	39.6
	5/23/2018	0.0	36.2
	5/31/2018	0.0	1.5
	6/6/2018	0.0	4.4
	6/13/2018	0.0	5.8
	6/21/2018	0.0	29.6
	6/28/2018	0.0	28.4
	7/3/2018	0.0	19.2
	7/12/2018	0.0	31.5
	7/18/2018	0.0	0.2
	8/1/2018	0.0	24.9
	8/8/2018	0.0	20.3
	8/15/2018	0.0	30.7
	8/22/2018	0.0	20.4
	8/29/2018	0.0	30.8
	9/6/2018	0.0	37.1

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 21 (continued)	9/12/2018	0.0	29.7
	9/19/2018	0.0	21.7
	9/25/2018	0.0	168.3
	10/3/2018	0.0	56.8
	10/10/2018	0.0	17.7
	10/17/2018	0.0	43.8
	10/24/2018	0.0	52.7
	10/31/2018	0.0	68.2
	11/7/2018	0.0	174.0
	11/14/2018	0.0	192.7
	11/27/2018	0.0	153.0
	12/4/2018	0.0	6.5
	12/12/2018	0.0	158.0
	12/26/2018	0.0	49.6
	1/3/2019	0.0	193.0
	1/10/2019	0.0	97.1
	1/16/2019	0.0	214.0
	1/24/2019	0.0	244.0
	1/30/2019	0.0	172.0
	2/6/2019	0.0	407.1
	2/15/2019	0.0	168.2
	2/21/2019	0.0	0.9
	2/27/2019	0.0	15.1
	3/6/2019	0.0	19.4
	3/13/2019	0.0	101.2
	3/20/2019	0.0	190.4
	3/27/2019	0.0	42.7
	4/3/2019	0.0	68.7
	4/9/2019	0.0	28.7
	4/17/2019	0.0	19.7
	4/24/2019	0.0	38.1
	5/1/2019	0.0	29.8
	5/8/2019	0.0	42.1
	5/15/2019	0.0	42.7
	5/22/2019	0.0	35.9
	5/29/2019	0.0	62.4
	6/5/2019	0.0	26.8
	6/12/2019	0.0	15.8
	6/19/2019	0.0	21.4
	6/26/2019	0.0	20.9
	7/2/2019	0.0	2.4
	7/10/2019	0.0	9.5
	7/19/2019	0.0	5.9
	7/24/2019	0.0	1.4
	7/31/2019	0.0	0.8
	8/5/2019	0.0	0.3
	8/13/2019	0.0	0.7
	8/21/2019	0.0	0.9
	8/28/2019	0.0	0.5
	9/4/2019	0.0	0.4
	9/11/2019	0.0	3.6
	9/18/2019	0.0	4.3
	9/24/2019	0.0	0.5
	10/1/2019	0.0	1.1
	10/9/2019	0.0	1.1
	10/16/2019	0.0	18.7
	10/23/2019	0.0	7.1
	11/14/2019	0.0	7.3
	11/19/2019	0.0	2.4
	11/26/2019	0.0	0.6
	12/4/2019	0.0	3.6
	12/11/2019	0.0	2.1
	12/18/2019	0.0	0.0
	12/23/2019	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 22	1/11/2017	0.0	17.7
	1/17/2017	0.0	23.7
	1/25/2017	0.0	525.0
	2/7/2017	0.0	105.7
	2/21/2017	0.0	210.8
	3/1/2017	0.0	754.6
	3/10/2017	0.0	79.8
	3/23/2017	0.0	82.6
	4/4/2017	0.0	1.9
	4/19/2017	0.0	0.5
	5/25/2017	0.0	0.0
	6/1/2017	0.0	0.0
	6/8/2017	0.0	40.1
	6/21/2017	0.0	0.0
	6/29/2017	0.0	0.0
	7/11/2017	0.0	0.0
	7/20/2017	0.0	0.0
	7/28/2017	0.0	2.3
	8/10/2017	0.0	0.2
	8/18/2017	0.0	0.0
	9/8/2017	0.0	0.4
	9/18/2017	0.0	3.1
	10/3/2017	0.0	0.5
	10/17/2017	0.0	58.6
	10/27/2017	0.0	24.9
	11/2/2017	0.0	0.7
	11/9/2017	0.0	70.1
	11/20/2017	0.0	52.8
	11/28/2017	0.0	32.7
	12/8/2017	0.0	45.7
	1/4/2018	0.0	0.0
	1/11/2018	0.0	37.4
	1/22/2018	0.0	5.3
	1/30/2018	0.0	4.6
	2/7/2018	0.0	22.5
	2/14/2018	0.0	68.3
	2/21/2018	0.0	115.8
	2/28/2018	0.0	113.5
	3/7/2018	0.0	48.1
	3/14/2018	0.0	70.3
	3/21/2018	0.0	58.2
	3/29/2018	0.0	79.6
	4/3/2018	0.0	200.0
	4/11/2018	0.0	101.9
	4/18/2018	0.0	0.3
	4/26/2018	0.0	2.7
	5/2/2018	0.0	0.1
	5/9/2018	0.0	0.0
	5/15/2018	0.0	0.0
	5/23/2018	0.0	0.0
	5/31/2018	0.0	0.0
	6/6/2018	0.0	0.0
	6/13/2018	0.0	0.0
	6/21/2018	0.0	0.0
	6/28/2018	0.0	0.0
	7/3/2018	0.0	0.0
	7/12/2018	0.0	0.1
	7/18/2018	0.0	0.0
	8/1/2018	0.0	0.0
	8/8/2018	0.0	0.0
	8/15/2018	0.0	0.0
	8/22/2018	0.0	0.0
	8/29/2018	0.0	0.0
	9/6/2018	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 22 (continued)	9/12/2018	0.0	0.0
	9/19/2018	0.0	0.0
	9/25/2018	0.0	0.0
	10/3/2018	0.0	0.0
	10/10/2018	0.0	0.0
	10/17/2018	0.0	0.0
	10/24/2018	0.0	0.0
	10/31/2018	0.0	0.0
	11/7/2018	0.0	81.7
	11/14/2018	0.0	115.0
	11/27/2018	0.0	163.0
	12/4/2018	0.0	58.1
	12/12/2018	0.0	217.0
	12/26/2018	0.0	15.6
	1/3/2019	0.0	473.0
	1/10/2019	0.0	252.0
	1/16/2019	0.0	581.0
	1/24/2019	0.0	407.0
	1/30/2019	0.0	414.0
	2/6/2019	0.0	67.8
	2/15/2019	0.0	180.9
	2/21/2019	0.0	4.6
	2/27/2019	0.0	19.8
	3/6/2019	0.0	34.1
	3/13/2019	0.0	28.9
	3/20/2019	0.0	70.1
	3/27/2019	0.0	1.3
	4/3/2019	0.0	6.1
	4/9/2019	0.0	0.0
	4/17/2019	0.0	0.0
	4/24/2019	0.0	0.0
	5/1/2019	0.0	0.0
	5/8/2019	0.0	0.0
	5/15/2019	0.0	0.0
	5/22/2019	0.0	0.0
	5/29/2019	0.0	0.0
	6/5/2019	0.0	0.0
	6/12/2019	0.0	25.1
	6/19/2019	0.0	29.7
	6/26/2019	0.0	23.4
	7/2/2019	0.0	26.2
	7/10/2019	0.0	20.3
	7/19/2019	0.0	84.7
	7/24/2019	0.0	0.9
	7/31/2019	0.0	0.0
	8/5/2019	0.0	1.8
	8/13/2019	0.0	0.3
	8/21/2019	0.0	3.1
	8/28/2019	0.0	0.8
	9/4/2019	0.0	0.0
	9/11/2019	0.0	0.0
	9/18/2019	0.0	0.0
	9/24/2019	0.0	0.0
	10/1/2019	0.0	0.0
	10/9/2019	0.0	0.2
	10/16/2019	0.0	1.6
	10/23/2019	0.0	0.0
	11/14/2019	0.0	0.0
	11/19/2019	0.0	10.4
	11/26/2019	0.0	35.6
	12/4/2019	0.0	51.7
	12/11/2019	0.0	29.4
	12/18/2019	0.0	0.0
	12/23/2019	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 23	1/11/2017	0.0	25.2
	1/17/2017	0.0	7.3
	1/25/2017	0.0	2.3
	2/7/2017	0.0	6.6
	2/21/2017	0.0	0.7
	3/1/2017	0.0	2.1
	3/10/2017	0.0	33.8
	3/23/2017	0.0	27.4
	4/4/2017	0.0	10.3
	4/19/2017	0.0	0.0
	5/25/2017	0.0	0.0
	6/1/2017	0.0	0.0
	6/8/2017	0.0	14.4
	6/21/2017	0.0	0.0
	6/29/2017	0.0	0.0
	7/11/2017	0.0	0.0
	7/20/2017	0.0	0.2
	7/28/2017	0.0	0.0
	8/10/2017	0.0	0.0
	8/18/2017	0.0	0.0
	9/8/2017	0.0	0.3
	9/18/2017	0.0	3.5
	10/3/2017	0.0	2.3
	10/17/2017	0.0	3.2
	10/27/2017	0.0	1.6
	11/2/2017	0.0	2.8
	11/9/2017	0.0	21.4
	11/20/2017	0.0	1.2
	11/28/2017	0.0	1.3
	12/8/2017	0.0	4.0
	1/4/2018	0.0	0.0
	1/11/2018	0.0	8.1
	1/22/2018	0.0	20.1
	1/30/2018	0.0	13.1
	2/7/2018	0.0	19.1
	2/14/2018	0.0	25.1
	2/21/2018	0.0	9.2
	2/28/2018	0.0	26.1
	3/7/2018	0.0	73.4
	3/14/2018	0.0	6.8
	3/21/2018	0.0	3.7
	3/29/2018	0.0	102.8
	4/3/2018	0.0	88.9
	4/11/2018	0.0	7.8
	4/18/2018	0.0	0.1
	4/26/2018	0.0	2.0
	5/2/2018	0.0	0.0
	5/9/2018	0.0	0.5
	5/15/2018	0.0	1.9
	5/23/2018	0.0	0.6
	5/31/2018	0.0	0.0
	6/6/2018	0.0	0.0
	6/13/2018	0.0	0.0
	6/21/2018	0.0	0.0
	6/28/2018	0.0	0.9
	7/3/2018	0.0	2.3
	7/12/2018	0.0	12.6
	7/18/2018	0.0	9.5
	8/1/2018	0.0	0.0
	8/8/2018	0.0	0.0
	8/15/2018	0.0	0.0
	8/22/2018	0.0	0.0
	8/29/2018	0.0	0.0
	9/6/2018	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 23 (continued)	9/12/2018	0.0	0.0
	9/19/2018	0.0	0.0
	9/25/2018	0.0	0.0
	10/3/2018	0.0	0.0
	10/10/2018	0.0	0.0
	10/17/2018	0.0	0.2
	10/24/2018	0.0	0.0
	10/31/2018	0.0	0.0
	11/7/2018	0.0	425.0
	11/14/2018	0.0	501.0
	11/27/2018	0.0	191.0
	12/4/2018	0.0	29.5
	12/12/2018	0.0	518.0
	12/26/2018	0.0	45.4
	1/3/2019	0.0	590.0
	1/10/2019	0.0	382.0
	1/16/2019	0.0	317.0
	1/24/2019	0.0	723.0
	1/30/2019	0.0	591.0
	2/6/2019	0.0	368.7
	2/15/2019	0.0	205.1
	2/21/2019	0.0	65.7
	2/27/2019	0.0	34.4
	3/6/2019	0.0	61.7
	3/13/2019	0.0	23.1
	3/20/2019	0.0	23.8
	3/27/2019	0.0	1.4
	4/3/2019	0.0	0.4
	4/9/2019	0.0	0.0
	4/17/2019	0.0	0.0
	4/24/2019	0.0	0.4
	5/1/2019	0.0	0.0
	5/8/2019	0.0	0.0
	5/15/2019	0.0	0.0
	5/22/2019	0.0	0.0
	5/29/2019	0.0	0.0
	6/5/2019	0.0	0.0
	6/12/2019	0.0	6.9
	6/19/2019	0.0	2.7
	6/26/2019	0.0	1.1
	7/2/2019	0.0	51.7
	7/10/2019	0.0	5.1
	7/19/2019	0.0	57.9
	7/24/2019	0.0	62.9
	7/31/2019	0.0	49.1
	8/5/2019	0.0	29.7
	8/13/2019	0.0	14.1
	8/21/2019	0.0	17.4
	8/28/2019	0.0	55.7
	9/4/2019	0.0	16.8
	9/11/2019	0.0	0.0
	9/18/2019	0.0	0.0
	9/24/2019	0.0	0.0
	10/1/2019	0.0	0.0
	10/9/2019	0.0	4.9
	10/16/2019	0.0	1.4
	10/23/2019	0.0	0.4
	11/14/2019	0.0	0.2
	11/19/2019	0.0	6.8
	11/26/2019	0.0	18.1
	12/4/2019	0.0	25.2
	12/11/2019	0.0	15.4
	12/18/2019	0.0	0.0
	12/23/2019	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 24	1/11/2017	0.0	38.2
	1/17/2017	0.0	42.1
	1/25/2017	0.0	0.2
	2/7/2017	0.0	1.8
	2/21/2017	0.0	0.5
	3/1/2017	0.0	0.0
	3/10/2017	0.0	2.4
	3/23/2017	0.0	75.1
	4/4/2017	0.0	0.0
	4/19/2017	0.0	0.0
	5/25/2017	0.0	0.0
	6/1/2017	0.0	0.0
	6/8/2017	0.0	1.5
	6/21/2017	0.0	0.0
	6/29/2017	0.0	0.0
	7/11/2017	0.0	0.0
	7/20/2017	0.0	0.0
	7/28/2017	0.0	0.0
	8/10/2017	0.0	0.0
	8/18/2017	0.0	0.0
	9/8/2017	0.0	0.0
	9/18/2017	0.0	0.0
	10/3/2017	0.0	2.1
	10/17/2017	0.0	2.8
	10/27/2017	0.0	2.1
	11/2/2017	0.0	5.7
	11/9/2017	0.0	17.6
	11/20/2017	0.0	6.4
	11/28/2017	0.0	18.2
	12/8/2017	0.0	37.1
	1/4/2018	0.0	9.2
	1/11/2018	0.0	29.7
	1/22/2018	0.0	16.8
	1/30/2018	0.0	40.7
	2/7/2018	0.0	30.6
	2/14/2018	0.0	37.6
	2/21/2018	0.0	0.0
	2/28/2018	0.0	0.7
	3/7/2018	0.0	40.8
	3/14/2018	0.0	55.2
	3/21/2018	0.0	15.9
	3/29/2018	0.0	5.1
	4/3/2018	0.0	28.7
	4/11/2018	0.0	12.6
	4/18/2018	0.0	1.9
	4/26/2018	0.0	1.0
	5/2/2018	0.0	0.0
	5/9/2018	0.0	0.2
	5/15/2018	0.0	0.0
	5/23/2018	0.0	0.0
	5/31/2018	0.0	0.0
	6/6/2018	0.0	0.0
	6/13/2018	0.0	0.0
	6/21/2018	0.0	0.0
	6/28/2018	0.0	0.0
	7/3/2018	0.0	0.0
	7/12/2018	0.0	0.3
	7/18/2018	0.0	0.4
	8/1/2018	0.0	0.0
	8/8/2018	0.0	0.0
	8/15/2018	0.0	0.0
	8/22/2018	0.0	0.0
	8/29/2018	0.0	0.0
	9/6/2018	0.0	0.0

TABLE 3
MONTHLY PID SCREENING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA

Location (Corresponds with Site Plan)	Date	Breathing Zone Readings (ppm)	Below Grade Readings (ppm)
Manhole 24 (continued)	9/12/2018	0.0	0.0
	9/19/2018	0.0	0.0
	9/25/2018	0.0	0.0
	10/3/2018	0.0	0.0
	10/10/2018	0.0	0.0
	10/17/2018	0.0	1.1
	10/24/2018	0.0	0.0
	10/31/2018	0.0	0.0
	11/7/2018	0.0	11.5
	11/14/2018	0.0	83.0
	11/27/2018	0.0	275.0
	12/4/2018	0.0	61.8
	12/12/2018	0.0	327.0
	12/26/2018	0.0	48.5
	1/3/2019	0.0	798.0
	1/10/2019	0.0	515.0
	1/16/2019	0.0	633.0
	1/24/2019	0.0	518.0
	1/30/2019	0.0	382.0
	2/6/2019	0.0	78.0
	2/15/2019	0.0	290.4
	2/21/2019	0.0	28.2
	2/27/2019	0.0	57.1
	3/6/2019	0.0	49.8
	3/13/2019	0.0	20.8
	3/20/2019	0.0	19.1
	3/27/2019	0.0	55.7
	4/3/2019	0.0	0.5
	4/9/2019	0.0	0.0
	4/17/2019	0.0	0.0
	4/24/2019	0.0	0.0
	5/1/2019	0.0	0.0
	5/8/2019	0.0	0.0
	5/15/2019	0.0	0.0
	5/22/2019	0.0	0.0
	5/29/2019	0.0	0.0
	6/5/2019	0.0	0.0
	6/12/2019	0.0	2.2
	6/19/2019	0.0	0.0
	6/26/2019	0.0	0.0
	7/2/2019	0.0	0.0
	7/10/2019	0.0	0.7
	7/19/2019	0.0	0.0
	7/24/2019	0.0	0.6
	7/31/2019	0.0	0.4
	8/5/2019	0.0	0.0
	8/13/2019	0.0	0.0
	8/21/2019	0.0	0.0
	8/28/2019	0.0	0.0
	9/4/2019	0.0	0.0
	9/11/2019	0.0	0.0
	9/18/2019	0.0	0.0
	9/24/2019	0.0	0.0
	10/1/2019	0.0	0.0
	10/9/2019	0.0	5.7
	10/16/2019	0.0	20.1
	10/23/2019	0.0	6.1
	11/14/2019	0.0	0.0
	11/19/2019	0.0	13.1
	11/26/2019	0.0	24.7
	12/4/2019	0.0	13.7
	12/11/2019	0.0	19.8
	12/18/2019	0.0	0.0
	12/23/2019	0.0	0.0

Notes: PID = Photoionization Detector ppm = parts per million

TABLE 4
GROUNDWATER TREATMENT SYSTEM
DISCHARGE SUMMARY
Ridgely Manor Park
Towson, MD
Case No. 1991-2100-BA
NPDES Permit # MDG915958

Month Year	Monthly Discharge Volume (gallons)	Cumulative Discharge Volume (gallons)
January 2015	51,520	51,520
February 2015	41,600	93,120
March 2015	31,090	124,210
April 2015	18,940	143,150
May 2015	23,180	166,330
June 2015	36,940	203,270
July 2015	24,170	227,440
August 2015	29,460	256,900
September 2015	24,570	281,470
October 2015	18,540	300,010
November 2015	27,850	327,860
December 2015	45,180	373,040
January 2016	35,570	408,610
February 2016	33,300	441,910
March 2016	38,030	479,940
April 2016	54,020	533,960
May 2016	75,280	609,240
June 2016	54,560	663,800
July 2016	37,250	701,050
August 2016	32,410	733,460
September 2016	39,190	772,650
October 2016	34,620	807,270
November 2016	42,680	849,950
December 2016	45,380	895,330
January 2017	57,450	952,780
February 2017	30,100	982,880
March 2017	35,940	1,018,820
April 2017	32,050	1,050,870
May 2017	50,660	1,101,530
June 2017	48,510	1,150,040
July 2017	67,450	1,217,490
August 2017	41,410	1,258,900
September 2017	52,870	1,311,770
October 2017	47,560	1,359,330
November 2017	35,300	1,394,630
December 2017	38,470	1,433,100
January 2018	51,060	1,484,160
February 2018	29,770	1,513,930
March 2018	41,760	1,555,690
April 2018	37,050	1,592,740
May 2018	37,120	1,629,860
June 2018	36,080	1,665,940
July 2018	32,020	1,697,960
August 2018	43,500	1,741,460
September 2018	44,960	1,786,420
October 2018	52,550	1,838,970
November 2018	42,510	1,881,480
December 2018	40,490	1,921,970
January 2019	43,930	1,965,900
February 2019	46,710	2,012,610
March 2019	45,230	2,057,840
April 2019	45,490	2,103,330
May 2019	83,670	2,187,000
June 2019	43,460	2,230,460
July 2019	69,230	2,299,690
August 2019	50,770	2,350,460
September 2019	65,450	2,415,910
October 2019	92,570	2,508,480
November 2019	57,370	2,565,850
December 2019	36,980	2,602,830

TABLE 5
GROUNDWATER TREATMENT SYSTEM SAMPLING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
NPDES Permit # MDG915958

Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	1/19/2015	1.1	7.7	77.6	107	193.4	11.8	1.42	0.898	2.318	49.3
EFF	1/19/2015	ND	ND	ND	ND	ND	2.7	ND	ND	ND	ND
INN	1/26/2015	0.48 (J)	4.4	35.2	68.7	108.78 (J)	ND	0.973	0.454	1.427	35.1
EFF	1/26/2015	0.26 (J)	2.3	15.7	38.5	56.76 (J)	6.8	0.418	0.267	0.685	12.3
INN	2/4/2015	1.2	10.9	96.1	173	281.2	12.4	1.70	1.21	2.91	60.1
EFF	2/4/2015	ND	0.74 (J)	1.6	16.0	18.34 (J)	7.0	ND	ND	ND	0.84 (J)
INN	2/20/2015	0.90	8.7	81.5	167	258.10	14.5	1.79	0.826	2.616	62.5
EFF	2/20/2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	3/3/2015	0.77	8.6	71.1	152	232.47	10.9	1.51	0.573	2.083	47.3
EFF	3/3/2015	ND	ND	ND	ND	ND	0.88 (J)	ND	ND	ND	ND
INF	3/30/2015	1.6	15.3	100	352	468.9	11.5	2.33	0.779	3.109	51.3
EFF	3/30/2015	ND	ND	ND	ND	ND	0.97 (J)	ND	ND	ND	ND
INF	4/7/2015	1.9	16.7	143	439	600.6	12.5	3.52	0.870	4.390	94.1
EFF	4/7/2015	ND	ND	ND	ND	ND	0.59 (J)	ND	ND	ND	ND
INF	4/27/2015	1.7	ND	ND	ND	1.7	ND	2.51	1.24	3.75	79.7
EFF	4/27/2015	ND	ND	ND	ND	ND	0.41 (J)	ND	ND	ND	ND
INN	5/4/2015	1.4	15.3	117	340	473.7	11.9	2.02	0.873	2.893	76.6
EFF	5/4/2015	ND	ND	ND	ND	ND	1.0	ND	0.192	0.192	ND
INF	5/18/2015	1.7	20.9	141	417	580.6	12.8	3.58	1.17	4.75	71.3
EFF	5/18/2015	ND	ND	ND	0.37 (J)	0.37 (J)	2.2	ND	ND	ND	ND
INF	6/2/2015	0.83	8.7	75.3	250	334.83	6.2	1.45	0.461	1.911	38.2
EFF	6/2/2015	ND	ND	ND	ND	ND	1.5	ND	0.114	0.114	ND
INF	6/23/2015	1.6	14.7	116	343	475.3	ND	1.45	0.937	2.387	69.3
EFF	6/23/2015	ND	ND	ND	ND	ND	2.3	ND	ND	ND	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

TABLE 5
GROUNDWATER TREATMENT SYSTEM SAMPLING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
NPDES Permit # MDG915958

Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	7/6/2015	1.7	13.1	109	355	478.8	11.6	2.20	1.02	3.22	67.4
EFF	7/6/2015	ND	ND	ND	0.27 (J)	0.27 (J)	3.8	ND	0.212	0.212	ND
INF	7/21/2015	1.4	10.4	81.4	278	371.2	7.0	2.03	0.943	2.973	58.7
EFF	7/21/2015	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
INN	8/3/2015	2.3	17.7	125	430	575.0	12.4	3.08	0.812	3.892	72.9
EFF	8/3/2015	ND	ND	ND	ND	ND	3.0	ND	ND	ND	ND
INF	8/20/2015	1.1	5.9	22.4	81.3	110.7	5.3	0.476	0.206	0.682	3.6 (J)
EFF	8/20/2015	ND	ND	ND	ND	ND	2.5	ND	0.239	0.239	ND
INF	9/9/2015	3.1	25.5	144	446	618.6	11.2	3.15	1.27	4.42	50.8
EFF	9/9/2015	ND	ND	ND	ND	ND	2.4	ND	0.448	0.448	ND
INN	9/22/2015	2.6	14.4	93.4	272	382.4	8.5	3.16	0.971	4.131	65.8
EFF	9/22/2015	ND	ND	ND	ND	ND	2.6	ND	0.0953	0.0953	ND
INF	10/7/2015	3.1	14.7	105	298	420.8	10.3	2.09	0.290	2.380	58.1
EFF	10/7/2015	ND	ND	ND	ND	ND	2.1	ND	0.0987	0.0987	ND
INF	10/13/2015	2.8	11.7	88.8	263	366.3	10.2	2.82	1.40	4.22	48.0
EFF	10/13/2015	ND	ND	ND	ND	ND	1.9	ND	0.105	0.105	ND
INN	11/10/2015	2.0	9.1	71.9	177	260.0	ND	1.98	0.807	2.787	35.7
EFF	11/10/2015	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
INF	12/2/2015	1.9	4.3	48.7	106	160.9	7.3	1.02	0.502	1.522	39.7
EFF	12/2/2015	ND	ND	ND	ND	ND	3.8	ND	ND	ND	ND
INF	12/16/2015	1.8	5.0	57.4	111	175.2	7.6	1.17	0.527	1.697	51.0
EFF	12/16/2015	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND
INF	1/6/2016	2.4	7.0	86.8	144	240.2	7.2	1.90	0.627	2.527	41.2
EFF	1/6/2016	ND	ND	ND	ND	ND	3.4	ND	ND	ND	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

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Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
NPDES Permit # MDG915958

Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	1/12/2016	1.2	3.7	36.5	83.2	124.6	5.4	1.31	0.376	1.686	21.0
EFF	1/12/2016	ND	ND	ND	ND	ND	3.1	ND	ND	ND	ND
INF	2/3/2016	0.86	3.3	26.6	66.1	96.86	3.2	0.668	0.340	1.008	17.5
EFF	2/3/2016	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND
INF	2/9/2016	2.6	11.8	96.2	219	329.6	7.1	1.79	0.665	2.455	49.6
EFF	2/9/2016	ND	ND	ND	ND	ND	2.1	ND	0.0850	0.0850	ND
INF	3/3/2016	3.1	12.2	112	367	494.3	7.6	2.71	0.717	3.427	68.5
EFF	3/3/2016	ND	ND	ND	ND	ND	5.3	ND	ND	ND	ND
INF	3/9/2016	3.1	14.1	125	377	519.2	6.6	3.03	0.665	3.695	76.7
EFF	3/9/2016	ND	ND	ND	0.78 (J)	0.78 (J)	6.2	ND	ND	ND	ND
INN	4/6/2016	4.6	35.1	156	505	700.7	7.3	3.78	0.947	4.727	75.3
EFF	4/6/2016	ND	0.32 (J)	0.75 (J)	2.3	3.37 (J)	2.4	ND	ND	ND	ND
INF	4/12/2016	4.3	29.0	109	439	581.3	7.4	2.83	0.994	3.824	74.9
EFF	4/12/2016	ND	0.17 (J)	0.41 (J)	1.4	1.98 (J)	1.4	ND	ND	ND	ND
INN	5/4/2016	2.7	23.1	123	358	506.8	5.0	2.43	0.656	3.086	63.2
EFF	5/4/2016	ND	0.40 (J)	0.94 (J)	3.6	4.94 (J)	3.7	ND	ND	ND	ND
INN	5/12/2016	3.8	29.2	166	388	587.0	7.4	3.28	1.40	4.68	76.1
EFF	5/12/2016	0.22 (J)	0.58 (J)	1.2	3.1	5.1 (J)	5.8	ND	0.269	0.269	ND
INN	6/8/2016	4.6	33.2	187	466	690.8	7.3	3.24	0.777	4.017	86.0
EFF	6/8/2016	0.50	1.4	3.5	10.4	15.80	7.2	0.226	ND	0.226	ND
INN	6/14/2016	4.9	30.1	164	422	621.0	7.2	2.94	0.822	3.762	74.4
EFF	6/14/2016	0.83	3.0	8.1	20.5	32.43	4.9	0.316	ND	0.316	ND
INN	7/7/2016	3.9	22.1	144	353	523.0	ND	2.64	1.11	3.75	73.8
EFF	7/7/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

TABLE 5
GROUNDWATER TREATMENT SYSTEM SAMPLING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
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Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	7/12/2016	2.2	11.6	68.8	203	285.6	3.5	1.66	0.957	2.617	42.9
EFF	7/12/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	8/3/2016	3.0	7.0	36.3	147	193.3	4.7	1.28	0.810	2.090	41.4
EFF	8/3/2016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	8/17/2016	3.5	12.4	81.5	273	370.4	5.2	2.10	0.792	2.892	63.1
EFF	8/17/2016	ND	ND	ND	ND	0.00	0.70 (J)	ND	ND	ND	ND
INN	9/8/2016	4.3	10.2	88.9	263	366.4	5.6	2.26	0.802	3.062	61.0
EFF	9/8/2016	ND	ND	0.36 (J)	0.40 (J)	0.76 (J)	1.4	ND	ND	ND	ND
INN	9/14/2016	3.8	8.4	84.9	218	315.1	4.7	1.92	1.06	2.980	58.2
EFF	9/14/2016	ND	ND	0.30 (J)	0.59 (J)	0.89 (J)	0.84	ND	ND	ND	ND
INN	10/12/2016	4.4	5.0	15.4	79.2	104.0	5.4	1.24	0.704	1.94	6.1
EFF	10/12/2016	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
INN	10/18/2016	4.9	6.8	46.0	177	234.7	4.9	2.72	1.06	3.78	53.7
EFF	10/18/2016	ND	ND	0.36 (J)	0.50 (J)	0.86 (J)	1.80	ND	ND	ND	ND
INN	11/3/2016	6.7	7.4	61.0	164	239.1	4.4	2.89	1.01	3.90	65.3
EFF	11/3/2016	ND	ND	0.35 (J)	ND	0.35 (J)	1.70	ND	ND	ND	ND
INN	11/8/2016	7.5	8.1	28.3	193	236.9	4.1	3.75	1.36	5.11	83.1
EFF	11/8/2016	ND	ND	ND	ND	ND	1.40	ND	ND	ND	ND
INN	12/7/2016	2.2	1.4	10.4	23.9	37.9	3.5	0.971	0.329	1.300	8.3
EFF	12/7/2016	ND	ND	ND	ND	ND	3.10	ND	ND	ND	ND
INN	12/15/2016	2.9	2.3	24.2	26.7	56.1	4.3	ND	0.486	0.486	18.2
EFF	12/15/2016	ND	ND	ND	ND	ND	2.3	ND	ND	ND	ND
INN	1/4/2017	2.7	5.3	26.6	34.7	69.3	4.7	1.12	0.46	1.58	13.8
EFF	1/4/2017	ND	ND	ND	ND	ND	1.40	ND	ND	ND	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

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Towson, MD
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Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	1/11/2017	3.5	4.7	44.2	43.1	95.5	5.4	1.12	0.367	1.49	18.8
EFF	1/11/2017	ND	ND	ND	ND	ND	1.8	ND	ND	ND	ND
INN	2/7/2017	3.9	4.3	53.6	59.0	120.8	5.5	1.58	0.464	2.04	21.1
EFF	2/7/2017	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND
INN	2/21/2017	3.1	3.3	47.1	60.5	114.0	5.2	1.62	0.394	2.01	17.5
EFF	2/21/2017	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND
INN	3/1/2017	3.0	3.3	49.6	65.0	120.9	5.3	1.54	0.322	1.86	17.0
EFF	3/1/2017	ND	ND	0.24 (J)	ND	0.24 (J)	2.5	ND	ND	ND	ND
INN	3/10/2017	2.9	3.0	40.3	59.1	105.3	5.8	1.09	0.444	1.53	21.0
EFF	3/10/2017	0.28 (J)	ND	0.58 (J)	1.2	2.06 (J)	2.5	0.123	ND	0.123	ND
INN	4/4/2017	2.1	4.7	53	187	246.8	6.8	2.07	0.708	2.778	24.9
EFF	4/4/2017	0.31 (J)	ND	0.51 (J)	2.8	3.62 (J)	3.9	0.113	ND	0.113	ND
INN	4/11/2017	2.3	6.2	59.2	168	235.7	8.1	1.63	1.140	2.770	31.8
EFF	4/11/2017	0.55	0.37 (J)	0.95 (J)	4.9	6.77 (J)	3.4	ND	0.114	0.114	ND
INN	5/3/2017	2.0	2.6	43.7	114	162.3	6.2	1.53	0.905	2.435	34.0
EFF	5/3/2017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	5/16/2017	1.6	2.2	31.6	107	142.4	6.3	1.09	0.813	1.903	34.3
EFF	5/16/2017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	6/1/2017	2.5	4.0	50.5	202	259.0	5.9	1.95	1.03	2.98	47.1
EFF	6/1/2017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	6/8/2017	2.7	6.0	76	440	524.7	5.1	3.34	1.84	5.18	72.5
EFF	6/8/2017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	7/11/2017	1.4	2.8	29.6	159	192.8	4.5	0.857	1.63	2.49	41.4
EFF	7/11/2017	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

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Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	7/20/2017	1.4	2.8	31.3	167	202.5	4.2	1.23	1.47	2.70	58.5
EFF	7/20/2017	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9
INN	8/10/2017	1.8	3.2	30.6	129	164.6	4.8	1.06	0.991	2.051	33.8
EFF	8/10/2017	ND	ND	ND	ND	ND	2.2	ND	ND	ND	ND
INN	8/18/2017	0.7	1.4	11.9	47.3	61.3	3.4	0.39	0.64	1.02	23.5
EFF	8/18/2017	ND	ND	ND	ND	ND	1.9	ND	ND	ND	ND
INN	9/7/2017	2.5	4.6	42.6	238	287.7	ND	1.97	2.19	4.16	82.5
EFF	9/7/2017	ND	1.4	0.38 (J)	2.4	4.18 (J)	243.0	ND	ND	ND	ND
INN	9/18/2017	3.6	6.5	57.0	167	234.1	4.2	1.23	1.47	2.70	68.9
EFF	9/18/2017	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND
INN	10/3/2017	3.4	5.5	44.2	157	210.1	3.7	1.82	1.22	3.04	64.3
EFF	10/3/2017	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
INN	10/17/2017	2.3	3.5	31.4	95.2	132.4	3.9	1.24	0.755	2.00	34.8
EFF	10/17/2017	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
INN	11/2/2017	2.7	3.0	19.3	86.1	111.1	5.9	1.05	2.780	3.83	24.9
EFF	11/2/2017	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND
INN	11/9/2017	1.4	1.5	10.3	47.1	60.3	4.4	0.643	1.20	1.84	13.4
EFF	11/9/2017	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
INN	12/8/2017	2.9	3.3	42.1	75.2	123.5	5.4	1.18	1.04	2.22	33.8
EFF	12/8/2017	ND	ND	ND	0.22 (J)	0.22 (J)	2.3	ND	ND	ND	ND
INN	12/21/2017	3.4	3.3	33.0	54.4	94.1	5.7	0.871	4.72	5.59	29.0
EFF	12/21/2017	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
INN	1/11/2018	1.1	0.98 (J)	9.3	17.2	28.6 (J)	5.2	0.315	1.72	2.035	17.5
EFF	1/11/2018	ND	ND	0.24 (J)	0.42 (J)	0.66 (J)	2.7	ND	0.0893	0.0893	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

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Towson, MD
Case # 1991-2100-BA
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Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	1/22/2018	2.5	2.2	22.3	32.2	59.2	5.2	0.358	1.48	1.838	15.2
EFF	1/22/2018	ND	ND	ND	ND	ND	2.2	ND	0.133	0.133	ND
INN	2/7/2018	2.0	2.1	18.7	33.1	55.9	5.8	0.656	1.22	1.876	14.3
EFF	2/7/2018	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND
INN	2/14/2018	1.3	2.5	17.1	44.9	65.8	6.3	0.731	1.05	1.781	8.4
EFF	2/14/2018	ND	ND	0.33 (J)	0.99 (J)	1.32 (J)	3.3	ND	0.108	0.108	ND
INN	3/7/2018	2.1	7.8	49.3	137	196.2	6.3	0.970	2.49	3.460	22.9
EFF	3/7/2018	ND	ND	0.33 (J)	1.2	1.5 (J)	3.5	ND	ND	ND	ND
INN	3/14/2018	2.3	7.6	55.2	149	214.1	5.8	1.29	1.01	2.30	28.3
EFF	3/14/2018	0.29 (J)	0.58 (J)	0.63 (J)	15.4	16.9 (J)	3.6	0.196 (J)	0.173	0.369 (J)	ND
INN	4/3/2018	2.3	6.3	59.2	162	230	6.3	1.35	0.755	2.11	27.8
EFF	4/3/2018	0.19 (J)	ND	0.60 (J)	2.5	3.3 (J)	3.0	0.110 (J)	0.0990	0.209 (J)	ND
INN	4/11/2018	2.5	5.8	70.6	188	267	5.4	1.41	0.933	2.34	31.1
EFF	4/11/2018	0.53	1.1	5.5	31.4	38.5	3.1	0.301	0.304	0.605	2.5 (J)
INN	5/2/2018	1.7	4.9	51.1	190	248	4.9	1.84	0.889	2.73	40.8
EFF	5/2/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	5/9/2018	2.8	7.6	80.5	302	393	6.8	2.15	1.46	3.61	50.6
EFF	5/9/2018	ND	ND	ND	ND	ND	ND	ND	0.179	0.179	ND
INN	6/6/2018	2.1	7.3	48.2	241	299	4.8	1.54	0.907	2.45	35.2
EFF	6/6/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	6/13/2018	2.0	6.8	39.5	214	262	4.4	1.47	0.728	2.20	34.3
EFF	6/13/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	7/3/2018	2.4	9.2	47.9	256	316	4.5	1.81	0.913	2.72	43.2
EFF	7/3/2018	ND	ND	ND	0.29 (J)	0.29 (J)	0.39 (J)	ND	ND	ND	ND
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

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Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	7/12/2018	3.0	9.5	50.9	271	334	5.2	1.82	0.728	2.55	55.6
EFF	7/12/2018	ND	ND	ND	ND	ND	0.41 (J)	ND	ND	ND	ND
INN	8/1/2018	3.0	6.6	36.2	181	227	4.6	1.58	ND	1.58	35.0
EFF	8/1/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	8/8/2018	3.9	9.0	52.8	234	300	5.6	1.81	0.851	2.66	47.2
EFF	8/8/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	9/4/2018	4.6	8.0	59.1	191	263	4.5	1.88	0.716	2.60	42.9
EFF	9/4/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	9/12/2018	4.0	5.8	43.0	181	234	4.5	1.61	0.315	1.93	34.7
EFF	9/12/2018	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INN	10/3/2018	4.1	6.7	39.6	263	313	3.8	1.88	0.974	2.85	55.5
EFF	10/3/2018	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND	0.65 (J)	ND (< 0.10)	ND (< 0.050)	ND (< 0.15)	ND (< 0.98)
INN	10/10/2018	4.0	6.3	44.6	263	317.9	3.7	1.69	0.677	2.37	52.7
EFF	10/10/2018	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND	0.95 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	11/7/2018	3.9	6.2	45.4	210	265.5	3.2	1.23	0.614	1.84	36.5
EFF	11/7/2018	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND	0.65 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	11/14/2018	2.6	3.9	25.3	158	189.8	2.4	0.850	0.672	1.522	26.3
EFF	11/14/2018	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND	0.60 (J)	ND (< 0.10)	ND (< 0.050)	ND (< 0.15)	ND (< 0.98)
INN	12/4/2018	5.7	11.8	90.7	363	471.2	4.2	2.51	1.63	4.14	34.7
EFF	12/4/2018	ND (< 0.43)	ND (< 0.53)	1.3	5.0	6.3	0.73 (J)	ND (< 0.10)	ND (< 0.048)	ND (< 0.15)	ND (< 0.98)
INN	12/12/2018	5.7	12.3	101	437	556.0	4.8	2.05	1.12	3.17	76.9
EFF	12/12/2018	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND	1.1	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	1/3/2019	5.1	9.9	55.4	377	447	3.9	1.94	0.707	2.65	58.1
EFF	1/3/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.98 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

TABLE 5
GROUNDWATER TREATMENT SYSTEM SAMPLING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
NPDES Permit # MDG915958

Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	1/10/2019	4.8	12.3	119	439	575	3.5	2.25	1.32	3.57	76.9
EFF	1/10/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.94 (J)	ND (< 0.10)	ND (< 0.052)	ND (< 0.15)	ND (< 0.98)
INN	2/6/2019	4.1	9.9	96.2	374	484	3.3	2.19	0.871	3.06	75.0
EFF	2/6/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.80 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	2/15/2019	2.9	6.7	61.0	280	351	2.9	2.25	0.963	3.21	39.3
EFF	2/15/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	4.5	< 6.1	1.0	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	3/6/2019	1.9	2.5	9.5	230	244	2.9	1.56	0.992	2.55	9.8
EFF	3/6/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	1.7	< 3.3	1.0	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	3/13/2019	3.5	7.4	44.8	350	406	3.5	2.36	1.18	3.54	43.3
EFF	3/13/2019	ND (< 0.43)	ND (< 0.53)	0.93 (J)	8.3	< 10.2	1.1	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	4/3/2019	4.5	13.8	112	419	549	2.5	3.29	1.08	4.37	76.7
EFF	4/3/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	1.4	< 3.0	0.97 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	4/17/2019	4.9	13.9	118	532	669	3.0	3.13	0.972	4.10	67.4
EFF	4/17/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	ND (< 0.51)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 0.98)
INN	5/1/2019	4.8	12.4	102	492	611	2.7	3.04	1.50	4.54	63.6
EFF	5/1/2019	ND (< 0.43)	0.80 (J)	ND (< 0.60)	ND (< 0.59)	< 2.42	ND (< 0.51)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	5/8/2019	6.3	17.1	142	499	664	3.5	3.17	1.11	4.28	87.6
EFF	5/8/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	ND (< 0.51)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	6/5/2019	4.4	11.2	91.9	455	563	3.3	2.60	1.06	3.66	69.3
EFF	6/5/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	0.63 (J)	< 2.19	ND (< 0.51)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	6/12/2019	4.8	12.3	100	456	573	2.9	2.94	1.14	4.08	77.0
EFF	6/12/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	3.0	4.6	ND (< 0.51)	ND (< 0.042)	ND (< 0.050)	ND (< 0.092)	ND (< 0.98)
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

TABLE 5
GROUNDWATER TREATMENT SYSTEM SAMPLING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
NPDES Permit # MDG915958

Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	7/10/2019	4.0	7.7	48.9	328	389	2.7	1.88	0.92	2.80	57.5
EFF	7/10/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	ND (< 0.51)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	7/19/2019	3.2	6.1	49.0	270	328.3	2.3	1.81	0.77	2.58	50.3
EFF	7/19/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	ND (< 0.51)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	8/5/2019	3.4	5.3	24.6	203	236.3	0.68 (J)	1.77	0.81	2.58	57.6
EFF	8/5/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.68 (J)	ND (< 0.042)	0.109	0.151	ND (< 0.98)
INN	8/13/2019	2.9	3.1	10.5	90.6	107.1	2.9	1.10	0.693	1.79	27.9
EFF	8/13/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.62 (J)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	9/4/2019	2.6	1.9	7.3	32.2	44.0	3.2	0.720	0.356	1.08	17.0
EFF	9/4/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	ND (< 0.51)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	9/11/2019	3.1	2.2	26.6	35.9	67.8	2.9	0.895	0.435	1.330	11.7
EFF	9/11/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.74 (J)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	10/1/2019	4.1	4.3	10.6	71.9	90.9	2.6	1.25	0.625	1.875	29.4
EFF	10/1/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.84 (J)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	10/9/2019	3.6	2.9	19.1	57.0	82.6	2.6	1.24	0.386	1.626	23.2
EFF	10/9/2019	0.48 (J)	ND (< 0.53)	ND (< 0.60)	1.0	<2.61	0.85 (J)	ND (< 0.042)	ND (< 0.053)	ND (< 0.095)	ND (< 0.98)
INN	11/14/2019	2.7	3.6	37.0	104	147	3.4	1.47	0.628	2.098	45.1
EFF	11/14/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.59 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 2.5)
INN	11/19/2019	2.9	4.2	43.2	117	167	3.4	1.33	0.646	1.976	47.5
EFF	11/19/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	0.79 (J)	<2.35	0.78 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 2.5)
INN	12/4/2019	1.4	2.2	26.4	56.4	86.4	2.0	0.695	0.158	0.853	16.9
EFF	12/4/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.67 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 2.5)
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

TABLE 5
GROUNDWATER TREATMENT SYSTEM SAMPLING RESULTS SUMMARY
Ridgely Manor Park
Towson, MD
Case # 1991-2100-BA
NPDES Permit # MDG915958

Groundwater Treatment System Sample Identification	Groundwater Treatment System Sample Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (Total) (µg/L)	Total BTEX (µg/L)	MTBE (µg/L)	TPH-GRO (mg/L)	TPH-DRO (mg/L)	Total TPH (mg/L)	Naphthalene (µg/L)
INN	12/11/2019	1.7	2.6	31.5	62.4	98.2	2.0	0.778	0.334	1.112	19.4
EFF	12/11/2019	ND (< 0.43)	ND (< 0.53)	ND (< 0.60)	ND (< 0.59)	ND (< 2.15)	0.62 (J)	ND (< 0.10)	ND (< 0.053)	ND (< 0.15)	ND (< 2.5)
	NPDES Permit Limits*	**5**	**NL**	**NL**	**NL**	**100**	**NL**	**NL**	**NL**	**15**	**NL**

*Effluent Limitations listed in NPDES Permit # MDG915958
EFF = Effluent Sample (Post-filtration)
INF = Influent Sample (Pre-filtration)
INN = Influent Sample (Pre-filtration)
ND = Constituent Compound Not Detected
NL = No limit listed in NPDES permit
NA = Not Analyzed
(J) = Laboratory-Estimated Value

µg/L = micrograms/Liter
MTBE = Methyl-Tertiary-Butyl Ether
Total BTEX = sum of Benzene, Toluene, Ethylbenzene, and Xylenes
TPH = Total Petroleum Hydrocarbons
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ND (< MDL) = Not Detected above Method Detection Limit

Dayton, NJ

12/03/19

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JC98692

Sampling Date: 11/13/19

Report to:

EMS Environmental, Inc.
4550 Bath Pike
Bethlehem, PA 18017
jfox@emsenv.com

ATTN: Jeremy Fox

Total number of pages in report: **61**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

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SGS North America Inc.

Sample Summary

EMS Environmental, Inc.

Job No: JC98692

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
This report contains results reported as ND = Not detected. The following applies:							
Organics ND = Not detected above the MDL							
JC98692-1	11/13/19	15:00	RL	11/15/19	AQ	Ground Water	MW-4
JC98692-2	11/13/19	14:30	RL	11/15/19	AQ	Ground Water	MW-7
JC98692-3	11/13/19	11:30	RL	11/15/19	AQ	Ground Water	YMW-1
JC98692-4	11/13/19	12:15	RL	11/15/19	AQ	Ground Water	YMW-2
JC98692-5	11/13/19	11:50	RL	11/15/19	AQ	Ground Water	YMW-3
JC98692-6	11/13/19	13:00	RL	11/15/19	AQ	Ground Water	YMW-4
JC98692-7	11/13/19	12:40	RL	11/15/19	AQ	Ground Water	YMW-8
JC98692-8	11/13/19	13:45	RL	11/15/19	AQ	Ground Water	YP-1
JC98692-9	11/13/19	14:10	RL	11/15/19	AQ	Ground Water	YP-2
JC98692-10	11/13/19	13:20	RL	11/15/19	AQ	Ground Water	YP-5

2

Summary of Hits

Job Number: JC98692
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 11/13/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC98692-1	**MW-4**					
Benzene		8.4	0.50	0.43	ug/l	SW846 8260C
Di-Isopropyl ether		1.7 J	2.0	0.68	ug/l	SW846 8260C
Ethylbenzene		37.5	1.0	0.60	ug/l	SW846 8260C
Isopropylbenzene		2.6	1.0	0.65	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.64 J	1.0	0.51	ug/l	SW846 8260C
Naphthalene		19.9	5.0	2.5	ug/l	SW846 8260C
n-Propylbenzene		4.5	2.0	0.60	ug/l	SW846 8260C
Tert Butyl Alcohol		16.8	10	5.8	ug/l	SW846 8260C
tert-Butyl Ethyl Ether		1.3 J	2.0	0.56	ug/l	SW846 8260C
Toluene		4.5	1.0	0.53	ug/l	SW846 8260C
1,2,4-Trimethylbenzene		19.3	2.0	1.0	ug/l	SW846 8260C
1,3,5-Trimethylbenzene		1.1 J	2.0	1.0	ug/l	SW846 8260C
m,p-Xylene		5.5	1.0	0.78	ug/l	SW846 8260C
o-Xylene		1.1	1.0	0.59	ug/l	SW846 8260C
Xylene (total)		6.6	1.0	0.59	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.507	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.168	0.083	0.053	mg/l	SW846 8015D
JC98692-2	**MW-7**					
Benzene		15.7	0.50	0.43	ug/l	SW846 8260C
n-Butylbenzene		2.2	2.0	0.52	ug/l	SW846 8260C
sec-Butylbenzene		2.9	2.0	0.62	ug/l	SW846 8260C
Di-Isopropyl ether		1.3 J	2.0	0.68	ug/l	SW846 8260C
Ethylbenzene		112	1.0	0.60	ug/l	SW846 8260C
Isopropylbenzene		14.9	1.0	0.65	ug/l	SW846 8260C
p-Isopropyltoluene		0.88 J	2.0	0.66	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.80 J	1.0	0.51	ug/l	SW846 8260C
Naphthalene		55.7	5.0	2.5	ug/l	SW846 8260C
n-Propylbenzene		43.5	2.0	0.60	ug/l	SW846 8260C
Tert Butyl Alcohol		8.0 J	10	5.8	ug/l	SW846 8260C
Toluene		12.5	1.0	0.53	ug/l	SW846 8260C
1,2,4-Trimethylbenzene		176	20	10	ug/l	SW846 8260C
1,3,5-Trimethylbenzene		26.8	2.0	1.0	ug/l	SW846 8260C
m,p-Xylene		91.5	1.0	0.78	ug/l	SW846 8260C
o-Xylene		5.4	1.0	0.59	ug/l	SW846 8260C
Xylene (total)		96.9	1.0	0.59	ug/l	SW846 8260C
TPH-GRO (C6-C10)		2.54	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		1.38	0.083	0.053	mg/l	SW846 8015D
JC98692-3	**YMW-1**					
Isopropylbenzene		0.98 J	1.0	0.65	ug/l	SW846 8260C

Summary of Hits

Job Number: JC98692
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 11/13/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
TPH-GRO (C6-C10)		0.128 J	0.20	0.10	mg/l	SW846 8015D
JC98692-4	**YMW-2**					
Di-Isopropyl ether		1.4 J	2.0	0.68	ug/l	SW846 8260C
Methyl Tert Butyl Ether		9.4	1.0	0.51	ug/l	SW846 8260C
Tert Butyl Alcohol		27.5	10	5.8	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.337	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.178	0.083	0.053	mg/l	SW846 8015D
JC98692-5	**YMW-3**					
No hits reported in this sample.						
JC98692-6	**YMW-4**					
Benzene		8.7	0.50	0.43	ug/l	SW846 8260C
sec-Butylbenzene		1.3 J	2.0	0.62	ug/l	SW846 8260C
Di-Isopropyl ether		4.6	2.0	0.68	ug/l	SW846 8260C
Isopropylbenzene		1.1	1.0	0.65	ug/l	SW846 8260C
Methyl Tert Butyl Ether		6.6	1.0	0.51	ug/l	SW846 8260C
n-Propylbenzene		0.90 J	2.0	0.60	ug/l	SW846 8260C
Tert Butyl Alcohol		120	10	5.8	ug/l	SW846 8260C
Toluene		0.60 J	1.0	0.53	ug/l	SW846 8260C
m,p-Xylene		2.5	1.0	0.78	ug/l	SW846 8260C
Xylene (total)		2.5	1.0	0.59	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.764	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.582	0.083	0.053	mg/l	SW846 8015D
JC98692-7	**YMW-8**					
Benzene [a]		26.8	2.5	2.1	ug/l	SW846 8260C
n-Butylbenzene [a]		13.3	10	2.6	ug/l	SW846 8260C
sec-Butylbenzene [a]		8.8 J	10	3.1	ug/l	SW846 8260C
1,2-Dichloroethane [a]		3.2 J	5.0	3.0	ug/l	SW846 8260C
Ethylbenzene [a]		673	5.0	3.0	ug/l	SW846 8260C
Isopropylbenzene [a]		55.9	5.0	3.2	ug/l	SW846 8260C
p-Isopropyltoluene [a]		11.5	10	3.3	ug/l	SW846 8260C
Methyl Tert Butyl Ether [a]		19.8	5.0	2.5	ug/l	SW846 8260C
Naphthalene [a]		217	25	13	ug/l	SW846 8260C
n-Propylbenzene [a]		176	10	3.0	ug/l	SW846 8260C
Toluene [a]		46.1	5.0	2.7	ug/l	SW846 8260C
1,2,4-Trimethylbenzene [a]		846	10	5.0	ug/l	SW846 8260C
1,3,5-Trimethylbenzene [a]		181	10	5.0	ug/l	SW846 8260C
m,p-Xylene [a]		926	5.0	3.9	ug/l	SW846 8260C

Summary of Hits

Job Number: JC98692
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 11/13/19

Lab Sample ID Client Sample ID Analyte	Result/ Qual	RL	MDL	Units	Method
o-Xylene [a]	76.8	5.0	3.0	ug/l	SW846 8260C
Xylene (total) [a]	1000	5.0	3.0	ug/l	SW846 8260C
TPH-GRO (C6-C10)	9.19	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)	2.94	0.083	0.053	mg/l	SW846 8015D
JC98692-8 YP-1					
Acetone [a]	26.2	20	12	ug/l	SW846 8260C
Benzene [a]	4.6	1.0	0.85	ug/l	SW846 8260C
n-Butylbenzene [a]	15.5	4.0	1.0	ug/l	SW846 8260C
sec-Butylbenzene [a]	9.5	4.0	1.2	ug/l	SW846 8260C
Ethylbenzene	602	20	12	ug/l	SW846 8260C
Isopropylbenzene [a]	50.2	2.0	1.3	ug/l	SW846 8260C
p-Isopropyltoluene [a]	2.8 J	4.0	1.3	ug/l	SW846 8260C
Methyl Tert Butyl Ether [a]	2.0	2.0	1.0	ug/l	SW846 8260C
Naphthalene [a]	237	10	5.0	ug/l	SW846 8260C
n-Propylbenzene [a]	166	4.0	1.2	ug/l	SW846 8260C
Tert Butyl Alcohol [a]	13.5 J	20	12	ug/l	SW846 8260C
Toluene [a]	9.8	2.0	1.1	ug/l	SW846 8260C
1,2,4-Trimethylbenzene [a]	106	4.0	2.0	ug/l	SW846 8260C
1,3,5-Trimethylbenzene [a]	70.5	4.0	2.0	ug/l	SW846 8260C
m,p-Xylene [a]	154	2.0	1.6	ug/l	SW846 8260C
o-Xylene [a]	2.8	2.0	1.2	ug/l	SW846 8260C
Xylene (total) [a]	157	2.0	1.2	ug/l	SW846 8260C
TPH-GRO (C6-C10)	6.35	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)	2.02	0.083	0.053	mg/l	SW846 8015D
JC98692-9 YP-2					
Benzene	6.5	0.50	0.43	ug/l	SW846 8260C
sec-Butylbenzene	1.6 J	2.0	0.62	ug/l	SW846 8260C
Di-Isopropyl ether	1.0 J	2.0	0.68	ug/l	SW846 8260C
1,2-Dichloroethane	0.95 J	1.0	0.60	ug/l	SW846 8260C
Isopropylbenzene	0.70 J	1.0	0.65	ug/l	SW846 8260C
Methyl Tert Butyl Ether	16.1	1.0	0.51	ug/l	SW846 8260C
Naphthalene	6.3	5.0	2.5	ug/l	SW846 8260C
Tert Butyl Alcohol	15.0	10	5.8	ug/l	SW846 8260C
1,2,4-Trimethylbenzene	6.1	2.0	1.0	ug/l	SW846 8260C
TPH-GRO (C6-C10)	0.422	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)	0.248	0.083	0.053	mg/l	SW846 8015D
JC98692-10 YP-5					
Acetone	8.8 J	10	6.0	ug/l	SW846 8260C

Summary of Hits

Job Number: JC98692
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 11/13/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method

(a) Diluted due to high concentration of target compound.

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-4			
Lab Sample ID:	JC98692-1		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171822.D	1	11/22/19 03:22	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	8.4	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.62	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	1.7	2.0	0.68	ug/l	J
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-4			
Lab Sample ID:	JC98692-1		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	37.5	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	2.6	1.0	0.65	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.64	1.0	0.51	ug/l	J
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	19.9	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	4.5	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	16.8	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	1.3	2.0	0.56	ug/l	J
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	4.5	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	19.3	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	1.1	2.0	1.0	ug/l	J
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	5.5	1.0	0.78	ug/l	
95-47-6	o-Xylene	1.1	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	6.6	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	99%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-4		
Lab Sample ID:	JC98692-1	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	97%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	95%		80-120%

(a) Associated CCV outside of control limits high, sample was ND.

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-4		
Lab Sample ID:	JC98692-1	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101930.D	1	11/20/19 12:31	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.507	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	103%		55-130%

ND = Not detected　　MDL = Method Detection Limit　　J = Indicates an estimated value
RL = Reporting Limit　　B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range　　N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-4		
Lab Sample ID:	JC98692-1	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78137.D	1	11/20/19 00:18	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.168	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	65%		22-140%
438-22-2	5a-Androstane	57%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MW-7		
Lab Sample ID:	JC98692-2	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171823.D	1	11/22/19 03:51	BK	n/a	n/a	V2C7722
Run #2	3B157321.D	10	11/27/19 14:29	JP	n/a	n/a	V3B7075

	Purge Volume
Run #1	5.0 ml
Run #2	5.0 ml

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	15.7	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	2.2	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	2.9	2.0	0.62	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	1.3	2.0	0.68	ug/l	J
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-7			
Lab Sample ID:	JC98692-2		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	112	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	14.9	1.0	0.65	ug/l	
99-87-6	p-Isopropyltoluene	0.88	2.0	0.66	ug/l	J
1634-04-4	Methyl Tert Butyl Ether	0.80	1.0	0.51	ug/l	J
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	55.7	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	43.5	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	8.0	10	5.8	ug/l	J
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	12.5	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	176 [b]	20	10	ug/l	
108-67-8	1,3,5-Trimethylbenzene	26.8	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	91.5	1.0	0.78	ug/l	
95-47-6	o-Xylene	5.4	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	96.9	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	101%	100%	80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-7		
Lab Sample ID:	JC98692-2	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	94%	100%	81-124%
2037-26-5	Toluene-D8	101%	102%	80-120%
460-00-4	4-Bromofluorobenzene	99%	93%	80-120%

(a) Associated CCV outside of control limits high, sample was ND.
(b) Result is from Run# 2

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-7			
Lab Sample ID:	JC98692-2		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8015D		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101937.D	1	11/20/19 15:24	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	2.54	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	101%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-7		
Lab Sample ID:	JC98692-2	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78138.D	1	11/20/19 00:52	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	1.38	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	55%		22-140%
438-22-2	5a-Androstane	39%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-1			
Lab Sample ID:	JC98692-3		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171838.D	1	11/22/19 11:14	BK	n/a	n/a	V2C7723
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.62	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	ND	2.0	0.68	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane [a]	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-1			
Lab Sample ID:	JC98692-3		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	0.98	1.0	0.65	ug/l	J
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.51	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	ND	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [b]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	ND	1.0	0.78	ug/l	
95-47-6	o-Xylene	ND	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-1		
Lab Sample ID:	JC98692-3	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	97%		81-124%
2037-26-5	Toluene-D8	100%		80-120%
460-00-4	4-Bromofluorobenzene	95%		80-120%

(a) Associated CCV outside of control limits low.
(b) Associated CCV outside of control limits high, sample was ND.

ND = Not detected　MDL = Method Detection Limit　J = Indicates an estimated value
RL = Reporting Limit　B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range　N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-1			
Lab Sample ID:	JC98692-3		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8015D		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101931.D	1	11/20/19 12:53	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.128	0.20	0.10	mg/l	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	95%		55-130%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-1		
Lab Sample ID:	JC98692-3	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78139.D	1	11/20/19 01:26	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	62%		22-140%
438-22-2	5a-Androstane	48%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-2			
Lab Sample ID:	JC98692-4		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171825.D	1	11/22/19 04:48	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.62	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	1.4	2.0	0.68	ug/l	J
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-2		
Lab Sample ID:	JC98692-4	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.65	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	9.4	1.0	0.51	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	27.5	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	ND	1.0	0.78	ug/l	
95-47-6	o-Xylene	ND	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-2		
Lab Sample ID:	JC98692-4	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	96%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	93%		80-120%

(a) Associated CCV outside of control limits high, sample was ND.

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-2			
Lab Sample ID:	JC98692-4		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8015D		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101932.D	1	11/20/19 13:22	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.337	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	97%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-2			
Lab Sample ID:	JC98692-4		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78140.D	1	11/20/19 02:00	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.178	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	66%		22-140%
438-22-2	5a-Androstane	49%		10-135%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-3		
Lab Sample ID:	JC98692-5	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171826.D	1	11/22/19 05:17	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.62	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	ND	2.0	0.68	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-3			
Lab Sample ID:	JC98692-5		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.65	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.51	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	ND	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	ND	1.0	0.78	ug/l	
95-47-6	o-Xylene	ND	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		80-120%

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E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-3			
Lab Sample ID:	JC98692-5		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	97%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	94%		80-120%

(a) Associated CCV outside of control limits high, sample was ND.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
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E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-3		
Lab Sample ID:	JC98692-5	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101933.D	1	11/20/19 13:43	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	95%		55-130%

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E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-3		
Lab Sample ID:	JC98692-5	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78141.D	1	11/20/19 02:35	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	50%		22-140%
438-22-2	5a-Androstane	34%		10-135%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-4		
Lab Sample ID:	JC98692-6	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171827.D	1	11/22/19 05:45	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	8.7	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	1.3	2.0	0.62	ug/l	J
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	4.6	2.0	0.68	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-4		
Lab Sample ID:	JC98692-6	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	1.1	1.0	0.65	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	6.6	1.0	0.51	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	0.90	2.0	0.60	ug/l	J
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	120	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	0.60	1.0	0.53	ug/l	J
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	2.5	1.0	0.78	ug/l	
95-47-6	o-Xylene	ND	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	2.5	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	99%		80-120%

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E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-4		
Lab Sample ID:	JC98692-6	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	95%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	95%		80-120%

(a) Associated CCV outside of control limits high, sample was ND.

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-4		
Lab Sample ID:	JC98692-6	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101934.D	1	11/20/19 14:12	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.764	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	97%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-4		
Lab Sample ID:	JC98692-6	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78142.D	1	11/20/19 03:09	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.582	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	68%		22-140%
438-22-2	5a-Androstane	53%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-8		
Lab Sample ID:	JC98692-7	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	2C171828.D	5	11/22/19 06:14	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	50	30	ug/l	
71-43-2	Benzene	26.8	2.5	2.1	ug/l	
108-86-1	Bromobenzene	ND	5.0	2.7	ug/l	
74-97-5	Bromochloromethane	ND	5.0	2.4	ug/l	
75-27-4	Bromodichloromethane	ND	5.0	2.9	ug/l	
75-25-2	Bromoform	ND	5.0	3.2	ug/l	
74-83-9	Bromomethane	ND	10	8.2	ug/l	
78-93-3	2-Butanone (MEK)	ND	50	34	ug/l	
104-51-8	n-Butylbenzene	13.3	10	2.6	ug/l	
135-98-8	sec-Butylbenzene	8.8	10	3.1	ug/l	J
98-06-6	tert-Butylbenzene	ND	10	3.4	ug/l	
56-23-5	Carbon tetrachloride	ND	5.0	2.8	ug/l	
108-90-7	Chlorobenzene	ND	5.0	2.8	ug/l	
75-00-3	Chloroethane	ND	5.0	3.6	ug/l	
67-66-3	Chloroform	ND	5.0	2.5	ug/l	
74-87-3	Chloromethane	ND	5.0	3.8	ug/l	
95-49-8	o-Chlorotoluene	ND	10	3.2	ug/l	
106-43-4	p-Chlorotoluene	ND	10	3.0	ug/l	
108-20-3	Di-Isopropyl ether	ND	10	3.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	10	6.0	ug/l	
124-48-1	Dibromochloromethane	ND	5.0	2.8	ug/l	
106-93-4	1,2-Dibromoethane	ND	5.0	2.4	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	5.0	2.7	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	5.0	2.7	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	5.0	2.5	ug/l	
75-71-8	Dichlorodifluoromethane	ND	10	6.8	ug/l	
75-34-3	1,1-Dichloroethane	ND	5.0	2.8	ug/l	
107-06-2	1,2-Dichloroethane	3.2	5.0	3.0	ug/l	J
75-35-4	1,1-Dichloroethene	ND	5.0	3.0	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	5.0	2.5	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	5.0	2.7	ug/l	
78-87-5	1,2-Dichloropropane	ND	5.0	2.5	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-8		
Lab Sample ID:	JC98692-7	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	5.0	2.1	ug/l	
594-20-7	2,2-Dichloropropane	ND	5.0	2.6	ug/l	
563-58-6	1,1-Dichloropropene	ND	5.0	4.1	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	5.0	2.4	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	5.0	2.2	ug/l	
100-41-4	Ethylbenzene	673	5.0	3.0	ug/l	
87-68-3	Hexachlorobutadiene	ND	10	2.8	ug/l	
98-82-8	Isopropylbenzene	55.9	5.0	3.2	ug/l	
99-87-6	p-Isopropyltoluene	11.5	10	3.3	ug/l	
1634-04-4	Methyl Tert Butyl Ether	19.8	5.0	2.5	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	25	9.3	ug/l	
74-95-3	Methylene bromide	ND	5.0	2.4	ug/l	
75-09-2	Methylene chloride	ND	10	5.0	ug/l	
91-20-3	Naphthalene	217	25	13	ug/l	
103-65-1	n-Propylbenzene	176	10	3.0	ug/l	
100-42-5	Styrene	ND	5.0	3.5	ug/l	
75-65-0	Tert Butyl Alcohol	ND	50	29	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	10	2.4	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	10	2.8	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	5.0	3.0	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	5.0	3.3	ug/l	
127-18-4	Tetrachloroethene	ND	5.0	4.5	ug/l	
108-88-3	Toluene	46.1	5.0	2.7	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	5.0	2.5	ug/l	
120-82-1	1,2,4-Trichlorobenzene [b]	ND	5.0	2.5	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	5.0	2.7	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	5.0	2.7	ug/l	
79-01-6	Trichloroethene	ND	5.0	2.6	ug/l	
75-69-4	Trichlorofluoromethane	ND	10	4.2	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	10	3.5	ug/l	
95-63-6	1,2,4-Trimethylbenzene	846	10	5.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	181	10	5.0	ug/l	
75-01-4	Vinyl chloride	ND	5.0	3.9	ug/l	
	m,p-Xylene	926	5.0	3.9	ug/l	
95-47-6	o-Xylene	76.8	5.0	3.0	ug/l	
1330-20-7	Xylene (total)	1000	5.0	3.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-8		
Lab Sample ID:	JC98692-7	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	96%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	98%		80-120%

(a) Diluted due to high concentration of target compound.
(b) Associated CCV outside of control limits high, sample was ND.

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YMW-8			
Lab Sample ID:	JC98692-7		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8015D		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101935.D	1	11/20/19 14:34	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	9.19	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	102%		55-130%

ND = Not detected　　MDL = Method Detection Limit　　J = Indicates an estimated value
RL = Reporting Limit　　B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range　　N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YMW-8		
Lab Sample ID:	JC98692-7	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78143.D	1	11/20/19 03:43	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	2.94	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	68%		22-140%
438-22-2	5a-Androstane	55%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-1		
Lab Sample ID:	JC98692-8	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	2C171829.D	2	11/22/19 06:42	BK	n/a	n/a	V2C7722
Run #2	2C171848.D	20	11/22/19 16:01	BK	n/a	n/a	V2C7723

	Purge Volume
Run #1	5.0 ml
Run #2	5.0 ml

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	26.2	20	12	ug/l	
71-43-2	Benzene	4.6	1.0	0.85	ug/l	
108-86-1	Bromobenzene	ND	2.0	1.1	ug/l	
74-97-5	Bromochloromethane	ND	2.0	0.96	ug/l	
75-27-4	Bromodichloromethane	ND	2.0	1.2	ug/l	
75-25-2	Bromoform	ND	2.0	1.3	ug/l	
74-83-9	Bromomethane	ND	4.0	3.3	ug/l	
78-93-3	2-Butanone (MEK)	ND	20	14	ug/l	
104-51-8	n-Butylbenzene	15.5	4.0	1.0	ug/l	
135-98-8	sec-Butylbenzene	9.5	4.0	1.2	ug/l	
98-06-6	tert-Butylbenzene	ND	4.0	1.4	ug/l	
56-23-5	Carbon tetrachloride	ND	2.0	1.1	ug/l	
108-90-7	Chlorobenzene	ND	2.0	1.1	ug/l	
75-00-3	Chloroethane	ND	2.0	1.5	ug/l	
67-66-3	Chloroform	ND	2.0	1.0	ug/l	
74-87-3	Chloromethane	ND	2.0	1.5	ug/l	
95-49-8	o-Chlorotoluene	ND	4.0	1.3	ug/l	
106-43-4	p-Chlorotoluene	ND	4.0	1.2	ug/l	
108-20-3	Di-Isopropyl ether	ND	4.0	1.4	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	4.0	2.4	ug/l	
124-48-1	Dibromochloromethane	ND	2.0	1.1	ug/l	
106-93-4	1,2-Dibromoethane	ND	2.0	0.95	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	2.0	1.1	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	2.0	1.1	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	2.0	1.0	ug/l	
75-71-8	Dichlorodifluoromethane	ND	4.0	2.7	ug/l	
75-34-3	1,1-Dichloroethane	ND	2.0	1.1	ug/l	
107-06-2	1,2-Dichloroethane	ND	2.0	1.2	ug/l	
75-35-4	1,1-Dichloroethene	ND	2.0	1.2	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	2.0	1.0	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	2.0	1.1	ug/l	
78-87-5	1,2-Dichloropropane	ND	2.0	1.0	ug/l	

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E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-1			
Lab Sample ID:	JC98692-8		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	2.0	0.85	ug/l	
594-20-7	2,2-Dichloropropane	ND	2.0	1.0	ug/l	
563-58-6	1,1-Dichloropropene	ND	2.0	1.6	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	2.0	0.94	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	2.0	0.86	ug/l	
100-41-4	Ethylbenzene	602 [b]	20	12	ug/l	
87-68-3	Hexachlorobutadiene	ND	4.0	1.1	ug/l	
98-82-8	Isopropylbenzene	50.2	2.0	1.3	ug/l	
99-87-6	p-Isopropyltoluene	2.8	4.0	1.3	ug/l	J
1634-04-4	Methyl Tert Butyl Ether	2.0	2.0	1.0	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	10	3.7	ug/l	
74-95-3	Methylene bromide	ND	2.0	0.96	ug/l	
75-09-2	Methylene chloride	ND	4.0	2.0	ug/l	
91-20-3	Naphthalene	237	10	5.0	ug/l	
103-65-1	n-Propylbenzene	166	4.0	1.2	ug/l	
100-42-5	Styrene	ND	2.0	1.4	ug/l	
75-65-0	Tert Butyl Alcohol	13.5	20	12	ug/l	J
994-05-8	tert-Amyl Methyl Ether	ND	4.0	0.94	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	4.0	1.1	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	2.0	1.2	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	2.0	1.3	ug/l	
127-18-4	Tetrachloroethene	ND	2.0	1.8	ug/l	
108-88-3	Toluene	9.8	2.0	1.1	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	2.0	1.0	ug/l	
120-82-1	1,2,4-Trichlorobenzene [c]	ND	2.0	1.0	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	2.0	1.1	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	2.0	1.1	ug/l	
79-01-6	Trichloroethene	ND	2.0	1.1	ug/l	
75-69-4	Trichlorofluoromethane	ND	4.0	1.7	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	4.0	1.4	ug/l	
95-63-6	1,2,4-Trimethylbenzene	106	4.0	2.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	70.5	4.0	2.0	ug/l	
75-01-4	Vinyl chloride	ND	2.0	1.6	ug/l	
	m,p-Xylene	154	2.0	1.6	ug/l	
95-47-6	o-Xylene	2.8	2.0	1.2	ug/l	
1330-20-7	Xylene (total)	157	2.0	1.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%	100%	80-120%

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E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YP-1		
Lab Sample ID:	JC98692-8	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	95%	97%	81-124%
2037-26-5	Toluene-D8	100%	102%	80-120%
460-00-4	4-Bromofluorobenzene	99%	93%	80-120%

(a) Diluted due to high concentration of target compound.
(b) Result is from Run# 2
(c) Associated CCV outside of control limits high, sample was ND.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YP-1		
Lab Sample ID:	JC98692-8	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101938.D	1	11/20/19 15:46	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	6.35	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	104%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-1		
Lab Sample ID:	JC98692-8	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78144.D	1	11/20/19 04:17	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	2.02	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	54%		22-140%
438-22-2	5a-Androstane	46%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-2		
Lab Sample ID:	JC98692-9	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171830.D	1	11/22/19 07:11	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	ND	10	6.0	ug/l	
71-43-2	Benzene	6.5	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	1.6	2.0	0.62	ug/l	J
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	1.0	2.0	0.68	ug/l	J
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	0.95	1.0	0.60	ug/l	J
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YP-2			
Lab Sample ID:	JC98692-9		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	0.70	1.0	0.65	ug/l	J
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	16.1	1.0	0.51	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	6.3	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	15.0	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	6.1	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	ND	1.0	0.78	ug/l	
95-47-6	o-Xylene	ND	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		80-120%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-2		
Lab Sample ID:	JC98692-9	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	97%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	94%		80-120%

(a) Associated CCV outside of control limits high, sample was ND.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-2		
Lab Sample ID:	JC98692-9	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101936.D	1	11/20/19 14:55	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.422	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	96%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YP-2		
Lab Sample ID:	JC98692-9	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78148.D	1	11/20/19 06:34	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.248	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	62%		22-140%
438-22-2	5a-Androstane	58%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-5			
Lab Sample ID:	JC98692-10		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2C171831.D	1	11/22/19 07:40	BK	n/a	n/a	V2C7722
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
67-64-1	Acetone	8.8	10	6.0	ug/l	J
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-86-1	Bromobenzene	ND	1.0	0.55	ug/l	
74-97-5	Bromochloromethane	ND	1.0	0.48	ug/l	
75-27-4	Bromodichloromethane	ND	1.0	0.58	ug/l	
75-25-2	Bromoform	ND	1.0	0.63	ug/l	
74-83-9	Bromomethane	ND	2.0	1.6	ug/l	
78-93-3	2-Butanone (MEK)	ND	10	6.9	ug/l	
104-51-8	n-Butylbenzene	ND	2.0	0.52	ug/l	
135-98-8	sec-Butylbenzene	ND	2.0	0.62	ug/l	
98-06-6	tert-Butylbenzene	ND	2.0	0.69	ug/l	
56-23-5	Carbon tetrachloride	ND	1.0	0.55	ug/l	
108-90-7	Chlorobenzene	ND	1.0	0.56	ug/l	
75-00-3	Chloroethane	ND	1.0	0.73	ug/l	
67-66-3	Chloroform	ND	1.0	0.50	ug/l	
74-87-3	Chloromethane	ND	1.0	0.76	ug/l	
95-49-8	o-Chlorotoluene	ND	2.0	0.63	ug/l	
106-43-4	p-Chlorotoluene	ND	2.0	0.60	ug/l	
108-20-3	Di-Isopropyl ether	ND	2.0	0.68	ug/l	
96-12-8	1,2-Dibromo-3-chloropropane	ND	2.0	1.2	ug/l	
124-48-1	Dibromochloromethane	ND	1.0	0.56	ug/l	
106-93-4	1,2-Dibromoethane	ND	1.0	0.48	ug/l	
95-50-1	1,2-Dichlorobenzene	ND	1.0	0.53	ug/l	
541-73-1	1,3-Dichlorobenzene	ND	1.0	0.54	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	1.0	0.51	ug/l	
75-71-8	Dichlorodifluoromethane	ND	2.0	1.4	ug/l	
75-34-3	1,1-Dichloroethane	ND	1.0	0.57	ug/l	
107-06-2	1,2-Dichloroethane	ND	1.0	0.60	ug/l	
75-35-4	1,1-Dichloroethene	ND	1.0	0.59	ug/l	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	0.51	ug/l	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	0.54	ug/l	
78-87-5	1,2-Dichloropropane	ND	1.0	0.51	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-5			
Lab Sample ID:	JC98692-10		**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water		**Date Received:**	11/15/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

VOA Full List + Oxygenates

CAS No.	Compound	Result	RL	MDL	Units	Q
142-28-9	1,3-Dichloropropane	ND	1.0	0.43	ug/l	
594-20-7	2,2-Dichloropropane	ND	1.0	0.52	ug/l	
563-58-6	1,1-Dichloropropene	ND	1.0	0.82	ug/l	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	0.47	ug/l	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	0.43	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
87-68-3	Hexachlorobutadiene	ND	2.0	0.56	ug/l	
98-82-8	Isopropylbenzene	ND	1.0	0.65	ug/l	
99-87-6	p-Isopropyltoluene	ND	2.0	0.66	ug/l	
1634-04-4	Methyl Tert Butyl Ether	ND	1.0	0.51	ug/l	
108-10-1	4-Methyl-2-pentanone(MIBK)	ND	5.0	1.9	ug/l	
74-95-3	Methylene bromide	ND	1.0	0.48	ug/l	
75-09-2	Methylene chloride	ND	2.0	1.0	ug/l	
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	
103-65-1	n-Propylbenzene	ND	2.0	0.60	ug/l	
100-42-5	Styrene	ND	1.0	0.70	ug/l	
75-65-0	Tert Butyl Alcohol	ND	10	5.8	ug/l	
994-05-8	tert-Amyl Methyl Ether	ND	2.0	0.47	ug/l	
637-92-3	tert-Butyl Ethyl Ether	ND	2.0	0.56	ug/l	
630-20-6	1,1,1,2-Tetrachloroethane	ND	1.0	0.60	ug/l	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	0.65	ug/l	
127-18-4	Tetrachloroethene	ND	1.0	0.90	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
87-61-6	1,2,3-Trichlorobenzene	ND	1.0	0.50	ug/l	
120-82-1	1,2,4-Trichlorobenzene [a]	ND	1.0	0.50	ug/l	
71-55-6	1,1,1-Trichloroethane	ND	1.0	0.54	ug/l	
79-00-5	1,1,2-Trichloroethane	ND	1.0	0.53	ug/l	
79-01-6	Trichloroethene	ND	1.0	0.53	ug/l	
75-69-4	Trichlorofluoromethane	ND	2.0	0.84	ug/l	
96-18-4	1,2,3-Trichloropropane	ND	2.0	0.70	ug/l	
95-63-6	1,2,4-Trimethylbenzene	ND	2.0	1.0	ug/l	
108-67-8	1,3,5-Trimethylbenzene	ND	2.0	1.0	ug/l	
75-01-4	Vinyl chloride	ND	1.0	0.79	ug/l	
	m,p-Xylene	ND	1.0	0.78	ug/l	
95-47-6	o-Xylene	ND	1.0	0.59	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		80-120%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-5		
Lab Sample ID:	JC98692-10	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

VOA Full List + Oxygenates

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
17060-07-0	1,2-Dichloroethane-D4	98%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	93%		80-120%

(a) Associated CCV outside of control limits high, sample was ND.

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	YP-5		
Lab Sample ID:	JC98692-10	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101941.D	1	11/20/19 17:05	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	95%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	YP-5		
Lab Sample ID:	JC98692-10	**Date Sampled:**	11/13/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78149.D	1	11/20/19 07:08	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	64%		22-140%
438-22-2	5a-Androstane	45%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

GW

CHAIN OF CUSTODY

ACCUTEST Laboratories

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

Page 1 of 1

FED-EX Tracking #	Bottle Order Control # SW-06419-209
Accutest Quote #	Accutest Job # JC98692

Client / Reporting Information

- Company Name: EMS Environmental, Inc.
- Address: 4550 Bath Pike
- City: Bethlehem State: PA Zip: 18017
- Project Contact: Jeremy Fox E-mail: jfox@emsenv.com
- Phone #: 610-866-7799
- Samplers's Name: Robert Lloyd

Project Information

- Project Name: Former Hess 20204
- Street: 1613 E. Joppa Road
- City: Towson State: MD
- Project #: 5713
- Fax #: 610-866-8195
- Client Purchase Order #: 5713

Requested Analysis

- 8260 ☐ 624 ☐ 8021 ☐ 602 ☐ BTEX ☐ MTBE ☐ TBA☐ NAP ☐
- 8260 ☐ 624 ☐ TCL ☐ PPL ☐ STARS ☐ MTBE ☐ TBA ☐ NAP☐ +10 ☐ +15 ☐
- 8270 ☐ 625 ☐ TCL ☐ PPL ☐ STARS☐ ABN☐ AE☐ BN☐ PAH☐ +TICs☐
- Full Scan VOC's + Fuel Oxygenates by 8260B
- TPH-GRO by 8015B
- TPH-DRO by 8015B

Accutest Sample #	Field ID / Point of Collection	SUMMA # / MEOH Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	NaHSO4	MEOH	ENCORE	8260 BTEX	8260 624	8270 625	Full Scan VOC's + Fuel Oxygenates by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B	LAB USE ONLY
1	MW-4		11/13/2019	15:00		GW	7	7											X	X	X	
2	MW-7		11/13/2019	14:30		GW	7	7											X	X	X	E15
3	YMW-1		11/13/2019	11:30		GW	7	7											X	X	X	V371
4	YMW-2		11/13/2019	12:15		GW	7	7											X	X	X	
5	YMW-3		11/13/2019	11:50		GW	7	7											X	X	X	
6	YMW-4		11/13/2019	13:00		GW	7	7											X	X	X	
7	YMW-8		11/13/2019	12:40		GW	7	7											X	X	X	
8	YP-1		11/13/2019	13:45		GW	7	7											X	X	X	
9	YP-2		11/13/2019	14:10		GW	7	7											X	X	X	
10	YP-5		11/13/2019	13:20		GW	7	7											X	X	X	

Matrix Codes

DW- Drinking Water
GW- Ground Water
WW- Water
SW- Surface Water
SO- Soil
SL-Sludge
OI-Oil
LIQ- Other Liquid
AIR- Air
SOL-Other Solid
WP-Wipe

Turnaround Time (Business days)

- ☐ Std. 15 Business Days
- ☐ 10 Day *RUSH*
- ☐ 5 Day *RUSH*
- ☐ 3 Day *EMERGENCY*
- ☐ 2 Day *EMERGENCY*
- ☐ 1 Day *EMERGENCY*
- ☒ Other 14 Day Hess Standard

Approved By:/ Date:

Emergency T/A data available VIA Lablink

Data Deliverable Information

- ☒ Commercial "A"
- ☐ Commercial "B"
- ☐ NJ Reduced
- ☐ NJ Full
- ☐ Other Full TIER 1
- ☐ FULL CLP
- ☐ NYASP Category A
- ☐ NYASP Category B
- ☐ State Forms
- ☐ EDD Format________

Commercial "A" = Results Only

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 [signature]	11-15-19 08:00	1 [signature]	2 [signature]	11/15/19 1320	2 P. Shah
Relinquished by: 3 P. Shah	Date Time: 11/15/19 18:50	Received By: 3 [signature]	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal #	Preserved where applicable ☑	On Ice ☒ Cooler Temp. 3.4 °C IR [illegible] 3.3

JC98692: Chain of Custody
Page 1 of 2

4.1
4

SGS Sample Receipt Summary

Job Number: JC98692 **Client:** EMS ENVIRONMENTAL, INC. **Project:** HESS #20204, 1613 EAST JOPPA ROAD, TOWS

Date / Time Received: 11/15/2019 6:50:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (3.4); Cooler 2: (3.3);

Cooler Temps (Corrected) °C: Cooler 1: (3.2); Cooler 2: (3.1);

Cooler Security

	Y	N
1. Custody Seals Present:	☑	☐
2. Custody Seals Intact:	☑	☐
3. COC Present:	☑	☐
4. Smpl Dates/Time OK	☑	☐

Cooler Temperature

	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	2	

Quality Control Preservation

	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation

	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition

	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions

	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JC98692: Chain of Custody
Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JC96122

Sampling Date: 10/01/19

Report to:

EMS Environmental, Inc.

rlloyd@emsenv.com

ATTN: Robert Lloyd

Total number of pages in report: **17**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

Table of Contents

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Sample Summary

EMS Environmental, Inc.

Job No: JC96122

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JC96122-1	10/01/19	12:20	BR	10/03/19	AQ	Influent	INF
JC96122-2	10/01/19	12:10	BR	10/03/19	AQ	Water	MID
JC96122-3	10/01/19	12:00	BR	10/03/19	AQ	Effluent	EFF

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

2

Summary of Hits

Job Number: JC96122
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 10/01/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC96122-1	**INF**					
Benzene		4.1	0.50	0.43	ug/l	SW846 8260C
Toluene		4.3	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		10.6	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		71.9	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		2.6	1.0	0.51	ug/l	SW846 8260C
Naphthalene		29.4	5.0	0.98	ug/l	SW846 8260C
TPH-GRO (C6-C10)		1.25	0.20	0.042	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.625	0.083	0.053	mg/l	SW846 8015D
JC96122-2	**MID**					
Benzene		0.50	0.50	0.43	ug/l	SW846 8260C
Ethylbenzene		0.72 J	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		3.3	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.92 J	1.0	0.51	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.205	0.20	0.042	mg/l	SW846 8015D
JC96122-3	**EFF**					
Methyl Tert Butyl Ether		0.84 J	1.0	0.51	ug/l	SW846 8260C

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC96122-1	**Date Sampled:**	10/01/19
Matrix:	AQ - Influent	**Date Received:**	10/03/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	1A194981.D	1	10/09/19 04:28	CSF	n/a	n/a	V1A8394
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	4.1	0.50	0.43	ug/l	
108-88-3	Toluene	4.3	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	10.6	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	71.9	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	2.6	1.0	0.51	ug/l	
91-20-3	Naphthalene	29.4	5.0	0.98	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		80-120%
17060-07-0	1,2-Dichloroethane-D4	106%		81-124%
2037-26-5	Toluene-D8	100%		80-120%
460-00-4	4-Bromofluorobenzene	104%		80-120%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC96122-1	**Date Sampled:**	10/01/19
Matrix:	AQ - Influent	**Date Received:**	10/03/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101847.D	1	10/07/19 10:39	XPL	n/a	n/a	GLM4228
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	1.25	0.20	0.042	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	93%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC96122-1	**Date Sampled:**	10/01/19
Matrix:	AQ - Influent	**Date Received:**	10/03/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y99437.D	1	10/08/19 15:40	SH	10/08/19 10:00	OP23205	G2Y3788
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.625	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	89%		22-140%
438-22-2	5a-Androstane	87%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC96122-2	**Date Sampled:**	10/01/19
Matrix:	AQ - Water	**Date Received:**	10/03/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	1A194982.D	1	10/09/19 04:53	CSF	n/a	n/a	V1A8394
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	0.50	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	0.72	1.0	0.60	ug/l	J
1330-20-7	Xylene (total)	3.3	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.92	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	0.98	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	102%		80-120%
17060-07-0	1,2-Dichloroethane-D4	107%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	106%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC96122-2	**Date Sampled:**	10/01/19
Matrix:	AQ - Water	**Date Received:**	10/03/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101846.D	1	10/07/19 10:10	XPL	n/a	n/a	GLM4228
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.205	0.20	0.042	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	93%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC96122-2	**Date Sampled:**	10/01/19
Matrix:	AQ - Water	**Date Received:**	10/03/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y99438.D	1	10/08/19 16:15	SH	10/08/19 10:00	OP23205	G2Y3788
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	86%		22-140%
438-22-2	5a-Androstane	85%		10-135%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC96122-3	**Date Sampled:**	10/01/19
Matrix:	AQ - Effluent	**Date Received:**	10/03/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	1A194973.D	1	10/09/19 01:10	CSF	n/a	n/a	V1A8394
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.84	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	0.98	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	104%		80-120%
17060-07-0	1,2-Dichloroethane-D4	107%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	108%		80-120%

ND = Not detected　　MDL = Method Detection Limit　　J = Indicates an estimated value
RL = Reporting Limit　　B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range　　N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF			
Lab Sample ID:	JC96122-3		**Date Sampled:**	10/01/19
Matrix:	AQ - Effluent		**Date Received:**	10/03/19
Method:	SW846 8015D		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101845.D	1	10/07/19 09:42	XPL	n/a	n/a	GLM4228
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.042	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	93%		55-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC96122-3	**Date Sampled:**	10/01/19
Matrix:	AQ - Effluent	**Date Received:**	10/03/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y99439.D	1	10/08/19 16:49	SH	10/08/19 10:00	OP23205	G2Y3788
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	82%		22-140%
438-22-2	5a-Androstane	80%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

ACCUTEST Laboratories

wW

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

Page 1

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job # JC96122

Client / Reporting Information

Company Name: EMS Environmental, Inc.
Address: 4550 Bath Pike
City: Bethlehem State: PA Zip: 18017
Project Contact: Jeremy Fox E-mail: jfox@emseny.com
Phone #: 610-866-7799
Samplers's Name: Brad Rohrbaugh

Project Information

Project Name: Former Hess - 20204
Street: 1613 E Joppa Road
City: Towson State: MD
Project #: 5713
Fax #: 610-866-8195
Client Purchase Order #: 5713

Requested Analysis: 8260 ☐ 624 ☐ 8021 ☐ 602 ☐ BTEX ☐ MTBE ☐ TBA☐ NAP ☐; 8260 ☐ 624 ☐ TCL ☐ PPL ☐ STARS ☐ MTBE ☐ TBA ☐ NAP☐ +10 ☐ +15 ☐; 8270 ☐ 625 ☐ TCL ☐ PPL ☐ STARS☐ ABN☐ AE☐ BN☐ PAH☐ +TICs☐; BTEX, MTBE and Naphthalene by 8260B; TPH-GRO by 8015B; TPH-DRO by 8015B

Accutest Sample #	Field ID / Point of Collection	SUMMA # MEOH Vial #	Date	Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	NaHSO4	MEOH	ENCORE	8260/624/8021/602	8260/624 TCL/PPL/STARS	8270/625	BTEX, MTBE and Naphthalene by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B	LAB USE ONLY
1	INF		10/1/2019	1220	BR	WW	7	7											X	X	X	E105
2	MID		10/1/2019	1210	BR	WW	7	7											X	X	X	V1155
3	EFF		10/1/2019	1200	BR	WW	7	7											X	X	X	

INITIAL ASSESSMENT 4B/TS

LABEL VERIFICATION

Matrix Codes: DW- Drinking Water; GW- Ground Water; WW- Water; SW- Surface Water; SO- Soil; SL- Sludge; OI- Oil; LIQ- Other Liquid; AIR- Air; SOL-Other Solid; WP-Wipe

Turnaround Time (Business days) — Approved By:/ Date:

- ☐ Std. 15 Business Days
- ☐ 10 Day RUSH
- ☐ 5 Day RUSH
- ☐ 3 Day EMERGENCY
- ☐ 2 Day EMERGENCY
- ☐ 1 Day EMERGENCY
- ☒ Other 14 Day Hess Standard

Emergency T/A data available VIA Lablink

Data Deliverable Information

- ☒ Commercial "A"
- ☐ Commercial "B"
- ☐ NJ Reduced
- ☐ NJ Full
- ☐ Other Full TIER 1
- ☐ FULL CLP
- ☐ NYASP Category A
- ☐ NYASP Category B
- ☐ State Forms
- ☐ EDD Format________

Commercial "A" = Results Only

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 [signature]	10-3-19 0800	1 [signature]	2 [signature]	10/3/19	2 [signature]
Relinquished By: 3 [signature]	Date Time: 10/3/19 15:45	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal #	Preserved where applicable ☑	On Ice ☑ Cooler Temp. 4.1°C

IR7 TF

JC96122: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: JC96122 **Client:** **Project:**

Date / Time Received: 10/3/2019 3:45:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (4.1);

Cooler Temps (Corrected) °C: Cooler 1: (4.0);

Cooler Security	Y	N		Y	N
1. Custody Seals Present:	☑	☐	3. COC Present:	☑	☐
2. Custody Seals Intact:	☑	☐	4. Smpl Dates/Time OK	☑	☐

Cooler Temperature	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	1	

Quality Control Preservation	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JC96122: Chain of Custody
Page 2 of 2

SGS

Dayton, NJ

11/12/19

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JC96541

Sampling Date: 10/09/19

Report to:

EMS Environmental, Inc.

rlloyd@emsenv.com

ATTN: Robert Lloyd

Total number of pages in report: **17**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

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Sample Summary

EMS Environmental, Inc.

Job No: JC96541

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JC96541-1	10/09/19	11:20	BR	10/10/19	AQ	Influent	INF
JC96541-2	10/09/19	11:10	BR	10/10/19	AQ	Ground Water	MID
JC96541-3	10/09/19	11:00	BR	10/10/19	AQ	Effluent	EFF

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

2

Summary of Hits

Job Number: JC96541
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 10/09/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC96541-1	**INF**					
Benzene		3.6	0.50	0.43	ug/l	SW846 8260C
Toluene		2.9	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		19.1	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		57.0	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		2.6	1.0	0.51	ug/l	SW846 8260C
Naphthalene		23.2	5.0	0.98	ug/l	SW846 8260C
TPH-GRO (C6-C10)		1.24	0.20	0.042	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.386	0.083	0.053	mg/l	SW846 8015D
JC96541-2	**MID**					
Benzene		0.96	0.50	0.43	ug/l	SW846 8260C
Toluene		0.56 J	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		2.4	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		8.1	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.87 J	1.0	0.51	ug/l	SW846 8260C
Naphthalene		2.0 J	5.0	0.98	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.282	0.20	0.042	mg/l	SW846 8015D
JC96541-3	**EFF**					
Benzene		0.48 J	0.50	0.43	ug/l	SW846 8260C
Xylene (total)		1.0	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.85 J	1.0	0.51	ug/l	SW846 8260C

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC96541-1	**Date Sampled:**	10/09/19
Matrix:	AQ - Influent	**Date Received:**	10/10/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3B156427.D	1	10/18/19 00:19	JP	n/a	n/a	V3B7031
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	3.6	0.50	0.43	ug/l	
108-88-3	Toluene	2.9	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	19.1	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	57.0	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	2.6	1.0	0.51	ug/l	
91-20-3	Naphthalene	23.2	5.0	0.98	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	96%		80-120%
17060-07-0	1,2-Dichloroethane-D4	103%		81-124%
2037-26-5	Toluene-D8	92%		80-120%
460-00-4	4-Bromofluorobenzene	86%		80-120%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC96541-1	**Date Sampled:**	10/09/19
Matrix:	AQ - Influent	**Date Received:**	10/10/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	PF153027.D	1	10/15/19 11:10	XPL	n/a	n/a	GPF4998
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	1.24	0.20	0.042	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	101%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC96541-1	**Date Sampled:**	10/09/19
Matrix:	AQ - Influent	**Date Received:**	10/10/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y99557.D	1	10/16/19 18:02	SH	10/16/19 10:00	OP23325	G2Y3791
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.386	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	75%		22-140%
438-22-2	5a-Androstane	75%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID			
Lab Sample ID:	JC96541-2		**Date Sampled:**	10/09/19
Matrix:	AQ - Ground Water		**Date Received:**	10/10/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3B156426.D	1	10/17/19 23:51	JP	n/a	n/a	V3B7031
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	0.96	0.50	0.43	ug/l	
108-88-3	Toluene	0.56	1.0	0.53	ug/l	J
100-41-4	Ethylbenzene	2.4	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	8.1	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.87	1.0	0.51	ug/l	J
91-20-3	Naphthalene	2.0	5.0	0.98	ug/l	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	96%		80-120%
17060-07-0	1,2-Dichloroethane-D4	106%		81-124%
2037-26-5	Toluene-D8	93%		80-120%
460-00-4	4-Bromofluorobenzene	87%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC96541-2	**Date Sampled:**	10/09/19
Matrix:	AQ - Ground Water	**Date Received:**	10/10/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	PF153026.D	1	10/15/19 10:43	XPL	n/a	n/a	GPF4998
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.282	0.20	0.042	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	106%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC96541-2	**Date Sampled:**	10/09/19
Matrix:	AQ - Ground Water	**Date Received:**	10/10/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y99555.D	1	10/16/19 16:42	SH	10/16/19 10:00	OP23325	G2Y3791
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	73%		22-140%
438-22-2	5a-Androstane	73%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC96541-3	**Date Sampled:**	10/09/19
Matrix:	AQ - Effluent	**Date Received:**	10/10/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	3B156424.D	1	10/17/19 22:55	JP	n/a	n/a	V3B7031
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	0.48	0.50	0.43	ug/l	J
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	1.0	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.85	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	0.98	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		80-120%
17060-07-0	1,2-Dichloroethane-D4	110%		81-124%
2037-26-5	Toluene-D8	90%		80-120%
460-00-4	4-Bromofluorobenzene	86%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC96541-3	**Date Sampled:**	10/09/19
Matrix:	AQ - Effluent	**Date Received:**	10/10/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	PF153036.D	1	10/15/19 15:30	XPL	n/a	n/a	GPF4998
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.042	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	110%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC96541-3	**Date Sampled:**	10/09/19
Matrix:	AQ - Effluent	**Date Received:**	10/10/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y99556.D	1	10/16/19 17:18	SH	10/16/19 10:00	OP23325	G2Y3791
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	71%		22-140%
438-22-2	5a-Androstane	72%		10-135%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

WW

ACCUTEST Laboratories

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

Page 1

FED-EX Tracking #	Bottle Order Control # SW-06419-209
Accutest Quote #	Accutest Job # JC96541

Client / Reporting Information

Company Name	EMS Environmental, Inc.
Address	4550 Bath Pike
City / State / Zip	Bethlehem / PA / 18017
Project Contact:	Jeremy Fox
E-mail	jfox@emsenv.com
Phone #	610-866-7799
Samplers's Name	Brad Rohrbaugh

Project Information

Project Name:	Former Hess - 20204
Street	1613 E. Joppa Road
City / State	Towson / MD
Project #	5713
Fax #	610-866-8195
Client Purchase Order #	5713

Requested Analysis

Accutest Sample #	Field ID / Point of Collection	SUMMA # / MEOH Vial #	Date	Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	NaHSO4	MEOH	ENCORE	8260 ☐ 624 ☐ 8021 ☐ 602 ☐ BTEX ☐ MTBE ☐ TBA☐ NAP ☐	8260 ☐ 624 ☐ TCL ☐ PPL ☐ STARS ☐ MTBE ☐ TBA ☐ NAP☐ +10 ☐ +15 ☐	8270 ☐ 625 ☐ TCL ☐ PPL ☐ STARS☐ ABN☐ AE☐ BN☐ PAH☐ +TICs☐	BTEX, MTBE and Naphthalene by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B						LAB USE ONLY
1	INF		10/9/2019	11:20	BR	WW	7	7											X	X	X						E67
2	MID		10/9/2019	11:10	BR	WW	7	7											X	X	X						V1216
3	EFF		10/9/2019	11:00	BR	WW	7	7											X	X	X						

INITIAL ASESSMENT 2 B ok

LABEL VERIFICATION

Matrix Codes: DW- Drinking Water; GW- Ground Water; WW- Water; SW- Surface Water; SO- Soil; SL-Sludge; OI-Oil; LIQ- Other Liquid; AIR- Air; SOL-Other Solid; WP-Wipe

Turnaround Time (Business days)

- ☐ Std. 15 Business Days
- ☐ 10 Day *RUSH*
- ☐ 5 Day *RUSH*
- ☐ 3 Day *EMERGENCY*
- ☐ 2 Day *EMERGENCY*
- ☐ 1 Day *EMERGENCY*
- ☒ Other 14 Day Hess Standard

Approved By:/ Date:

Emergency T/A data available VIA Lablink

Data Deliverable Information

- ☒ Commercial "A"
- ☐ Commercial "B"
- ☐ NJ Reduced
- ☐ NJ Full
- ☐ Other Full TIER 1
- ☐ FULL CLP
- ☐ NYASP Category A
- ☐ NYASP Category B
- ☐ State Forms
- ☐ EDD Format

Commercial "A" = Results Only

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 Brad Rohrbaugh	10/10/19	1	2	10/10/19	2 B R 10/10/19 1130
Relinquished by:	**Date Time:**	**Received By:**	**Relinquished By:**	**Date Time:**	**Received By:**
3 B R 10/10/19	1513	3	4		4
Relinquished by:	**Date Time:**	**Received By:**	**Custody Seal #**	**Preserved where applicable** ☐	**On Ice** ☐ **Cooler Temp.**
5		5			

C IR 3.3

JC96541: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: JC96541 **Client:** EMS ENVIRONMENTAL, INC. **Project:** HESS #20204, 1613 EAST JOPPA ROAD, TOW

Date / Time Received: 10/10/2019 3:13:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (3.3);

Cooler Temps (Corrected) °C: Cooler 1: (3.2);

Cooler Security

	Y	N
1. Custody Seals Present:	☑	☐
2. Custody Seals Intact:	☑	☐
3. COC Present:	☑	☐
4. Smpl Dates/Time OK	☑	☐

Cooler Temperature

	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	1	

Quality Control Preservation

	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation

	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition

	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions

	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JC96541: Chain of Custody
Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JC98693

Sampling Date: 11/14/19

Report to:

EMS Environmental, Inc.
4550 Bath Pike
Bethlehem, PA 18017
jfox@emsenv.com

ATTN: Jeremy Fox

Total number of pages in report: **17**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

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Sample Summary

EMS Environmental, Inc.

Job No: JC98693

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JC98693-1	11/14/19	12:00	BR	11/15/19	AQ	Influent	INF
JC98693-2	11/14/19	11:50	BR	11/15/19	AQ	Ground Water	MID
JC98693-3	11/14/19	11:40	BR	11/15/19	AQ	Effluent	EFF

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

2

Summary of Hits

Job Number: JC98693
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 11/14/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC98693-1	**INF**					
Benzene		2.7	0.50	0.43	ug/l	SW846 8260C
Toluene		3.6	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		37.0	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		104	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		3.4	1.0	0.51	ug/l	SW846 8260C
Naphthalene		45.1	5.0	2.5	ug/l	SW846 8260C
TPH-GRO (C6-C10)		1.47	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.628	0.083	0.053	mg/l	SW846 8015D
JC98693-2	**MID**					
Xylene (total)		1.6	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.88 J	1.0	0.51	ug/l	SW846 8260C
JC98693-3	**EFF**					
Methyl Tert Butyl Ether		0.59 J	1.0	0.51	ug/l	SW846 8260C

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC98693-1	**Date Sampled:**	11/14/19
Matrix:	AQ - Influent	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2V63376.D	1	11/23/19 04:25	DG	n/a	n/a	V2V2610
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	2.7	0.50	0.43	ug/l	
108-88-3	Toluene	3.6	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	37.0	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	104	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	3.4	1.0	0.51	ug/l	
91-20-3	Naphthalene	45.1	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		80-120%
17060-07-0	1,2-Dichloroethane-D4	97%		81-124%
2037-26-5	Toluene-D8	100%		80-120%
460-00-4	4-Bromofluorobenzene	102%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC98693-1	**Date Sampled:**	11/14/19
Matrix:	AQ - Influent	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101944.D	1	11/20/19 18:18	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	1.47	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	96%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC98693-1	**Date Sampled:**	11/14/19
Matrix:	AQ - Influent	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78150.D	1	11/20/19 07:42	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.628	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	63%		22-140%
438-22-2	5a-Androstane	45%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC98693-2	**Date Sampled:**	11/14/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2V63377.D	1	11/23/19 04:51	DG	n/a	n/a	V2V2610
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	1.6	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.88	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	103%		80-120%
17060-07-0	1,2-Dichloroethane-D4	99%		81-124%
2037-26-5	Toluene-D8	100%		80-120%
460-00-4	4-Bromofluorobenzene	101%		80-120%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC98693-2	**Date Sampled:**	11/14/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM101943.D	1	11/20/19 17:56	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	94%		55-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC98693-2	**Date Sampled:**	11/14/19
Matrix:	AQ - Ground Water	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78151.D	1	11/20/19 08:16	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	58%		22-140%
438-22-2	5a-Androstane	44%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC98693-3	**Date Sampled:**	11/14/19
Matrix:	AQ - Effluent	**Date Received:**	11/15/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2V63364.D	1	11/22/19 23:18	DG	n/a	n/a	V2V2610
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.59	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	102%		80-120%
17060-07-0	1,2-Dichloroethane-D4	99%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	102%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC98693-3	**Date Sampled:**	11/14/19
Matrix:	AQ - Effluent	**Date Received:**	11/15/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	LM101942.D	1	11/20/19 17:27	XPL	n/a	n/a	GLM4233
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	**Surrogate Recoveries**	**Run# 1**	**Run# 2**	**Limits**
98-08-8	aaa-Trifluorotoluene	96%		55-130%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC98693-3	**Date Sampled:**	11/14/19
Matrix:	AQ - Effluent	**Date Received:**	11/15/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z78152.D	1	11/20/19 08:50	SH	11/19/19 11:30	OP24095	G2Z2957
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	69%		22-140%
438-22-2	5a-Androstane	55%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

WW

ACCUTEST Laboratories

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

Page 1

FED-EX Tracking #
Bottle Order Control #
Accutest Quote #
Accutest Job # JC98693

Client / Reporting Information

Company Name	EMS Environmental, Inc.
Address	4550 Bath Pike
City	Bethlehem
State	PA
Zip	18017
Project Contact	Jeremy Fox
E-mail	jfox@emsenv.com
Phone #	610-866-7799
Samplers's Name	Brad Rohrbaugh

Project Information

Project Name	Former Hess - 20204
Street	1613 E. Joppa Road
City	Towson
State	MD
Project #	5713
Fax #	610-866-8195
Client Purchase Order #	5713

Requested Analysis: 8260 ☐ 624 ☐ 8021 ☐ 602 ☐ BTEX ☐ MTBE ☐ TBA☐ NAP ☐; 8260 ☐ 624 ☐ TCL ☐ PPL ☐ STARS ☐ MTBE ☐ TBA ☐ NAP☐ +10 ☐ +15 ☐; 8270 ☐ 625 ☐ TCL ☐ PPL ☐ STARS☐ ABN☐ AE☐ BN☐ PAH☐ +TICs☐; BTEX, MTBE and Naphthalene by 8260B; TPH-GRO by 8015B; TPH-DRO by 8015B

Accutest Sample #	Field ID / Point of Collection	SUMMA # / MEOH Vial #	Date	Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	NaHSO4	MEOH	ENCORE	8260/624/8021/602	8260/624	8270/625	BTEX, MTBE and Naphthalene by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B	LAB USE ONLY
1	INF		11/14/2019	12:00	BR	WW	7	7											X	X	X	
2	MID		11/14/2019	11:30	BR	WW	7	7											X	X	X	E83
3	EFF		11/14/2019	11:40	BR	WW	7	7											X	X	X	V327

Matrix Codes: DW- Drinking Water; GW- Ground Water; WW- Water; SW- Surface Water; SO- Soil; SL-Sludge; OI-Oil; LIQ- Other Liquid; AIR- Air; SOL-Other Solid; WP-Wipe

Turnaround Time (Business days) — Approved By:/ Date:

- [ ] Std. 15 Business Days
- [ ] 10 Day RUSH
- [ ] 5 Day RUSH
- [ ] 3 Day EMERGENCY
- [ ] 2 Day EMERGENCY
- [ ] 1 Day EMERGENCY
- [x] Other 14 Day Hess Standard

Emergency T/A data available VIA Lablink

Data Deliverable Information

- [x] Commercial "A"
- [ ] Commercial "B"
- [ ] NJ Reduced
- [ ] NJ Full
- [ ] Other Full TIER 1
- [ ] FULL CLP
- [ ] NYASP Category A
- [ ] NYASP Category B
- [ ] State Forms
- [ ] EDD Format________

Commercial "A" = Results Only

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler: 1 Bradley Rohrbaugh	Date Time: 08:00 11-15-19	Received By: 1 [signature]	Relinquished By: 2 [signature]	Date Time: 11/15/19 1320	Received By: 2 R. Shah
Relinquished by: 3 R. Shah	Date Time: 11/15/19 18:50	Received By: 3 [signature]	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal #	Preserved where applicable ✓	On Ice ☒ Cooler Temp. 3.4C-P 3.3C-P

JC98693: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: JC98693 **Client:** **Project:**

Date / Time Received: 11/15/2019 6:15:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (3.4); Cooler 2: (3.3);

Cooler Temps (Corrected) °C: Cooler 1: (3.2); Cooler 2: (3.1);

Cooler Security	Y	N		Y	N
1. Custody Seals Present:	☑	☐	3. COC Present:	☑	☐
2. Custody Seals Intact:	☑	☐	4. Smpl Dates/Time OK	☑	☐

Cooler Temperature	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	2	

Quality Control Preservation	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JC98693: Chain of Custody
Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JC98988

Sampling Date: 11/19/19

Report to:

EMS Environmental, Inc.
4550 Bath Pike
Bethlehem, PA 18017
jfox@emsenv.com

ATTN: Jeremy Fox

Total number of pages in report: **17**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

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SGS North America Inc.

Sample Summary

EMS Environmental, Inc.

Job No: JC98988

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JC98988-1	11/19/19	13:20	BR	11/21/19	AQ	Influent	INF
JC98988-2	11/19/19	13:10	BR	11/21/19	AQ	Water	MID
JC98988-3	11/19/19	13:00	BR	11/21/19	AQ	Effluent	EFF

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Summary of Hits

Job Number: JC98988
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 11/19/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC98988-1	**INF**					
Benzene		2.9	0.50	0.43	ug/l	SW846 8260C
Toluene		4.2	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		43.2	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		117	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		3.4	1.0	0.51	ug/l	SW846 8260C
Naphthalene		47.5	5.0	2.5	ug/l	SW846 8260C
TPH-GRO (C6-C10)		1.33	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.646	0.083	0.053	mg/l	SW846 8015D
JC98988-2	**MID**					
Xylene (total)		0.79 J	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.78 J	1.0	0.51	ug/l	SW846 8260C
TPH-DRO (C10-C28)		0.0922	0.083	0.053	mg/l	SW846 8015D
JC98988-3	**EFF**					
Benzene		0.79	0.50	0.43	ug/l	SW846 8260C
Toluene		0.77 J	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		5.4	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		18.9	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		1.3	1.0	0.51	ug/l	SW846 8260C
Naphthalene		5.4	5.0	2.5	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.309	0.20	0.10	mg/l	SW846 8015D

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC98988-1	**Date Sampled:**	11/19/19
Matrix:	AQ - Influent	**Date Received:**	11/21/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D98392.D	1	12/03/19 10:38	JP	n/a	n/a	V4D4351
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	2.9	0.50	0.43	ug/l	
108-88-3	Toluene	4.2	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	43.2	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	117	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	3.4	1.0	0.51	ug/l	
91-20-3	Naphthalene	47.5	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	98%		80-120%
17060-07-0	1,2-Dichloroethane-D4	106%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	104%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC98988-1	**Date Sampled:**	11/19/19
Matrix:	AQ - Influent	**Date Received:**	11/21/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102025.D	1	11/25/19 10:27	XPL	n/a	n/a	GLM4242
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	1.33	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	90%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC98988-1	**Date Sampled:**	11/19/19
Matrix:	AQ - Influent	**Date Received:**	11/21/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZZ94409.D	1	11/23/19 21:30	RK	11/23/19 10:00	OP24205	GZZ3407
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.646	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	74%		22-140%
438-22-2	5a-Androstane	79%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC98988-2	**Date Sampled:**	11/19/19
Matrix:	AQ - Water	**Date Received:**	11/21/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D98391.D	1	12/03/19 10:09	JP	n/a	n/a	V4D4351
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	0.79	1.0	0.59	ug/l	J
1634-04-4	Methyl Tert Butyl Ether	0.78	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	96%		80-120%
17060-07-0	1,2-Dichloroethane-D4	101%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	104%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC98988-2	**Date Sampled:**	11/19/19
Matrix:	AQ - Water	**Date Received:**	11/21/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102024.D	1	11/25/19 09:58	XPL	n/a	n/a	GLM4242
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	87%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC98988-2	**Date Sampled:**	11/19/19
Matrix:	AQ - Water	**Date Received:**	11/21/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZZ94410.D	1	11/23/19 22:04	RK	11/23/19 10:00	OP24205	GZZ3407
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.0922	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	65%		22-140%
438-22-2	5a-Androstane	69%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC98988-3	**Date Sampled:**	11/19/19
Matrix:	AQ - Effluent	**Date Received:**	11/21/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2E157725.D	1	11/23/19 17:20	MD	n/a	n/a	V2E7006
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	0.79	0.50	0.43	ug/l	
108-88-3	Toluene	0.77	1.0	0.53	ug/l	J
100-41-4	Ethylbenzene	5.4	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	18.9	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	1.3	1.0	0.51	ug/l	
91-20-3	Naphthalene	5.4	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	110%		80-120%
17060-07-0	1,2-Dichloroethane-D4	109%		81-124%
2037-26-5	Toluene-D8	99%		80-120%
460-00-4	4-Bromofluorobenzene	98%		80-120%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC98988-3	**Date Sampled:**	11/19/19
Matrix:	AQ - Effluent	**Date Received:**	11/21/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102023.D	1	11/25/19 09:36	XPL	n/a	n/a	GLM4242
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.309	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	89%		55-130%

ND = Not detected　　MDL = Method Detection Limit　　J = Indicates an estimated value
RL = Reporting Limit　　B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range　　N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC98988-3	**Date Sampled:**	11/19/19
Matrix:	AQ - Effluent	**Date Received:**	11/21/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZZ94411.D	1	11/23/19 22:38	RK	11/23/19 10:00	OP24205	GZZ3407
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	64%		22-140%
438-22-2	5a-Androstane	68%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

ACCUTEST Laboratories

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

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FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job # JC98988

Client / Reporting Information

Company Name: EMS Environmental, Inc.
Address: 4550 Bath Pike
City: Bethlehem State: PA Zip: 18017
Project Contact: Jeremy Fox E-mail: jfox@emsenv.com
Phone #: 610-866-7799
Samplers's Name: Brad Rohrbaugh

Project Information

Project Name: Former Hess - 20204
Street: 1613 E. Joppa Road
City: Towson State: MD
Project #: 5713
Fax #: 610-866-8195
Client Purchase Order #: 5713

Requested Analysis: 8260 □ 624 □ 8021 □ 602 □ BTEX □ MTBE □ TBA□ NAP □; 8260 □ 624 □ TCL □ PPL □ STARS □ MTBE □ TBA □ NAP□ +10 □ +15 □; 8270 □ 625 □ TCL □ PPL □ STARS□ ABN□ AE□ BN□ PAH□ +TICs□; BTEX, MTBE and Naphthalene by 8260B; TPH-GRO by 8015B; TPH-DRO by 8015B

Matrix Codes: DW- Drinking Water; GW- Ground Water; WW- Water; SW- Surface Water; SO- Soil; SL-Sludge; OI-Oil; LIQ- Other Liquid; AIR- Air; SOL-Other Solid; WP-Wipe

Accutest Sample #	Field ID / Point of Collection	SUMMA # / MECH Vial #	Date	Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	NaHSO4	MECH	ENCORE	BTEX, MTBE and Naphthalene by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B	LAB USE ONLY
1	INF		11/19/2019	1320	BR	WW	7	7								X	X	X	
2	MID		11/19/2019	1310	BR	WW	7	7								X	X	X	
3	EFF		11/19/2019	1300	BR	WW	7	7								X	X	X	

E/R
V418

Turnaround Time (Business days)

- [ ] Std. 15 Business Days
- [ ] 10 Day RUSH
- [ ] 5 Day RUSH
- [ ] 3 Day EMERGENCY
- [ ] 2 Day EMERGENCY
- [ ] 1 Day EMERGENCY
- [X] Other 14 Day Hess Standard

Approved By:/ Date:

Emergency T/A data available VIA Lablink

Data Deliverable Information

- [X] Commercial "A"
- [ ] Commercial "B"
- [ ] NJ Reduced
- [ ] NJ Full
- [ ] Other Full TIER 1
- [ ] FULL CLP
- [ ] NYASP Category A
- [ ] NYASP Category B
- [ ] State Forms
- [ ] EDD Format______

Commercial "A" = Results Only

Comments / Remarks

300mL HCL DRO

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 [signature]	11-21-19 08:00	1	2	11/21/19 12:45	2 P Shah
Relinquished by:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
3 P Shah	11/21/19 14:15	3	4		4
Relinquished by:	Date Time:	Received By:	Custody Seal #	Preserved where applicable	On Ice / Cooler Temp.
5		5		□	☒ 3.1C-P

INITIAL ASSESSMENT [initials]
LABEL VERIFICATION ______

JC98988: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: JC98988 **Client:** **Project:**

Date / Time Received: 11/21/2019 2:05:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (3.1);

Cooler Temps (Corrected) °C: Cooler 1: (2.9);

Cooler Security	Y	N
1. Custody Seals Present:	☑	☐
2. Custody Seals Intact:	☑	☐
3. COC Present:	☑	☐
4. Smpl Dates/Time OK	☑	☐

Cooler Temperature	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	1	

Quality Control Preservation	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JC98988: Chain of Custody
Page 2 of 2

SGS

Dayton, NJ

12/13/19

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JC99786

Sampling Date: 12/04/19

Report to:

EMS Environmental, Inc.
4550 Bath Pike
Bethlehem, PA 18017
jfox@emsenv.com

ATTN: Jeremy Fox

Total number of pages in report: **17**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

Test results relate only to samples analyzed.

Table of Contents

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SGS North America Inc.

Sample Summary

EMS Environmental, Inc.

Job No: JC99786

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JC99786-1	12/04/19	13:10	BR	12/06/19	AQ	Influent	INF
JC99786-2	12/04/19	13:20	BR	12/06/19	AQ	Water	MID
JC99786-3	12/04/19	13:30	BR	12/06/19	AQ	Effluent	EFF

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Summary of Hits

Job Number: JC99786
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 12/04/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JC99786-1	**INF**					
Benzene		1.4	0.50	0.43	ug/l	SW846 8260C
Toluene		2.2	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		26.4	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		56.4	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		2.0	1.0	0.51	ug/l	SW846 8260C
Naphthalene		16.9	5.0	2.5	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.695	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.158	0.083	0.053	mg/l	SW846 8015D
JC99786-2	**MID**					
Ethylbenzene		2.7	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		7.5	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.76 J	1.0	0.51	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.150 J	0.20	0.10	mg/l	SW846 8015D
JC99786-3	**EFF**					
Methyl Tert Butyl Ether		0.67 J	1.0	0.51	ug/l	SW846 8260C

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC99786-1	**Date Sampled:**	12/04/19
Matrix:	AQ - Influent	**Date Received:**	12/06/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D98784.D	1	12/13/19 05:08	KC	n/a	n/a	V4D4367
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	1.4	0.50	0.43	ug/l	
108-88-3	Toluene	2.2	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	26.4	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	56.4	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	2.0	1.0	0.51	ug/l	
91-20-3	Naphthalene	16.9	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	97%		80-120%
17060-07-0	1,2-Dichloroethane-D4	103%		81-124%
2037-26-5	Toluene-D8	100%		80-120%
460-00-4	4-Bromofluorobenzene	104%		80-120%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC99786-1	**Date Sampled:**	12/04/19
Matrix:	AQ - Influent	**Date Received:**	12/06/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102259.D	1	12/11/19 09:53	XPL	n/a	n/a	GLM4254
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.695	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	100%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JC99786-1	**Date Sampled:**	12/04/19
Matrix:	AQ - Influent	**Date Received:**	12/06/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y100293.D	1	12/11/19 12:57	SH	12/10/19 12:30	OP24514	G2Y3825
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.158	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	75%		22-140%
438-22-2	5a-Androstane	62%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC99786-2	**Date Sampled:**	12/04/19
Matrix:	AQ - Water	**Date Received:**	12/06/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D98783.D	1	12/13/19 04:39	KC	n/a	n/a	V4D4367
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	2.7	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	7.5	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.76	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	95%		80-120%
17060-07-0	1,2-Dichloroethane-D4	100%		81-124%
2037-26-5	Toluene-D8	101%		80-120%
460-00-4	4-Bromofluorobenzene	101%		80-120%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC99786-2	**Date Sampled:**	12/04/19
Matrix:	AQ - Water	**Date Received:**	12/06/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102257.D	1	12/11/19 09:03	XPL	n/a	n/a	GLM4254
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.150	0.20	0.10	mg/l	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	101%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JC99786-2	**Date Sampled:**	12/04/19
Matrix:	AQ - Water	**Date Received:**	12/06/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y100294.D	1	12/11/19 13:32	SH	12/10/19 12:30	OP24514	G2Y3825
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	82%		22-140%
438-22-2	5a-Androstane	67%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC99786-3	**Date Sampled:**	12/04/19
Matrix:	AQ - Effluent	**Date Received:**	12/06/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D98770.D	1	12/12/19 22:27	KC	n/a	n/a	V4D4367
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.67	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	95%		80-120%
17060-07-0	1,2-Dichloroethane-D4	100%		81-124%
2037-26-5	Toluene-D8	102%		80-120%
460-00-4	4-Bromofluorobenzene	102%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC99786-3	**Date Sampled:**	12/04/19
Matrix:	AQ - Effluent	**Date Received:**	12/06/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102256.D	1	12/11/19 08:41	XPL	n/a	n/a	GLM4254
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	101%		55-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JC99786-3	**Date Sampled:**	12/04/19
Matrix:	AQ - Effluent	**Date Received:**	12/06/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	ZZ94609.D	1	12/11/19 16:55	SH	12/11/19 09:00	OP24536	GZZ3417
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	82%		22-140%
438-22-2	5a-Androstane	88%		10-135%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

WW

CHAIN OF CUSTODY

ACCUTEST Laboratories

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job # JC99786

Client / Reporting Information		Project Information	
Company Name: EMS Environmental, Inc.		Project Name: Former Hess - 20204	
Address: 4550 Bath Pike		Street: 1613 E Joppa Road	
City: Bethlehem	State: PA Zip: 18017	City: Towson	State: MD
Project Contact: Jeremy Fox	E-mail: jfox@emsenv.com	Project #: 5713	
Phone #: 610-866-7799		Fax #: 610-866-8195	
Samplers's Name: Brad Rohrbaugh		Client Purchase Order #: 5713	

Requested Analysis: 8260 ☐ 624 ☐ 8021 ☐ 602 ☐ BTEX ☐ MTBE ☐ TBA☐ NAP ☐; 8260 ☐ 624 ☐ TCL ☐ PPL ☐ STARS ☐ MTBE ☐ TBA ☐ NAP☐ +10 ☐ +15 ☐; 8270 ☐ 625 ☐ TCL ☐ PPL ☐ STARS☐ ABN☐ AE☐ BN☐ PAH☐ +TICs☐; BTEX, MTBE and Naphthalene by 8260B; TPH-GRO by 8015B; TPH-DRO by 8015B

Accutest Sample #	Field ID / Point of Collection	SUMMA # MEOH Vial #	Date	Time	Sampled by	Matrix	# of bottles	HCl	BTEX, MTBE and Naphthalene by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B	LAB USE ONLY
1	INF		12/4/2019	1310	BR	WW	7	7	X	X	X	
2	MID		12/4/2019	1320	BR	WW	7	7	X	X	X	
3	EFF		12/4/2019	1330	BR	WW	7	7	X	X	X	E78 V570

Number of preserved Bottles: HCl, NaOH, HNO3, H2SO4, NONE, NaHSO4, MEOH, ENCORE

Matrix Codes: DW- Drinking Water; GW- Ground Water; WW- Water; SW- Surface Water; SO- Soil; SL- Sludge; OI- Oil; LIQ- Other Liquid; AIR- Air; SOL- Other Solid; WP- Wipe

INITIAL ASSESSMENT BY 4
LABEL VERIFICATION

Turnaround Time (Business days) — Approved By:/ Date:

- ☐ Std. 15 Business Days
- ☐ 10 Day RUSH
- ☐ 5 Day RUSH
- ☐ 3 Day EMERGENCY
- ☐ 2 Day EMERGENCY
- ☐ 1 Day EMERGENCY
- ☒ Other 14 Day Hess Standard

Emergency T/A data available VIA Lablink

Data Deliverable Information

- ☒ Commercial "A"
- ☐ Commercial "B"
- ☐ NJ Reduced
- ☐ NJ Full
- ☐ Other Full TIER 1
- ☐ FULL CLP
- ☐ NYASP Category A
- ☐ NYASP Category B
- ☐ State Forms
- ☐ EDD Format________

Commercial "A" = Results Only

Comments / Remarks

⊘ 2x300mL HCL Ext

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 [signature]	12-6-19	1	2 [signature]		2 [signature]
Relinquished by:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
3 [signature]	12/6/19 1712	3 [signature]	4		4
Relinquished by:	Date Time:	Received By:	Custody Seal #	Preserved where applicable	On Ice / Cooler Temp.
5		5		☐	☒ 2.1° IR

IR-7

JC99786: Chain of Custody
Page 1 of 2

4.1
4

SGS Sample Receipt Summary

Job Number: JC99786 **Client:** **Project:**

Date / Time Received: 12/6/2019 5:12:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (2.1);

Cooler Temps (Corrected) °C: Cooler 1: (1.9);

Cooler Security

	Y	N
1. Custody Seals Present:	☑	☐
2. Custody Seals Intact:	☑	☐
3. COC Present:	☑	☐
4. Smpl Dates/Time OK	☑	☐

Cooler Temperature

	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	1	

Quality Control Preservation

	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation

	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition

	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions

	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JC99786: Chain of Custody
Page 2 of 2

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

EMS Environmental, Inc.

HESS #20204, 1613 East Joppa Road, Towson, MD

5713

SGS Job Number: JD325

Sampling Date: 12/11/19

Report to:

EMS Environmental, Inc.
4550 Bath Pike
Bethlehem, PA 18017
jfox@emsenv.com

ATTN: Jeremy Fox

Total number of pages in report: **17**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Laura Degenhardt
General Manager

Client Service contact: Beth Wasserman 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, FL, IL, IN, KS, KY, LA, MA, MD, ME, MN, NC, OH VAP (CL0056), AK (UST-103), AZ (AZ0786), PA, RI, SC, TX, UT, VA, WV, DoD ELAP (ANAB L2248)

Table of Contents

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SGS North America Inc.

Sample Summary

EMS Environmental, Inc.

Job No: JD325

HESS #20204, 1613 East Joppa Road, Towson, MD
Project No: 5713

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
This report contains results reported as ND = Not detected. The following applies:							
Organics ND = Not detected above the MDL							
JD325-1	12/11/19	13:05	BR	12/13/19	AQ	Influent	INF
JD325-2	12/11/19	12:55	BR	12/13/19	AQ	Water	MID
JD325-3	12/11/19	12:45	BR	12/13/19	AQ	Effluent	EFF

Summary of Hits

Job Number: JD325
Account: EMS Environmental, Inc.
Project: HESS #20204, 1613 East Joppa Road, Towson, MD
Collected: 12/11/19

Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JD325-1	**INF**					
Benzene		1.7	0.50	0.43	ug/l	SW846 8260C
Toluene		2.6	1.0	0.53	ug/l	SW846 8260C
Ethylbenzene		31.5	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		62.4	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		2.0	1.0	0.51	ug/l	SW846 8260C
Naphthalene		19.4	5.0	2.5	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.778	0.20	0.10	mg/l	SW846 8015D
TPH-DRO (C10-C28)		0.334	0.083	0.053	mg/l	SW846 8015D
JD325-2	**MID**					
Benzene		0.45 J	0.50	0.43	ug/l	SW846 8260C
Ethylbenzene		3.9	1.0	0.60	ug/l	SW846 8260C
Xylene (total)		8.7	1.0	0.59	ug/l	SW846 8260C
Methyl Tert Butyl Ether		0.72 J	1.0	0.51	ug/l	SW846 8260C
TPH-GRO (C6-C10)		0.168 J	0.20	0.10	mg/l	SW846 8015D
JD325-3	**EFF**					
Methyl Tert Butyl Ether		0.62 J	1.0	0.51	ug/l	SW846 8260C

Sample Results

Report of Analysis

SGS North America Inc.

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JD325-1	**Date Sampled:**	12/11/19
Matrix:	AQ - Influent	**Date Received:**	12/13/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D99033.D	1	12/21/19 03:52	KC	n/a	n/a	V4D4378
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	1.7	0.50	0.43	ug/l	
108-88-3	Toluene	2.6	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	31.5	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	62.4	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	2.0	1.0	0.51	ug/l	
91-20-3	Naphthalene	19.4	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	90%		80-120%
17060-07-0	1,2-Dichloroethane-D4	90%		81-124%
2037-26-5	Toluene-D8	98%		80-120%
460-00-4	4-Bromofluorobenzene	100%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JD325-1	**Date Sampled:**	12/11/19
Matrix:	AQ - Influent	**Date Received:**	12/13/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102358.D	1	12/17/19 09:15	XPL	n/a	n/a	GLM4259
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.778	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	90%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	INF		
Lab Sample ID:	JD325-1	**Date Sampled:**	12/11/19
Matrix:	AQ - Influent	**Date Received:**	12/13/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y100384.D	1	12/18/19 14:01	SH	12/17/19 17:30	OP24667	G2Y3830
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	0.334	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	77%		22-140%
438-22-2	5a-Androstane	54%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MID			
Lab Sample ID:	JD325-2		**Date Sampled:**	12/11/19
Matrix:	AQ - Water		**Date Received:**	12/13/19
Method:	SW846 8260C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D99034.D	1	12/21/19 04:21	KC	n/a	n/a	V4D4378
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	0.45	0.50	0.43	ug/l	J
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	3.9	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	8.7	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.72	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	90%		80-120%
17060-07-0	1,2-Dichloroethane-D4	89%		81-124%
2037-26-5	Toluene-D8	98%		80-120%
460-00-4	4-Bromofluorobenzene	99%		80-120%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JD325-2	**Date Sampled:**	12/11/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102357.D	1	12/17/19 08:54	XPL	n/a	n/a	GLM4259
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	0.168	0.20	0.10	mg/l	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	90%		55-130%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	MID		
Lab Sample ID:	JD325-2	**Date Sampled:**	12/11/19
Matrix:	AQ - Water	**Date Received:**	12/13/19
Method:	SW846 8015D SW846 3510C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y100385.D	1	12/18/19 14:35	SH	12/17/19 17:30	OP24667	G2Y3830
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	76%		22-140%
438-22-2	5a-Androstane	59%		10-135%

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JD325-3	**Date Sampled:**	12/11/19
Matrix:	AQ - Effluent	**Date Received:**	12/13/19
Method:	SW846 8260C	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	4D99023.D	1	12/20/19 23:06	KC	n/a	n/a	V4D4378
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics, MTBE, Naphthalene

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	0.50	0.43	ug/l	
108-88-3	Toluene	ND	1.0	0.53	ug/l	
100-41-4	Ethylbenzene	ND	1.0	0.60	ug/l	
1330-20-7	Xylene (total)	ND	1.0	0.59	ug/l	
1634-04-4	Methyl Tert Butyl Ether	0.62	1.0	0.51	ug/l	J
91-20-3	Naphthalene	ND	5.0	2.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	91%		80-120%
17060-07-0	1,2-Dichloroethane-D4	89%		81-124%
2037-26-5	Toluene-D8	98%		80-120%
460-00-4	4-Bromofluorobenzene	101%		80-120%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	EFF		
Lab Sample ID:	JD325-3	**Date Sampled:**	12/11/19
Matrix:	AQ - Effluent	**Date Received:**	12/13/19
Method:	SW846 8015D	**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	LM102356.D	1	12/17/19 08:23	XPL	n/a	n/a	GLM4259
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	ND	0.20	0.10	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	88%		55-130%

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	EFF			
Lab Sample ID:	JD325-3		**Date Sampled:**	12/11/19
Matrix:	AQ - Effluent		**Date Received:**	12/13/19
Method:	SW846 8015D SW846 3510C		**Percent Solids:**	n/a
Project:	HESS #20204, 1613 East Joppa Road, Towson, MD			

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Y100386.D	1	12/18/19 15:09	SH	12/17/19 17:30	OP24667	G2Y3830
Run #2							

	Initial Volume	Final Volume
Run #1	300 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	0.083	0.053	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	76%		22-140%
438-22-2	5a-Androstane	59%		10-135%

ND = Not detected   MDL = Method Detection Limit   J = Indicates an estimated value
RL = Reporting Limit   B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range   N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

WW

ACCUTEST Laboratories

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

Page 1

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job # JD325

Client / Reporting Information		Project Information	
Company Name	EMS Environmental, Inc.	Project Name:	Former Hess - 20204
Address	4550 Bath Pike	Street	1613 E. Joppa Road
City / State / Zip	Bethlehem / PA / 18017	City / State	Towson / MD
Project Contact:	Jeremy Fox	E-mail	jfox@emsenv.com
Project #	5713		
Phone #	610-866-7799	Fax #	610-866-8196
Samplers's Name	Brad Rohrbaugh	Client Purchase Order #	5713

Requested Analysis: 8260 ☐ 624 ☐ 8021 ☐ 602 ☐ BTEX ☐ MTBE ☐ TBA☐ NAP ☐ | 8260 ☐ 624 ☐ TCL ☐ PPL ☐ STARS ☐ MTBE ☐ TBA ☐ NAP☐ +10 ☐ +15 ☐ | 8270 ☐ 625 ☐ TCL ☐ PPL ☐ STARS☐ ABN☐ AE☐ BN☐ PAH☐ +TICs☐ | BTEX, MTBE and Naphthalene by 8260B | TPH-GRO by 8015B | TPH-DRO by 8015B

Accutest Sample #	Field ID / Point of Collection	SUMMA # MEOH Vial #	Date	Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	NaHSO4	MEOH	ENCORE	8260/624/8021/602	8260/624 TCL PPL STARS	8270/625 TCL PPL STARS	BTEX, MTBE and Naphthalene by 8260B	TPH-GRO by 8015B	TPH-DRO by 8015B	LAB USE ONLY
1	INF		12/11/2019	1205	BR	WW	7	7											X	X	X	
2	MID		12/11/2019	1255	BR	WW	7	7											X	X	X	
3	EFF		12/11/2019	1245	BR	WW	7	7											X	X	X	

Matrix Codes: DW- Drinking Water, GW- Ground Water, WW- Water, SW- Surface Water, SO- Soil, SL-Sludge, OI-Oil, LIQ- Other Liquid, AIR- Air, SOL-Other Solid, WP-Wipe

E64
V615

Turnaround Time (Business days)

- ☐ Std. 15 Business Days
- ☐ 10 Day RUSH
- ☐ 5 Day RUSH
- ☐ 3 Day EMERGENCY
- ☐ 2 Day EMERGENCY
- ☐ 1 Day EMERGENCY
- ☒ Other 14 Day Hess Standard

Approved By:/ Date:

Emergency T/A data available VIA Lablink

Data Deliverable Information

- ☒ Commercial "A"
- ☐ Commercial "B"
- ☐ NJ Reduced
- ☐ NJ Full
- ☐ Other Full TIER 1
- ☐ FULL CLP
- ☐ NYASP Category A
- ☐ NYASP Category B
- ☐ State Forms
- ☐ EDD Format______

Commercial "A" = Results Only

Comments / Remarks

INITIAL ASSESSMENT 3A on

LABEL VERIFICATION

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 (Sampler) [signature]	1020 [redacted] 12-13-19	1 [signature]	2 [signature]	12/13/19	2 Robertcharlmers
3 Robertcharlmers	12-13-19 1647	3 [signature]	4		4
5		5	Custody Seal #	Preserved where applicable ☐	On Ice ☒ Cooler Temp. IR-7 Ip 3.4°C

HCL pH<2

JD325: Chain of Custody
Page 1 of 2

SGS Sample Receipt Summary

Job Number: JD325 **Client:** **Project:**

Date / Time Received: 12/13/2019 4:47:00 PM **Delivery Method:** **Airbill #'s:**

Cooler Temps (Raw Measured) °C: Cooler 1: (3.4);

Cooler Temps (Corrected) °C: Cooler 1: (3.2);

Cooler Security

	Y	N
1. Custody Seals Present:	☑	☐
2. Custody Seals Intact:	☑	☐
3. COC Present:	☑	☐
4. Smpl Dates/Time OK	☑	☐

Cooler Temperature

	Y	N
1. Temp criteria achieved:	☑	☐
2. Cooler temp verification:	IR Gun	
3. Cooler media:	Ice (Bag)	
4. No. Coolers:	1	

Quality Control Preservation

	Y	N	N/A
1. Trip Blank present / cooler:	☐	☑	☐
2. Trip Blank listed on COC:	☐	☑	☐
3. Samples preserved properly:	☑	☐	
4. VOCs headspace free:	☑	☐	☐

Sample Integrity - Documentation

	Y	N
1. Sample labels present on bottles:	☑	☐
2. Container labeling complete:	☑	☐
3. Sample container label / COC agree:	☑	☐

Sample Integrity - Condition

	Y	N
1. Sample recvd within HT:	☑	☐
2. All containers accounted for:	☑	☐
3. Condition of sample:	Intact	

Sample Integrity - Instructions

	Y	N	N/A
1. Analysis requested is clear:	☑	☐	
2. Bottles received for unspecified tests	☐	☑	
3. Sufficient volume recvd for analysis:	☑	☐	
4. Compositing instructions clear:	☐	☐	☑
5. Filtering instructions clear:	☐	☐	☑

Test Strip Lot #s: pH 1-12: 229517 pH 12+: 208717 Other: (Specify)

Comments

SM089-03
Rev. Date 12/7/17

JD325: Chain of Custody
Page 2 of 2

APPENDIX

B

WSP SITE INVESTIGATION SUMMARY LETTER- MAY 2018

VIA ELECTRONIC MAIL

May 30, 2018

Ellen Jackson
Maryland Department of the Environment
Oil Control Program
Suite 260
1800 Washington Boulevard
Baltimore, MD 21230-1719

Subject: **Site Investigation Summary**
Former Hess Station #20204, 1613 East Joppa Road, Towson, Maryland

Dear Ms. Jackson:

WSP USA Inc. (WSP), on behalf of Hess Corporation, is pleased to present this summary of the site investigation at the former Hess Filling Station on Joppa Road in Towson, Maryland. The site investigation was performed in accordance with WSP's April 7, 2017, Site Investigation Work Plan, approved by the Maryland Department of the Environment (MDE) in a letter dated May 9, 2017.

The scope of the investigation included (1) defining the areas of maximum concentrations of site contaminants, (2) collecting additional groundwater data needed to evaluate in situ treatment options, and (3) performing an in situ chemical oxidation (ISCO) bench scale study. The investigation was designed to collect data needed to evaluate potential corrective measures to reduce concentrations in the areas of the site with significant contaminant mass, primarily benzene, toluene, ethylbenzene, and xylene (BTEX) and total petroleum hydrocarbons (TPH). The investigation results provide the information needed to evaluate a potential corrective action for the area of maximum remaining contaminant concentrations.

SITE INVESTIGATION

The site investigation was performed September 18 through 21, 2017, and extended from the southern area of the former Hess Filling Station onto Ridgely Manor Park, located south of the former Hess Filling Station on Yakona Road.

The investigation was performed in accordance with the *Site Investigation Work Plan* and consisted of the following steps:

- Field preparation
- Membrane interface probe (MIP)/ Hydraulic profiling tool (HPT) investigation
- Groundwater sampling

FIELD PREPARATION

Before initiating the work, Hess arranged property access with the property owners. Soil boring permits were obtained from Baltimore County, and the health and safety plan was updated. Public safety measures, including temporary barriers, were set up around work zones before initiating work, and public and private utility locates were performed to mark the location of utilities in advance of intrusive work.

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MIP-HPT INVESTIGATION

The MIP/HPT evaluation was performed by Cascade Technical Services of Millersville, Maryland, on September 18 and 19, 2017. The locations of the 9 MIP/HPT soil borings (MIP-01 through MIP-09) are shown on Figure 1. The MIP/HPT evaluation provided data on the vertical and horizontal location of the 'hot spot' of maximum contaminant concentrations and identified conductive zones where preferential contaminant transport is occurring. The MIP/HPT report is provided as Enclosure A. The maximum probe responses (over 1 x107 microvolts) were measured at MIP-02, located in the southern portion of the former Hess Filling Station, and MIP-07 and MIP-08, located in the northern portion of Ridgely Manor Park. The depth below ground surface (bgs) of the maximum probe responses ranged from 25 to 32 feet bgs at MIP-02 to 21 to 26 feet bgs at MIP-07 to 18 to 32 feet bgs at MIP-08.

Although variability was noted between locations, the HPT pressure tended to be highest, and inversely the flow rate the lowest, at the upper (e.g., less than 5 feet bgs) and lower portion (e.g., greater than 30 feet bgs) of the borings, with the minimum pressures and maximum flow rates noted in the middle interval. The maximum MIP responses occurred at depths typically corresponding to decreasing HPT pressure and increased flow, indicating the intervals containing the maximum contaminant concentrations are present in more permeable flow zones.

Two groundwater and four soil samples were collected after the MIP/HPT screening to provide quantitative laboratory analytical data for comparison to the MIP qualitative data. Groundwater samples were collected at MIP-2 (25-30 feet bgs) and MIP-8 (18-22 feet bgs), corresponding to the depths of maximum probe response and lowest HPT pressure in those two borings. The soil samples were collected from the locations and depths corresponding to the maximum probe responses, MIP-02 (25-30 feet bgs), MIP-07 (21-26 feet bgs), and MIP-08 (18-22 and 27-30 feet bgs). The samples were labeled, stored in an ice cooler, and submitted to Pace Analytical Laboratories for analysis of BTEX by U.S. Environmental Protection Agency (EPA) Method 8260 and TPH-diesel range organics (DRO) and TPH-gasoline-range organics (GRO) by EPA Method 8015. The analytical results are provided as Enclosure B.

Groundwater results were compared to Maryland Environmental Assessment Technology (MEAT) Generic Numeric Cleanup Standards Type I/II Aquifers in Table 1, and soil results were compared to the MEAT Generic Numeric Cleanup Standards for Non-Residential Soil in Table 2. The groundwater and soil results are also displayed on Figures 2 and 3. The maximum BTEX and TPH concentrations were measured at MIP-08 (18-22 feet bgs) in groundwater and MIP-2 (25-30 feet bgs) in soil. TPH-DRO and TPH-GRO concentrations greater than MEAT standards were detected in groundwater samples from both MIP-02 (25-30 feet bgs) and MIP-08 (18-22 feet bgs). Benzene was also detected above the MEAT standard in the groundwater sample at MIP-08 (18-22 feet bgs) at a concentration of 23.5 micrograms per liter (µg/l). All soil concentrations were below the MEAT standards except for the TPH-GRO and TPH-DRO concentrations at MIP-2 (1,220 milligrams per kilogram [mg/kg] and 803 mg/kg, respectively).

Approximately 60 pounds of soil from the identified 'hot spot' was collected from MIP-08 (18-22 feet bgs) for the bench scale ISCO treatability study and shipped to Terra Systems in Claymont, Delaware. The soil was collected from multiple borings installed at MIP-08 until the required mass of soil was collected.

GROUNDWATER SAMPLING

Groundwater samples were collected September 19 and 20, 2017, from four wells south of the former underground storage tank (MW-4, YMW-3, YMW-7, and YP-1; Figure 1). Three of the locations (MW-4, YMW-7, and YP-1) were selected using historical groundwater results to represent maximum contaminant concentrations. The remaining sampling location (YMW-3) was non-detect in previous sampling events for TPH and BTEX compounds, and was selected to provide background geochemical data.

The groundwater samples were collected using low flow sampling methods in accordance with WSP Standard Operating Procedures. Temperature, pH, specific conductivity, turbidity, dissolved oxygen, and oxidation-reduction potential (ORP) were measured during purging using a multi-parameter water quality meter with a flow-through cell to minimize atmospheric interference. These readings, along with observations on groundwater quality, were recorded on groundwater purge forms (Enclosure C). Groundwater was removed via bladder pump from the well until parameters stabilized. After the well was adequately purged, groundwater samples were collected using the bladder pump. The samples were labeled with the appropriate identification, stored in a cooler with ice and submitted to Pace Analytical Laboratories for analysis of BTEX by U.S. EPA Method 8260, TPH-DRO/GRO by EPA Method 8015, and selected electron acceptors (alkalinity, sulfate, and sulfide). The analytical results are provided as Enclosure B, and summarized in Figure 2 and Table 1.

One equipment blank and one trip blank were collected during the groundwater sampling event as quality assurance samples. The equipment blank was analyzed for the site contaminants (BTEX and TPH-DRO/GRO), and the trip blank was analyzed for BTEX compounds. Eight liters of groundwater was collected from two contaminated well locations (YMW-7 and YP-1) and shipped to Terra Systems for the bench scale study.

The groundwater samples from MW-4, YMW-7, and YP-1 contained benzene, TPH-DRO, and TPH-GRO concentrations above the MEAT standards, with the maximum BTEX and TPH concentrations detected at YMW-7 (Table 1). Although the samples were collected using a different method in this event (low flow versus traditional multiple volume purge), the contaminant concentrations at each location were consistent with the concentrations measured in recent quarterly sampling events. As anticipated, the site contaminants were non-detect in the sample from background well YMW-3. The quality assurance samples were non-detect for all compounds analyzed, confirming proper equipment decontamination and field handling of samples. Alkalinity concentrations ranged from 24 milligrams per liter (mg/l) at YMW-3 to 242 mg/l at MW-4. Sulfate was only detected at background well YMW-3 (65.2 mg/l), and sulfide was non-detect at all four locations. Ferrous iron was measured using a field test kit at two locations, MW-4 and YP-1, with a concentration above 3.3 mg/l measured at both locations. Dissolved oxygen concentrations in the purge water were low, ranging from 0 to 1.16 mg/l at YP-1, and ORP in the purge water was less than 0 millivolts at all locations except for YMW-3, the background well, where it was measured at 132 millivolts. These measurements demonstrate that anaerobic (reducing) conditions are present in the wells with contamination.

ISCO TREATABILITY STUDY

The bench scale ISCO treatability study was performed by Terra Systems of Claymont, Delaware, to evaluate the effectiveness of Klozur® SP, a persulfate formulation distributed by PeroxyChem, on site soil and groundwater samples collected during the September 2017 investigation. The bench scale study tested both natural activation (also referred to as unactivated) and base activation of the persulfate. The activation of persulfate forms oxidative radical species which will oxidize site contaminants and other organic compounds. The base activation test included the addition of a 25% sodium hydroxide solution to raise and maintain a pH of 10.5 SU in soil and groundwater. The unactivated and activated tests evaluated three different persulfate concentrations (10, 20, and 40 grams per liter [g/l]). Replicate controls were also prepared for each set of tests. The treatability study summary report from Terra Systems is provided as Enclosure D.

Components of the study included the initial sample (baseline) characterization, site soil and groundwater oxidant demand testing, testing of contaminant destruction at the three different oxidant doses and one control, and reporting. All testing was completed using near field-encountered soil to groundwater ratios, in vessels with minimal headspace, and without periodic soil mixing. The treatability study was initiated in October 2017, following receipt of the data for the baseline characterization samples. As the base activation causes faster consumption of the persulfate, the base-activated study was performed over a shorter duration than the unactivated study. The base-activated study was performed for 14 days, through October 30, 2017, and the unactivated study was continued for 91 days, through January 15, 2018.

Periodic measurements of pH, persulfate, and other factors (e.g., oxidant demand) were monitored throughout the study. If the pH of the base-activated persulfate batches fell below 10.5 SU, then additional 25% sodium hydroxide was added to maintain the elevated pH.

During the treatability study, ten soil and twelve groundwater samples were collected from the test batches for laboratory analysis at 0 days (baseline characterization), 14 days (base-activated persulfate study conclusion), and 91 days (unactivated persulfate study conclusion). The samples were submitted to Pace Analytical Laboratories for analysis of BTEX by U.S. EPA Method 8260, TPH-DRO/TPH-GRO by EPA Method 8015. The analytical results are provided as Enclosure B.

The potential for the treatment to cause mobilization of naturally occurring metals was evaluated by analyzing water samples for chromium, molybdenum, selenium, uranium and vanadium. Groundwater samples of the 20 g/l persulfate dose were collected and analyzed for these oxyanions at baseline, 14 days for the base-activated batches, and 91 days for the unactivated batches. These samples were analyzed by Pace Analytical Laboratories using EPA Method 6020 (Enclosure B).

BENCH SCALE TREATABILITY STUDY RESULTS

The effectiveness of the treatability study was evaluated by comparing the contaminant concentrations from the baseline samples to the treated samples collected in the study, and by evaluating the longevity of the persulfate at the end of the study. Due to limited sample volume, the base-activated samples collected at 14 days and the unactivated samples collected at 91 days were diluted by an order of magnitude. Therefore, the groundwater results provided in Table 3 and the soil results provided in Table 4 are corrected by an order of magnitude dilution. The post-treatment concentrations summarized in the discussion below are corrected for the dilution. Table 5 provides the mass balance and mass removal calculations for the base-activated and unactivated samples.

The base-activated persulfate results indicated a 45 to 90% reduction in persulfate concentrations by the end of the 14-day study, with the highest depletion of persulfate noted in the 20 g/l of persulfate batch (Enclosure D). As mentioned previously, the pH was maintained at 10.5 SU or higher throughout the study, with the pH readings ranging from 10.9 to 12.7 SU. The unactivated persulfate testing results indicated a 51 to 65% reduction in persulfate concentrations through Day 91 of the study, with the highest depletion noted in the 40 g/l of persulfate. The results showed a decrease in pH during the study, from initial readings of 7.5 to 8.6 SU at the beginning of the study to 3.6 to 7.2 SU at the conclusion of the 91-day study.

Metals concentrations, which were non-detect in the baseline water samples, significantly increased in the base-activated tests (Table 3). Chromium and vanadium concentrations increased to concentrations well above the MEAT generic numeric cleanup standards in the 14-day base-activated results. The metals concentrations remained non-detect in the unactivated persulfate tests, except for total chromium, which was detected at a concentration of 11 μg/l (below the MEAT generic numeric cleanup standard). In summary, these results indicate metals mobilization occurred with the base activation to concentrations above criteria.

MASS REMOVAL

The total contaminant mass for each persulfate concentration tested was calculated as the sum of the mass in the water and soil; the contaminant mass in water and soil were based on the concentrations in the laboratory results, including the correction factor of 10 for diluted samples, and the quantities of groundwater (220 milliliters) and soil (980 g) in each treatability study. The mass reduction was then calculated based on changes in mass from baseline. The mass and mass reduction for each persulfate concentration are shown in Table 5.

Over 97% BTEX reduction was noted at all three persulfate concentrations with the base activation, with TPH-GRO reduction ranging from 65% (10 g/l persulfate) to 78% (40 g/l) persulfate and TPH-DRO reduction ranging from 52% (10 g/l persulfate) to 66% (40 g/l persulfate). Concentrations of TPH-GRO and TPH-GRO in groundwater remained above MEAT standards at the end of the study (Table 3).

The contaminant trends indicated an over 99% reduction in BTEX concentrations, with TPH-GRO reduction ranging from 80% (10 g/l persulfate) to 100% (20 g/l persulfate) and TPH-DRO reduction ranging from 33% (40 g/l persulfate) to 56% (20 g/l persulfate). As shown in Table 3, the concentrations of TPH-DRO remained above MEAT standards at the end of the study for all persulfate test samples. The concentrations of TPH-GRO and BTEX had decreased to below MEAT standards in the unactivated persulfate test samples.

CONCLUSIONS

In conclusion, the bench scale study demonstrated that activated and unactivated persulfate were both effective at reducing contaminant concentrations, with complete to near complete destruction of BTEX and TPH-GRO. Destruction of BTEX, which is still present in the collected groundwater at concentrations above the NPDES permit discharge limit, is necessary to remove the need for granular activated carbon treatment on site. The treatability study indicates that ISCO with persulfate will not reduce TPH-DRO concentrations to less than the MEAT standard. However, it would create favorable conditions for continued biodegradation of TPH.

The unactivated persulfate treatment demonstrated the following advantages:

- Improved persulfate longevity with unactivated persulfate compared to activated persulfate.
- Unactivated persulfate resulted in similar contaminant reduction results as activated persulfate, without causing metals mobilization.

Of the three persulfate concentrations tested, the 20 g/l concentration of persulfate was the most effective at mass reduction (Table 5).

The investigation met the objectives of defining the limits of maximum contaminant concentrations, and collecting data needed to evaluate and design a corrective action. As the next step, Hess Corporation and WSP request a meeting with MDE to review the site investigation results and current site conditions and to discuss remedial goals and the path towards site closure. Any further corrective actions would be presented in a corrective action plan and submitted to MDE for approval.

WSP looks forward to scheduling the meeting with you. Should you have any questions in the meanwhile, please contact us at (703) 709-6500.

Kind regards,

David Sarr
David Sarr, PE
Practice Leader

Pam Groff Robertson
Pam Groff Robertson
Senior Technical Manager

cc/encl: John Schenkewitz, Hess
Thomas Jackson, Baker Botts

FIGURES

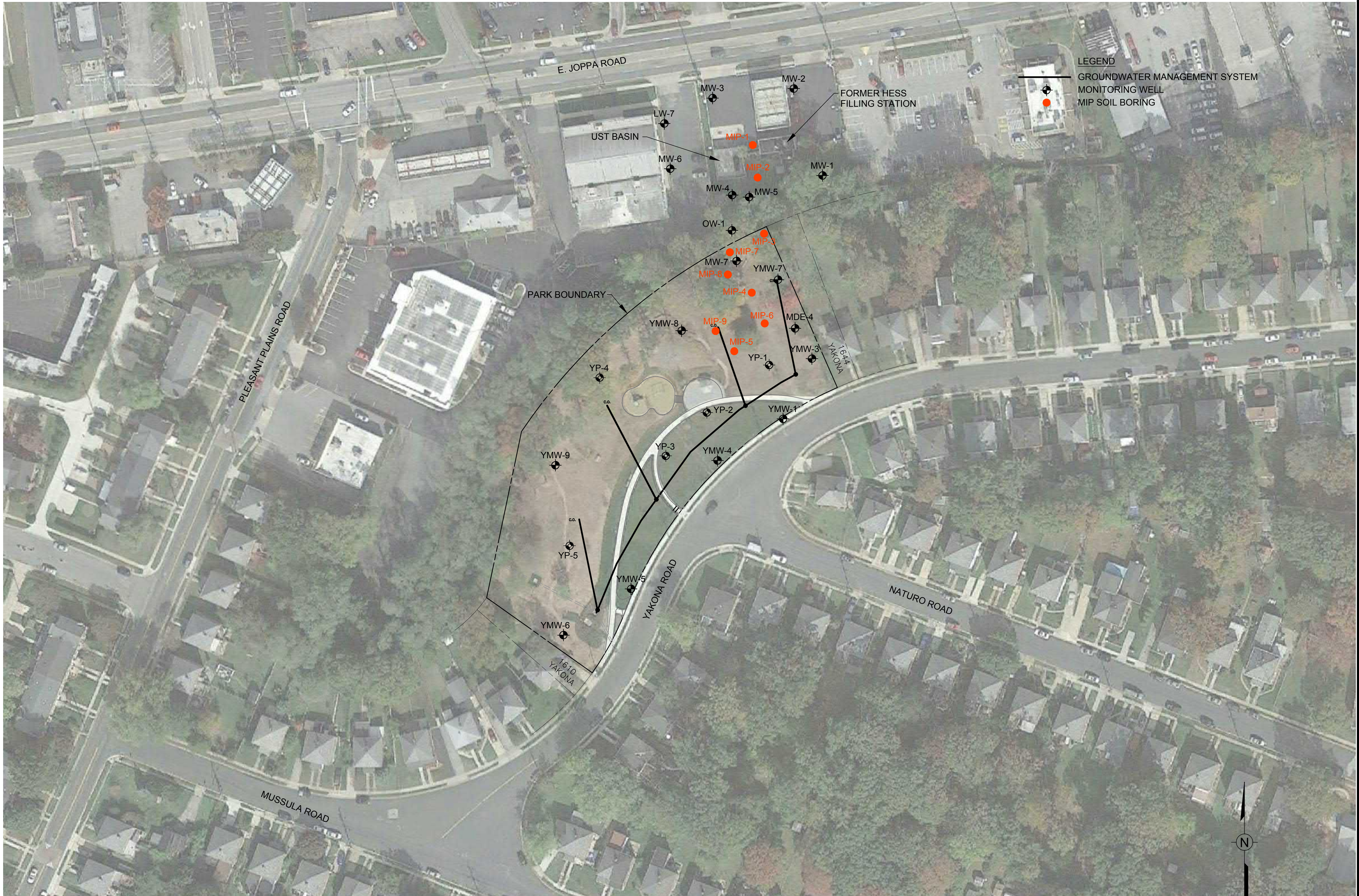

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Figure 1

MIP LOCATIONS
SEPTEMBER 2017

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MW-4	9/20/2017
VOCs (ug/l)	
Benzene	**82.6**
Ethylbenzene	269
Toluene	12.5
Xylene	56.1
TPH	
TPH-GRO (ug/l)	**1,710**
TPH-DRO (mg/l)	**2**

MIP-8 (18-22)	9/21/2017
VOCs (ug/l)	
Benzene	**23.5**
Ethylbenzene	599
Toluene	123
Xylene	1,680
TPH	
TPH-GRO (ug/l)	**10,300**
TPH-DRO (mg/l)	**3.5**

MIP-2 (25-30)	9/20/2017
VOCs (ug/l)	
Benzene	1 U
Ethylbenzene	109
Toluene	38.7
Xylene	652
TPH	
TPH-GRO (ug/l)	**8,480**
TPH-DRO (mg/l)	**2.2**

YMW-7	9/19/2017
VOCs (ug/l)	
Benzene	**64.1**
Ethylbenzene	274
Toluene	68
Xylene	994
TPH	
TPH-GRO (ug/l)	**7,640**
TPH-DRO (mg/l)	**1.3**

YMW-3	9/19/2017
VOCs (ug/l)	
Benzene	1 U
Ethylbenzene	1 U
Toluene	1 U
Xylene	3 U
TPH	
TPH-GRO (ug/l)	200 U
TPH-DRO (mg/l)	0.1 U

YP-1	9/20/2017
VOCs (ug/l)	
Benzene	**7.6**
Ethylbenzene	539
Toluene	26.5
Xylene	439
TPH	
TPH-GRO (ug/l)	**5,000**
TPH-DRO (mg/l)	**1.3**

LEGEND
- GROUNDWATER MANAGEMENT SYSTEM
- MONITORING WELL
- MIP SOIL BORING

MEAT Generic Numeric Cleanup Groundwater Standards	
VOCs (ug/l)	
Benzene	5
Ethylbenzene	700
Toluene	1,000
Xylene	10,000
TPH	
TPH-GRO (ug/l)	47
TPH-DRO (mg/l)	0.047

COMPOUNDS IN **BOLD** EXCEED THE MEAT CLEANUP STANDARD

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Figure 2

GROUNDWATER SAMPLE RESULTS
SEPTEMBER 2017

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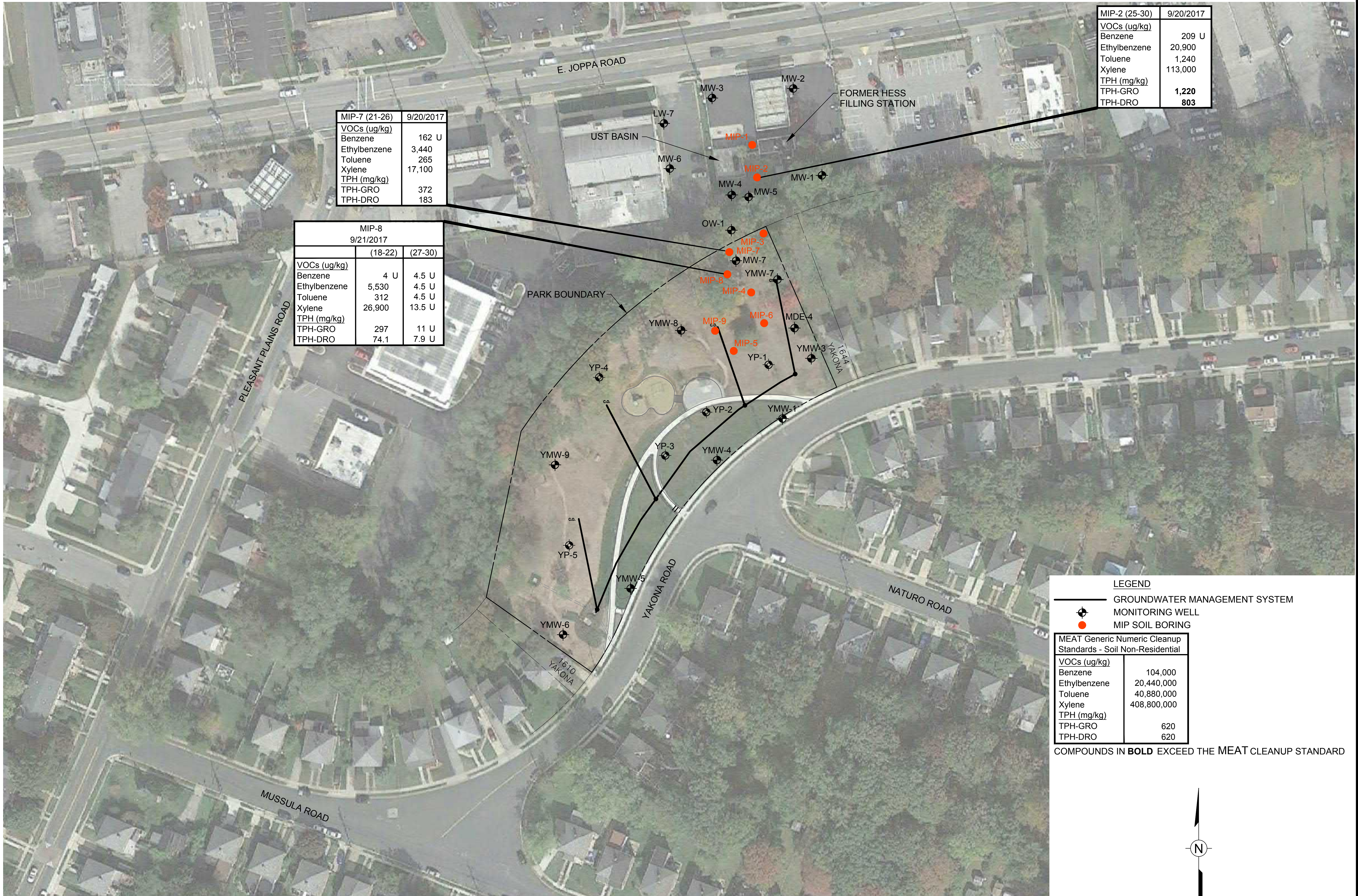
wsp



MIP-7 (21-26)	9/20/2017
VOCs (ug/kg)	
Benzene	162 U
Ethylbenzene	3,440
Toluene	265
Xylene	17,100
TPH (mg/kg)	
TPH-GRO	372
TPH-DRO	183

MIP-8 9/21/2017	(18-22)	(27-30)
VOCs (ug/kg)		
Benzene	4 U	4.5 U
Ethylbenzene	5,530	4.5 U
Toluene	312	4.5 U
Xylene	26,900	13.5 U
TPH (mg/kg)		
TPH-GRO	297	11 U
TPH-DRO	74.1	7.9 U

MIP-2 (25-30)	9/20/2017
VOCs (ug/kg)	
Benzene	209 U
Ethylbenzene	20,900
Toluene	1,240
Xylene	113,000
TPH (mg/kg)	
TPH-GRO	**1,220**
TPH-DRO	**803**

LEGEND

- GROUNDWATER MANAGEMENT SYSTEM
- MONITORING WELL
- MIP SOIL BORING

MEAT Generic Numeric Cleanup Standards - Soil Non-Residential	
VOCs (ug/kg)	
Benzene	104,000
Ethylbenzene	20,440,000
Toluene	40,880,000
Xylene	408,800,000
TPH (mg/kg)	
TPH-GRO	620
TPH-DRO	620

COMPOUNDS IN **BOLD** EXCEED THE MEAT CLEANUP STANDARD

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Approved: RKA 3/5/2018
DWG Name: 314M0408-002

RIDGELY MANOR PARK
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Figure 3

SOIL SAMPLE RESULTS
SEPTEMBER 2017

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TABLES

Table 1

Groundwater Sampling Results - September 2017
Monitoring Wells and MIP Locations
Former Hess Filling Station
Towson, MD

	Units	**MEAT Generic Numeric Cleanup Groundwater Standards Type I/II Aquifers**	**Sample ID:**	**MIP-2 (25-30)**	**MIP-8 (18-22)**	**MW-4**	**YMW-3**	**YMW-7**	**YP-1**	**EB-091917**	**TB-091917**
			Sample Date:	**9/20/2017**	**9/21/2017**	**9/20/2017**	**9/19/2017**	**9/19/2017**	**9/20/2017**	**9/19/2017**	**9/19/2017**
			Sample Depth (ft bgs):	25-30	18-22	10-15	4.9-19.5	18-28	8-13	-	-
VOCs (8260)											
Benzene	ug/l	5		1 U	**23.5**	**82.6**	1 U	**64.1**	**7.6**	1 U	1 U
Ethylbenzene	ug/l	700		109	599	269	1 U	274	539	1 U	1 U
Toluene	ug/l	1,000		38.7	123	12.5	1 U	68	26.5	1 U	1 U
Xylene	ug/l	10,000		652	1,680	56.1	3 U	994	439	3 U	3 U
Total Petroleum Hydrocarbons											
TPH-GRO (5030/8015)	ug/l	47		**8,480**	**10,300**	**1,710**	200 U	**7,640**	**5,000**	200 U	NA
TPH-DRO (8015)	mg/l	0.047		**2.2**	**3.5**	**2**	0.1 U	**1.3**	**1.3**	0.1 U	NA
Natural Attenuation Parameters											
Alkalinity, Total	mg/l	NS		NA	NA	242	24	128	188	NA	NA
Sulfate	mg/l	NS		NA	NA	0.5 U	65.2	0.5 U	0.5 U	NA	NA
Sulfide	mg/l	NS		NA	NA	1 U	1 U	1 U	1 U	NA	NA
Field Parameters											
Total Iron	mg/l	-		-	-	>3.3	NM	NM	>3.3	-	-
Ferrous Iron	mg/l	-		-	-	>3.3	NM	NM	>3.3	-	-
pH	SU	-		-	-	6.89	5.71	6.76	6.89	-	-
Conductivity	mS/cm	-		-	-	0.771	0.248	0.829	1.39	-	-
Turbidity	NTU	-		-	-	25.1	15.2	38.6	195	-	-
DO	mg/l	-		-	-	0	0	0	1.16	-	-
Temperature	°C	-		-	-	22.51	19.65	21.7	19.06	-	-
ORP	mV	-		-	-	-79	132	-59	-57	-	-

Note:
a/ ug/l = micrograms per liter; mg/l = milligrams per liter; SU = standard units; mS/cm = millisiemens per centimeter; NTU = Nephelometric Turbidity Units; °C = degrees Celsius; mV = millivolts; U = not detected above laboratory detection limit; NA = not analyzed; NS = no standard; ft bgs = feet bgs; TPH = total petroleum hydrocarbons; TPH-GRO = TPH - gasoline range organics; TPH-DRO = TPH - diesel range organics. Compounds in **bold** exceed the cleanup standard.

Table 2

Soil Sampling Results - September 2017
MIP Locations
Former Hess Filling Station
Towson, MD

	Units	**MEAT Generic Numeric Cleanup Standards - Soil Non-Residential**	**Sample ID:** **Sample Depth (ft bgs):** **Sample Date:**	**MIP-2 (25-30)** **25-30** **9/20/2017**	**MIP-7 (21-26)** **21-26** **9/20/2017**	**MIP-8 (18-22)** **18-22** **9/21/2017**	**MIP-8 (27-30)** **27-30** **9/21/2017**
VOCs (8260)							
Benzene	ug/kg	104,000		209 U	162 U	4 U	4.5 U
Ethylbenzene	ug/kg	20,440,000		20,900	3,440	5,530	4.5 U
Toluene	ug/kg	40,880,000		1,240	265	312	4.5 U
Xylene	ug/kg	408,800,000		113,000	17,100	26,900	13.5 U
Total Petroleum Hydrocarbons							
TPH-GRO (5030/8015)	mg/kg	620		**1,220**	372	297	11 U
TPH-DRO (C10-C28) (8015)	mg/kg	620		**803**	183	74.1	7.9 U
Percent Moisture	%	-		16.5	17	16.5	17.4

Notes:

a/ ug/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; U = not detected above laboratory detection limit; ft bgs = feet bgs; TPH = total petroleum hydrocarbons; TPH-DRO = TPH-diesel range organics; TPH-GRO = TPH-gasoline range organics. Compounds in **bold** exceed the cleanup standard.

Table 3

Bench Scale Treatability Study
Groundwater Results Summary
Former Hess Filling Station
Towson, Maryland

		Benzene ug/l	Ethylbenzene ug/l	Toluene ug/l	Xylene ug/l	TPH-GRO ug/l	TPH-DRO mg/l	Chromium ug/l	Molybdenum ug/l	Selenium ug/l	Uranium-238 ug/l	Vanadium ug/l
MEAT Generic Numeric Cleanup Standards		5	700	1,000	10,000	47	0.047	100 (c)	NS	50 (c)	NS	3.7 (c)
Category												
Baseline	**Date**											
Baseline	9/25/2017	**18.8**	359	31.3	581	**4,360**	**1.3**	0.5 U	0.5 U	0.5 U	0.5 U	1 U
14 Day - Corrected for 10X Dilution Base Activated (d)												
Control	10/30/2017	10 U	122	12	689	**4,470**	**14**	NA	NA	NA	NA	NA
10 g/L PS + NaOH	10/30/2017	10 U	44	10 U	170	**2,540**	**29**	NA	NA	NA	NA	NA
20 g/L PS + NaOH	10/30/2017	10 U	11	10 U	30 U	**901** J	**7.9**	**19,000**	4,850	**258**	3,010	**18,800**
40 g/L PS + NaOH	10/30/2017	10 U	29	10 U	25 J	**1,570** J	**32**	NA	NA	NA	NA	NA
91 Day - Corrected for 10X Dilution Unactivated (d)												
Control	1/15/2018	10 U	100	10 U	553	**2,810**	**8.5**	NA	NA	NA	NA	NA
10 g/L PS	1/15/2018	10 U	47	10 U	221	2,000 U	**11**	NA	NA	NA	NA	NA
20 g/L PS	1/15/2018	10 U	26	10 U	75	2,000 U	**16**	11	5 U	5	5 U	10 U
40 g/L PS	1/15/2018	10 U	10 U	10 U	30 U	2,000 U	**9.1**	NA	NA	NA	NA	NA

Notes:

a/ ug/l = micrograms per liter; mg/l = milligrams per liter; J = estimated value; U = not detected above laboratory detection limit; NA = not analyzed; NS = no standard; TPH = total petroleum hydrocarbons;
TPH-GRO = TPH - gasoline range organics; TPH-DRO = TPH - diesel range organics. Compounds in **bold** exceed the cleanup standard.

b/ Baseline water sample is a composite of groundwater collected from YMW-7 and YP-1.

c/ No MEAT standard promulgated for the compound; standard provided is from MDE Generic Numeric Cleanup Standards for Groundwater.

d/ Results are corrected for a dilution factor of 10 applied in the study.

Table 4

Bench Scale Treatability Study
Soil Results Summary
Former Hess Filling Station
Towson, Maryland

		Benzene	Ethylbenzene	Toluene	Xylene	TPH-GRO	TPH-DRO
		ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	mg/kg
MEAT Generic Numeric Cleanup Standards		104,000	20,440,000	40,880,000	408,800,000	620	620
Category							
Baseline	**Date**						
Hess Soil A	9/25/2017	244 U	1,610	244 U	9,250	89.3	223
Hess Soil B	9/25/2017	245 U	909	245 U	5,310	53.3	99.1
14 Day Base Activated							
Control	10/30/2017	4.1 U	104	4.5	572	11.0	82.4
10 g/L PS + NaOH	10/30/2017	5 U	32.6	5 U	148	25	70.7
20 g/L PS + NaOH	10/30/2017	4.5 U	10.3	4.5 U	23.9	13.2	57.3
40 g/L PS + NaOH	10/30/2017	4.2 U	12.7	4.2 U	20.7	15.7	46.8
91 Day Unactivated							
Control	1/15/2018	4.7 U	64.4	4.7 U	323	17.6	33.1
10 g/L PS	1/15/2018	5.4 U	5.4 U	5.4 U	16.2 U	14.3	95.5
20 g/L PS	1/15/2018	4.4 U	4.4 U	4.4 U	13.3 U	11.9 U	67.8
40 g/L PS	1/15/2018	4.6 U	4.6 U	4.6 U	13.9 U	10.3	106

Notes:

a/ ug/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; U = not detected above laboratory detection limit;
g/L = grams per liter; PS = persulfate; NaOH = sodium hydroxide; TPH = total petroleum hydrocarbons;
TPH-GRO = TPH - gasoline range organics; TPH-DRO = TPH-diesel range organics.

b/ Hess Soil A and Hess Soil B samples were generated from a composite of soil collected from MIP-2 (25-30') and MIP-8 (18-22').

Table 5

Bench Scale Treatability Study
Total Mass and Mass Reduction Summaries
Former Hess Filling Station
Towson, Maryland

Mass Calcluations

Category		Benzene ug	Ethylbenzene ug	Toluene ug	Xylene ug	BTEX ug	TPH-GRO ug	TPH-DRO ug
Baseline								
Control (b)	10/30/2017	4.1	1,313.3	6.9	7,262	8,587	70,833	158,115
14 Day Base Activated (c)								
Control	10/30/2017	0.0	128.8	7.1	712.1	848.0	11,763	83,832
10 g/L PS + NaOH	10/30/2017	0.0	41.6	0.0	182.4	224.1	25,059	75,666
20 g/L PS + NaOH	10/30/2017	0.0	12.5	0.0	23.4	35.9	13,134	57,892
40 g/L PS + NaOH	10/30/2017	0.0	18.8	0.0	25.8	44.6	15,731	52,904
91 Day Unactivated (c)								
Control	1/15/2018	0.0	85.1	0.0	438.2	523.3	17,866	34,308
10 g/L PS	1/15/2018	0.0	10.3	0.0	48.6	59.0	14,014	96,010
20 g/L PS	1/15/2018	0.0	5.7	0.0	16.5	22.2	0	69,964
40 g/L PS	1/15/2018	0.0	0.0	0.0	0.0	0.0	10,094	105,882

Table 5

Bench Scale Treatability Study
Total Mass and Mass Reduction Summaries
Former Hess Filling Station
Towson, Maryland

Mass Reduction								
Category		**Benzene** %	**Ethylbenzene** %	**Toluene** %	**Xylene** %	**BTEX** %	**TPH-GRO** %	**TPH-DRO** %
14 Day Base Activated (c)								
Control	10/30/2017	100%	90.2%	-2.4%	90.2%	90.1%	83.4%	47.0%
10 g/L PS + NaOH	10/30/2017	100%	96.8%	100.0%	97.5%	97.4%	64.6%	52.1%
20 g/L PS + NaOH	10/30/2017	100%	99.0%	100.0%	99.7%	99.6%	81.5%	63.4%
40 g/L PS + NaOH	10/30/2017	100%	98.6%	100.0%	99.6%	99.5%	77.8%	66.5%
91 Day Unactivated (c)								
Control	1/15/2018	100%	93.5%	100.0%	94.0%	93.9%	74.8%	78.3%
10 g/L PS	1/15/2018	100%	99.2%	100.0%	99.3%	99.3%	80.2%	39.3%
20 g/L PS	1/15/2018	100%	99.6%	100.0%	99.8%	99.7%	100.0%	55.8%
40 g/L PS	1/15/2018	100%	100.0%	100.0%	100.0%	100.0%	85.7%	33.0%

Notes:
a/ ug = micrograms; % = percent; g/L PS = grams per liter persulfate; NaOH = sodium hydroxide; BTEX = benzene, toluene, ethylbenzene, and xylenes;
TPH = total petroleum hydrocarbons; TPH-GRO = TPH - gasoline range hydrocarbons; TPH-DRO = TPH-diesel range hydrocarbons.
Mass calculation is the sum of mass in water and soil, calculated using the concentrations provided in Tables 3 and 4 and the quantities of water and soil in the study (220 milliters of water and 980 grams of soil).
In samples where the groundwater or soil concentration was below a detection limit, a mass value of 0 was assumed in the calcluation.
b/ The baseline control sample's total mass includes the average of the two baseline soil samples.
c/ Mass is based on corrected bench scale water results for 14 day and 91 day samples with dilution factor of 10 applied.

ENCLOSURE A

Final Data Package for Membrane Interface Probe – Hydraulic Profiling Tool Services

Site Location: 1613 E. Joppa Road, Towson, Maryland.

Project Number: 202.17.1105

Report Date: November 5th, 2017

Prepared for:
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Project Narrative

Cascade Technical Services (Cascade) is pleased to present this data report to WSP for the membrane interface-hydraulic profiling tool (MIHPT) services that were provided between the dates of September 18th and 19th 2017 at the site located at 1613 East Joppa Road, Towson, Maryland.

The results associated with the data and plots presented in this report were generated in accordance to Cascade's and Geoprobe's Standard Operating Procedures (SOPs) for MIHPT services.

All field work and data management were completed by trained, scientific professionals and all quality assurance/quality control (QA/QC) measurements associated with these data were found to be within the tolerances set forth in the SOPs for these services. Response tests conducted previous to, and subsequent to the MIHPT borings were found to be within the tolerances set forth for this MIHPT survey and therefore the data are deemed acceptable for use. Exception/deviations regarding these response tests and the related data are noted on the MiHPT summary table that is part of this report.

I certify that the data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the laboratory manager or his designee, as verified by the following signature.

Signature: ___________________________________

CHARLES TERRY -- EASTERN FIELD SUPERVISOR OF SITE CHARACTERIZATION

Project Site Map and MIHPT Locations

Approximate boring locations are provided below. Field staff estimated boring locations using reference points observed on site in relation to the same reference points visible in Google Earth map software.

MiHPT Probe Data Summary Table

Provided below is a summary of MIP information, including response test acceptability and any deviations from the standard operating procedure that occurred during the field activities.

*Acceptable values for ECD, PID, and XSD detectors are 200mV, 25mV, and 3.5mV, respectively

MIP Location	Total Depth (ft)	Response Test Results, ECD - (mV)			Response Test Results, PID - (mV)			Response Test Results, XSD - (mV)			Comments/Deviations
		Pre	Post	Acceptable	Pre	Post	Acceptable	Pre	Post	Acceptable	
MIHPT-01	33.90	2304.9	2212.3	YES	52.6	65.6	YES	8.4	8.2	YES	None.
MIHPT-03	30.45	2212.3	2186.3	YES	65.6	81.1	YES	8.2	10.1	YES	None.
MIHPT-04	31.65	2186.3	1950.5	YES	81.1	101.7	YES	10.1	3.9	YES	None.
MIHPT-05	26.35	1950.5	1828.5	YES	101.7	164.4	YES	3.9	4.5	YES	None.
MIHPT-07	34.55	1828.5	1903.4	YES	164.4	65.8	YES	4.5	6.8	YES	None.
MIHPT-06	32.20	1903.4	1606.1	YES	65.8	48.9	YES	6.8	3.8	YES	None.
MIHPT-08	32.00	1606.1	2285.8	YES	48.9	81.8	YES	3.8	7.0	YES	None.
MIHPT-02	34.15	2285.8	1933.7	YES	81.8	25.6	YES	7.0	3.5	YES	None.
MIHPT-09	27.90	1518.2	1535.6	YES	144.7	50.9	YES	2.9	2.3	NO	Unable to allow XSD to properly heat due to time constraints related to site access hours.

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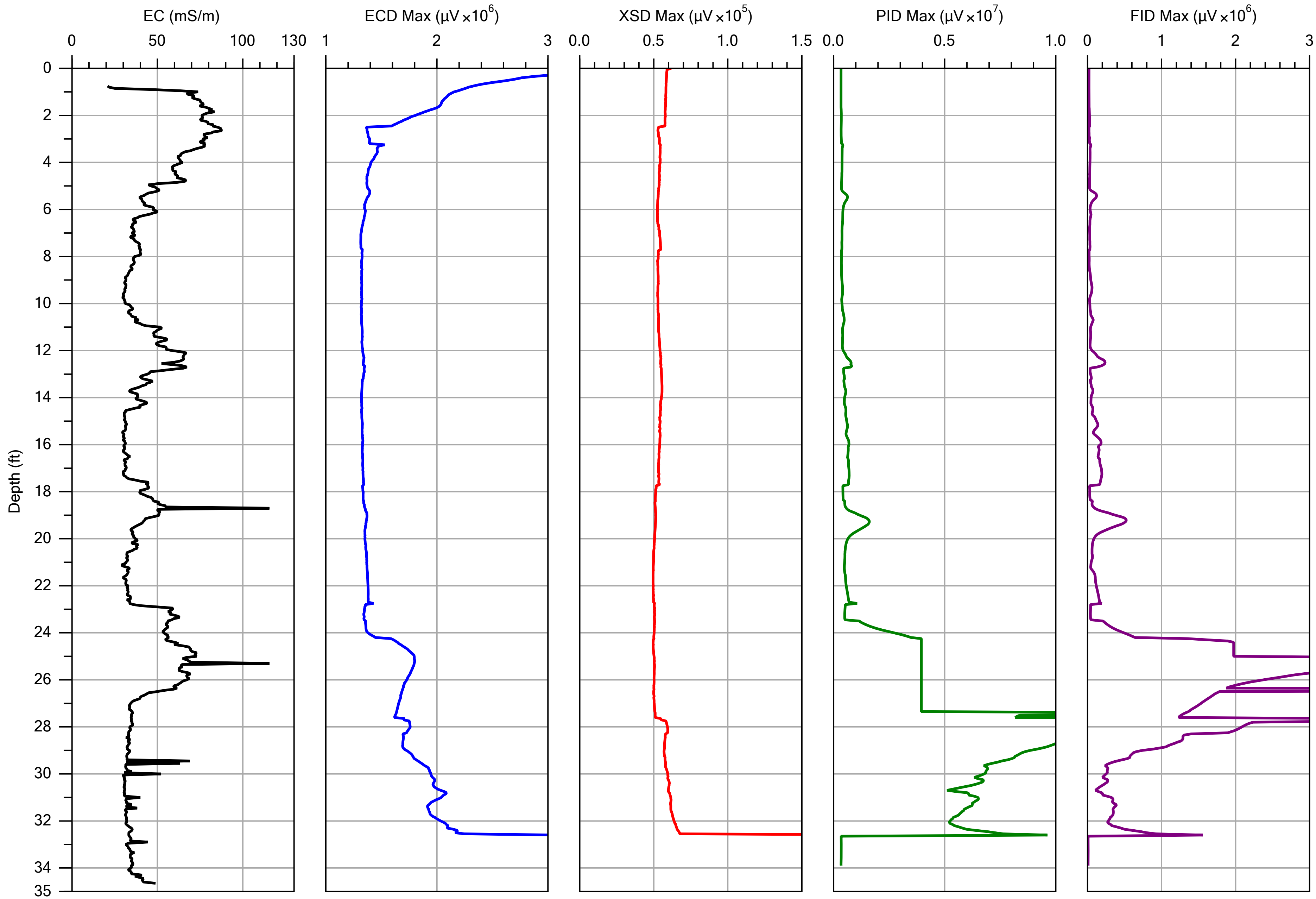
MiHPT Data Plots – Low Range Scales



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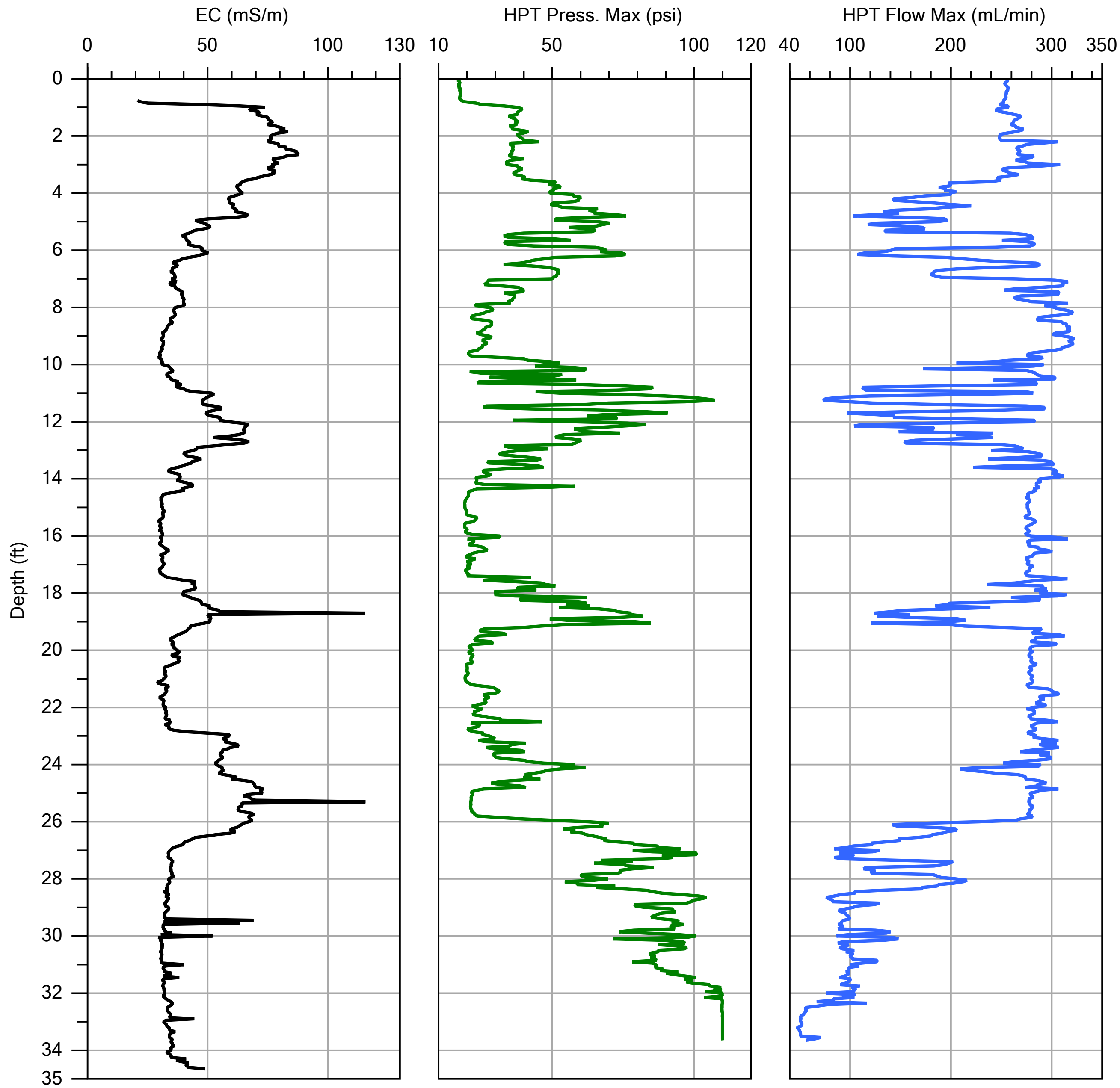

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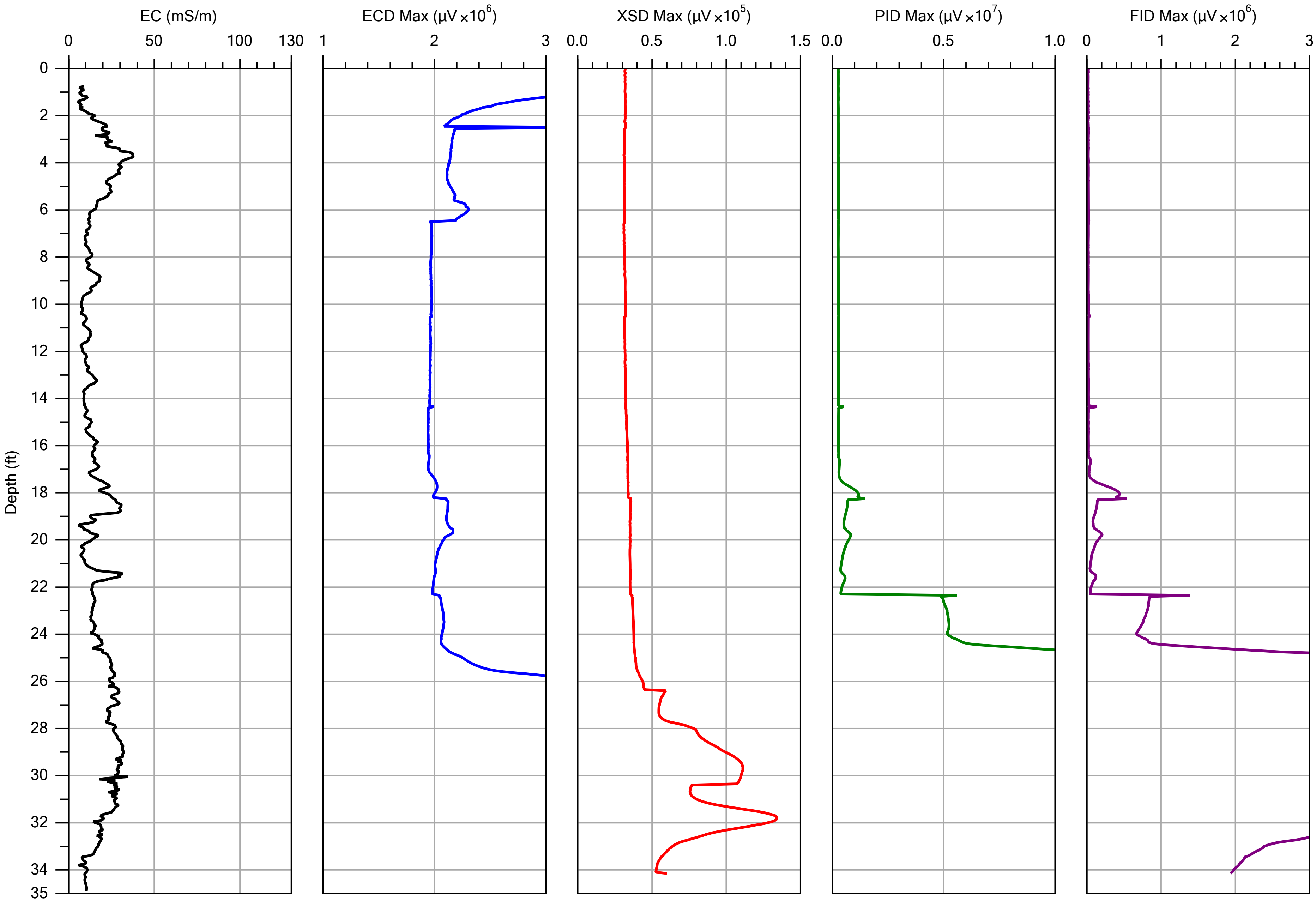

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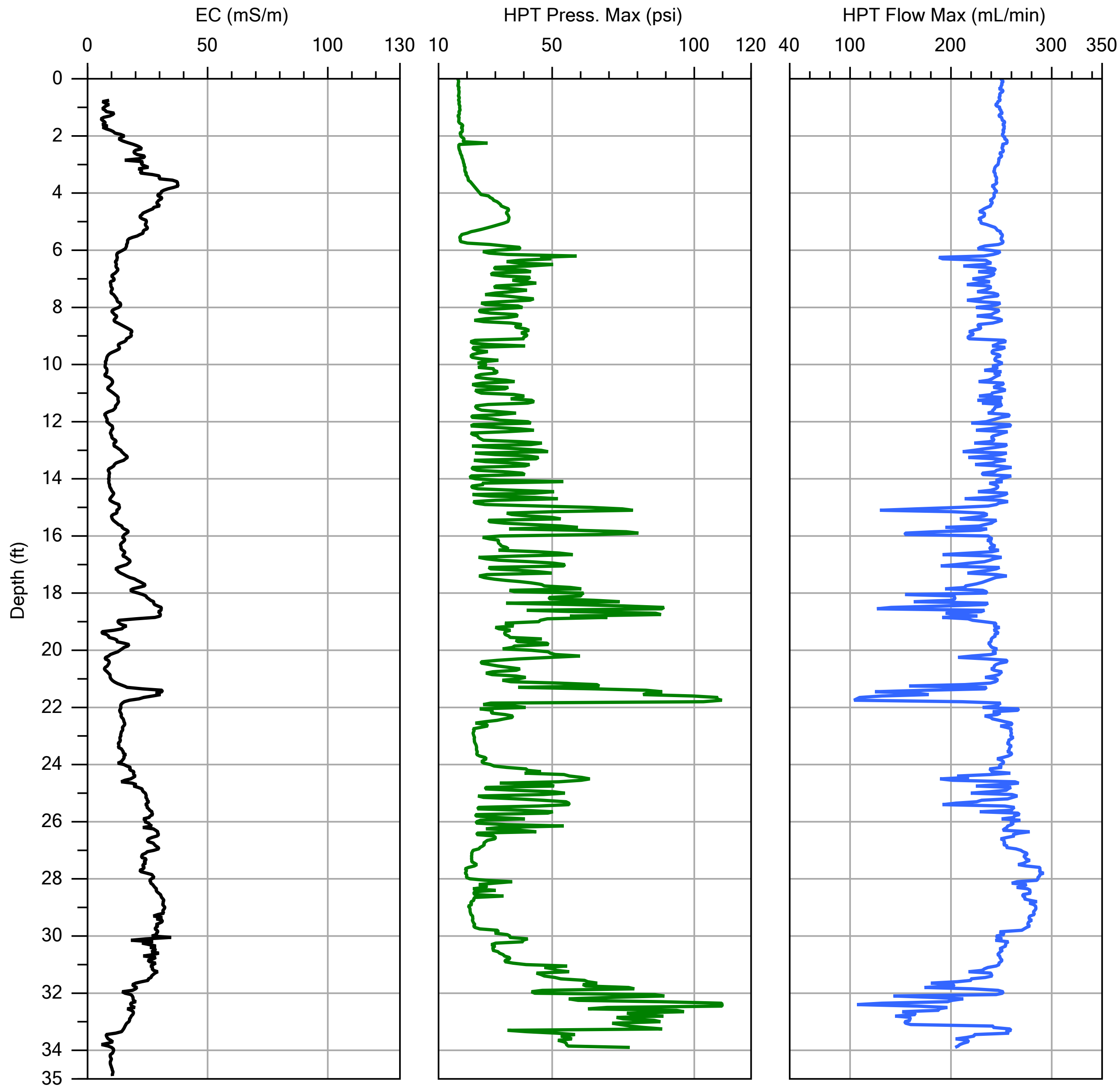

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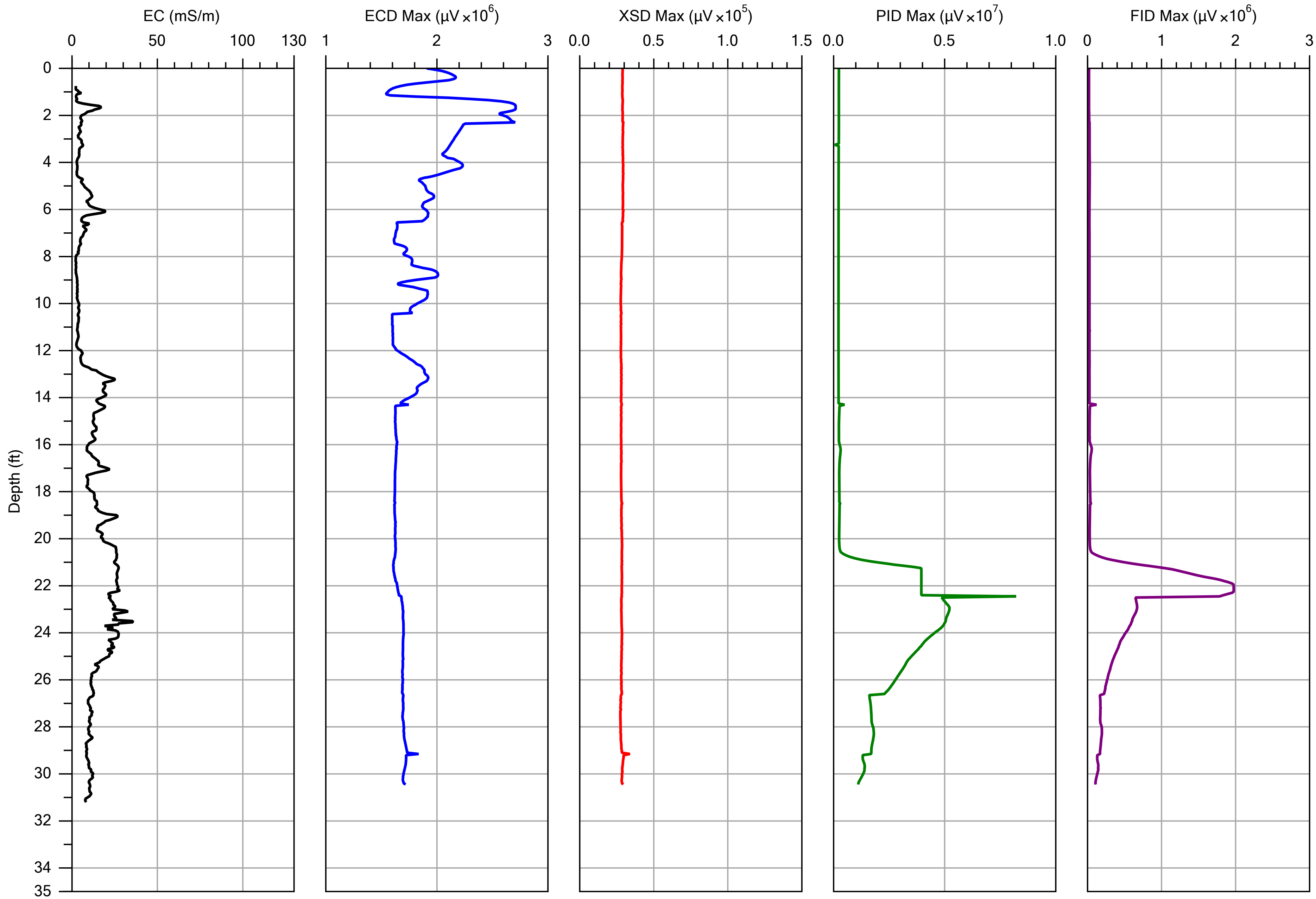

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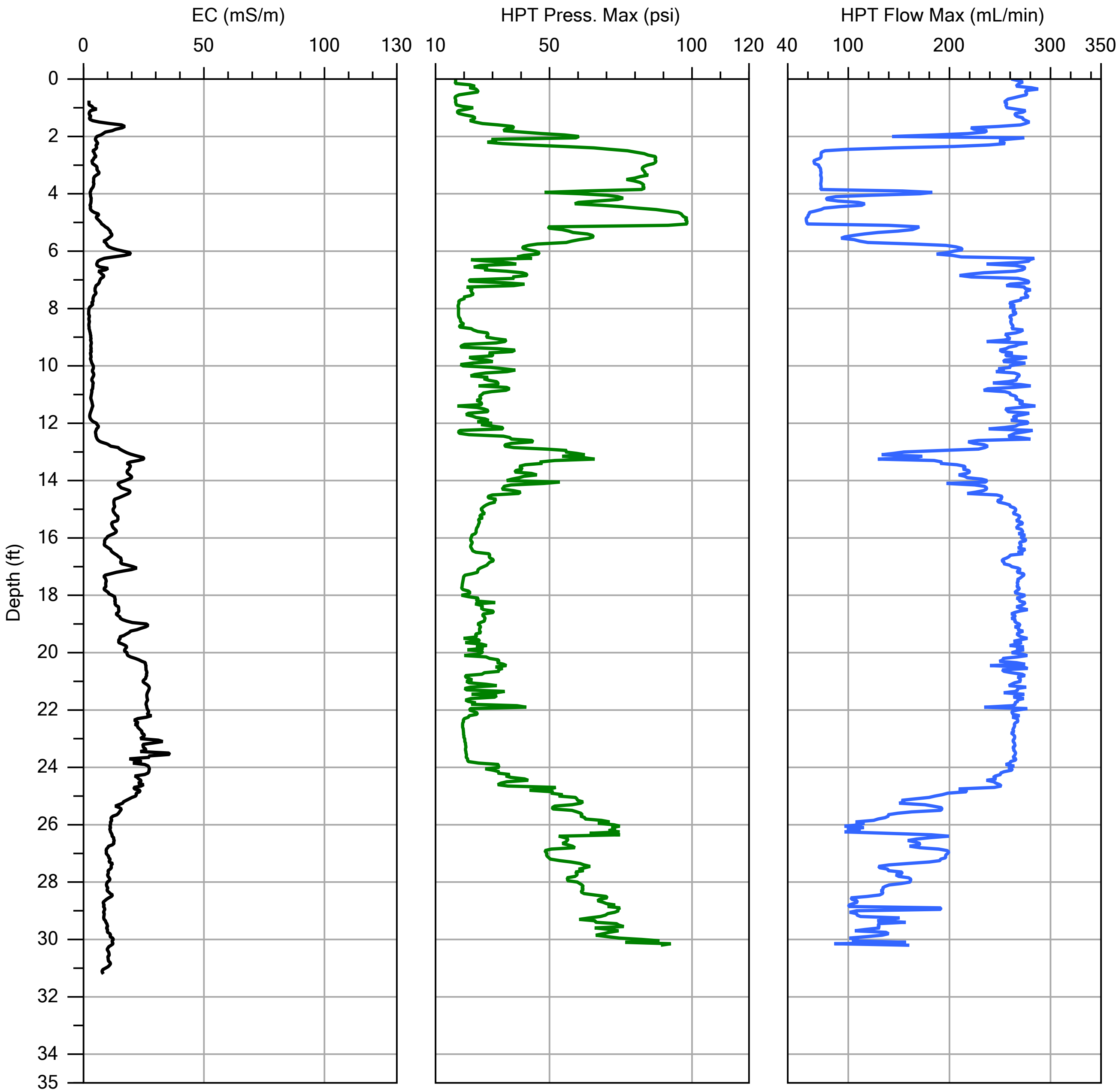

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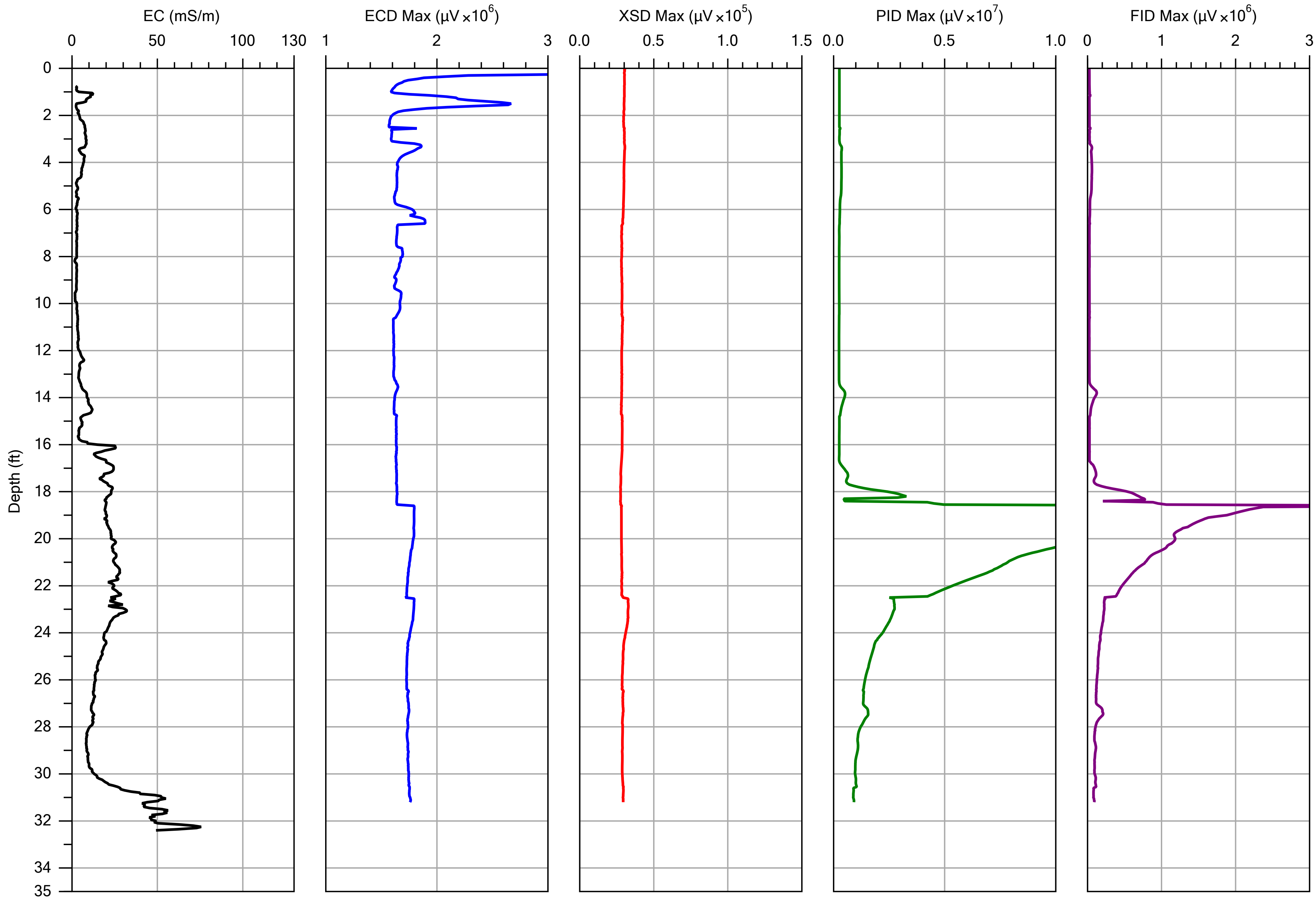

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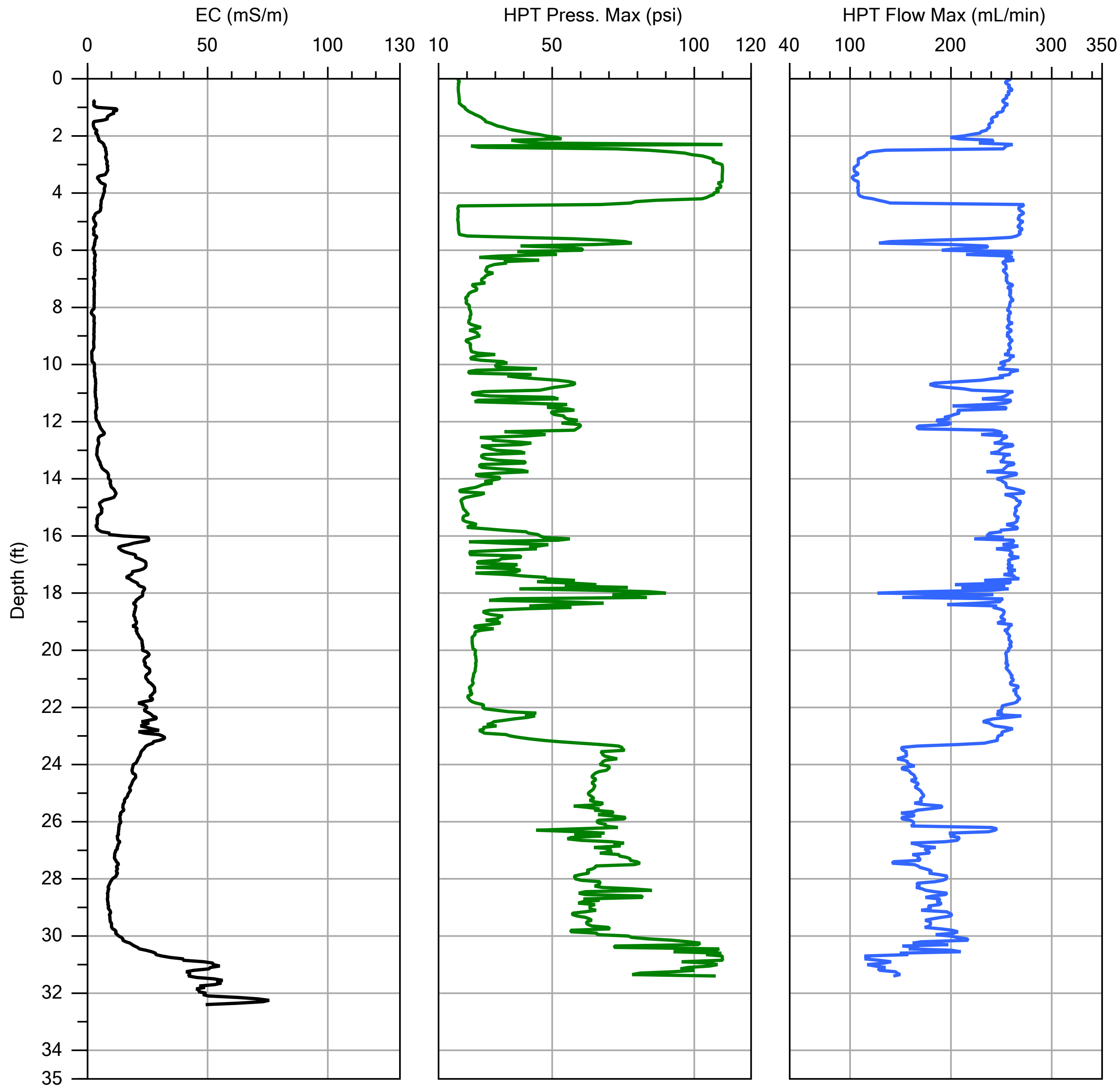

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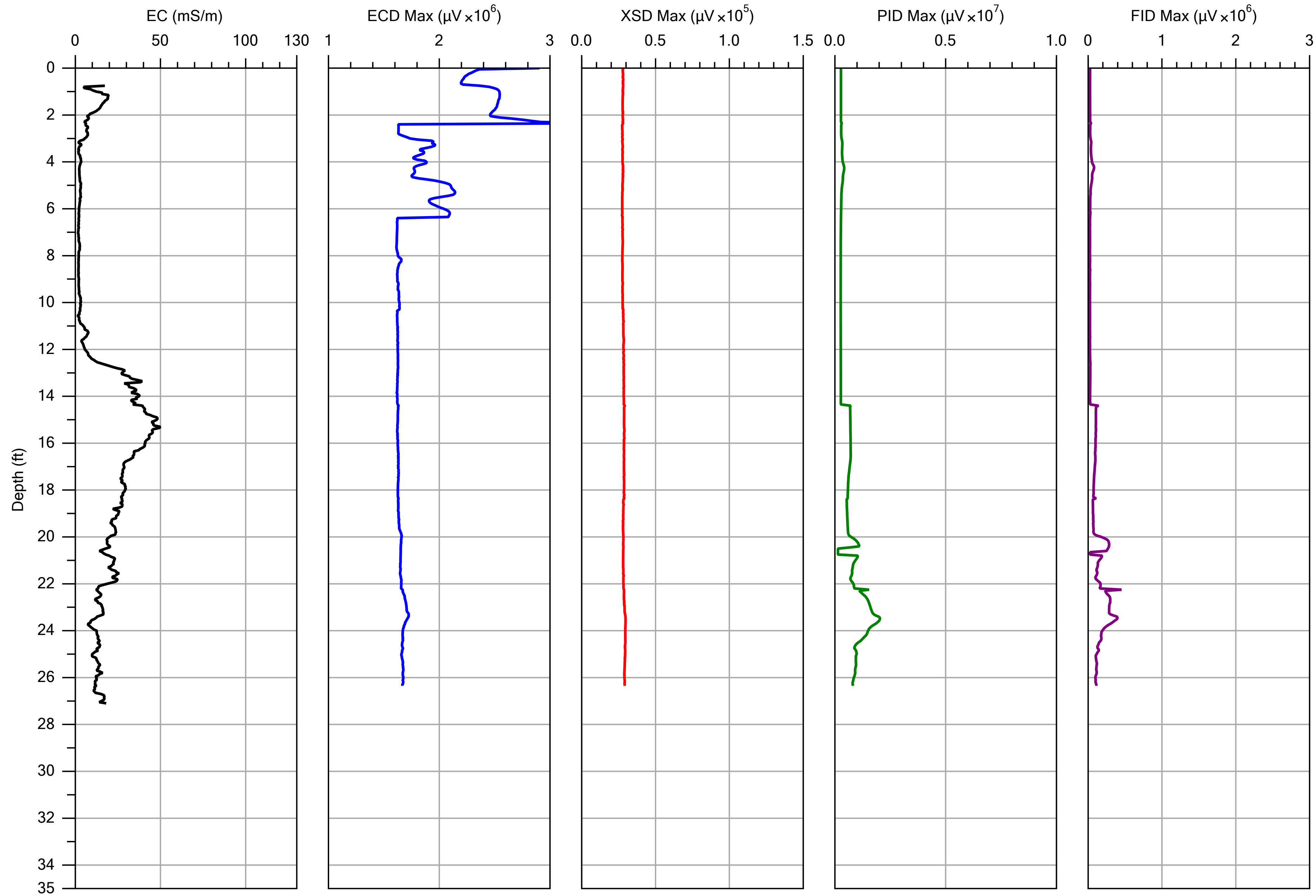

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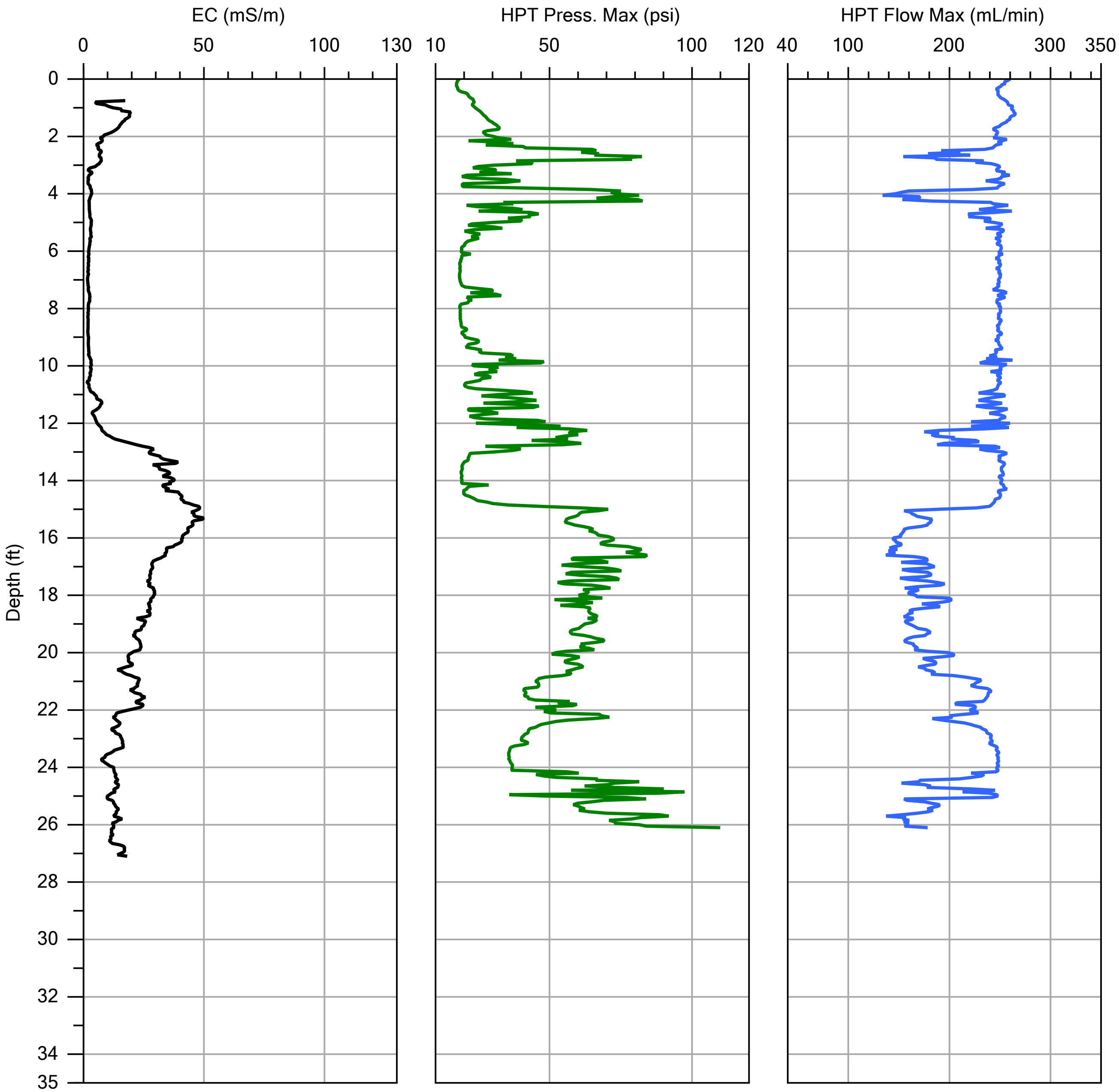

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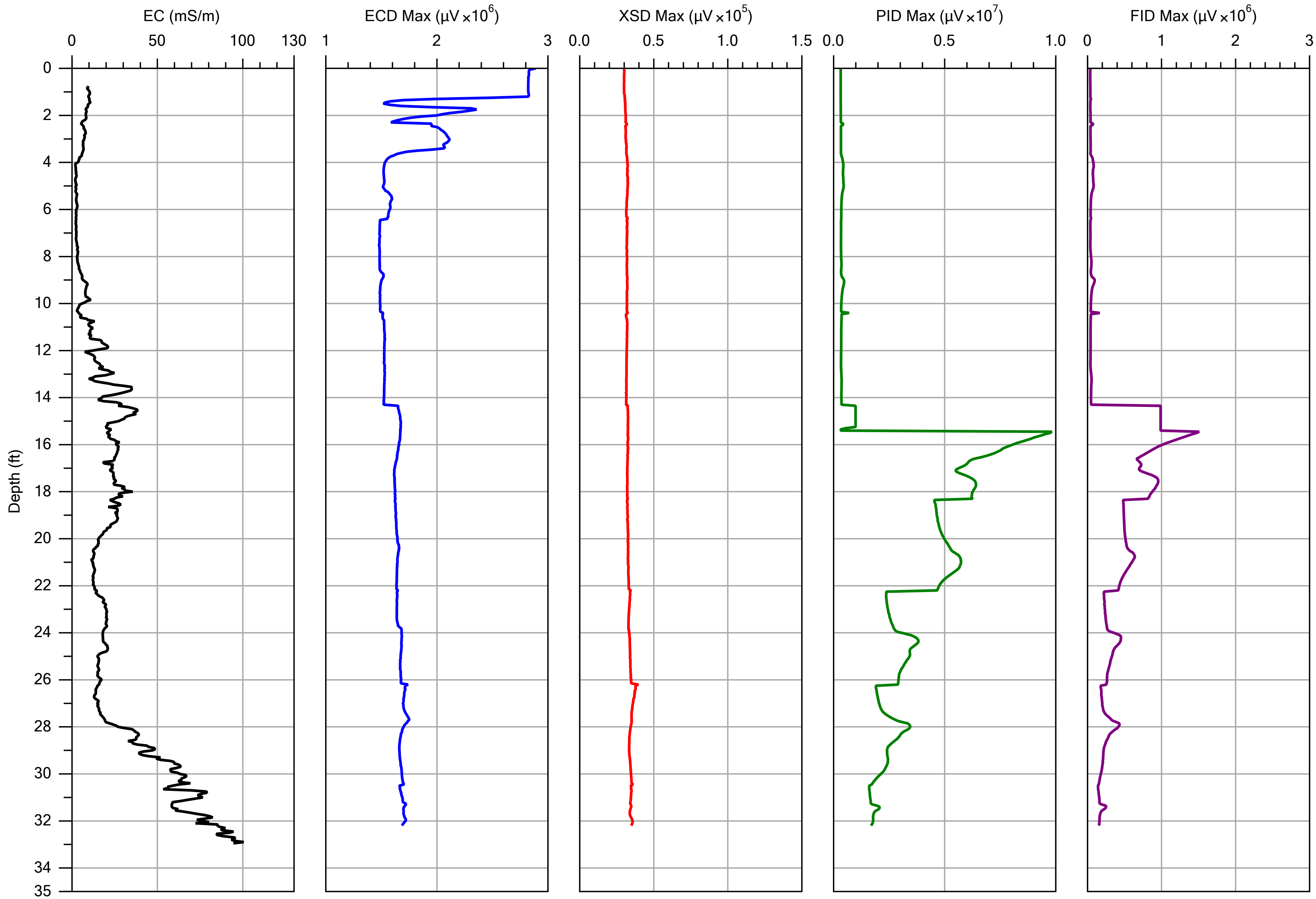

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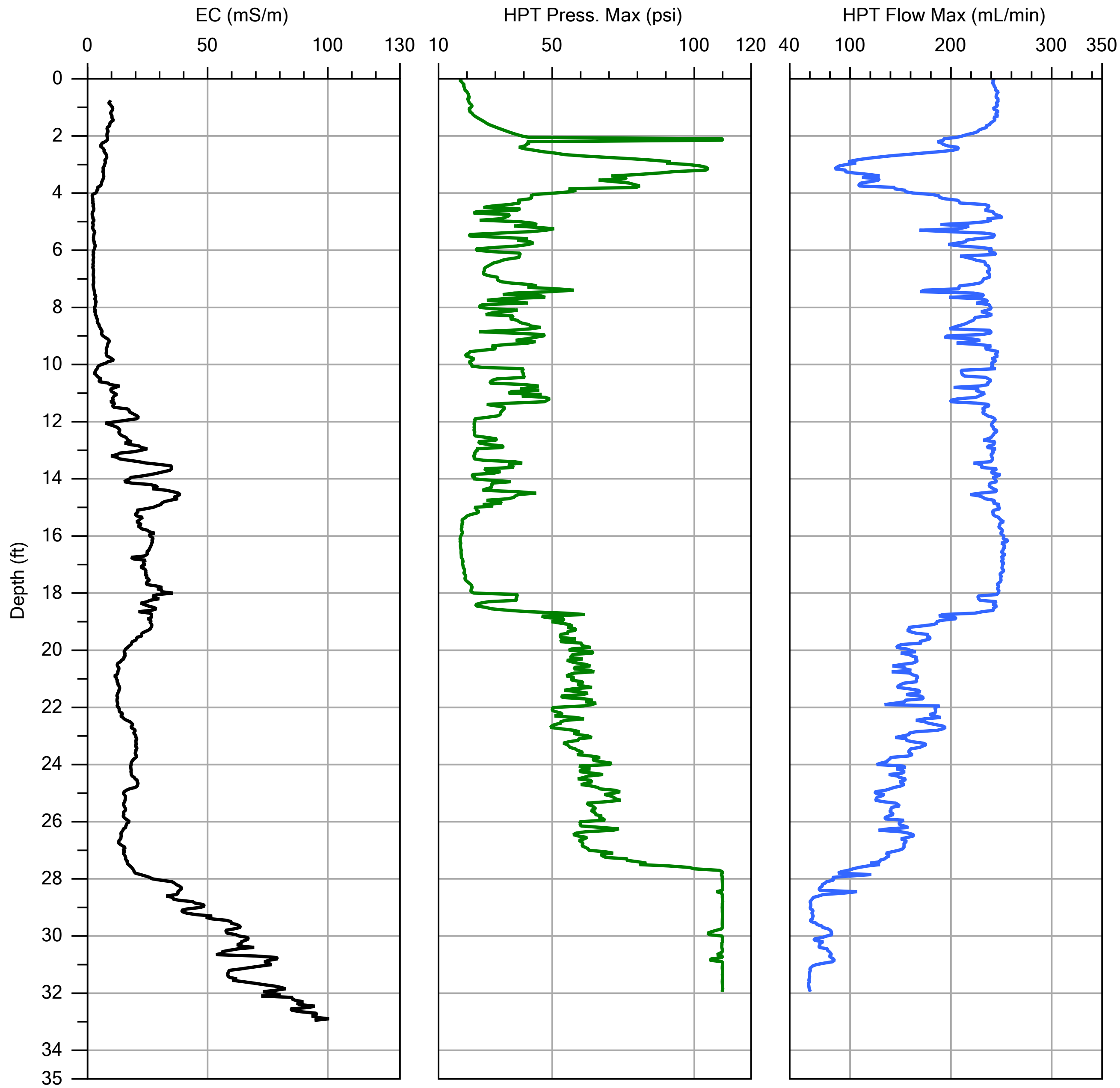

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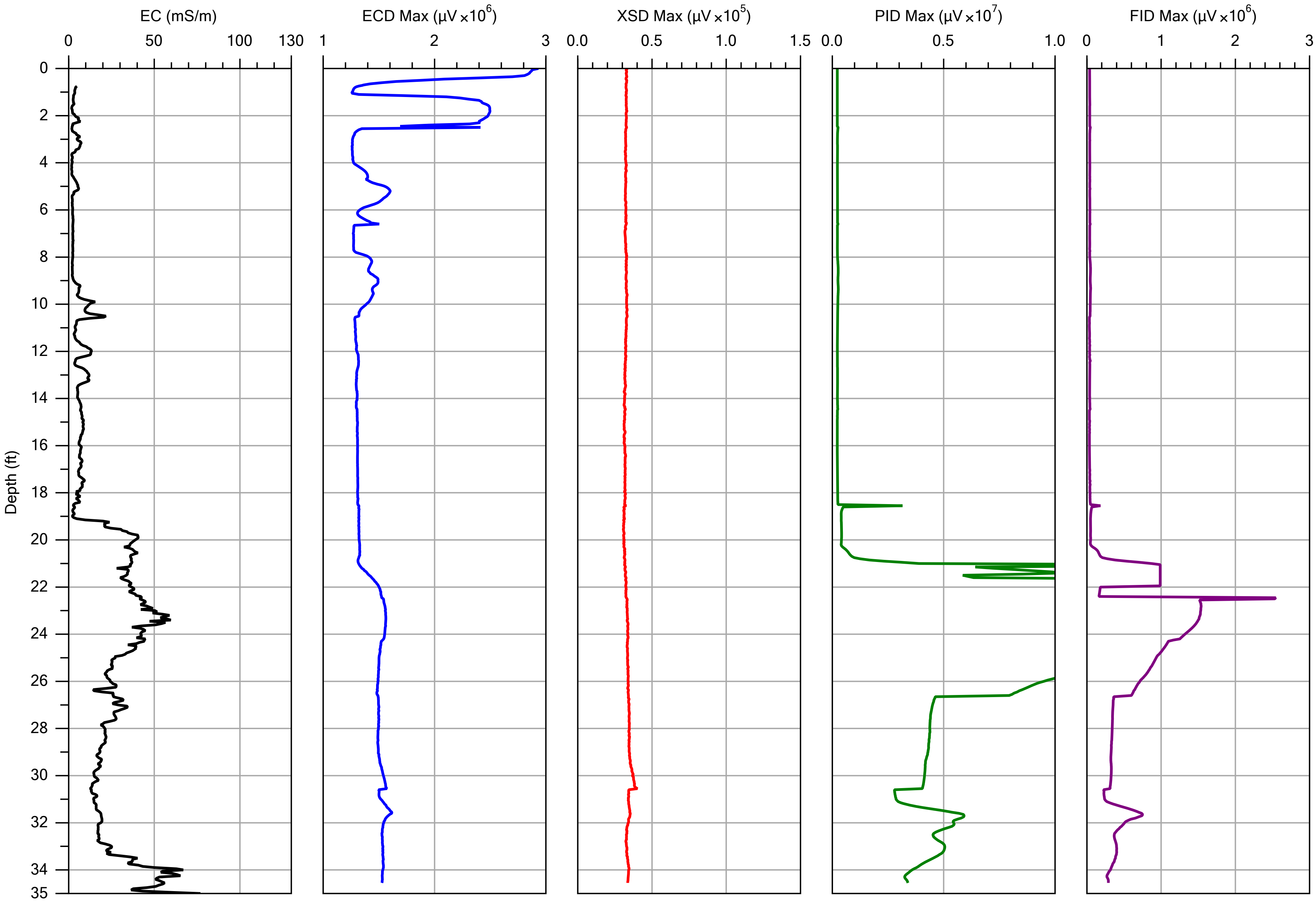

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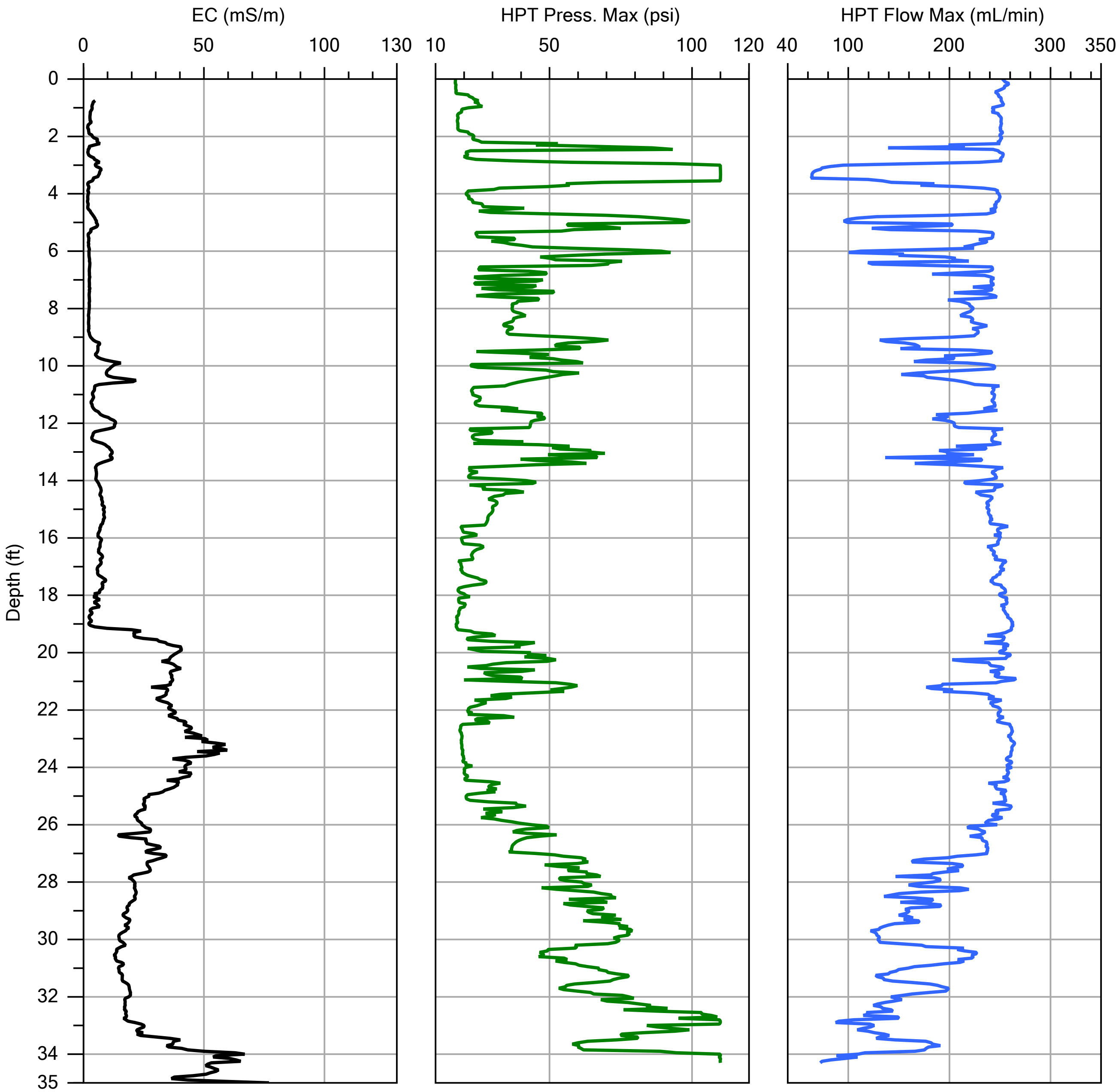

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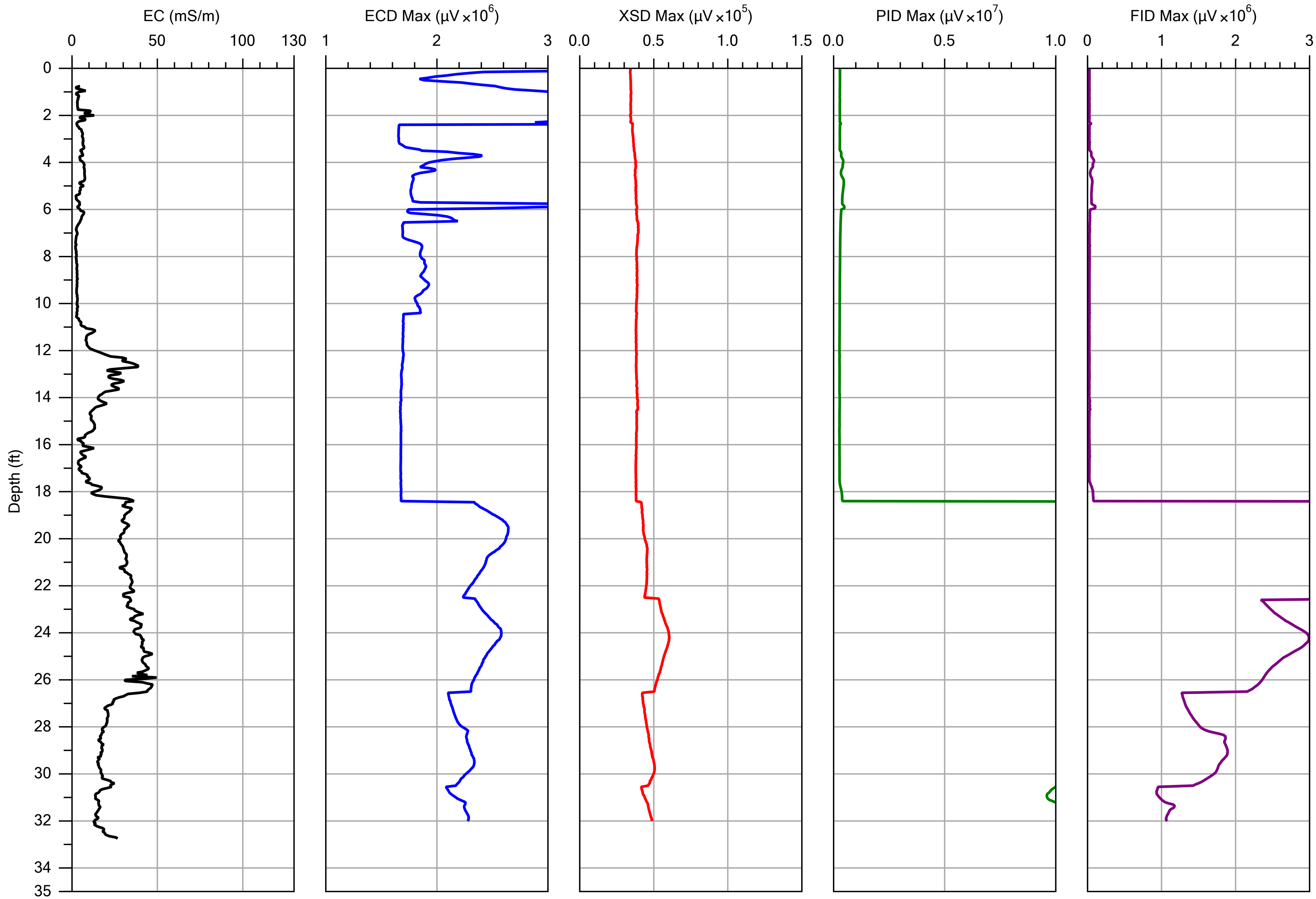

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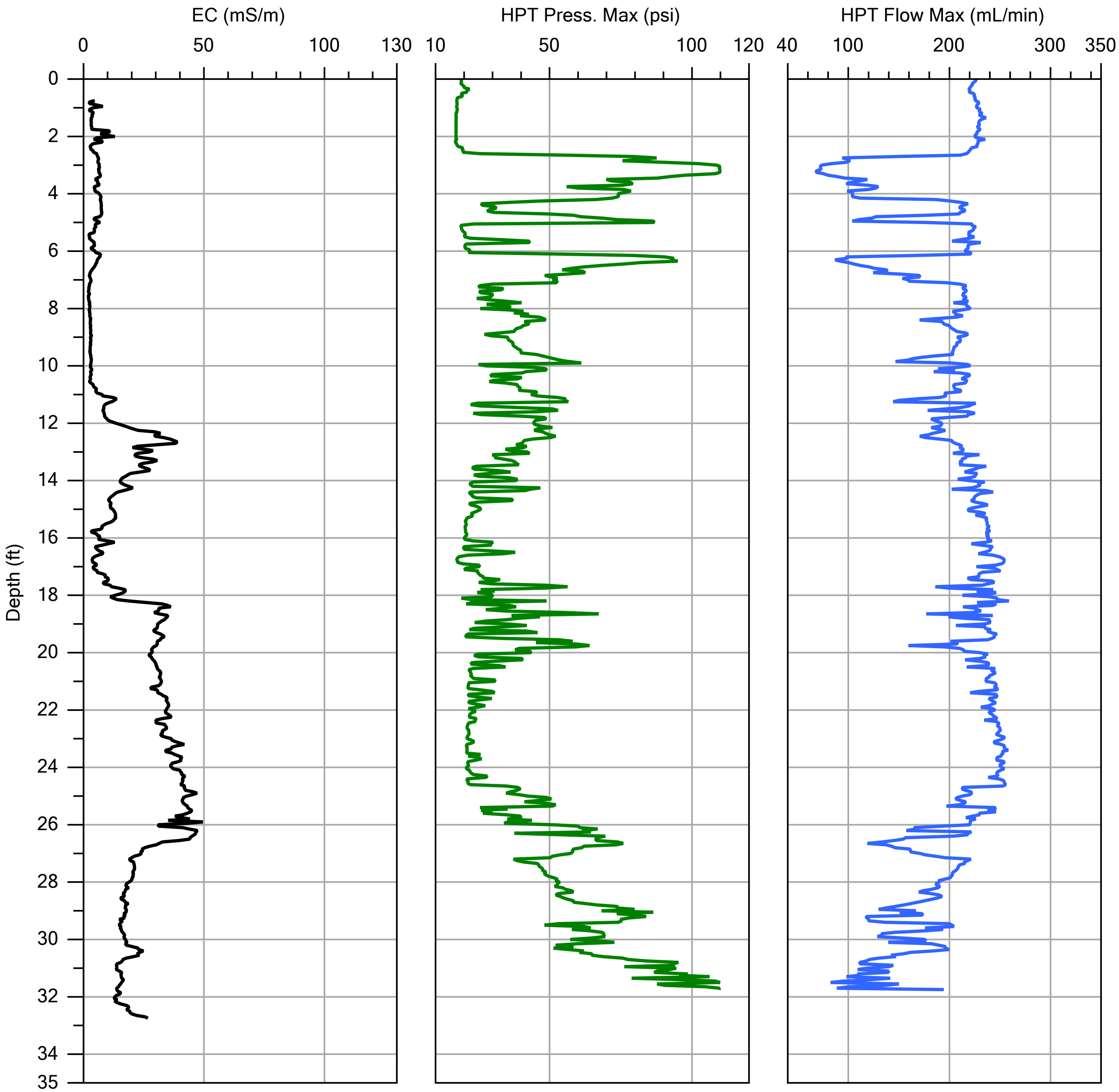

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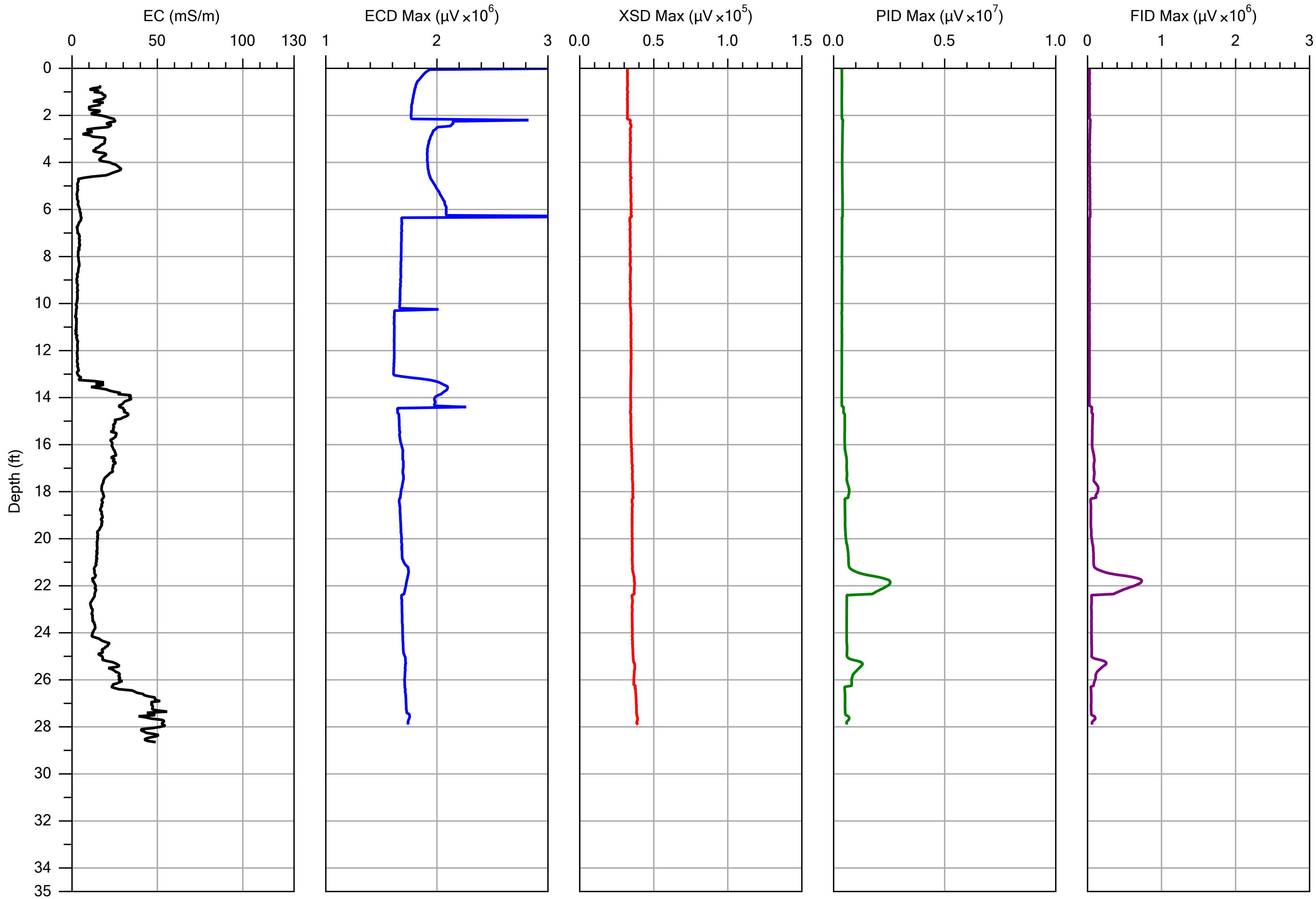

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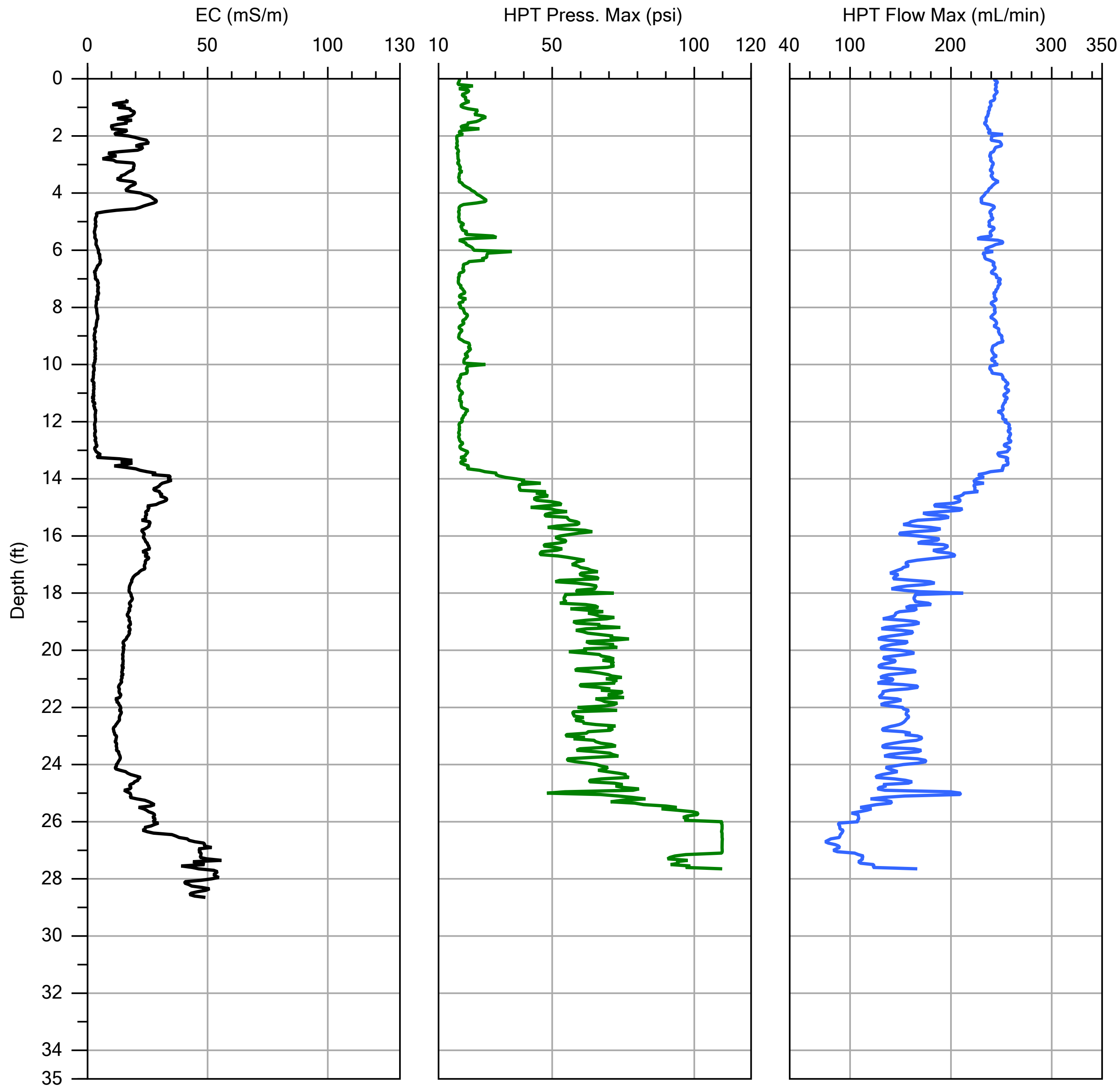

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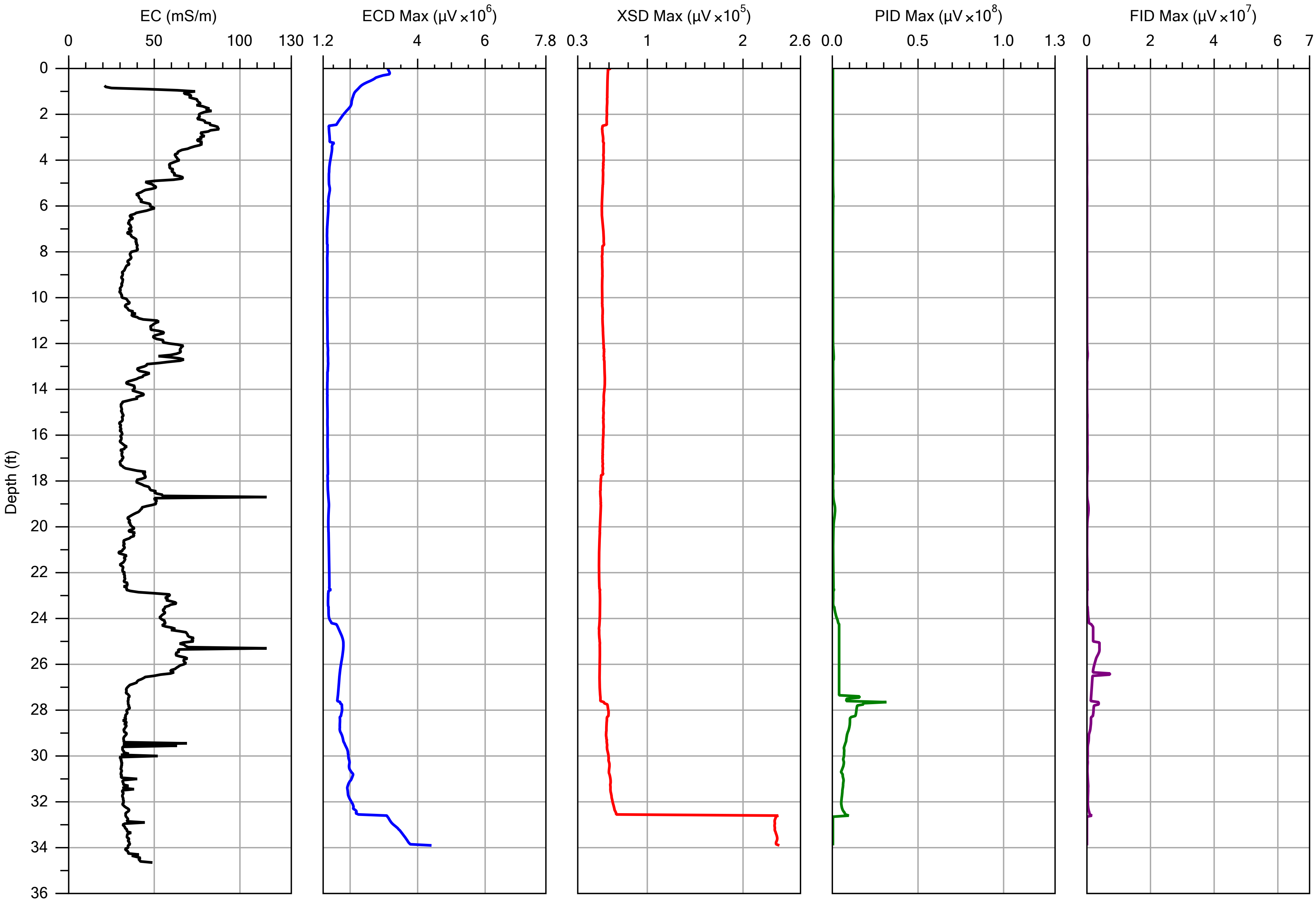
MiHPT Data Plots – High Range Scales



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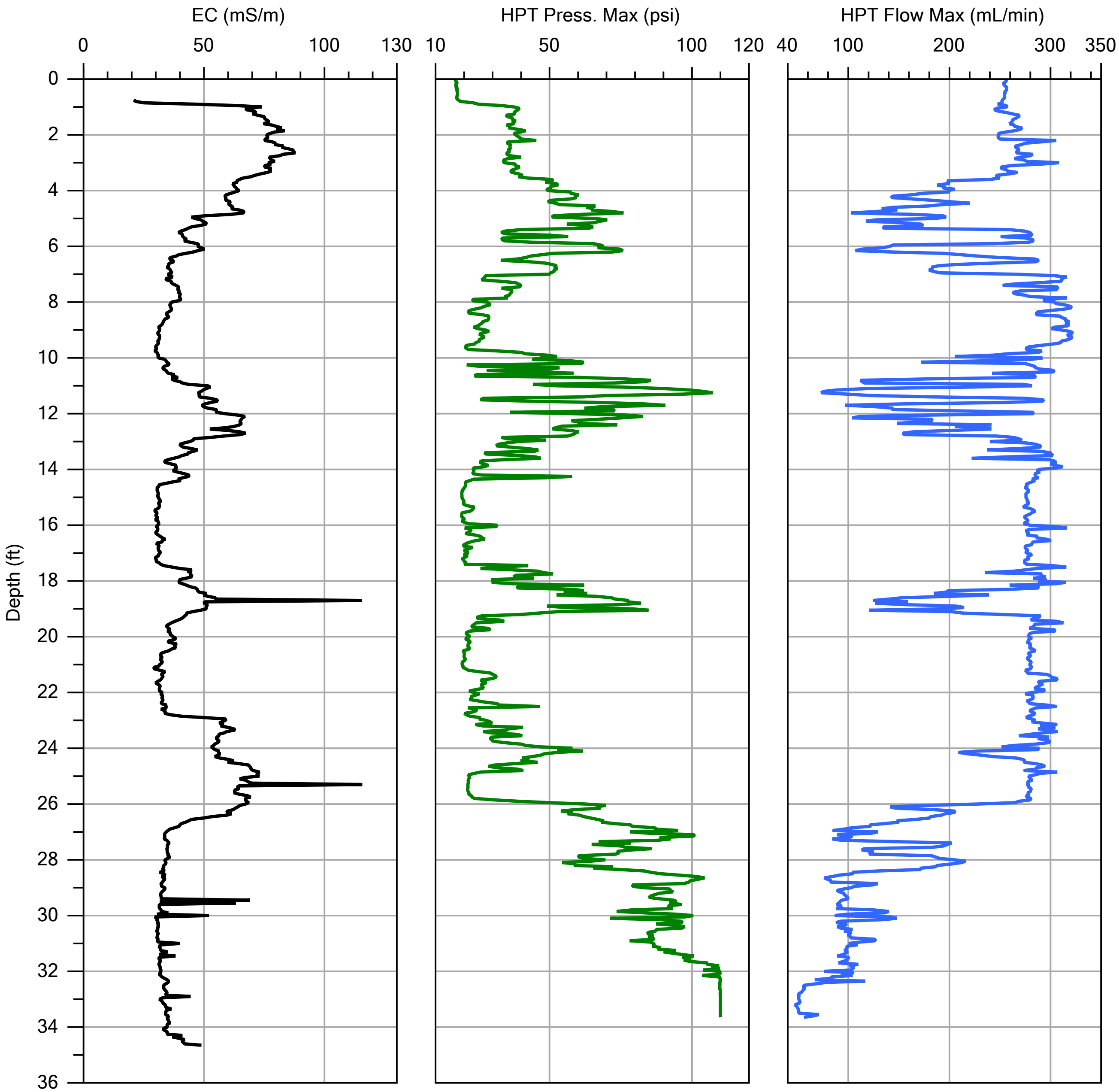

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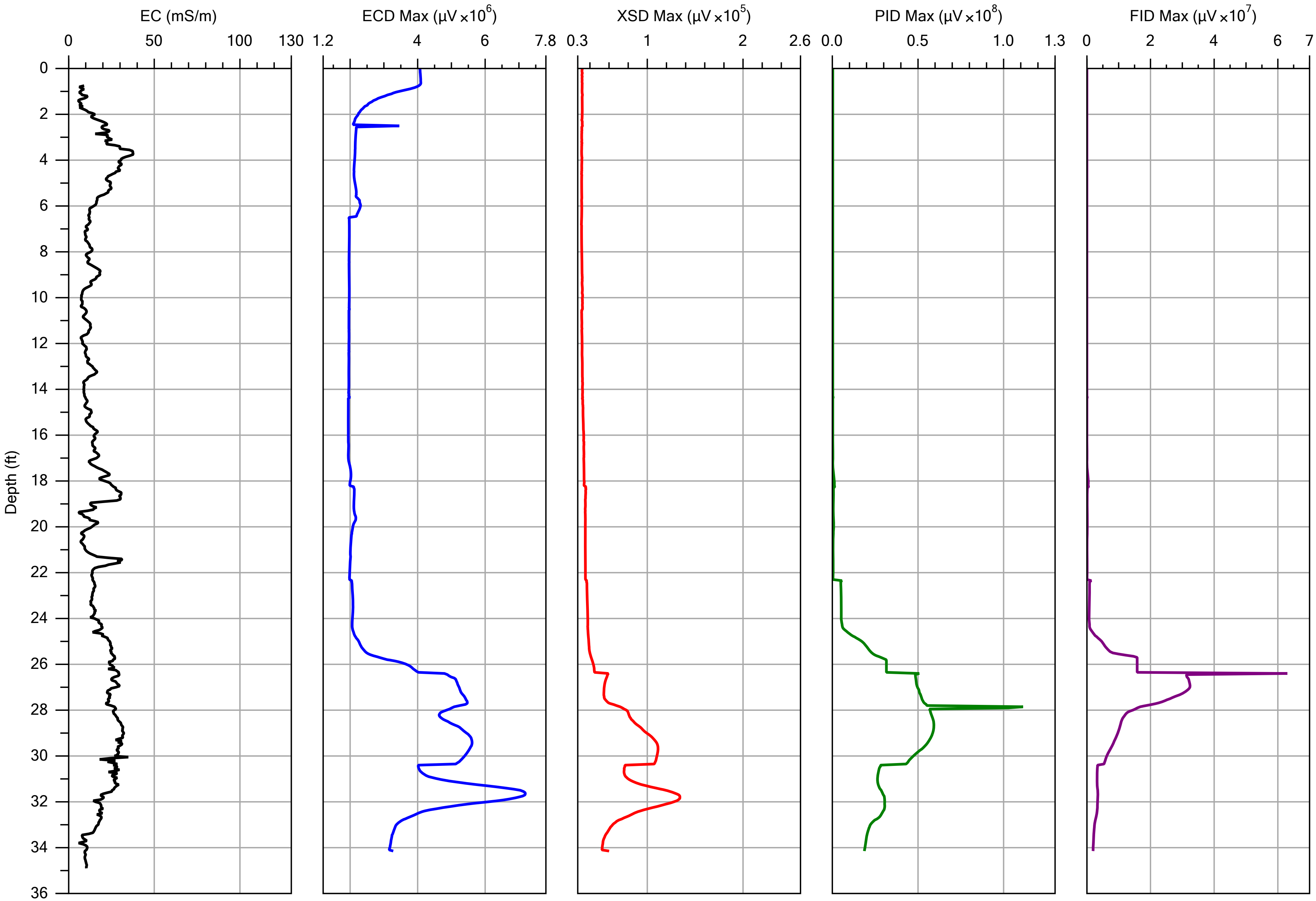

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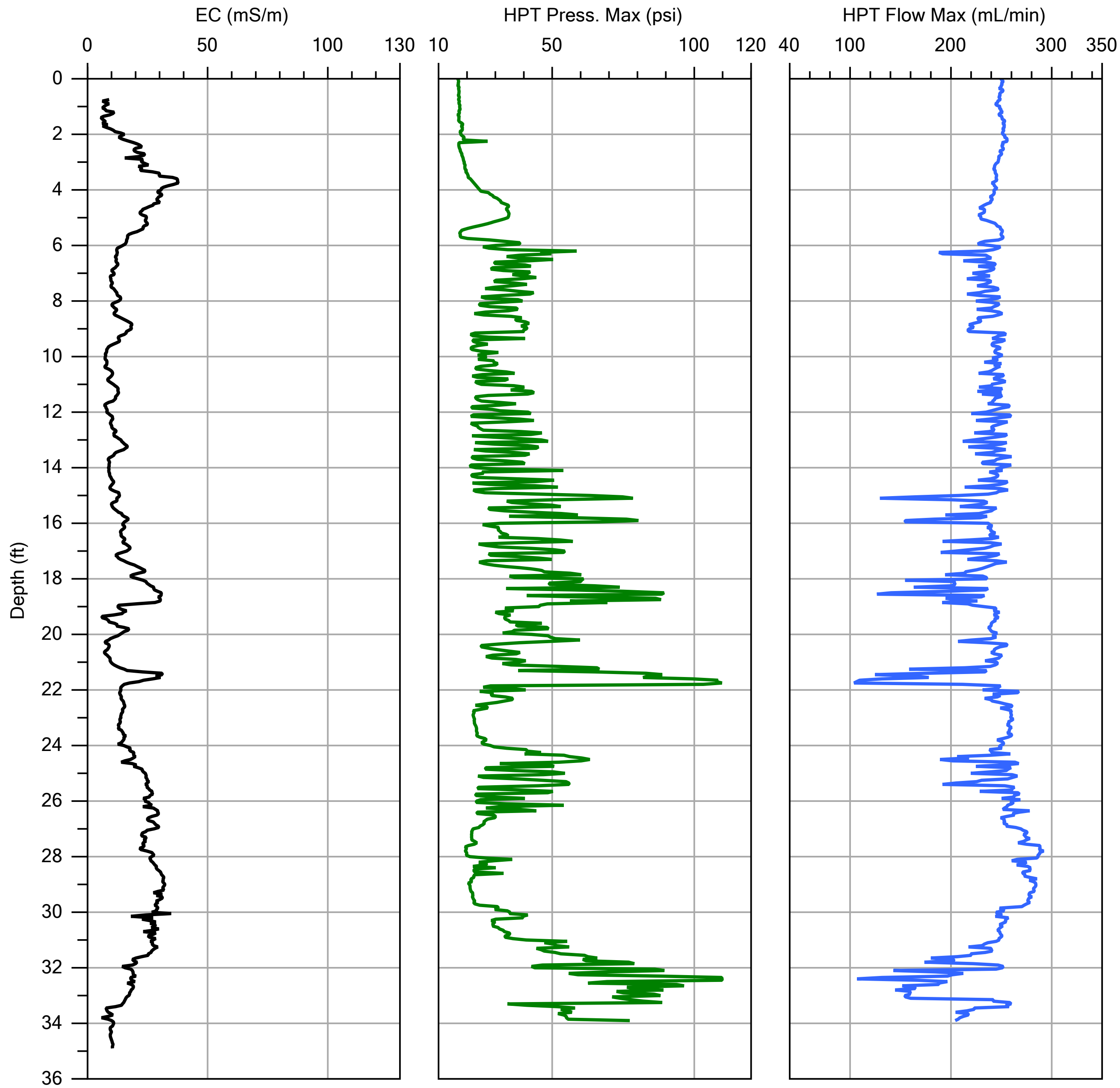

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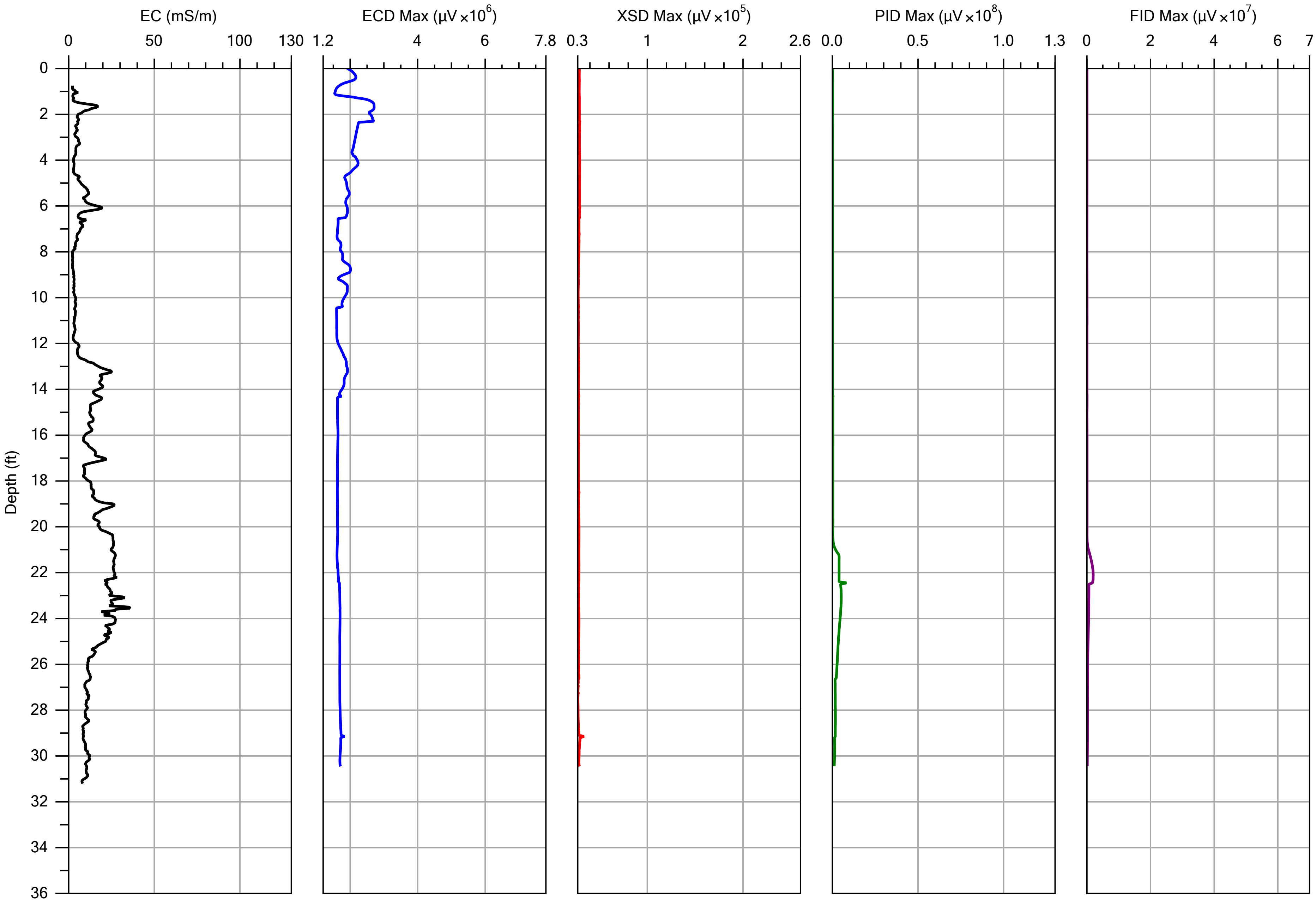

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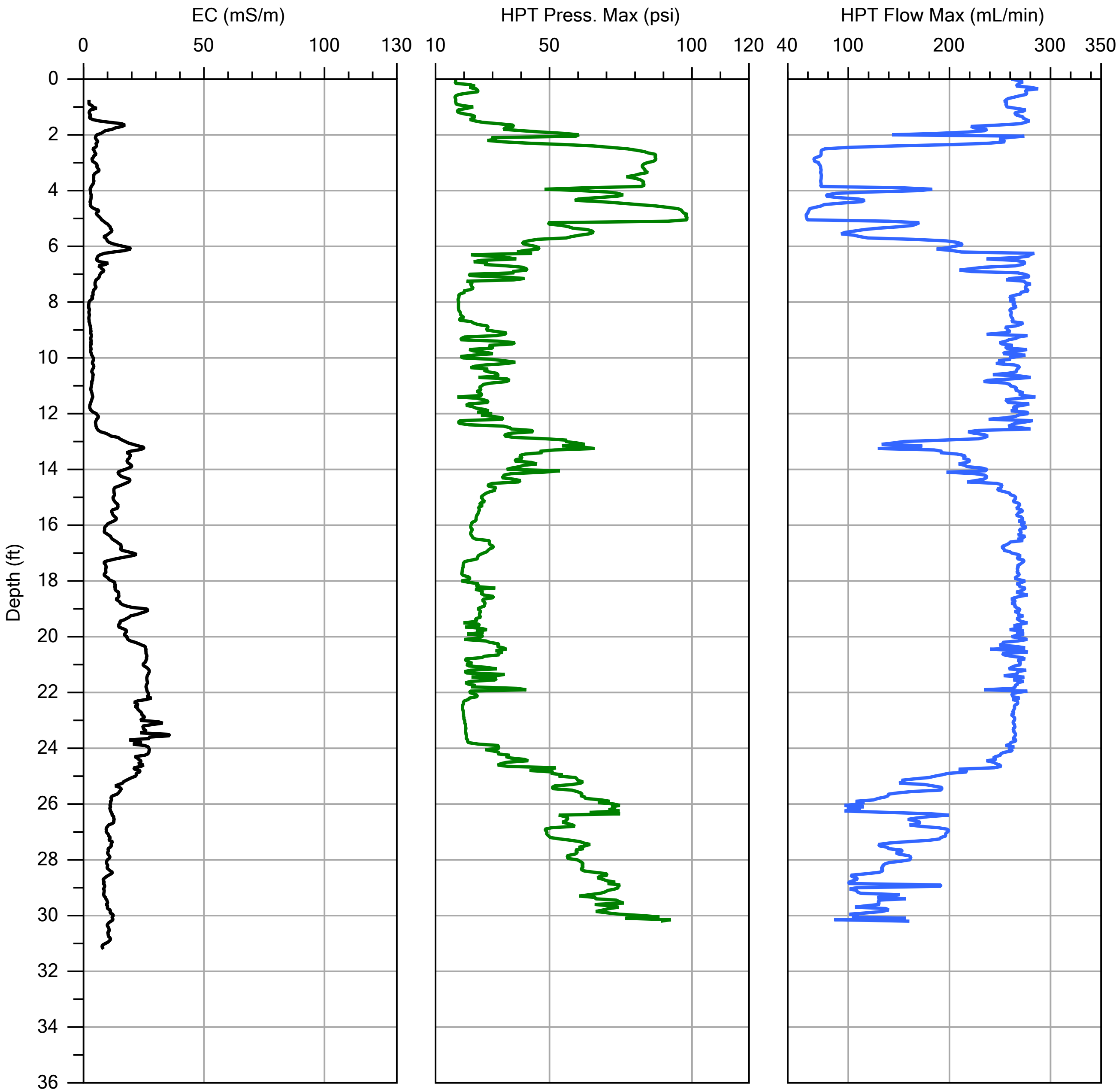

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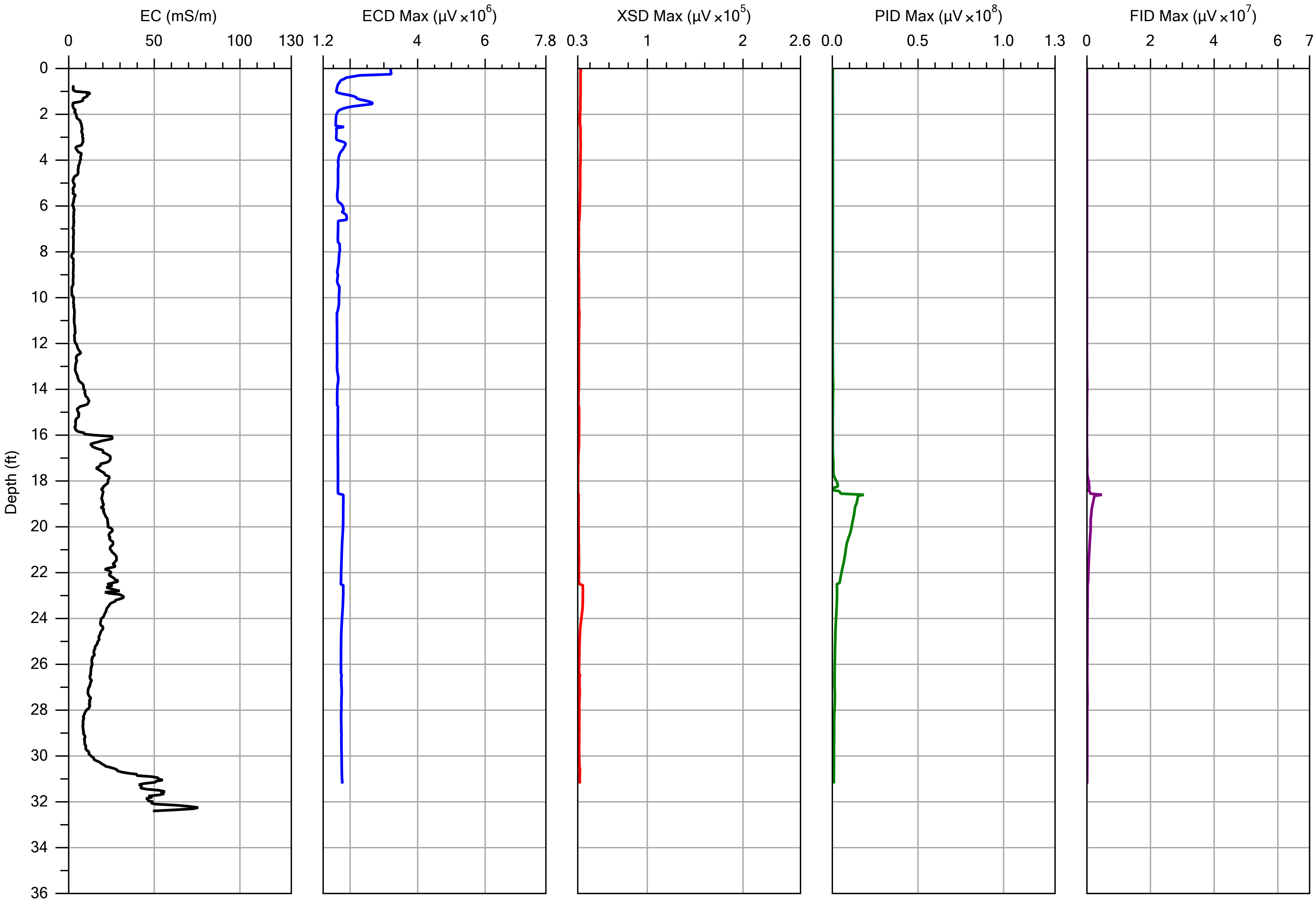
Project ID: 202.17.1105	Client: WSP USA	Location:



CASCADE DRILLING | TECHNICAL SERVICES EXCELLENCE ON EVERY LEVEL™

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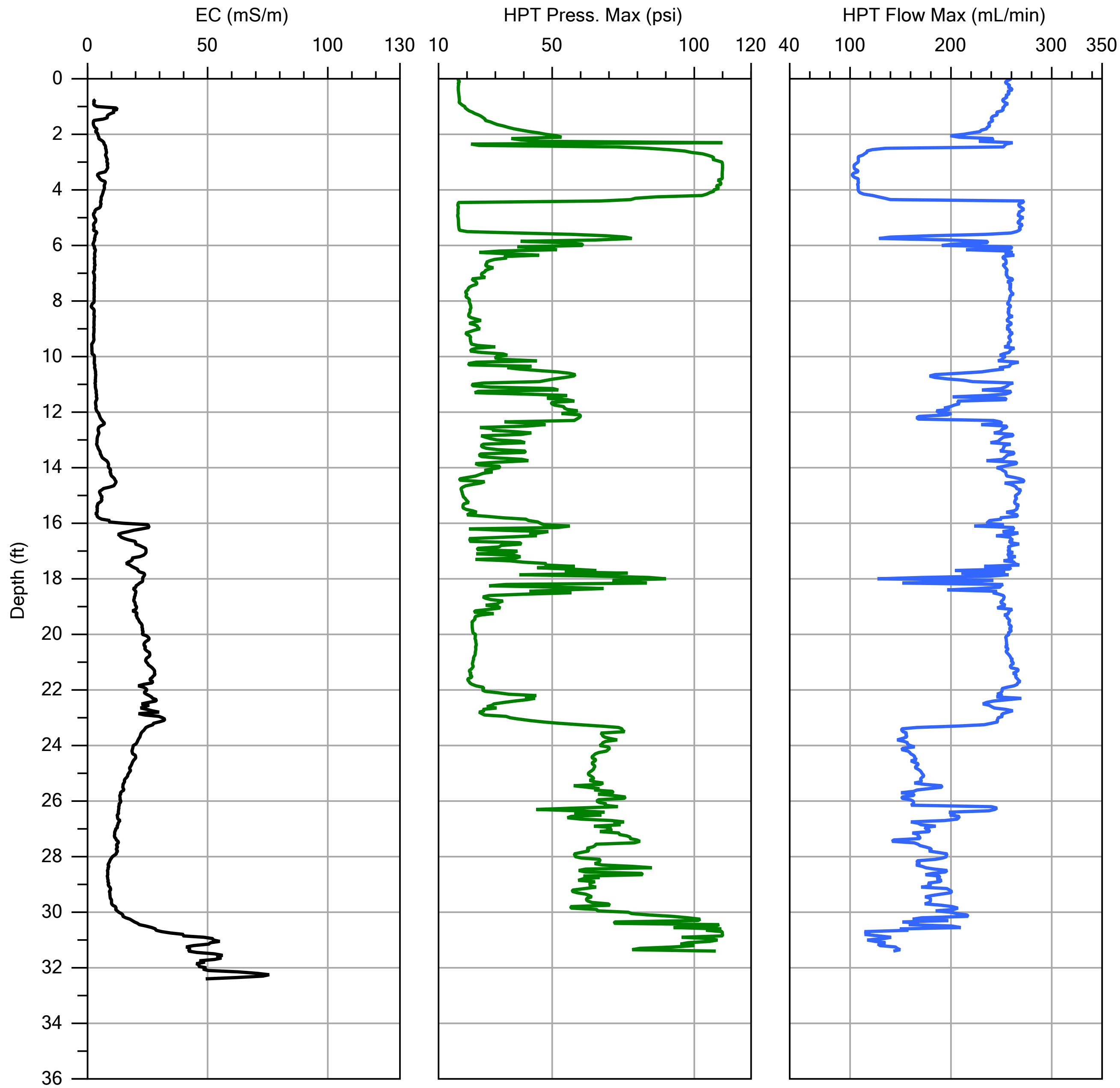
Company: Cascade Technical Services	Operator: EO	Date: 9/18/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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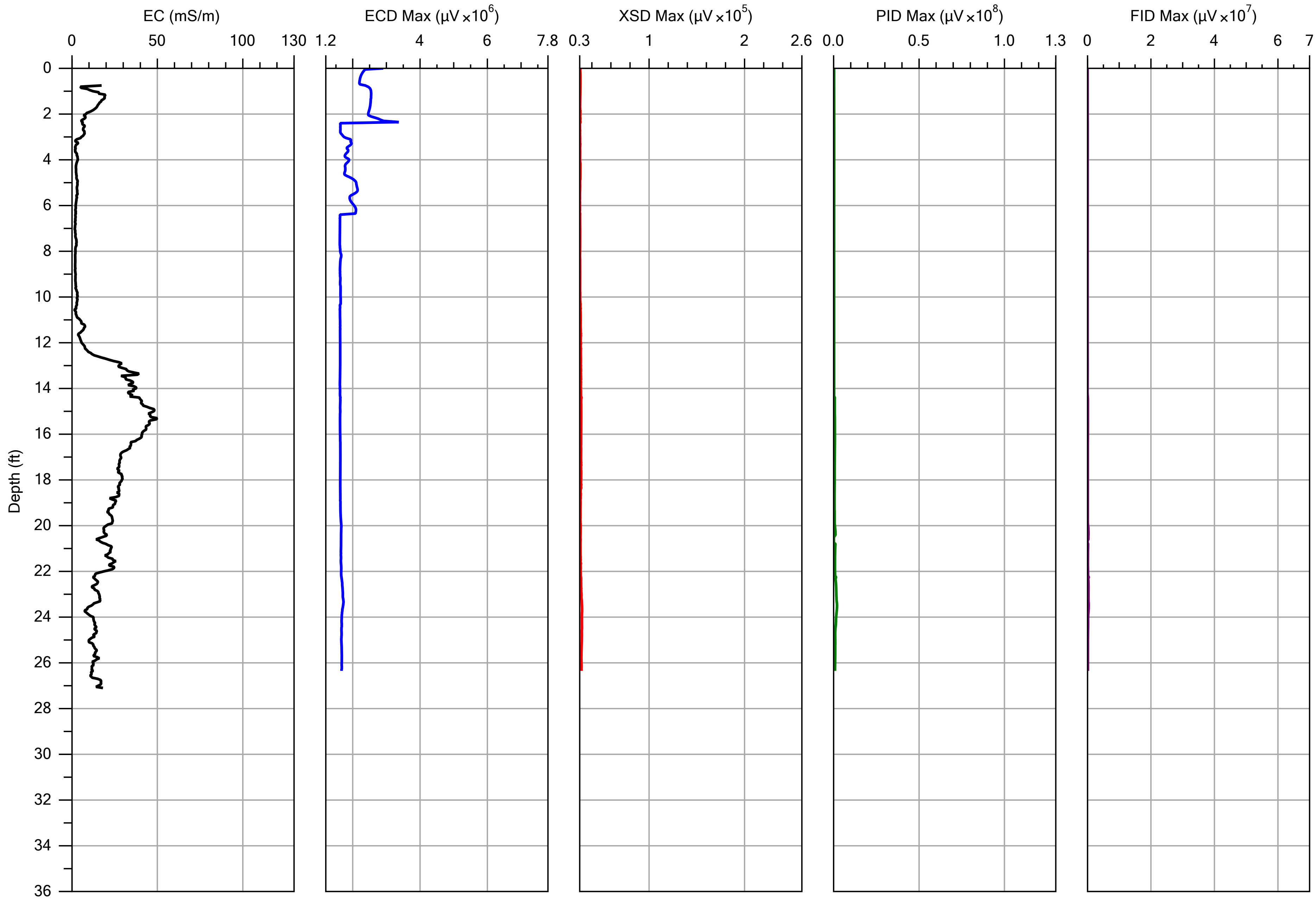
Company: Cascade Technical Services	Operator: EO	Date: 9/18/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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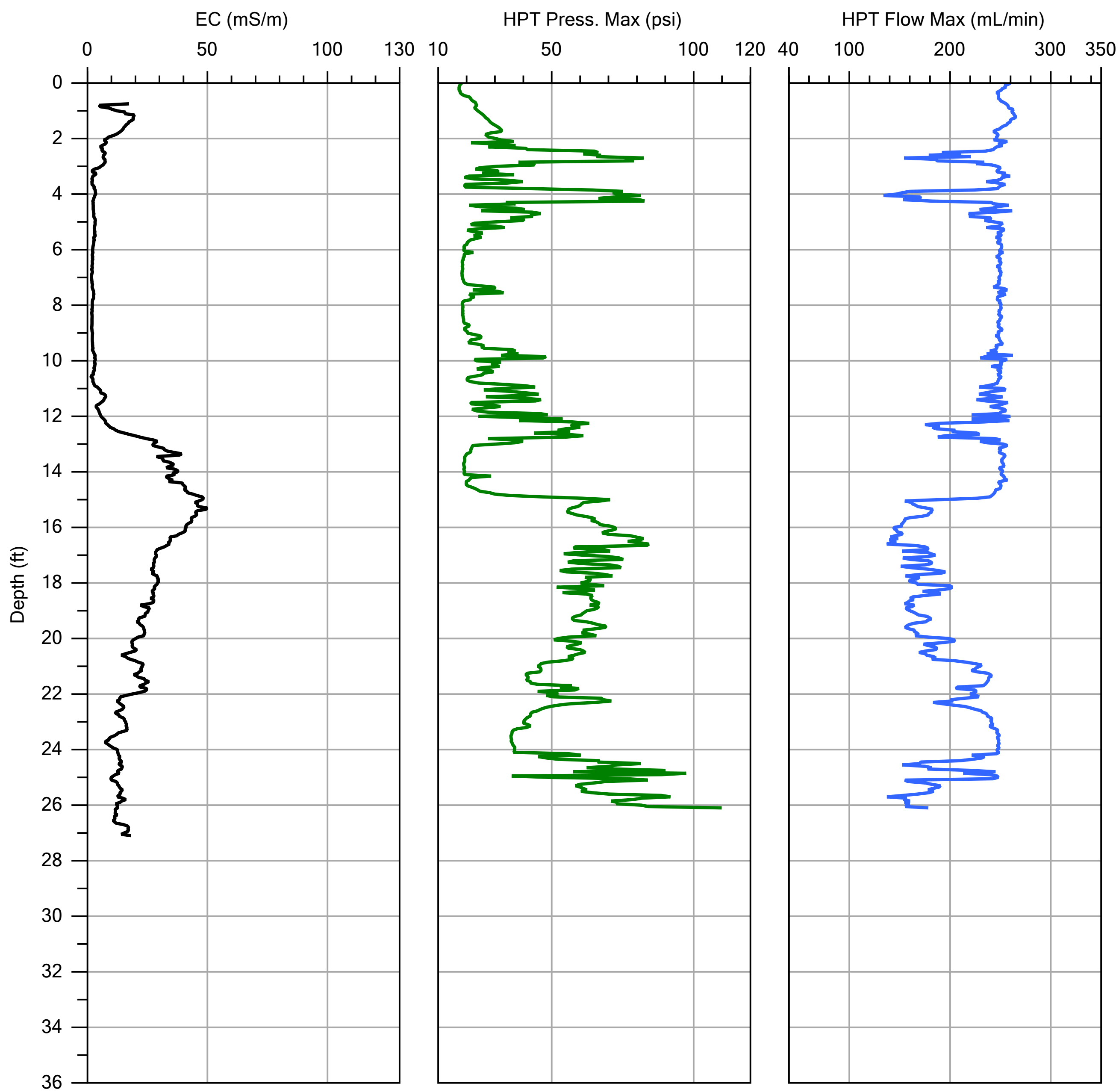
Company: Cascade Technical Services	Operator: EO	Date: 9/18/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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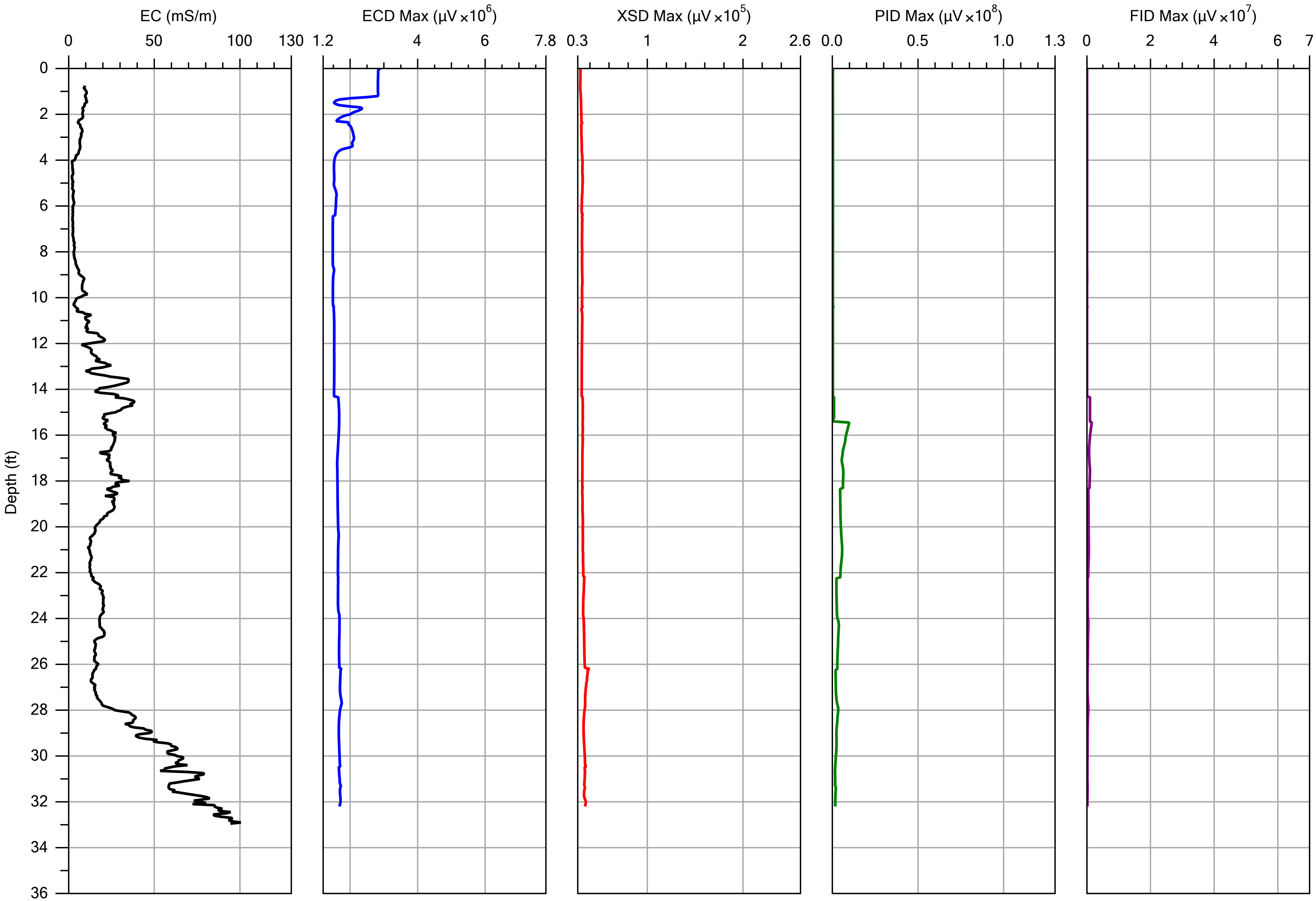
Company: Cascade Technical Services	Operator: EO	Date: 9/18/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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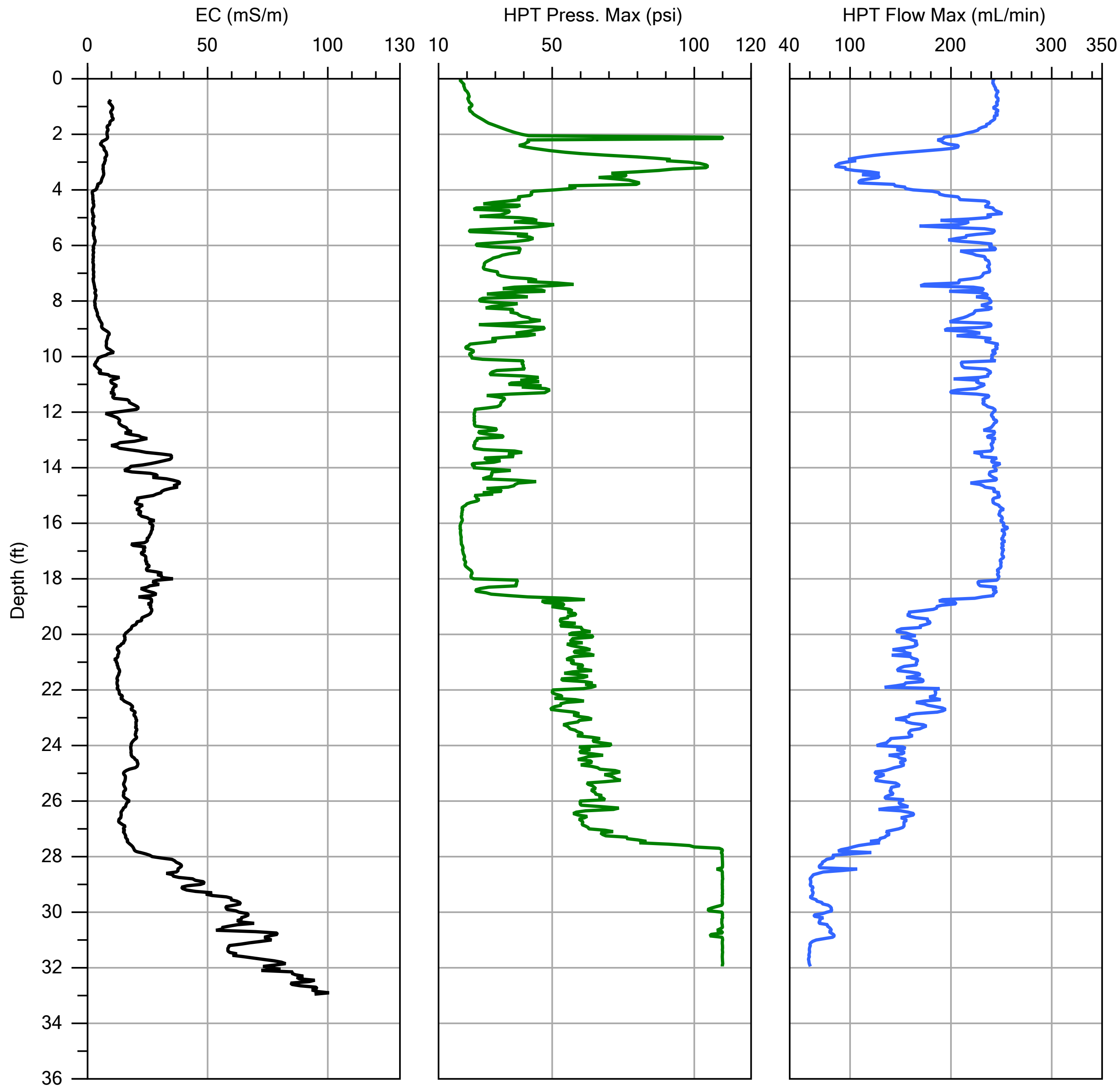
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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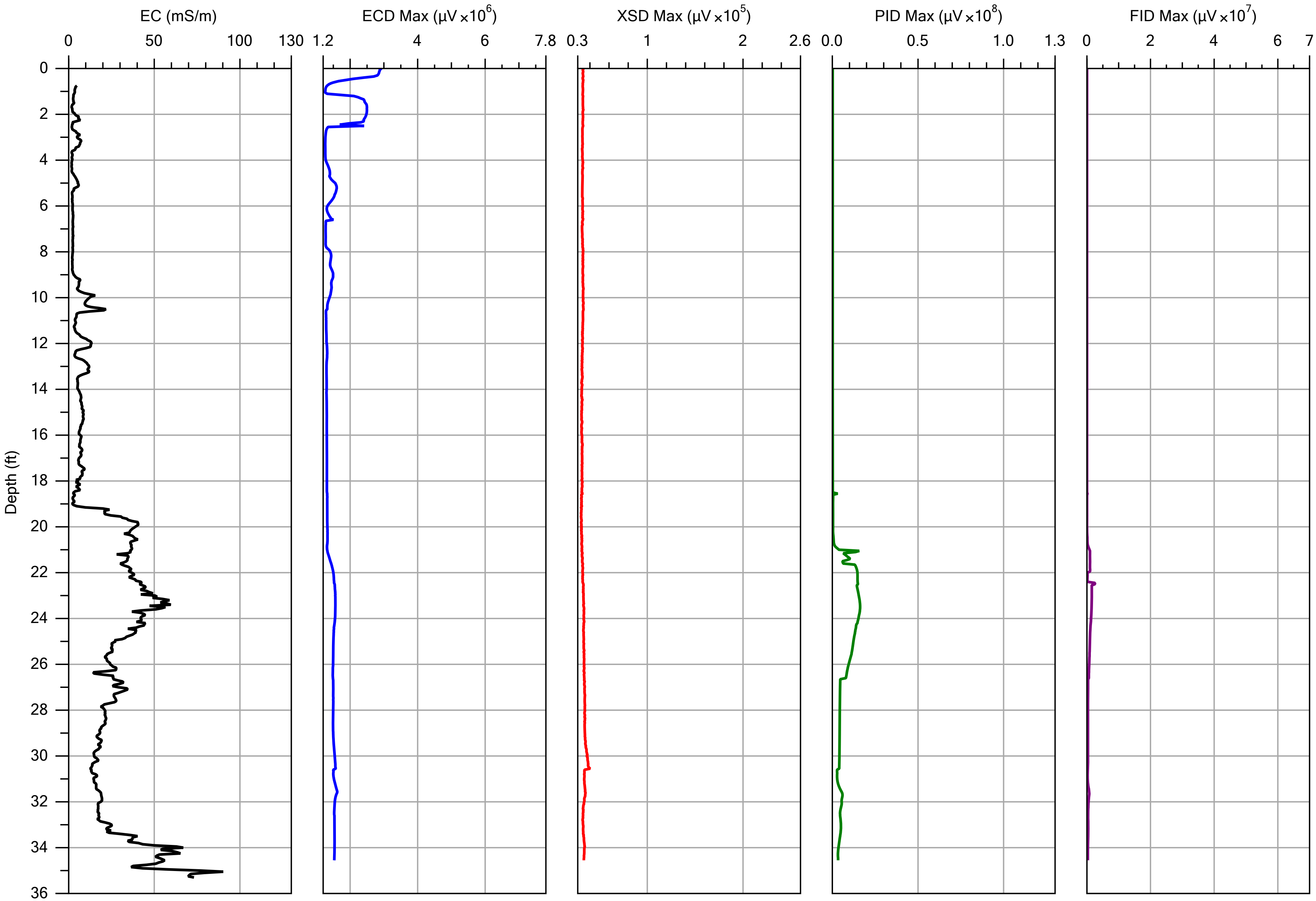
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



CASCADE
DRILLING | TECHNICAL SERVICES
EXCELLENCE ON EVERY LEVEL™

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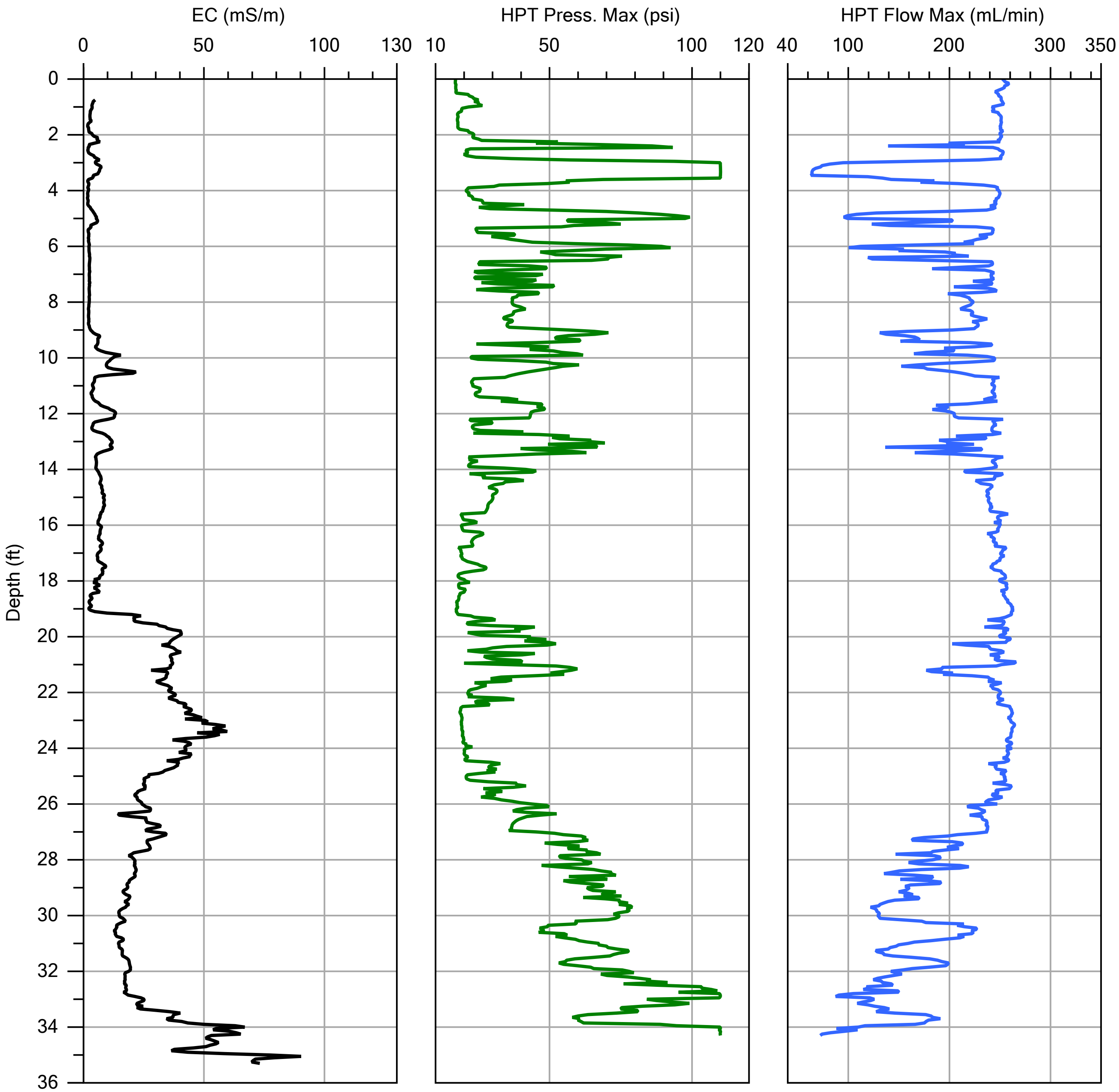
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



CASCADE DRILLING | TECHNICAL SERVICES EXCELLENCE ON EVERY LEVEL™

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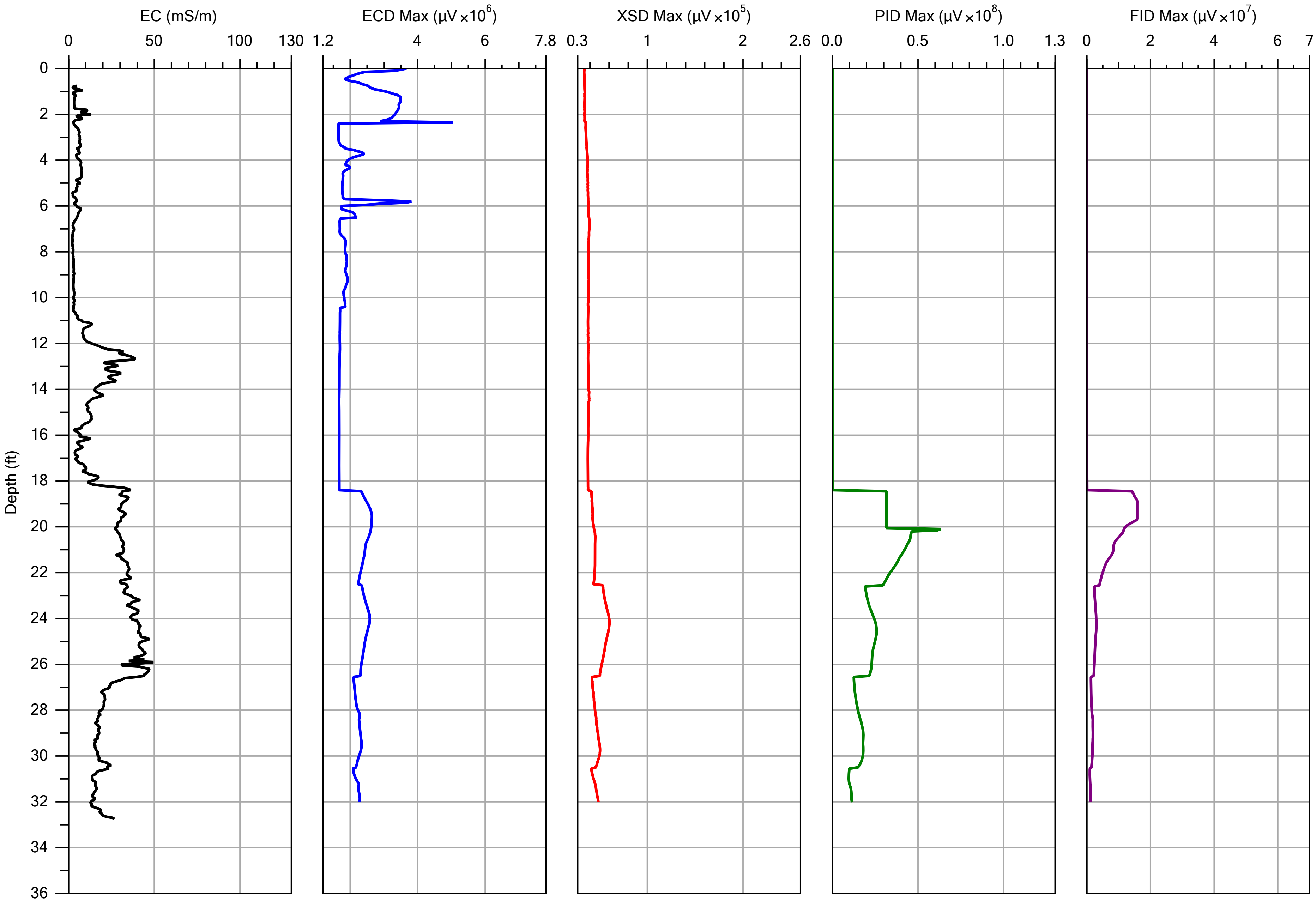
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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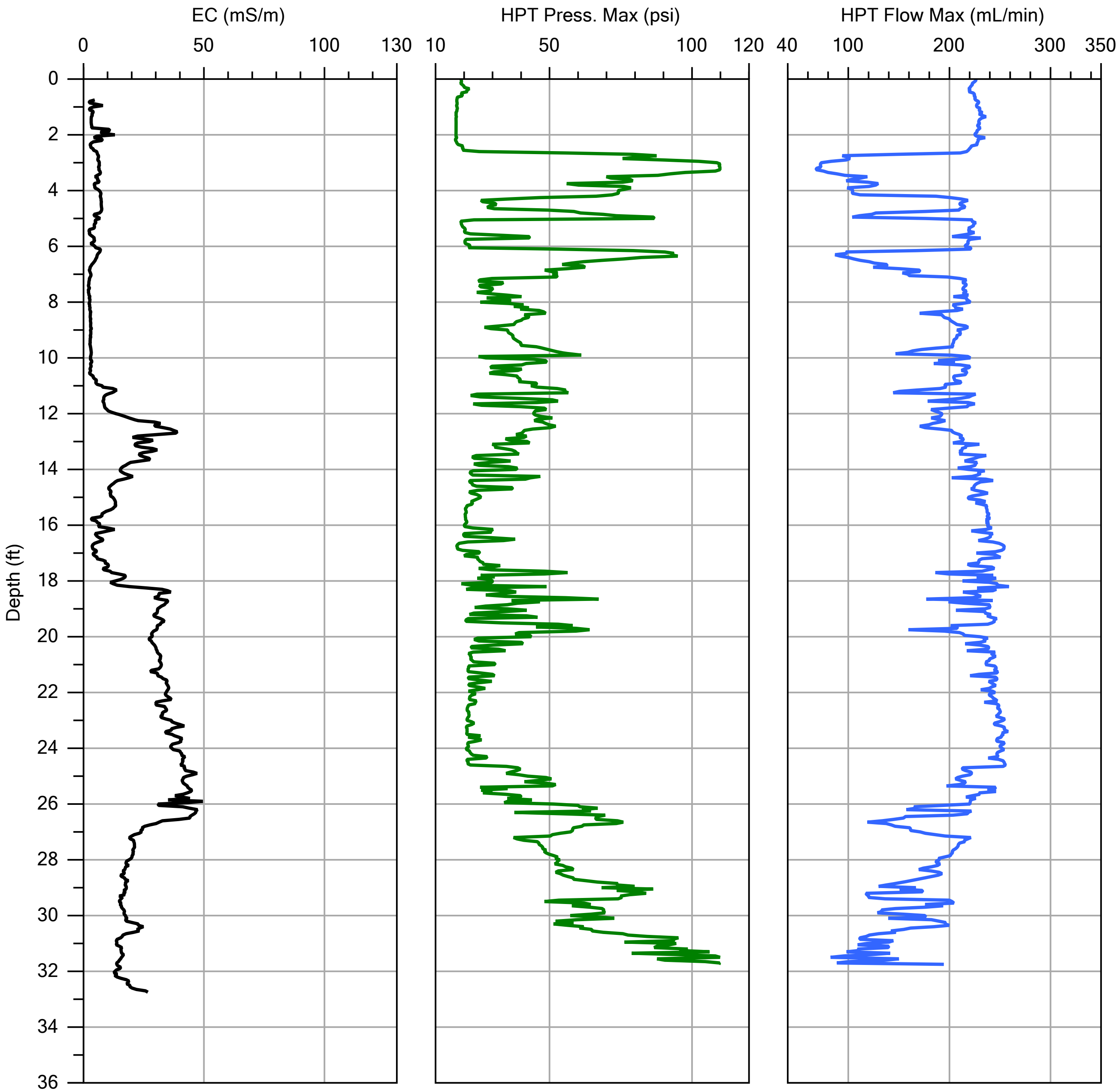
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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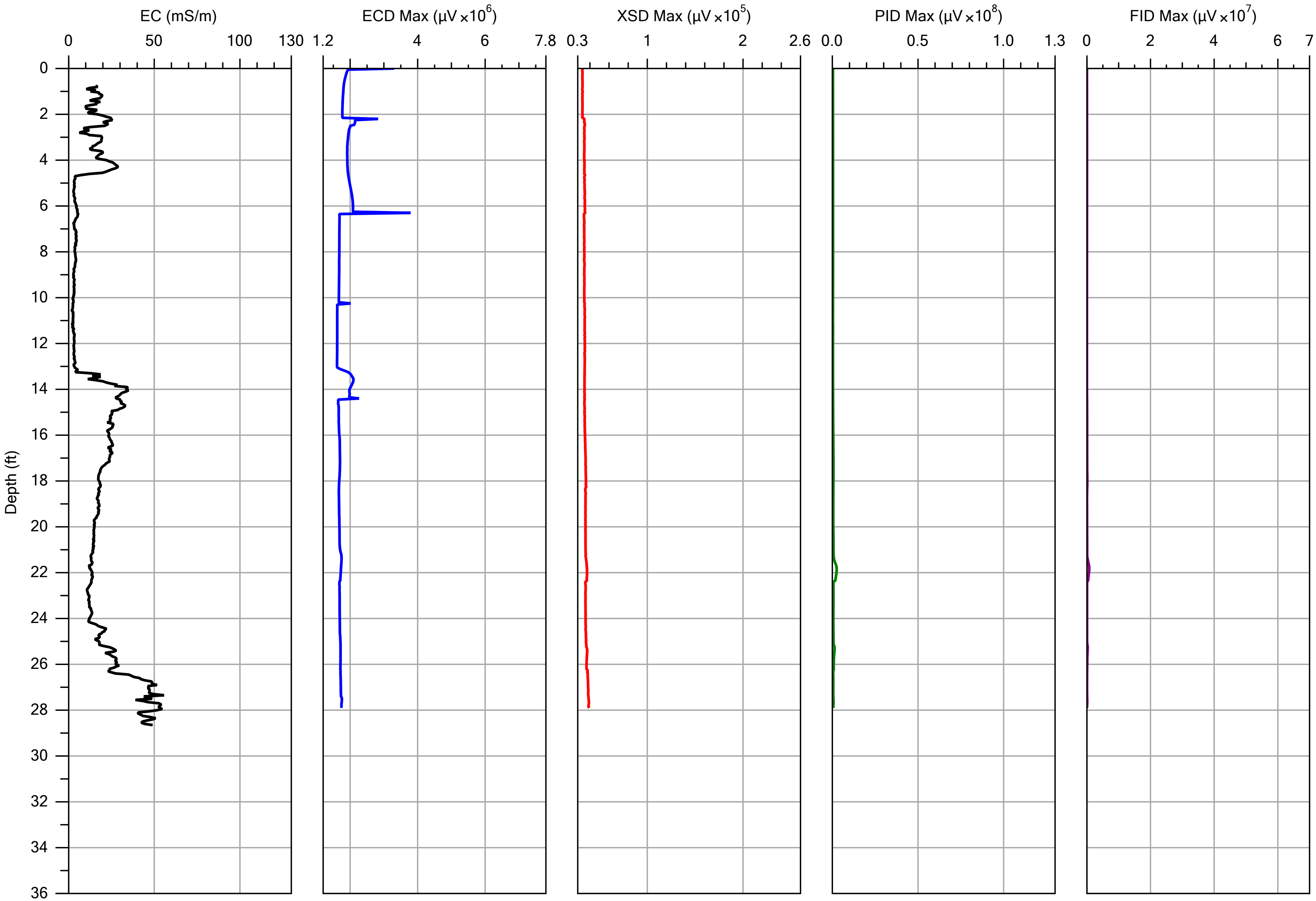
		File: MIHPT-08.MHP
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



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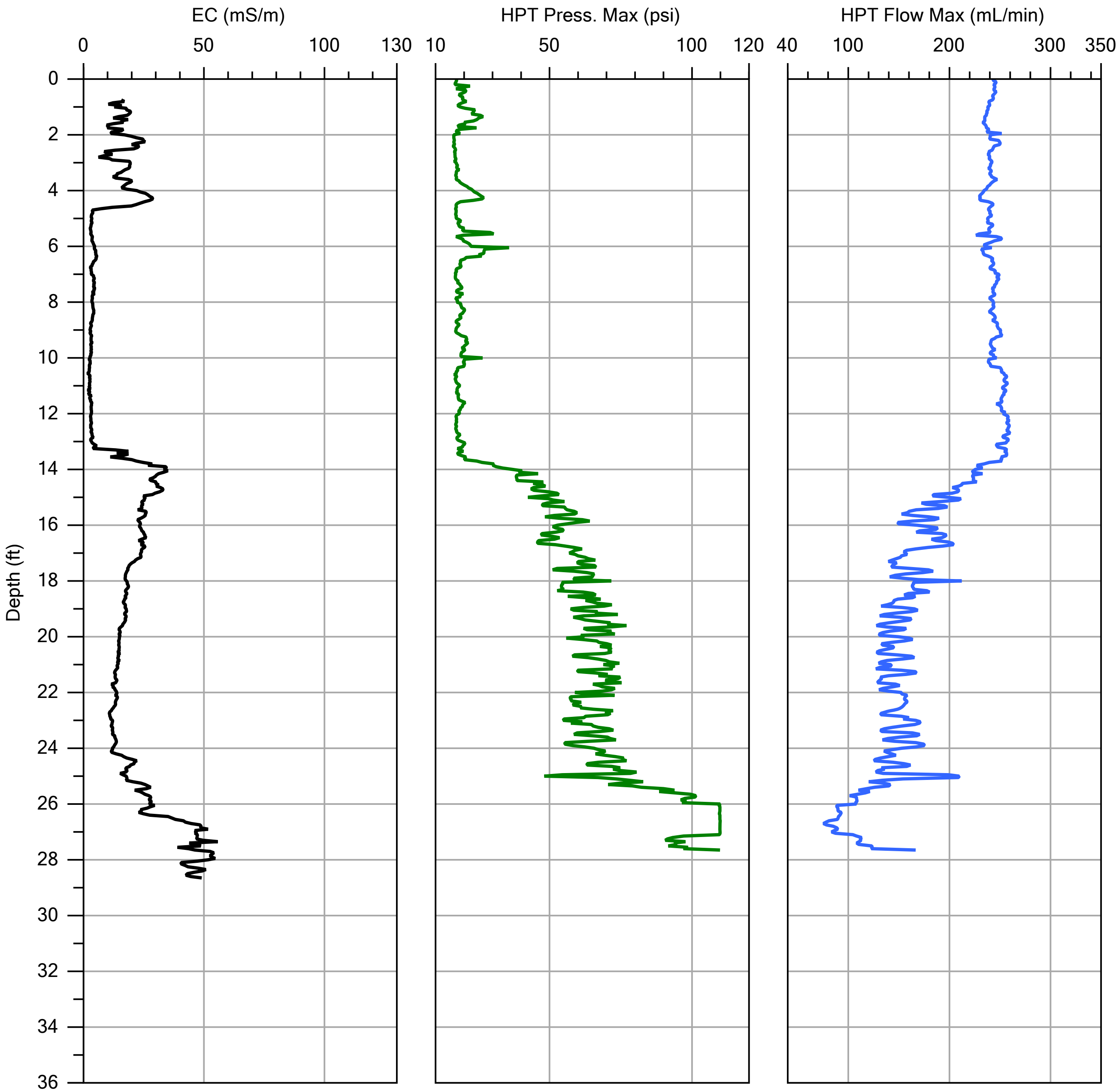
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:



CASCADE
DRILLING | TECHNICAL SERVICES
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		File: MIHPT-09.MHP
Company: Cascade Technical Services	Operator: EO	Date: 9/19/2017
Project ID: 202.17.1105	Client: WSP USA	Location:

Reference Material

The sections below provide information regarding the Cascade Personnel present at the site during the field activities, the specific equipment used during field activities, and background information on the MIP and HPT systems.

Cascade Personnel

The following personnel were present during field activities at the Site:

- Mr. Ethan Olson, Cascade Technical Services (HRSC Technician)
- Mr. John Dixon, Cascade Technical Services (DPT Operator)

Equipment

The following equipment was utilized during field activities at this site:

- Geoprobe 78 Series Direct Push Drill Rig
- MIP Controller (Nitrogen Flow and Heater)
- Geoprobe FI 6000 Computer
- HP Model 5890 Gas Chromatograph
- K6300 HPT Controller
- Electrical Conductivity
- ECD (Electron Capture Detector)
- XSD (Halogen Specific Detector)
- PID (Photo Ionization Detector) 10.2 eV Lamp
- FID (Flame Ionization Detector)
- 150' MIP/HPT Trunkline
- 1.75" O.D. MIHPT Probe
- 1.75" O.D. Drive Rods
- Ultra-High Purity Nitrogen
- Ultra-High Purity Hydrogen

MIP System Overview

The MIP is commonly used for quickly determining the locations of volatile organic compound (VOC) source zones and plumes. The MIP is most valuable in terms of its ability to provide “spatial correspondence”, meaning that where the MIP detector response show peaks, there is likely to be elevated soil and groundwater concentrations. The MIP can also be used to provide extremely valuable data to streamline subsequent investigative tasks and improve the overall efficiency and accuracy of the site investigation. Vertical profiles, cross sectional views and 3D images of contaminant distribution can all be produced from the electronic data generated by the MIP logs. The unique capability of providing reliable, real-time information allows for informed and timely decision making in the field. The MIP works by heating the soils and groundwater adjacent to the probe to 120 degrees C. This volatilizes the VOCs and allows the VOCs to transfer through a Teflon membrane via a combination of concentration and pressure gradients. These VOCs are then swept into a nitrogen gas loop that carries these vapors to a series of detectors housed at the surface. Continuous chemical profiles are generated from each hole. Electrical conductivity of the soil is also measured and these logs can be compared to the chemical logs to better understand the relationship between the lithology and the contaminant distribution. The MIP technology is only appropriate for VOCs. The following section discusses the various detection systems that are commonly used with the MIP system.

Detector Overview

- ECD – Electron Capture Detector uses a radioactive Beta emitter (electrons) to ionize some of the carrier gas and produce a current between a biased pair of electrodes. When organic molecules contain electronegative functional groups, such as halogens, phosphorous, and nitro groups pass by the detector, they capture some of the electrons and reduce the current measured between the electrodes.
- XSD – The Halogen Specific Detector converts compounds containing halogens to their oxidation products and free halogen atoms by oxidative pyrolysis. These halogen atoms are adsorbed onto the activated platinum surface of the detector probe assembly resulting in an increase thermionic emission. This emission current provides a corresponding voltage that is measured via an electrometer circuit in the detector controller.
- PID – Photo Ionization Detector sample stream flows through the detector's reaction chamber where it is continuously irradiated with high energy ultraviolet light. When compounds are present that have a lower ionization potential than that of the irradiation energy (10.2 electron volts with standard lamp) they are ionized. The ions formed are collected in an electrical field, producing an ion current that is proportional to compound concentration. The ion current is amplified and output by the gas chromatograph's electrometer.
- FID – Flame Ionization Detector consists of a hydrogen / air flame and a collector plate. The effluent from the GC (trunkline) passes through the flame, which breaks down organic molecules and produces ions. The ions are collected on a biased electrode and produce an electric signal.

MIP Data Collection

- Depth - Data is collected every 0.05 feet, or twenty points per foot.
- Electrical Conductivity - Electrical Conductivity data is measured/collected in milli-siemens per Meter (ms/M). The conductivity of soils is different for each type of media. Finer grained sediments, such as silts or clays, will typically have a higher EC signal. While coarser grained sediments, sands and gravel, will typically have a lower EC signal.
- Rate of Penetration - Rate of penetration (ROP) is measured/collected in feet per minute (ft/min). Speed is an indication of the advancement rate of the MIP probe. In order to allow

for adequate heating of the MIP tooling, the MIP's ROP should not exceed one foot per minute.

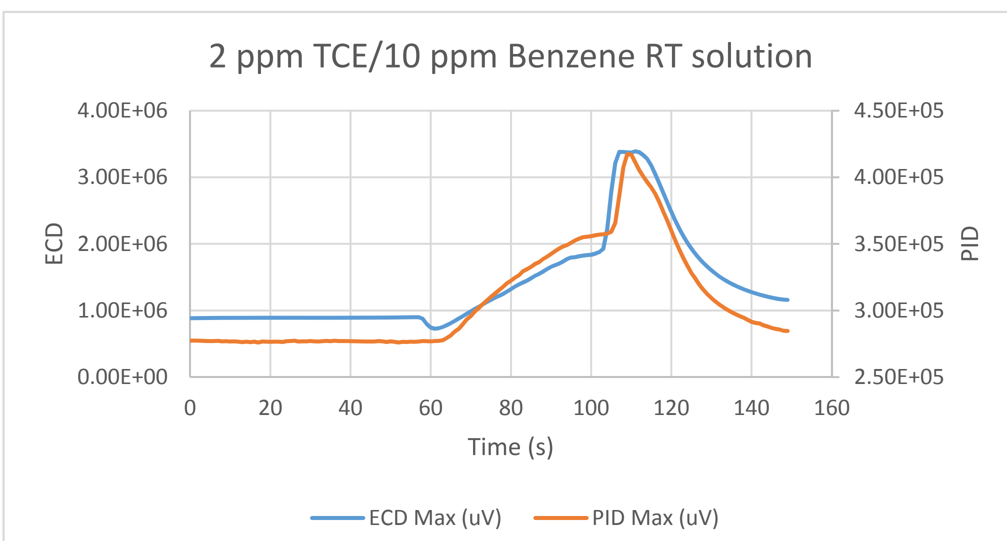
- Temperature - Temperature data is measured/collected in Degrees Celsius. Temperature is an indication of the physical temperature of the MIP block. Minimum and Maximum temperature is collected at each vertical interval. Cascade's temperature protocol indicates that the MIP probe temperature shall maintain a minimum temperature of 90 Degrees Celsius.
- Pressure - Pressure data is measured/collected in PSI. The pressure readings represent the pressure being delivered to the MIP's nitrogen gas line. Deviations greater than of 1.5 PSI outside of the starting pressure indicate a system leak or obstruction is present.
- Detector (ECD, XSD, PID, FID) - Detector responses are measured/collected in micro Volts (uV). Detector responses are an indication of relative contaminant responses. Minimum and Maximum detector responses are collected at each vertical interval.

Response Testing

Response testing (RT) is an integral part of ensuring the quality of data from the MIP system. Response testing is conducted before and after each log. This ensures the validity of the data and the integrity of the system. The RT provides a traceable indication that the MIP system detectors are adequately responding and allows the carrier gas trip time to be calculated on the physical components of the system.

Cascade uses acceptance criteria to evaluate the RTs. The acceptable criteria for an RT is defined for specified concentrations of RT solution and a specified N2 trunkline flow rate. Documenting the RTs will provide a level of quality assurance for each MIP project and will also allow operators and data reviewers to identify systems in need of maintenance.

The trip time is measured by recording the time between the moment when the VOA is placed over the membrane and the response of the detectors, as viewed on the MIP data acquisition unit. The baseline and peak response value are also recorded for comparison with other MIP response tests. The trip time is entered manually into the data acquisition system account for the time it takes for compounds in the subsurface to travel the length of the trunkline during the MIP boring.



HPT System Overview

The HPT system is designed to evaluate the hydraulic behavior of unconsolidated materials. As the probe is pushed or hammered at 2cm/s, clean water is injected through a screen on the side of the HPT probe at a flow rate usually less than 300 mL/min. The injection pressure, which is monitored and plotted with depth, is an indication of the hydraulic properties of the soil. A relatively low pressure response indicates a relatively large grain size, and the ability to easily transmit water. However, a relatively high pressure response indicates a relatively small grain size, which correlates with the inability to transmit water.

HPT Data Collection

The HPT system collects depth, electrical conductivity, advancement rate, hydraulic pressure, and flow information. Additional detail regarding each of these parameters is provided below.

- Depth - Data is collected every 0.05 feet, or twenty points per foot.
- Electrical Conductivity - Electrical Conductivity (EC) data is collected in milli-siemens per meter (ms/M). The conductivity of soils is different for each type of media. Finer grained sediments, such as silts or clays, will typically have a higher EC signal. While coarser grained sediments, sands and gravel, will typically have a lower EC signal. Rate of penetration (ROP) – ROP is collected in units of feet per minute (ft/min). ROP of the HPT probe can vary due to operator advancement and soil types encountered.
- Pressure - Pressure data is collected in pounds per square inch (PSI). Pressure is an indication of hydraulic pressure applied to the subsurface by the HPT system. The system collects both the minimum and maximum pressures over each vertical interval.
- Flow - Flow data is collected in milliliters per minute (mL/min). Flow is an indication of the rate water that is pumped out of the membrane at the HPT probe. The system collects both the minimum and maximum flow over each vertical interval.
- Estimated Hydraulic Conductivity (est. K) – Hydraulic conductivity, symbolically represented as K, is an in-situ property that describes the ease with which water can move through pore spaces or fractures. It is dependent on the intrinsic permeability of the material and on the degree of saturation. With respect to the HPT system, the estimated K values are only applicable to the saturated portion of the formation. The estimated K value is calculated using the HPT pressure and flow data. It is also necessary to collect HPT response test data before and after each boring. Additionally, it is necessary to conduct at least one pressure dissipation test during the logging operation, below the static water table level.

HPT Reference Testing and Dissipation Tests

Reference testing is done to ensure that the HPT pressure transducer is working correctly and to evaluate the condition of the HPT injection screen. The HPT reference test also calculates atmospheric pressure which is required to obtain static water level readings and to determine the estimated K values for the log. HPT reference test utilizes a test tube to specifications such that a valve is located 6 inches above the HPT injection screen and the top of the tube is 6 inches above the valve. When the tube is filled completely with water, the 12 inches of water will supply an additional 0.433 psi of pressure on the injection screen (in addition to atmospheric pressure). When the valve (located 6 inches from the top of the tube and 6 inches from the injection screen) is opened, only 0.217 psi of additional pressure is applied to the HPT injection screen. Therefore, the accuracy of the pressure transducer can be assessed by comparing the pressure reading when the tube is filled and when the tube is filled to the valve. There should be a 0.217 psi difference, this value is checked with and without flow. A tolerance of ±10% is applied for a passing test.

Dissipation tests are conducted to determine the additional static pressure added to the HPT pressure values from water in the formation. To conduct a dissipation test, advancement of the tooling is stopped, the HPT pump is stopped, and flow drops to zero. The pressure applied to the HPT pressure transducer by the injection of water into the formation begins to dissipate. This pressure should dissipate to a value equal to atmospheric pressure plus the static water pressure applied by water in the formation. In post-processing of the HPT log, the dissipation value and the atmospheric pressure determined during HPT reference testing can be used to remove the influence of atmospheric pressure and formational static water pressure from the HPT pressure values. Thereby correcting the HPT pressure to values that only indicates the hydraulic properties of the subsurface material.

ENCLOSURE B

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

October 06, 2017

Chris Cresci
WSP USA
13530 Dulles Technology Drive
Suite 300
Herndon, VA 20171

RE: Project: Hess Towson
Pace Project No.: 30230598

Dear Chris Cresci:

Enclosed are the analytical results for sample(s) received by the laboratory on September 20, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Timothy Reed for
Penny Westrick
penny.westrick@pacelabs.com
724 850-5610
Project Manager

Enclosures

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project:	Hess Towson
Pace Project No.:	30230598

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Pace Analytical Services, LLC
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Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: MW-4 **Lab ID: 30230598001** Collected: 09/20/17 11:25 Received: 09/20/17 20:10 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**2.0**	mg/L	0.52	5	09/24/17 12:09	10/04/17 14:08		1c
Surrogates								
o-Terphenyl (S)	43	%	35-101	5	09/24/17 12:09	10/04/17 14:08	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**1710**	ug/L	200	1		10/03/17 17:48		
Surrogates								
4-Bromofluorobenzene (S)	112	%	72-124	1		10/03/17 17:48	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	**82.6**	ug/L	1.0	1		09/26/17 09:06	71-43-2	
Ethylbenzene	**269**	ug/L	1.0	1		09/26/17 09:06	100-41-4	
Toluene	**12.5**	ug/L	1.0	1		09/26/17 09:06	108-88-3	
Xylene (Total)	**56.1**	ug/L	3.0	1		09/26/17 09:06	1330-20-7	
Surrogates								
Toluene-d8 (S)	97	%	80-120	1		09/26/17 09:06	2037-26-5	
4-Bromofluorobenzene (S)	103	%	79-129	1		09/26/17 09:06	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	80-120	1		09/26/17 09:06	17060-07-0	
Dibromofluoromethane (S)	97	%	80-120	1		09/26/17 09:06	1868-53-7	
2320B Alkalinity	Analytical Method: SM2320B-97							
Alkalinity,Total (CaCO3 pH4.5)	**242**	mg/L	10.0	1		10/02/17 17:35		
4500S2F Sulfide, Iodometric	Analytical Method: SM4500S2F-00							
Sulfide	ND	mg/L	1.0	1		09/25/17 18:23	18496-25-8	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	ND	mg/L	0.50	1		10/02/17 10:36	14808-79-8	

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(724)850-5600

ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: YP-1	Lab ID: 30230598002	Collected: 09/20/17 08:45	Received: 09/20/17 20:10	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**1.3**	mg/L	0.10	1	09/24/17 12:09	10/04/17 00:59		1c
Surrogates								
o-Terphenyl (S)	40	%	35-101	1	09/24/17 12:09	10/04/17 00:59	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**5000**	ug/L	200	1		09/26/17 06:47		
Surrogates								
a,a,a-Trifluorotoluene (S)	92	%	60-158	1		09/26/17 06:47	98-08-8	
4-Bromofluorobenzene (S)	104	%	72-124	1		09/26/17 06:47	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	**7.6**	ug/L	1.0	1		09/26/17 09:33	71-43-2	
Ethylbenzene	**539**	ug/L	10.0	10		09/27/17 00:47	100-41-4	
Toluene	**26.5**	ug/L	1.0	1		09/26/17 09:33	108-88-3	
Xylene (Total)	**439**	ug/L	3.0	1		09/26/17 09:33	1330-20-7	
Surrogates								
Toluene-d8 (S)	99	%	80-120	1		09/26/17 09:33	2037-26-5	
4-Bromofluorobenzene (S)	104	%	79-129	1		09/26/17 09:33	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	80-120	1		09/26/17 09:33	17060-07-0	
Dibromofluoromethane (S)	91	%	80-120	1		09/26/17 09:33	1868-53-7	
2320B Alkalinity	Analytical Method: SM2320B-97							
Alkalinity,Total (CaCO3 pH4.5)	**188**	mg/L	10.0	1		10/02/17 17:42		
4500S2F Sulfide, Iodometric	Analytical Method: SM4500S2F-00							
Sulfide	ND	mg/L	1.0	1		09/25/17 18:24	18496-25-8	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	ND	mg/L	0.50	1		10/02/17 10:52	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: YMW-7 | **Lab ID: 30230598003** | Collected: 09/19/17 13:20 | Received: 09/20/17 20:10 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**1.3**	mg/L	0.10	1	09/24/17 12:09	10/04/17 00:13		1c
Surrogates								
o-Terphenyl (S)	51	%	35-101	1	09/24/17 12:09	10/04/17 00:13	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**7640**	ug/L	2000	10		10/03/17 16:49		
Surrogates								
4-Bromofluorobenzene (S)	112	%	72-124	10		10/03/17 16:49	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	**64.1**	ug/L	1.0	1		09/26/17 10:11	71-43-2	
Ethylbenzene	**274**	ug/L	1.0	1		09/26/17 10:11	100-41-4	
Toluene	**68.0**	ug/L	1.0	1		09/26/17 10:11	108-88-3	
Xylene (Total)	**994**	ug/L	3.0	1		09/26/17 10:11	1330-20-7	
Surrogates								
Toluene-d8 (S)	96	%	80-120	1		09/26/17 10:11	2037-26-5	
4-Bromofluorobenzene (S)	106	%	79-129	1		09/26/17 10:11	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	80-120	1		09/26/17 10:11	17060-07-0	
Dibromofluoromethane (S)	91	%	80-120	1		09/26/17 10:11	1868-53-7	
2320B Alkalinity	Analytical Method: SM2320B-97							
Alkalinity,Total (CaCO3 pH4.5)	**128**	mg/L	10.0	1		10/02/17 17:45		
4500S2F Sulfide, Iodometric	Analytical Method: SM4500S2F-00							
Sulfide	ND	mg/L	1.0	1		09/25/17 18:21	18496-25-8	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	ND	mg/L	0.50	1		10/02/17 11:09	14808-79-8	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: YMW-3 | **Lab ID: 30230598004** | Collected: 09/19/17 11:10 | Received: 09/20/17 20:10 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	ND	mg/L	0.10	1	09/24/17 12:09	10/04/17 00:20		1c
Surrogates								
o-Terphenyl (S)	54	%	35-101	1	09/24/17 12:09	10/04/17 00:20	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	ND	ug/L	200	1		09/26/17 05:28		
Surrogates								
a,a,a-Trifluorotoluene (S)	74	%	60-158	1		09/26/17 05:28	98-08-8	
4-Bromofluorobenzene (S)	114	%	72-124	1		09/26/17 05:28	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		09/26/17 08:12	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		09/26/17 08:12	100-41-4	
Toluene	ND	ug/L	1.0	1		09/26/17 08:12	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		09/26/17 08:12	1330-20-7	
Surrogates								
Toluene-d8 (S)	94	%	80-120	1		09/26/17 08:12	2037-26-5	
4-Bromofluorobenzene (S)	102	%	79-129	1		09/26/17 08:12	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	80-120	1		09/26/17 08:12	17060-07-0	
Dibromofluoromethane (S)	96	%	80-120	1		09/26/17 08:12	1868-53-7	
2320B Alkalinity	Analytical Method: SM2320B-97							
Alkalinity,Total (CaCO3 pH4.5)	**24.0**	mg/L	10.0	1		10/02/17 17:47		
4500S2F Sulfide, Iodometric	Analytical Method: SM4500S2F-00							
Sulfide	ND	mg/L	1.0	1		09/25/17 18:22	18496-25-8	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**65.2**	mg/L	50.0	100		09/29/17 23:10	14808-79-8	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: EB-091917 **Lab ID: 30230598005** Collected: 09/19/17 11:40 Received: 09/20/17 20:10 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	ND	mg/L	0.10	1	09/24/17 12:09	10/04/17 00:35		1c
Surrogates								
o-Terphenyl (S)	40	%	35-101	1	09/24/17 12:09	10/04/17 00:35	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	ND	ug/L	200	1		10/03/17 17:09		
Surrogates								
4-Bromofluorobenzene (S)	113	%	72-124	1		10/03/17 17:09	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		09/26/17 03:41	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		09/26/17 03:41	100-41-4	
Toluene	ND	ug/L	1.0	1		09/26/17 03:41	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		09/26/17 03:41	1330-20-7	
Surrogates								
Toluene-d8 (S)	95	%	80-120	1		09/26/17 03:41	2037-26-5	
4-Bromofluorobenzene (S)	103	%	79-129	1		09/26/17 03:41	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	80-120	1		09/26/17 03:41	17060-07-0	
Dibromofluoromethane (S)	99	%	80-120	1		09/26/17 03:41	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: Trip Blank **Lab ID: 30230598006** Collected: 09/19/17 00:01 Received: 09/20/17 20:10 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		09/26/17 03:14	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		09/26/17 03:14	100-41-4	
Toluene	ND	ug/L	1.0	1		09/26/17 03:14	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		09/26/17 03:14	1330-20-7	
Surrogates								
Toluene-d8 (S)	96	%	80-120	1		09/26/17 03:14	2037-26-5	
4-Bromofluorobenzene (S)	102	%	79-129	1		09/26/17 03:14	460-00-4	
1,2-Dichloroethane-d4 (S)	102	%	80-120	1		09/26/17 03:14	17060-07-0	
Dibromofluoromethane (S)	98	%	80-120	1		09/26/17 03:14	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: MIP-2 (25-30) **Lab ID: 30230598007** Collected: 09/20/17 10:15 Received: 09/20/17 20:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**803**	mg/kg	159	20	10/03/17 08:56	10/04/17 19:33		
Surrogates								
o-Terphenyl (S)	236	%	24-123	20	10/03/17 08:56	10/04/17 19:33	84-15-1	S4
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
Gasoline Range Organics	**1220**	mg/kg	120	10	09/25/17 12:32	09/27/17 15:35		B,L1
Surrogates								
a,a,a-Trifluorotoluene (S)	88	%	10-174	10	09/25/17 12:32	09/27/17 15:35	98-08-8	
4-Bromofluorobenzene (S)	89	%	85-109	10	09/25/17 12:32	09/27/17 15:35	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	209	50	10/03/17 10:30	10/03/17 19:15	71-43-2	1c
Ethylbenzene	**20900**	ug/kg	2090	500	10/03/17 10:30	10/04/17 13:43	100-41-4	1c
Toluene	**1240**	ug/kg	209	50	10/03/17 10:30	10/03/17 19:15	108-88-3	1c
Xylene (Total)	**113000**	ug/kg	6270	500	10/03/17 10:30	10/04/17 13:43	1330-20-7	
Surrogates								
Toluene-d8 (S)	113	%	76-124	50	10/03/17 10:30	10/03/17 19:15	2037-26-5	
4-Bromofluorobenzene (S)	104	%	70-133	50	10/03/17 10:30	10/03/17 19:15	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	74-131	50	10/03/17 10:30	10/03/17 19:15	17060-07-0	
Dibromofluoromethane (S)	79	%	71-130	50	10/03/17 10:30	10/03/17 19:15	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**16.5**	%	0.10	1		10/01/17 12:39		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: MIP-2 (GW-25-30) **Lab ID: 30230598008** Collected: 09/20/17 12:25 Received: 09/20/17 20:10 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**2.2**	mg/L	0.55	5	09/24/17 12:09	10/04/17 14:16		1c,A5
Surrogates								
o-Terphenyl (S)	37	%	35-101	5	09/24/17 12:09	10/04/17 14:16	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**8480**	ug/L	2000	10		10/03/17 18:08		
Surrogates								
4-Bromofluorobenzene (S)	111	%	72-124	10		10/03/17 18:08	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		09/26/17 08:39	71-43-2	
Ethylbenzene	**109**	ug/L	1.0	1		09/26/17 08:39	100-41-4	
Toluene	**38.7**	ug/L	1.0	1		09/26/17 08:39	108-88-3	
Xylene (Total)	**652**	ug/L	3.0	1		09/26/17 08:39	1330-20-7	
Surrogates								
Toluene-d8 (S)	97	%	80-120	1		09/26/17 08:39	2037-26-5	
4-Bromofluorobenzene (S)	104	%	79-129	1		09/26/17 08:39	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	80-120	1		09/26/17 08:39	17060-07-0	
Dibromofluoromethane (S)	96	%	80-120	1		09/26/17 08:39	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230598

Sample: MIP-7 (21-26) **Lab ID: 30230598009** Collected: 09/20/17 15:00 Received: 09/20/17 20:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**183**	mg/kg	39.4	5	10/03/17 08:56	10/04/17 19:52		
Surrogates								
o-Terphenyl (S)	59	%	24-123	5	10/03/17 08:56	10/04/17 19:52	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
Gasoline Range Organics	**372**	mg/kg	120	10	09/25/17 12:32	09/27/17 15:55		B,L1
Surrogates								
a,a,a-Trifluorotoluene (S)	138	%	10-174	10	09/25/17 12:32	09/27/17 15:55	98-08-8	
4-Bromofluorobenzene (S)	102	%	85-109	10	09/25/17 12:32	09/27/17 15:55	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	162	50	09/29/17 09:36	09/29/17 20:55	71-43-2	1c
Ethylbenzene	**3440**	ug/kg	162	50	09/29/17 09:36	09/29/17 20:55	100-41-4	1c
Toluene	**265**	ug/kg	162	50	09/29/17 09:36	09/29/17 20:55	108-88-3	1c
Xylene (Total)	**17100**	ug/kg	487	50	09/29/17 09:36	09/29/17 20:55	1330-20-7	
Surrogates								
Toluene-d8 (S)	103	%	76-124	50	09/29/17 09:36	09/29/17 20:55	2037-26-5	
4-Bromofluorobenzene (S)	101	%	70-133	50	09/29/17 09:36	09/29/17 20:55	460-00-4	
1,2-Dichloroethane-d4 (S)	87	%	74-131	50	09/29/17 09:36	09/29/17 20:55	17060-07-0	
Dibromofluoromethane (S)	83	%	71-130	50	09/29/17 09:36	09/29/17 20:55	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**17.0**	%	0.10	1		10/01/17 12:39		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 272875 — Analysis Method: EPA 8015B
QC Batch Method: EPA 5035A/5030B — Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30230598007, 30230598009

METHOD BLANK: 1342818 — Matrix: Solid
Associated Lab Samples: 30230598007, 30230598009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Gasoline Range Organics	mg/kg	ND	10.0	09/25/17 15:37	CH
4-Bromofluorobenzene (S)	%	111	85-109	09/25/17 15:37	ST
a,a,a-Trifluorotoluene (S)	%	99	10-174	09/25/17 15:37	

LABORATORY CONTROL SAMPLE: 1342819

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Gasoline Range Organics	mg/kg	50	61.1	122	71-141	CH,L1
4-Bromofluorobenzene (S)	%			101	85-109	
a,a,a-Trifluorotoluene (S)	%			100	10-174	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1342820 1342821

Parameter	Units	30230586003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Gasoline Range Organics	mg/kg	10.9 U	54.3	54.3	60.4	61.3	109	110	72-141	1	CH
4-Bromofluorobenzene (S)	%						101	101	85-109		
a,a,a-Trifluorotoluene (S)	%						99	103	10-174		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 272925 | Analysis Method: EPA 5030/8015B
QC Batch Method: EPA 5030/8015B | Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30230598002, 30230598004

METHOD BLANK: 1342966 | Matrix: Water
Associated Lab Samples: 30230598002, 30230598004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C06-C10)	ug/L	ND	200	09/26/17 00:13	CH
4-Bromofluorobenzene (S)	%	112	72-124	09/26/17 00:13	
a,a,a-Trifluorotoluene (S)	%	79	60-158	09/26/17 00:13	

LABORATORY CONTROL SAMPLE: 1342967

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	ug/L	1000	979	98	71-141	CH
4-Bromofluorobenzene (S)	%			108	72-124	
a,a,a-Trifluorotoluene (S)	%			111	60-158	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1342968 1342969

Parameter	Units	30230695001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C06-C10)	ug/L	ND	1000	1000	958	1180	93	115	11-165	21	
4-Bromofluorobenzene (S)	%						105	104	72-124		
a,a,a-Trifluorotoluene (S)	%						112	112	60-158		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273768 | Analysis Method: EPA 5030/8015B
QC Batch Method: EPA 5030/8015B | Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30230598001, 30230598003, 30230598005, 30230598008

METHOD BLANK: 1346956 | Matrix: Water
Associated Lab Samples: 30230598001, 30230598003, 30230598005, 30230598008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C06-C10)	ug/L	ND	200	10/03/17 16:10	
4-Bromofluorobenzene (S)	%	112	72-124	10/03/17 16:10	

LABORATORY CONTROL SAMPLE: 1346957

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	ug/L	1000	970	97	71-141	
4-Bromofluorobenzene (S)	%			103	72-124	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1346958 1346959

Parameter	Units	30231469003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C06-C10)	ug/L	ND	1000	1000	824	815	82	81	11-165	1	
4-Bromofluorobenzene (S)	%						103	105	72-124		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273621 Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30230598009

METHOD BLANK: 1345838 Matrix: Solid
Associated Lab Samples: 30230598009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	250	09/29/17 12:47	
Ethylbenzene	ug/kg	ND	250	09/29/17 12:47	
Toluene	ug/kg	ND	250	09/29/17 12:47	
Xylene (Total)	ug/kg	ND	750	09/29/17 12:47	
1,2-Dichloroethane-d4 (S)	%	97	74-131	09/29/17 12:47	
4-Bromofluorobenzene (S)	%	99	70-133	09/29/17 12:47	
Dibromofluoromethane (S)	%	95	71-130	09/29/17 12:47	
Toluene-d8 (S)	%	97	76-124	09/29/17 12:47	

LABORATORY CONTROL SAMPLE: 1345839

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	20	18.1	91	70-130	
Ethylbenzene	ug/kg	20	18.3	91	70-130	
Toluene	ug/kg	20	18.5	93	70-130	
Xylene (Total)	ug/kg	60	58.0	97	70-130	
1,2-Dichloroethane-d4 (S)	%			86	74-131	
4-Bromofluorobenzene (S)	%			99	70-133	
Dibromofluoromethane (S)	%			98	71-130	
Toluene-d8 (S)	%			101	76-124	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273981 | Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A | Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30230598007

METHOD BLANK: 1347690 | Matrix: Solid
Associated Lab Samples: 30230598007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	250	10/03/17 10:26	
Ethylbenzene	ug/kg	ND	250	10/03/17 10:26	
Toluene	ug/kg	ND	250	10/03/17 10:26	
Xylene (Total)	ug/kg	ND	750	10/03/17 10:26	
1,2-Dichloroethane-d4 (S)	%	101	74-131	10/03/17 10:26	
4-Bromofluorobenzene (S)	%	96	70-133	10/03/17 10:26	
Dibromofluoromethane (S)	%	100	71-130	10/03/17 10:26	
Toluene-d8 (S)	%	93	76-124	10/03/17 10:26	

LABORATORY CONTROL SAMPLE: 1347691

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	20	21.1	106	70-130	
Ethylbenzene	ug/kg	20	21.3	106	70-130	
Toluene	ug/kg	20	20.3	102	70-130	
Xylene (Total)	ug/kg	60	63.3	106	70-130	
1,2-Dichloroethane-d4 (S)	%			98	74-131	
4-Bromofluorobenzene (S)	%			98	70-133	
Dibromofluoromethane (S)	%			104	71-130	
Toluene-d8 (S)	%			98	76-124	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273056 Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B Analysis Description: 8260B MSV UST-WATER
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004, 30230598005, 30230598006, 30230598008

METHOD BLANK: 1343359 Matrix: Water
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004, 30230598005, 30230598006, 30230598008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	09/26/17 02:47	
Ethylbenzene	ug/L	ND	1.0	09/26/17 02:47	
Toluene	ug/L	ND	1.0	09/26/17 02:47	
Xylene (Total)	ug/L	ND	3.0	09/26/17 02:47	
1,2-Dichloroethane-d4 (S)	%	104	80-120	09/26/17 02:47	
4-Bromofluorobenzene (S)	%	104	79-129	09/26/17 02:47	
Dibromofluoromethane (S)	%	98	80-120	09/26/17 02:47	
Toluene-d8 (S)	%	95	80-120	09/26/17 02:47	

LABORATORY CONTROL SAMPLE: 1343360

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	19.6	98	70-130	
Ethylbenzene	ug/L	20	19.9	99	70-130	
Toluene	ug/L	20	20.6	103	70-130	
Xylene (Total)	ug/L	60	60.0	100	70-130	
1,2-Dichloroethane-d4 (S)	%			97	80-120	
4-Bromofluorobenzene (S)	%			106	79-129	
Dibromofluoromethane (S)	%			99	80-120	
Toluene-d8 (S)	%			98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1343361 1343362

Parameter	Units	30230867001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Benzene	ug/L	30.5	20	20	64.4	49.5	170	95	67-121	26	MH
Ethylbenzene	ug/L	ND	20	20	22.5	23.3	112	117	70-127	4	
Toluene	ug/L	ND	20	20	23.8	24.7	116	121	77-125	4	
Xylene (Total)	ug/L	ND	60	60	68.0	72.1	113	120	69-128	6	
1,2-Dichloroethane-d4 (S)	%						96	90	80-120		
4-Bromofluorobenzene (S)	%						105	103	79-129		
Dibromofluoromethane (S)	%						97	96	80-120		
Toluene-d8 (S)	%						99	100	80-120		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273938 — Analysis Method: EPA 8015B
QC Batch Method: EPA 3546 — Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30230598007, 30230598009

METHOD BLANK: 1347510 — Matrix: Solid
Associated Lab Samples: 30230598007, 30230598009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/kg	ND	6.7	10/04/17 02:27	B
o-Terphenyl (S)	%	54	24-123	10/04/17 02:27	

LABORATORY CONTROL SAMPLE: 1347511

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/kg	66.7	47.0	71	43-98	
o-Terphenyl (S)	%			86	24-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1347512 1347513

Parameter	Units	30231631001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C10-C28)	mg/kg	35.5	72.2	72.1	84.6	73.2	68	52	10-175	14	
o-Terphenyl (S)	%						77	78	24-123		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 272858 | Analysis Method: EPA 8015B
QC Batch Method: EPA 3510C | Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004, 30230598005, 30230598008

METHOD BLANK: 1342778 | Matrix: Water
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004, 30230598005, 30230598008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/L	ND	0.10	10/03/17 23:49	
o-Terphenyl (S)	%	36	35-101	10/03/17 23:49	

LABORATORY CONTROL SAMPLE: 1342779

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/L	1	0.48	48	41-103	
o-Terphenyl (S)	%			69	35-101	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273758 | Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 | Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 30230598007, 30230598009

SAMPLE DUPLICATE: 1346940

Parameter	Units	30230590001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	37.0	38.9	5	

SAMPLE DUPLICATE: 1346941

Parameter	Units	30230598007 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	16.5	18.6	12	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273912 — Analysis Method: SM2320B-97
QC Batch Method: SM2320B-97 — Analysis Description: 2320B Alkalinity
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004

METHOD BLANK: 1347410 — Matrix: Water
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity,Total (CaCO3 pH4.5)	mg/L	ND	10.0	10/02/17 17:32	

LABORATORY CONTROL SAMPLE: 1347411

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity,Total (CaCO3 pH4.5)	mg/L	20	20.0	100	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1347412 — 1347413

Parameter	Units	30230598001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Alkalinity,Total (CaCO3 pH4.5)	mg/L	242	50	50	296	290	108	96	85-115	2	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 272989 | Analysis Method: SM4500S2F-00
QC Batch Method: SM4500S2F-00 | Analysis Description: 4500S2F Sulfide, Iodometric
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004

METHOD BLANK: 1343174 | Matrix: Water
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfide	mg/L	ND	1.0	09/25/17 18:13	

LABORATORY CONTROL SAMPLE: 1343175

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfide	mg/L	5.7	6.0	105	85-115	

MATRIX SPIKE SAMPLE: 1343177

Parameter	Units	30230545001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfide	mg/L	4.0	5.7	9.2	91	85-115	

SAMPLE DUPLICATE: 1343176

Parameter	Units	30230347001 Result	Dup Result	RPD	Qualifiers
Sulfide	mg/L	ND	ND		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230598

QC Batch: 273520 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions 28day
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004

METHOD BLANK: 1345393 Matrix: Water
Associated Lab Samples: 30230598001, 30230598002, 30230598003, 30230598004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	0.50	09/29/17 20:42	

LABORATORY CONTROL SAMPLE: 1345394

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	2	2.0	98	90-110	

MATRIX SPIKE SAMPLE: 1345396

Parameter	Units	30230889011 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	115	100	209	95	90-110	

SAMPLE DUPLICATE: 1345395

Parameter	Units	30230889011 Result	Dup Result	RPD	Qualifiers
Sulfate	mg/L	115	114	1	

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QUALIFIERS

Project: Hess Towson
Pace Project No.: 30230598

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

BATCH QUALIFIERS

Batch: 272858

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 273621

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 273981

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

1c	A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
A5	Greater than 5% sediment in sample determined by visual observation. Aqueous portion decanted from the sediment and extracted.
B	Analyte was detected in the associated method blank.
CH	The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
L1	Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results for this analyte in associated samples may be biased high.
MH	Matrix spike recovery and/or matrix spike duplicate recovery was above laboratory control limits. Result may be biased high.
S4	Surrogate recovery not evaluated against control limits due to sample dilution.
ST	Surrogate recovery was above laboratory control limits. Results may be biased high.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Hess Towson
Pace Project No.: 30230598

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
30230598007	**MIP-2 (25-30)**	EPA 3546	273938	EPA 8015B	274087
30230598009	**MIP-7 (21-26)**	EPA 3546	273938	EPA 8015B	274087
30230598001	**MW-4**	EPA 3510C	272858	EPA 8015B	274070
30230598002	**YP-1**	EPA 3510C	272858	EPA 8015B	274070
30230598003	**YMW-7**	EPA 3510C	272858	EPA 8015B	274070
30230598004	**YMW-3**	EPA 3510C	272858	EPA 8015B	274070
30230598005	**EB-091917**	EPA 3510C	272858	EPA 8015B	274070
30230598008	**MIP-2 (GW-25-30)**	EPA 3510C	272858	EPA 8015B	274070
30230598007	**MIP-2 (25-30)**	EPA 5035A/5030B	272875	EPA 8015B	273006
30230598009	**MIP-7 (21-26)**	EPA 5035A/5030B	272875	EPA 8015B	273006
30230598001	**MW-4**	EPA 5030/8015B	273768		
30230598002	**YP-1**	EPA 5030/8015B	272925		
30230598003	**YMW-7**	EPA 5030/8015B	273768		
30230598004	**YMW-3**	EPA 5030/8015B	272925		
30230598005	**EB-091917**	EPA 5030/8015B	273768		
30230598008	**MIP-2 (GW-25-30)**	EPA 5030/8015B	273768		
30230598007	**MIP-2 (25-30)**	EPA 5035A	273981	EPA 8260B	274020
30230598009	**MIP-7 (21-26)**	EPA 5035A	273621	EPA 8260B	273645
30230598001	**MW-4**	EPA 8260B	273056		
30230598002	**YP-1**	EPA 8260B	273056		
30230598003	**YMW-7**	EPA 8260B	273056		
30230598004	**YMW-3**	EPA 8260B	273056		
30230598005	**EB-091917**	EPA 8260B	273056		
30230598006	**Trip Blank**	EPA 8260B	273056		
30230598008	**MIP-2 (GW-25-30)**	EPA 8260B	273056		
30230598007	**MIP-2 (25-30)**	ASTM D2974-87	273758		
30230598009	**MIP-7 (21-26)**	ASTM D2974-87	273758		
30230598001	**MW-4**	SM2320B-97	273912		
30230598002	**YP-1**	SM2320B-97	273912		
30230598003	**YMW-7**	SM2320B-97	273912		
30230598004	**YMW-3**	SM2320B-97	273912		
30230598001	**MW-4**	SM4500S2F-00	272989		
30230598002	**YP-1**	SM4500S2F-00	272989		
30230598003	**YMW-7**	SM4500S2F-00	272989		
30230598004	**YMW-3**	SM4500S2F-00	272989		
30230598001	**MW-4**	EPA 300.0	273520		
30230598002	**YP-1**	EPA 300.0	273520		
30230598003	**YMW-7**	EPA 300.0	273520		
30230598004	**YMW-3**	EPA 300.0	273520		

30230598 -

CHAIN-OF-CUSTODY RECORD

3 Coolers

No. 008061 — wsp

WSP USA Office Address	
Herndon, VA	
Project Name: Hess Towson	WSP USA Contact Name: Pam Groff
Project Location: Towson	WSP USA Contact E-mail: pam.groff @wsp.com
Project Number & Task: 31400408/3	WSP USA Contact Phone: 703 709 6500
Sampler(s) Name(s): Molly Long, Chris Cresci	Sampler(s) Signature(s): [illegible]

Laboratory Name & Location: Pace Analytical

Laboratory Project Manager: Clare Perosine

Requested Turn-Around-Time: ☒ Standard ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ ___ HR

Level II

Requested Analyses & Preservatives

Sample Identification	Matrix	Collection Start* Date	Collection Stop* Time	Number of Containers	BTEX 8260	TPH-GRO 8015	TPH-DRO 8015	Alkalinity 2320B	Sulfate 300	Sulfide 4500					Sample Comments	
MW-4	AQ	9/20/17	1125	10	X	X	X	X	X	X						001
YP-1	AQ	9/20/17	0845	10	X	X	X	X	X	X						002
YMW-7	AQ	9/19/17	1320	10	X	X	X	X	X	X						003
YMW-3	AQ	9/19/17	1110	10	X	X	X	X	X	X						004
EB-091917	AQ	9/19/17	1146	8	X	X	X									005
Trip Blank	AQ	lab provided		2	X										ID Name: TB-092017	006
MIP2(25-30)	Soil	9/20/17	1015		X	X	X									007
MIP2(GW-25-30)	AQ	9/20/17	1225	8	X	X	X									008
MIP2(21-26)	S	9/20/17	1500		X	X	X									009

WO#: 30230598

30230598

Relinquished By (Signature)	Date	Time	Received By (Signature)	Date	Time	Shipment Method	Tracking Number(s)
[illegible]	9/20/17		David Hillegass/Pace	9/20/17	1532		
David Hillegass/Pace	9/20/17	2010	[illegible]	9/20/17	2010	Number of Packages:	Custody Seal Number(s): 08355, 03253, 08294

Custody Sealed

*Use stop time/date for composite and/or air samples; use only start time/date for all other samples.

9/20/17 2330 [illegible] 9/20/17 2330

Matrix: AQ = Aqueous, S = Soil, SE = Sediment, A = Air, W = Wipe, B = Bulk, O = Other (detail in comments)

Pittsburgh Lab Sample Condition Upon Receipt

Pace Analytical

Client Name: WSP Project # 30230598

Label ZH
LIMS Login [illegible]

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace Other ______

Tracking #: N/A

Custody Seal on Cooler/Box Present: ☑ yes ☐ no Seals intact: ☑ yes ☐ no

Thermometer Used 8 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 2.7, 2.9 °C Correction Factor: 0.0 °C Final Temp: 2.7, 2.9 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: ZH 9/21/17

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID Matrix: WT + 3L				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered			✓	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			✓	13.
Organic Samples checked for dechlorination:	✓			14.
Filtered volume received for Dissolved tests	~~✓~~		✓	15. ARU 9/21/17
All containers have been checked for preservation.	✓			16.
All containers needing preservation are found to be in compliance with EPA recommendation.			✓	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed ZH; Date/time of preservation; Lot # of added preservative
Headspace in VOA Vials (>6mm):		✓		17.
Trip Blank Present:	✓			18.
Trip Blank Custody Seals Present	✓			
Rad Aqueous Samples Screened > 0.5 mrem/hr			✓	Initial when completed: Date:

Client Notification/ Resolution:

Person Contacted: ______ Date/Time: ______ Contacted By: ______

Comments/ Resolution: ______

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)
*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

J:\QAQC\Master\Document Management\Sample Mgt\Sample Condition Upon Receipt Pittsburgh (C056-6 18Aug2017)

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

October 13, 2017

Chris Cresci
WSP USA
13530 Dulles Technology Drive
Suite 300
Herndon, VA 20171

RE: Project: Hess Towson
Pace Project No.: 30230752

Dear Chris Cresci:

Enclosed are the analytical results for sample(s) received by the laboratory on September 21, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revision 1 - This report replaces the October 06, 2017 report. This project was revised on October13, 2017 in order to correct the reported DRO and GRO carbon ranges as per the COC.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Timothy Reed for
Penny Westrick
penny.westrick@pacelabs.com
724 850-5610
Project Manager

Enclosures

cc: Pam Robertson, WSP USA

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project:	Hess Towson
Pace Project No.:	30230752

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230752

Sample: MIP-8 (18-22) **Lab ID: 30230752001** Collected: 09/21/17 08:30 Received: 09/21/17 23:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**74.1**	mg/kg	7.9	1	10/03/17 08:56	10/04/17 05:35		
Surrogates								
o-Terphenyl (S)	60	%	24-123	1	10/03/17 08:56	10/04/17 05:35	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
Gasoline Range Organics	**297**	mg/kg	103	10	09/25/17 12:32	09/27/17 16:15		B,L1
Surrogates								
a,a,a-Trifluorotoluene (S)	131	%	10-174	10	09/25/17 12:32	09/27/17 16:15	98-08-8	
4-Bromofluorobenzene (S)	104	%	85-109	10	09/25/17 12:32	09/27/17 16:15	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	4.0	1	10/04/17 11:12	10/04/17 15:56	71-43-2	1c
Ethylbenzene	**5530**	ug/kg	203	50	10/05/17 12:00	10/05/17 17:23	100-41-4	1c
Toluene	**312**	ug/kg	4.0	1	10/04/17 11:12	10/04/17 15:56	108-88-3	1c
Xylene (Total)	**26900**	ug/kg	610	50	10/05/17 12:00	10/05/17 17:23	1330-20-7	
Surrogates								
Toluene-d8 (S)	159	%	76-124	1	10/04/17 11:12	10/04/17 15:56	2037-26-5	ST
4-Bromofluorobenzene (S)	146	%	70-133	1	10/04/17 11:12	10/04/17 15:56	460-00-4	ST
1,2-Dichloroethane-d4 (S)	167	%	74-131	1	10/04/17 11:12	10/04/17 15:56	17060-07-0	ST
Dibromofluoromethane (S)	49	%	71-130	1	10/04/17 11:12	10/04/17 15:56	1868-53-7	SR
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**16.5**	%	0.10	1		10/04/17 13:59		

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230752

Sample: MIP-8 (27-30) **Lab ID: 30230752002** Collected: 09/21/17 09:05 Received: 09/21/17 23:30 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	ND	mg/kg	7.9	1	10/03/17 08:56	10/04/17 05:45		
Surrogates								
o-Terphenyl (S)	50	%	24-123	1	10/03/17 08:56	10/04/17 05:45	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
Gasoline Range Organics	ND	mg/kg	11.0	1	09/25/17 12:32	09/25/17 23:34		B,CH,L1
Surrogates								
a,a,a-Trifluorotoluene (S)	82	%	10-174	1	09/25/17 12:32	09/25/17 23:34	98-08-8	
4-Bromofluorobenzene (S)	112	%	85-109	1	09/25/17 12:32	09/25/17 23:34	460-00-4	S3
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	4.5	1	10/04/17 11:12	10/04/17 16:15	71-43-2	1c
Ethylbenzene	ND	ug/kg	4.5	1	10/04/17 11:12	10/04/17 16:15	100-41-4	1c
Toluene	ND	ug/kg	4.5	1	10/04/17 11:12	10/04/17 16:15	108-88-3	1c
Xylene (Total)	ND	ug/kg	13.5	1	10/04/17 11:12	10/04/17 16:15	1330-20-7	
Surrogates								
Toluene-d8 (S)	95	%	76-124	1	10/04/17 11:12	10/04/17 16:15	2037-26-5	
4-Bromofluorobenzene (S)	99	%	70-133	1	10/04/17 11:12	10/04/17 16:15	460-00-4	
1,2-Dichloroethane-d4 (S)	103	%	74-131	1	10/04/17 11:12	10/04/17 16:15	17060-07-0	
Dibromofluoromethane (S)	103	%	71-130	1	10/04/17 11:12	10/04/17 16:15	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**17.4**	%	0.10	1		10/04/17 13:59		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230752

Sample: MIP-8 (GW-18-22) **Lab ID: 30230752003** Collected: 09/21/17 11:45 Received: 09/21/17 23:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**3.5**	mg/L	1.1	10	09/24/17 12:09	10/04/17 14:26		1c,A5
Surrogates								
o-Terphenyl (S)	43	%	35-101	10	09/24/17 12:09	10/04/17 14:26	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**10300**	ug/L	2000	10		10/04/17 10:04		
Surrogates								
4-Bromofluorobenzene (S)	110	%	72-124	10		10/04/17 10:04	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	**23.5**	ug/L	1.0	1		09/28/17 10:52	71-43-2	
Ethylbenzene	**599**	ug/L	50.0	50		09/28/17 11:19	100-41-4	
Toluene	**123**	ug/L	1.0	1		09/28/17 10:52	108-88-3	
Xylene (Total)	**1680**	ug/L	150	50		09/28/17 11:19	1330-20-7	
Surrogates								
Toluene-d8 (S)	99	%	80-120	1		09/28/17 10:52	2037-26-5	
4-Bromofluorobenzene (S)	108	%	79-129	1		09/28/17 10:52	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	80-120	1		09/28/17 10:52	17060-07-0	
Dibromofluoromethane (S)	93	%	80-120	1		09/28/17 10:52	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30230752

Sample: Trip Blank **Lab ID: 30230752004** Collected: 09/21/17 00:01 Received: 09/21/17 23:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		09/28/17 02:08	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		09/28/17 02:08	100-41-4	
Toluene	ND	ug/L	1.0	1		09/28/17 02:08	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		09/28/17 02:08	1330-20-7	
Surrogates								
Toluene-d8 (S)	99	%	80-120	1		09/28/17 02:08	2037-26-5	
4-Bromofluorobenzene (S)	104	%	79-129	1		09/28/17 02:08	460-00-4	
1,2-Dichloroethane-d4 (S)	98	%	80-120	1		09/28/17 02:08	17060-07-0	
Dibromofluoromethane (S)	93	%	80-120	1		09/28/17 02:08	1868-53-7	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 272875 | Analysis Method: EPA 8015B
QC Batch Method: EPA 5035A/5030B | Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30230752001, 30230752002

METHOD BLANK: 1342818 | Matrix: Solid
Associated Lab Samples: 30230752001, 30230752002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Gasoline Range Organics	mg/kg	ND	10.0	09/25/17 15:37	CH
4-Bromofluorobenzene (S)	%	111	85-109	09/25/17 15:37	ST
a,a,a-Trifluorotoluene (S)	%	99	10-174	09/25/17 15:37	

LABORATORY CONTROL SAMPLE: 1342819

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Gasoline Range Organics	mg/kg	50	61.1	122	71-141	CH,L1
4-Bromofluorobenzene (S)	%			101	85-109	
a,a,a-Trifluorotoluene (S)	%			100	10-174	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1342820 1342821

Parameter	Units	30230586003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Gasoline Range Organics	mg/kg	10.9 U	54.3	54.3	60.4	61.3	109	110	72-141	1	CH
4-Bromofluorobenzene (S)	%						101	101	85-109		
a,a,a-Trifluorotoluene (S)	%						99	103	10-174		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 273768
QC Batch Method: EPA 5030/8015B
Analysis Method: EPA 5030/8015B
Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30230752003

METHOD BLANK: 1346956 Matrix: Water
Associated Lab Samples: 30230752003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C06-C10)	ug/L	ND	200	10/03/17 16:10	
4-Bromofluorobenzene (S)	%	112	72-124	10/03/17 16:10	

LABORATORY CONTROL SAMPLE: 1346957

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	ug/L	1000	970	97	71-141	
4-Bromofluorobenzene (S)	%			103	72-124	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1346958 1346959

Parameter	Units	30231469003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C06-C10)	ug/L	ND	1000	1000	824	815	82	81	11-165	1	
4-Bromofluorobenzene (S)	%						103	105	72-124		

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 274174 — Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A — Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30230752001, 30230752002

METHOD BLANK: 1348491 — Matrix: Solid
Associated Lab Samples: 30230752001, 30230752002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	5.0	10/04/17 14:08	
Ethylbenzene	ug/kg	ND	5.0	10/04/17 14:08	
Toluene	ug/kg	ND	5.0	10/04/17 14:08	
Xylene (Total)	ug/kg	ND	15.0	10/04/17 14:08	
1,2-Dichloroethane-d4 (S)	%	102	74-131	10/04/17 14:08	
4-Bromofluorobenzene (S)	%	95	70-133	10/04/17 14:08	
Dibromofluoromethane (S)	%	103	71-130	10/04/17 14:08	
Toluene-d8 (S)	%	95	76-124	10/04/17 14:08	

LABORATORY CONTROL SAMPLE: 1348492

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	20	18.5	93	70-130	
Ethylbenzene	ug/kg	20	18.9	94	70-130	
Toluene	ug/kg	20	17.6	88	70-130	
Xylene (Total)	ug/kg	60	55.0	92	70-130	
1,2-Dichloroethane-d4 (S)	%			97	74-131	
4-Bromofluorobenzene (S)	%			93	70-133	
Dibromofluoromethane (S)	%			101	71-130	
Toluene-d8 (S)	%			95	76-124	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 274372 | Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A | Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30230752001

METHOD BLANK: 1349299 | Matrix: Solid
Associated Lab Samples: 30230752001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Ethylbenzene	ug/kg	ND	250	10/05/17 12:32	
Xylene (Total)	ug/kg	ND	750	10/05/17 12:32	
1,2-Dichloroethane-d4 (S)	%	98	74-131	10/05/17 12:32	
4-Bromofluorobenzene (S)	%	98	70-133	10/05/17 12:32	
Dibromofluoromethane (S)	%	100	71-130	10/05/17 12:32	
Toluene-d8 (S)	%	95	76-124	10/05/17 12:32	

LABORATORY CONTROL SAMPLE: 1349300

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Ethylbenzene	ug/kg	20	18.2	91	70-130	
Xylene (Total)	ug/kg	60	52.8	88	70-130	
1,2-Dichloroethane-d4 (S)	%			99	74-131	
4-Bromofluorobenzene (S)	%			95	70-133	
Dibromofluoromethane (S)	%			103	71-130	
Toluene-d8 (S)	%			97	76-124	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 273376 | Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B | Analysis Description: 8260B MSV UST-WATER
Associated Lab Samples: 30230752003, 30230752004

METHOD BLANK: 1344663 | Matrix: Water
Associated Lab Samples: 30230752003, 30230752004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	09/28/17 01:41	
Ethylbenzene	ug/L	ND	1.0	09/28/17 01:41	
Toluene	ug/L	ND	1.0	09/28/17 01:41	
Xylene (Total)	ug/L	ND	3.0	09/28/17 01:41	
1,2-Dichloroethane-d4 (S)	%	96	80-120	09/28/17 01:41	
4-Bromofluorobenzene (S)	%	101	79-129	09/28/17 01:41	
Dibromofluoromethane (S)	%	93	80-120	09/28/17 01:41	
Toluene-d8 (S)	%	98	80-120	09/28/17 01:41	

LABORATORY CONTROL SAMPLE: 1344664

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	20.8	104	70-130	
Ethylbenzene	ug/L	20	21.1	105	70-130	
Toluene	ug/L	20	21.7	109	70-130	
Xylene (Total)	ug/L	60	64.9	108	70-130	
1,2-Dichloroethane-d4 (S)	%			98	80-120	
4-Bromofluorobenzene (S)	%			106	79-129	
Dibromofluoromethane (S)	%			100	80-120	
Toluene-d8 (S)	%			100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1344665 1344666

Parameter	Units	30230912001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Benzene	ug/L	ND	20	20	20.6	21.7	103	109	67-121	5	
Ethylbenzene	ug/L	ND	20	20	21.3	20.7	106	104	70-127	3	
Toluene	ug/L	ND	20	20	21.5	21.4	108	107	77-125	1	
Xylene (Total)	ug/L	ND	60	60	64.9	64.3	108	107	69-128	1	
1,2-Dichloroethane-d4 (S)	%						89	95	80-120		
4-Bromofluorobenzene (S)	%						101	101	79-129		
Dibromofluoromethane (S)	%						94	99	80-120		
Toluene-d8 (S)	%						97	99	80-120		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 273938 — Analysis Method: EPA 8015B
QC Batch Method: EPA 3546 — Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30230752001, 30230752002

METHOD BLANK: 1347510 — Matrix: Solid
Associated Lab Samples: 30230752001, 30230752002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/kg	ND	6.7	10/04/17 02:27	B
o-Terphenyl (S)	%	54	24-123	10/04/17 02:27	

LABORATORY CONTROL SAMPLE: 1347511

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/kg	66.7	47.0	71	43-98	
o-Terphenyl (S)	%			86	24-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1347512 1347513

Parameter	Units	30231631001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C10-C28)	mg/kg	35.5	72.2	72.1	84.6	73.2	68	52	10-175	14	
o-Terphenyl (S)	%						77	78	24-123		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 272858 | Analysis Method: EPA 8015B
QC Batch Method: EPA 3510C | Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30230752003

METHOD BLANK: 1342778 | Matrix: Water
Associated Lab Samples: 30230752003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/L	ND	0.10	10/03/17 23:49	
o-Terphenyl (S)	%	36	35-101	10/03/17 23:49	

LABORATORY CONTROL SAMPLE: 1342779

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/L	1	0.48	48	41-103	
o-Terphenyl (S)	%			69	35-101	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30230752

QC Batch: 274228 — Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 — Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 30230752001, 30230752002

SAMPLE DUPLICATE: 1348699

Parameter	Units	30230736001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	32.3	17.9	58	D6

SAMPLE DUPLICATE: 1348700

Parameter	Units	30230736002 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	21.0	18.3	14	

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: Hess Towson
Pace Project No.: 30230752

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

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TNI - The NELAC Institute.

BATCH QUALIFIERS

Batch: 272858

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 274174

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 274372

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

1c	A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
A5	Greater than 5% sediment in sample determined by visual observation. Aqueous portion decanted from the sediment and extracted.
B	Analyte was detected in the associated method blank.
CH	The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased high.
D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
L1	Analyte recovery in the laboratory control sample (LCS) was above QC limits. Results for this analyte in associated samples may be biased high.
S3	Surrogate recovery exceeded laboratory control limits. Analyte presence below reporting limits in associated sample.
SR	Surrogate recovery was below laboratory control limits. Results may be biased low.
ST	Surrogate recovery was above laboratory control limits. Results may be biased high.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Hess Towson
Pace Project No.: 30230752

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
30230752001	**MIP-8 (18-22)**	EPA 3546	273938	EPA 8015B	274087
30230752002	**MIP-8 (27-30)**	EPA 3546	273938	EPA 8015B	274087
30230752003	**MIP-8 (GW-18-22)**	EPA 3510C	272858	EPA 8015B	274070
30230752001	**MIP-8 (18-22)**	EPA 5035A/5030B	272875	EPA 8015B	273006
30230752002	**MIP-8 (27-30)**	EPA 5035A/5030B	272875	EPA 8015B	273006
30230752003	**MIP-8 (GW-18-22)**	EPA 5030/8015B	273768		
30230752001	**MIP-8 (18-22)**	EPA 5035A	274174	EPA 8260B	274189
30230752001	**MIP-8 (18-22)**	EPA 5035A	274372	EPA 8260B	274387
30230752002	**MIP-8 (27-30)**	EPA 5035A	274174	EPA 8260B	274189
30230752003	**MIP-8 (GW-18-22)**	EPA 8260B	273376		
30230752004	**Trip Blank**	EPA 8260B	273376		
30230752001	**MIP-8 (18-22)**	ASTM D2974-87	274228		
30230752002	**MIP-8 (27-30)**	ASTM D2974-87	274228		

CHAIN-OF-CUSTODY RECORD

No. 008063 wsp

WSP USA Office Address: 13530 Dulles Technology Dr. Suite 300 Herndon, VA 20171

Project Name: Hess Towson

WSP USA Contact Name: Pam Groff

Project Location: Towson, MD

WSP USA Contact E-mail: Pam.Groff @wsp.com

Project Number & Task: 31400408 / 3

WSP USA Contact Phone: 703-709-6500

Sampler(s) Name(s): Chris Cresci

Sampler(s) Signature(s): [signature]

Laboratory Name & Location: Pace Analytical

Laboratory Project Manager: Clare Peragine

Requested Turn-Around-Time: ☒ Standard ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ ___ HR

Sample Identification	Matrix	Collection Start* Date	Collection Start* Time	Collection Stop* Date	Collection Stop* Time	Number of Containers	BTEX By 8260	TPH-GRO By 8015	TPH-DRO By 8015	Sample Comments
MIP-8(18-22)	Soil	9/21/17	0830				X	X	X	001
MIP-8(27-30)	Soil	9/21/17	0905				X	X	X	002
MIP-8(GW-18-22)	AQ	9/21/17	1145				X	X	X	003
Trip Blank	TB					2	X			004

WO#: 30230752

30230752

Rec'D C. Carnell 9/21/17 2330

Relinquished By (Signature)	Date	Time	Received By (Signature)	Date	Time	Shipment Method	Tracking Number(s)
[signature]	9/21/17	1800	David L Hillegas Pace	9/21/17	1800		
David L Hillegas Pace	9/21/17	1957	[signature]	9/21/17	1955	Number of Packages:	Custody Seal Number(s): 08352

*Use stop time/date for composite and/or air samples; use only start time/date for all other samples.

Matrix: AQ = Aqueous, S = Soil, SE = Sediment, A = Air, W = Wipe, B = Bulk, O = Other (detail in comments)

Pittsburgh Lab Sample Condition Upon Receipt

30230752

Pace Analytical

Client Name: WSP Project #

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace Other

Tracking #: OC 9/22/17

Label	OC
LIMS Login	AR

Custody Seal on Cooler/Box Present: ☐ yes ☐ no Seals intact: ☐ yes ☐ no

Thermometer Used 6 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 1.4 °C Correction Factor: 0.0 °C Final Temp: 1.4 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: 9/22/17 OC

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID Matrix: SL/WT				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered			✓	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			✓	13.
Organic Samples checked for dechlorination:	✓			14.
Filtered volume received for Dissolved tests			✓	15.
All containers have been checked for preservation.	✓			16.
All containers needing preservation are found to be in compliance with EPA recommendation.			✓	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed OC / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):		✓		17.
Trip Blank Present:	✓			18.
Trip Blank Custody Seals Present	✓			
Rad Aqueous Samples Screened > 0.5 mrem/hr			✓	Initial when completed: / Date:

Client Notification/ Resolution:

Person Contacted: Date/Time: Contacted By:

Comments/ Resolution:

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

***PM review** is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

J:\QAQC\Master\Document Management\Sample Mgt\Sample Condition Upon Receipt Pittsburgh (C056-6 18Aug2017)

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(724)850-5600

October 10, 2017

Chris Cresci
WSP USA
13530 Dulles Technology Drive
Suite 300
Herndon, VA 20171

RE: Project: WSP Hess Towson
Pace Project No.: 30231096

Dear Chris Cresci:

Enclosed are the analytical results for sample(s) received by the laboratory on September 26, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Timothy Reed for
Penny Westrick
penny.westrick@pacelabs.com
724 850-5610
Project Manager

Enclosures

Pace Analytical Services, LLC
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CERTIFICATIONS

Project: WSP Hess Towson
Pace Project No.: 30231096

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414-2485
A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: UST-078
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas Certification #: 88-0680
California Certification #: MN00064
CNMI Saipan Certification #:MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts Certification #: M-MN064
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: MN00064
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon NwTPH Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DW Certification #: 9952 C
West Virginia DEP Certification #: 382
Wisconsin Certification #: 999407970
Wyoming via EPA Region 8 Certification #: 8TMS-L

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification

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CERTIFICATIONS

Project:	WSP Hess Towson
Pace Project No.:	30231096

Pennsylvania Certification IDs

Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

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SAMPLE ANALYTE COUNT

Project: WSP Hess Towson
Pace Project No.: 30231096

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30231096001	**Hess Towson GW**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	MAK	2	PASI-PA
		EPA 6020	TT3	5	PASI-M
		EPA 8260B	LEL	8	PASI-PA
30231096002	**Hess Towson Soil A**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	MAK	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30231096003	**Hess Towson Soil B**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	MAK	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30231096004	**Trip Blank**	EPA 8260B	LEL	8	PASI-PA

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ANALYTICAL RESULTS

Project: WSP Hess Towson
Pace Project No.: 30231096

Sample: Hess Towson GW **Lab ID: 30231096001** Collected: 09/25/17 15:15 Received: 09/26/17 10:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**1.3**	mg/L	0.10	1	09/28/17 13:16	10/07/17 03:15		1c
Surrogates								
o-Terphenyl (S)	44	%	35-101	1	09/28/17 13:16	10/07/17 03:15	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**4360**	ug/L	200	1		10/03/17 21:25		
Surrogates								
4-Bromofluorobenzene (S)	106	%	72-124	1		10/03/17 21:25	460-00-4	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3020							
Chromium	ND	ug/L	0.50	1	10/03/17 03:56	10/06/17 01:56	7440-47-3	
Molybdenum	ND	ug/L	0.50	1	10/03/17 03:56	10/06/17 01:56	7439-98-7	
Selenium	ND	ug/L	0.50	1	10/03/17 03:56	10/06/17 01:56	7782-49-2	
Uranium-238	ND	ug/L	0.50	1	10/03/17 03:56	10/06/17 01:56	7440-61-1	
Vanadium	ND	ug/L	1.0	1	10/03/17 03:56	10/06/17 01:56	7440-62-2	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	**18.8**	ug/L	1.0	1		09/29/17 17:48	71-43-2	
Ethylbenzene	**359**	ug/L	1.0	1		09/29/17 17:48	100-41-4	
Toluene	**31.3**	ug/L	1.0	1		09/29/17 17:48	108-88-3	
Xylene (Total)	**581**	ug/L	3.0	1		09/29/17 17:48	1330-20-7	
Surrogates								
Toluene-d8 (S)	100	%	80-120	1		09/29/17 17:48	2037-26-5	
4-Bromofluorobenzene (S)	101	%	79-129	1		09/29/17 17:48	460-00-4	
1,2-Dichloroethane-d4 (S)	102	%	80-120	1		09/29/17 17:48	17060-07-0	
Dibromofluoromethane (S)	98	%	80-120	1		09/29/17 17:48	1868-53-7	

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ANALYTICAL RESULTS

Project: WSP Hess Towson
Pace Project No.: 30231096

Sample: Hess Towson Soil A **Lab ID: 30231096002** Collected: 09/25/17 15:30 Received: 09/26/17 10:00 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**223**	mg/kg	76.2	10	10/03/17 08:56	10/04/17 18:54		
Surrogates								
o-Terphenyl (S)	86	%	24-123	10	10/03/17 08:56	10/04/17 18:54	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
Gasoline Range Organics	**89.3**	mg/kg	9.6	1	09/28/17 08:28	09/29/17 21:46		
Surrogates								
a,a,a-Trifluorotoluene (S)	48	%	10-174	1	09/28/17 08:28	09/29/17 21:46	98-08-8	
4-Bromofluorobenzene (S)	89	%	85-109	1	09/28/17 08:28	09/29/17 21:46	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	244	50	10/04/17 12:55	10/09/17 14:35	71-43-2	1c
Ethylbenzene	**1610**	ug/kg	244	50	10/04/17 12:55	10/09/17 14:35	100-41-4	1c
Toluene	ND	ug/kg	244	50	10/04/17 12:55	10/09/17 14:35	108-88-3	1c
Xylene (Total)	**9250**	ug/kg	731	50	10/04/17 12:55	10/09/17 14:35	1330-20-7	
Surrogates								
Toluene-d8 (S)	97	%	76-124	50	10/04/17 12:55	10/09/17 14:35	2037-26-5	
4-Bromofluorobenzene (S)	102	%	70-133	50	10/04/17 12:55	10/09/17 14:35	460-00-4	
1,2-Dichloroethane-d4 (S)	105	%	74-131	50	10/04/17 12:55	10/09/17 14:35	17060-07-0	
Dibromofluoromethane (S)	102	%	71-130	50	10/04/17 12:55	10/09/17 14:35	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**13.5**	%	0.10	1		10/07/17 11:48		

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ANALYTICAL RESULTS

Project: WSP Hess Towson
Pace Project No.: 30231096

Sample: Hess Towson Soil B **Lab ID: 30231096003** Collected: 09/25/17 15:45 Received: 09/26/17 10:00 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.
Comments: • Sample 003 was not listed on COC, sample ID and collection date/time came from sample bottles.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**99.1**	mg/kg	7.7	1	10/03/17 08:56	10/04/17 03:34		
Surrogates								
o-Terphenyl (S)	60	%	24-123	1	10/03/17 08:56	10/04/17 03:34	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
Gasoline Range Organics	**53.3**	mg/kg	9.6	1	09/28/17 08:28	09/29/17 22:05		
Surrogates								
a,a,a-Trifluorotoluene (S)	43	%	10-174	1	09/28/17 08:28	09/29/17 22:05	98-08-8	
4-Bromofluorobenzene (S)	85	%	85-109	1	09/28/17 08:28	09/29/17 22:05	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	245	50	10/04/17 12:55	10/09/17 15:01	71-43-2	1c
Ethylbenzene	**909**	ug/kg	245	50	10/04/17 12:55	10/09/17 15:01	100-41-4	1c
Toluene	ND	ug/kg	245	50	10/04/17 12:55	10/09/17 15:01	108-88-3	1c
Xylene (Total)	**5310**	ug/kg	734	50	10/04/17 12:55	10/09/17 15:01	1330-20-7	
Surrogates								
Toluene-d8 (S)	100	%	76-124	50	10/04/17 12:55	10/09/17 15:01	2037-26-5	
4-Bromofluorobenzene (S)	105	%	70-133	50	10/04/17 12:55	10/09/17 15:01	460-00-4	
1,2-Dichloroethane-d4 (S)	101	%	74-131	50	10/04/17 12:55	10/09/17 15:01	17060-07-0	
Dibromofluoromethane (S)	100	%	71-130	50	10/04/17 12:55	10/09/17 15:01	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**16.0**	%	0.10	1		10/07/17 11:48		

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ANALYTICAL RESULTS

Project: WSP Hess Towson
Pace Project No.: 30231096

Sample: Trip Blank **Lab ID: 30231096004** Collected: 09/25/17 00:01 Received: 09/26/17 10:00 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		09/29/17 13:10	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		09/29/17 13:10	100-41-4	
Toluene	ND	ug/L	1.0	1		09/29/17 13:10	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		09/29/17 13:10	1330-20-7	
Surrogates								
Toluene-d8 (S)	98	%	80-120	1		09/29/17 13:10	2037-26-5	
4-Bromofluorobenzene (S)	102	%	79-129	1		09/29/17 13:10	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	80-120	1		09/29/17 13:10	17060-07-0	
Dibromofluoromethane (S)	101	%	80-120	1		09/29/17 13:10	1868-53-7	

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 273409 Analysis Method: EPA 8015B
QC Batch Method: EPA 5035A/5030B Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30231096002, 30231096003

METHOD BLANK: 1344895 Matrix: Solid
Associated Lab Samples: 30231096002, 30231096003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Gasoline Range Organics	mg/kg	ND	10.0	09/29/17 16:30	
4-Bromofluorobenzene (S)	%	113	85-109	09/29/17 16:30	
a,a,a-Trifluorotoluene (S)	%	67	10-174	09/29/17 16:30	

LABORATORY CONTROL SAMPLE: 1344896

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Gasoline Range Organics	mg/kg	50	51.5	103	71-141	
4-Bromofluorobenzene (S)	%			106	85-109	
a,a,a-Trifluorotoluene (S)	%			73	10-174	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1344897 1344898

Parameter	Units	30231110001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Gasoline Range Organics	mg/kg	ND	57.4	57.4	49.6	50.2	85	86	72-141	1	
4-Bromofluorobenzene (S)	%						104	105	85-109		
a,a,a-Trifluorotoluene (S)	%						51	57	10-174		

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

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Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 273768 — Analysis Method: EPA 5030/8015B
QC Batch Method: EPA 5030/8015B — Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30231096001

METHOD BLANK: 1346956 — Matrix: Water
Associated Lab Samples: 30231096001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C06-C10)	ug/L	ND	200	10/03/17 16:10	
4-Bromofluorobenzene (S)	%	112	72-124	10/03/17 16:10	

LABORATORY CONTROL SAMPLE: 1346957

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	ug/L	1000	970	97	71-141	
4-Bromofluorobenzene (S)	%			103	72-124	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1346958 1346959

Parameter	Units	30231469003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C06-C10)	ug/L	ND	1000	1000	824	815	82	81	11-165	1	
4-Bromofluorobenzene (S)	%						103	105	72-124		

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 499864 Analysis Method: EPA 6020
QC Batch Method: EPA 3020 Analysis Description: 6020 MET
Associated Lab Samples: 30231096001

METHOD BLANK: 2718005 Matrix: Water
Associated Lab Samples: 30231096001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chromium	ug/L	ND	0.50	10/06/17 01:50	
Molybdenum	ug/L	ND	0.50	10/06/17 01:50	
Selenium	ug/L	ND	0.50	10/06/17 01:50	
Uranium-238	ug/L	ND	0.50	10/06/17 01:50	
Vanadium	ug/L	ND	1.0	10/06/17 01:50	

LABORATORY CONTROL SAMPLE: 2718006

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chromium	ug/L	100	107	107	80-120	
Molybdenum	ug/L	100	103	103	80-120	
Selenium	ug/L	100	113	113	80-120	
Uranium-238	ug/L	100	106	106	80-120	
Vanadium	ug/L	100	104	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2718007 2718008

Parameter	Units	30231096001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Chromium	ug/L	ND	100	100	108	108	108	108	75-125	0	
Molybdenum	ug/L	ND	100	100	104	106	104	106	75-125	2	
Selenium	ug/L	ND	100	100	110	112	110	112	75-125	1	
Uranium-238	ug/L	ND	100	100	104	106	104	106	75-125	2	
Vanadium	ug/L	ND	100	100	106	107	106	107	75-125	1	

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 274208 | Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A | Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30231096002, 30231096003

METHOD BLANK: 1348623 | Matrix: Solid
Associated Lab Samples: 30231096002, 30231096003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	250	10/09/17 12:23	
Ethylbenzene	ug/kg	ND	250	10/09/17 12:23	
Toluene	ug/kg	ND	250	10/09/17 12:23	
Xylene (Total)	ug/kg	ND	750	10/09/17 12:23	
1,2-Dichloroethane-d4 (S)	%	99	74-131	10/09/17 12:23	
4-Bromofluorobenzene (S)	%	94	70-133	10/09/17 12:23	
Dibromofluoromethane (S)	%	102	71-130	10/09/17 12:23	
Toluene-d8 (S)	%	94	76-124	10/09/17 12:23	

LABORATORY CONTROL SAMPLE: 1348624

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	20	17.6	88	70-130	
Ethylbenzene	ug/kg	20	17.0	85	70-130	
Toluene	ug/kg	20	16.5	82	70-130	
Xylene (Total)	ug/kg	60	51.5	86	70-130	
1,2-Dichloroethane-d4 (S)	%			102	74-131	
4-Bromofluorobenzene (S)	%			99	70-133	
Dibromofluoromethane (S)	%			106	71-130	
Toluene-d8 (S)	%			92	76-124	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 273663 Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B Analysis Description: 8260B MSV UST-WATER
Associated Lab Samples: 30231096001, 30231096004

METHOD BLANK: 1346053 Matrix: Water
Associated Lab Samples: 30231096001, 30231096004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	09/29/17 12:44	
Ethylbenzene	ug/L	ND	1.0	09/29/17 12:44	
Toluene	ug/L	ND	1.0	09/29/17 12:44	
Xylene (Total)	ug/L	ND	3.0	09/29/17 12:44	
1,2-Dichloroethane-d4 (S)	%	101	80-120	09/29/17 12:44	
4-Bromofluorobenzene (S)	%	102	79-129	09/29/17 12:44	
Dibromofluoromethane (S)	%	102	80-120	09/29/17 12:44	
Toluene-d8 (S)	%	97	80-120	09/29/17 12:44	

LABORATORY CONTROL SAMPLE: 1346054

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	17.6	88	70-130	
Ethylbenzene	ug/L	20	17.2	86	70-130	
Toluene	ug/L	20	17.9	89	70-130	
Xylene (Total)	ug/L	60	52.9	88	70-130	
1,2-Dichloroethane-d4 (S)	%			96	80-120	
4-Bromofluorobenzene (S)	%			98	79-129	
Dibromofluoromethane (S)	%			101	80-120	
Toluene-d8 (S)	%			103	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1346055 1346056

Parameter	Units	30231099005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Benzene	ug/L	ND	20	20	17.8	17.9	89	89	67-121	0	
Ethylbenzene	ug/L	ND	20	20	17.5	18.0	88	90	70-127	3	
Toluene	ug/L	ND	20	20	18.5	18.2	93	91	77-125	2	
Xylene (Total)	ug/L	ND	60	60	54.2	53.9	90	90	69-128	0	
1,2-Dichloroethane-d4 (S)	%						98	93	80-120		
4-Bromofluorobenzene (S)	%						99	100	79-129		
Dibromofluoromethane (S)	%						101	98	80-120		
Toluene-d8 (S)	%						101	102	80-120		

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 273938 — Analysis Method: EPA 8015B
QC Batch Method: EPA 3546 — Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30231096002, 30231096003

METHOD BLANK: 1347510 — Matrix: Solid
Associated Lab Samples: 30231096002, 30231096003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/kg	ND	6.7	10/04/17 02:27	B
o-Terphenyl (S)	%	54	24-123	10/04/17 02:27	

LABORATORY CONTROL SAMPLE: 1347511

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/kg	66.7	47.0	71	43-98	
o-Terphenyl (S)	%			86	24-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1347512 1347513

Parameter	Units	30231631001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C10-C28)	mg/kg	35.5	72.2	72.1	84.6	73.2	68	52	10-175	14	
o-Terphenyl (S)	%						77	78	24-123		

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 273432 | Analysis Method: EPA 8015B
QC Batch Method: EPA 3510C | Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30231096001

METHOD BLANK: 1344962 | Matrix: Water
Associated Lab Samples: 30231096001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/L	ND	0.10	10/07/17 01:49	
o-Terphenyl (S)	%	52	35-101	10/07/17 01:49	

LABORATORY CONTROL SAMPLE: 1344963

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/L	1	0.65	65	41-103	
o-Terphenyl (S)	%			79	35-101	

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QUALITY CONTROL DATA

Project: WSP Hess Towson
Pace Project No.: 30231096

QC Batch: 274569 | Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 | Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 30231096002, 30231096003

SAMPLE DUPLICATE: 1350754

Parameter	Units	30230930001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	5.2	5.2	0	

SAMPLE DUPLICATE: 1350755

Parameter	Units	30230931001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	6.6	2.3	97	D6

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QUALIFIERS

Project: WSP Hess Towson
Pace Project No.: 30231096

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M	Pace Analytical Services - Minneapolis
PASI-PA	Pace Analytical Services - Greensburg

BATCH QUALIFIERS

Batch: 273432

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 274208

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

1c	A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
B	Analyte was detected in the associated method blank.
D6	The precision between the sample and sample duplicate exceeded laboratory control limits.

Pace Analytical Services, LLC
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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: WSP Hess Towson
Pace Project No.: 30231096

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
30231096002	**Hess Towson Soil A**	EPA 3546	273938	EPA 8015B	274087
30231096003	**Hess Towson Soil B**	EPA 3546	273938	EPA 8015B	274087
30231096001	**Hess Towson GW**	EPA 3510C	273432	EPA 8015B	274407
30231096002	**Hess Towson Soil A**	EPA 5035A/5030B	273409	EPA 8015B	273436
30231096003	**Hess Towson Soil B**	EPA 5035A/5030B	273409	EPA 8015B	273436
30231096001	**Hess Towson GW**	EPA 5030/8015B	273768		
30231096001	**Hess Towson GW**	EPA 3020	499864	EPA 6020	500447
30231096002	**Hess Towson Soil A**	EPA 5035A	274208	EPA 8260B	274227
30231096003	**Hess Towson Soil B**	EPA 5035A	274208	EPA 8260B	274227
30231096001	**Hess Towson GW**	EPA 8260B	273663		
30231096004	**Trip Blank**	EPA 8260B	273663		
30231096002	**Hess Towson Soil A**	ASTM D2974-87	274569		
30231096003	**Hess Towson Soil B**	ASTM D2974-87	274569		

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

2168789

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: WSP	Report To: Micheel Dlee	Attention:
Address:	Copy To: Pem Groff	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name: WSP Hess Towson	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

- NPDES
- GROUND WATER
- DRINKING WATER
- UST
- RCRA
- OTHER ______

Site Location STATE: ______

Section D Required Client Information

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Matrix Codes	MATRIX / CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	HCl 8RO 8015	HCl VOA 8260	DRO 8015	HNO3 Metal 6020	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	Hess Towson GW	WT	C	9/25/17	15:15				10		X	X	X						X	X	X	X		001
2	Hess Towson Soil A	SL	C	9/25/17	15:30				9						X	X			X	X	X			002
3																								003
4																								TB 004
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								

Metals= U, Se, V, Cr, Mo

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Michael Lee TerraSystems	9/25/17	16:45	Fed Ex						
				Ashley [illegible] / Pace	9-26-17	1000	6.0	Y	Y	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY):

WO#:30231096

30231096

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

Pittsburgh Lab Sample Condition Upon Receipt

30231096

Pace Analytical

Client Name: WSP Project #

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other

Label ML

Tracking #: 7060 2536 7580

LIMS Login ANL

Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals intact: ☒ yes ☐ no

Thermometer Used 6 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 6.0 °C Correction Factor: +0.0 °C Final Temp: 6.0 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: AML 9-26-17

Comments:	Yes	No	N/A	
Chain of Custody Present:	X			1.
Chain of Custody Filled Out:	X			2.
Chain of Custody Relinquished:	X			3.
Sampler Name & Signature on COC:		X		4.
Sample Labels match COC:				5.
-Includes date/time/ID Matrix: WT SL				
Samples Arrived within Hold Time:	X			6.
Short Hold Time Analysis (<72hr remaining):		X		7.
Rush Turn Around Time Requested:				8.
Sufficient Volume:				9.
Correct Containers Used:	X			10.
-Pace Containers Used:	X			
Containers Intact:		X		11. Received one VOA broken from 001
Orthophosphate field filtered			X	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			X	13.
Organic Samples checked for dechlorination:	X		~~X~~	14. AML 9-26-17
Filtered volume received for Dissolved tests			X	15.
All containers have been checked for preservation.	X			16.
All containers needing preservation are found to be in compliance with EPA recommendation.	X			
exceptions: VOA coliform, TOC, O&G, Phenolics				Initial when completed / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):		X		17. One VOA from sample 001
Trip Blank Present:	X			18.
Trip Blank Custody Seals Present	X			
Rad Aqueous Samples Screened > 0.5 mrem/hr			X	Initial when completed: Date:

Client Notification/ Resolution:

Person Contacted: Pam Groff Date/Time: 26 SEP 17 1355 Contacted By: TPL

Comments/ Resolution: Soil B needs to be run, same testing as soil A. Samples were collected in MD.

received 3 organics for sample 001

Soil B → Date/Time

9-25-17 / 1545

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

PLEASE RETURN THIS COPY WITH COC

Pace Container Order #277230

30231096 -

Addresses

Order By:		Ship To:		Return To:	
Company	WSP	Company	Terra Systems, Inc.	Company	Pace Analytical Pittsburgh
Contact	Pam Groff	Contact	michael Lee	Contact	Reed, Timothy
Email	pam.groff@wsp.com	Email	mlee@terrasystems.net	Email	timothy.reed@pacelabs.com
Address	750 Holiday Drive	Address	130 Hickman Road	Address	1638 Roseytown Road
Address 2	Suite 410	Address 2	Suite 1	Address 2	Suites 2,3,4
City	Pittsburgh	City	Claymont	City	Greensburg
State	PA Zip 15220	State	DE Zip 19703	State	PA Zip 15601
Phone	(571) 329-1255	Phone	(571) 329-1255	Phone	724-850-5614

Info

Project Name Hess Towson

Project Manager Reed, Timothy

Due Date 09/15/2017

Return

Profile 7798 L2,3

Carrier FedEx Standard Overnight

Quote

Location

Trip Blanks

[X] Include Trip Blanks

Bottle Labels

[X] Blank
[ ] Pre-Printed No Sample IDs
[ ] Pre-Printed With Sample IDs

Bottles

[ ] Boxed Cases
[X] Individually Wrapped
[ ] Grouped By Sample

Return Shipping Labels

[ ] No Shipper Number
[X] With Shipper Number

COC Options

[X] Number of Blanks 1
[ ] Pre-Printed

Misc

[ ] Sampling Instructions
[X] Custody Seal
[X] Temp. Blanks
[X] Coolers
[ ] Syringes
[X] Extra Bubble Wrap
[ ] Short Hold/Rush Stickers
[ ] DI Water Liter(s)
[ ] USDA Regulated Soils

# of Samples	Matrix	Test	Container	Total	# of QC	Lot #	Notes
2	SL	VOC 8260 5035 Low Level Terracore kit w/ sodium bisulfate	1-Terracore kit	4	2	321447	MS/MSD
2	SL	DRO by 8015	4oz jar	2	0	071017-3TE	
1	WT	VOC by 8260	(3) 40ml clear vial HCL	3	0	7192030	
1	WT	GRO 8015	3-40mL glass vial HCL-hydrochloric acid	3	0	7192030	
1	WT	DRO by 8015	1L amber glass, unpres	3	2	073117-1CKG	MS/MSD
1	WT	Metals by 6020	1-250 ml plastic w/ HNO3	1	0	081417-2AFW	
1	WT	COD	250mL plastic H2SO4	1	0	073117-4CFX	
1	WT	Trip BLANK	2-40mL HCL w/custody seal	2	0	7192030	

Hazard Shipping Placard In Place : NO

*Sample receiving hours are Monday through Friday 8:00 am to 6:00 pm and Saturday from 9:00 am to 12:00 pm unless special arrangements are made with your project manager.
*Pace Analytical reserves the right to return hazardous, toxic, or radioactive samples to you.
*Pace Analytical reserves the right to charge for unused bottles, as well as cost associated with sample storage and disposal.
*Payment term are net 30 days.
*Please include the proposal number on the chain of custody to insure proper billing.

Sample Notes

Solid GRO will be run from voc soil kit

Ship Date : 09/14/2017
Prepared By: David F Gunsallus
Verified By: Ashleigh Lowe

F-ALL-C-009-rev.00, 19Dec2016

10405165

Chain of Custody

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Workorder: 30231096 **Workorder Name:** WSP Hess Towson **Owner Received Date:** 9/26/2017 **Results Requested By:** 10/10/2017

Report To	Subcontract To
Penny Westrick Pace Analytical Pittsburgh 1638 Roseytown Road Suites 2,3,4 Greensburg, PA 15601 Phone 724 850-5610	Pace Analytical Minnesota 1700 Elm Street SE Suite 200 Minneapolis, MN 55414 Phone (612)607-1700

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: HNO3	Requested Analysis: 6020 U, Se, V, Cr, Mo	LAB USE ONLY
1	Hess Towson GW	PS	9/25/2017 15:15	30231096001	Water	1	X	001
2								
3								
4								
5								

Transfers	Released By	Date/Time	Received By	Date/Time
1	Ben [signature]	9-27-17 1640	[signature]	9/28/17 930
2		BM 9-27-17		
3				

Comments

Cooler Temperature on Receipt 19.0 C **Custody Seal** Y or N **Received on Ice** Y or N **Samples Intact** Y or N

****In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.*
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: 30Aug2017 Page 1 of 2
	Document No.: F-MN-L-213-rev.21	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Pace Pittsburgh

Project #: WO# : 10405165

10405165

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number: 7060-2530-9778

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other: **Temp Blank?** ☐ Yes ☒ No

Thermometer Used: ☐ 151401163 ☒ G87A9155100842 **Type of Ice:** ☐ Wet ☐ Blue ☒ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 19.5 **Cooler Temp Corrected (°C):** 19.0 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** -0.5 **Date and Initials of Person Examining Contents:** 9/28/17 SD

USDA Regulated Soil (☐ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☐ No	☒ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☒ Yes	☐ No		
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☒ Yes	☐ No	☐ N/A	13. ☒ HNO_3 ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample # 1/1
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☒ Yes	☐ No	☐ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: **Date:** 9/28/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
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(724)850-5600

November 15, 2017

Chris Cresci
WSP USA
13530 Dulles Technology Drive
Suite 300
Herndon, VA 20171

RE: Project: Hess Towson
Pace Project No.: 30234624

Dear Chris Cresci:

Enclosed are the analytical results for sample(s) received by the laboratory on October 31, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revision 1 - This report replaces the November 14, 2017 report. This report was reissued on November 15, 2017 to include estimated values on Samples 30234624005 and 30234624007 per client's request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Rachel D Christner

Rachel Christner
rachel.christner@pacelabs.com
724-850-5611
Project Manager

Enclosures

cc: Environment Accounts Payable, WSP, Environmental Accounts Payable
Pam Robertson, WSP USA

CERTIFICATIONS

Project:	Hess Towson
Pace Project No.:	30234624

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414-2485
A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas Certification #: 88-0680
California Certification #: 2929
CNMI Saipan Certification #:MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts Certification #: M-MN064
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: MN00064
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon NwTPH Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DW Certification #: 9952 C
West Virginia DEP Certification #: 382
Wisconsin Certification #: 999407970

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification

Pace Analytical Services, LLC
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(724)850-5600

CERTIFICATIONS

Project:	Hess Towson
Pace Project No.:	30234624

Pennsylvania Certification IDs

Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

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SAMPLE SUMMARY

Project: Hess Towson
Pace Project No.: 30234624

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30234624001	**Control S 14 Aq**	Water	10/30/17 11:00	10/31/17 10:20
30234624002	**Control S 14 Soil**	Solid	10/30/17 11:05	10/31/17 10:20
30234624003	**10g/LPS + NaOH S 14 Aq**	Water	10/30/17 11:15	10/31/17 10:20
30234624004	**10g/LPS + NaOH S 14 Soil**	Solid	10/30/17 11:20	10/31/17 10:20
30234624005	**20g/LPS + NaOH S 14 Aq**	Water	10/30/17 11:30	10/31/17 10:20
30234624006	**20g/LPS + NaOH S 14 Soil**	Solid	10/30/17 11:35	10/31/17 10:20
30234624007	**40g/LPS + NaOH S 14 Aq**	Water	10/30/17 11:45	10/31/17 10:20
30234624008	**40g/LPS + NaOH S 14 Soil**	Solid	10/30/17 11:50	10/31/17 10:20
30234624009	**Trip Blank Aq**	Water	10/30/17 00:01	10/31/17 10:20
30234624010	**Trip Blank Soil**	Solid	10/30/17 00:01	10/31/17 10:20

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SAMPLE ANALYTE COUNT

Project: Hess Towson
Pace Project No.: 30234624

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30234624001	**Control S 14 Aq**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	MAK	2	PASI-PA
		EPA 8260B	JAS	8	PASI-PA
30234624002	**Control S 14 Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	MAK	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30234624003	**10g/LPS + NaOH S 14 Aq**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	MAK	2	PASI-PA
		EPA 8260B	JAS	8	PASI-PA
30234624004	**10g/LPS + NaOH S 14 Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	MAK	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30234624005	**20g/LPS + NaOH S 14 Aq**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	MAK	2	PASI-PA
		EPA 6020	TT3	5	PASI-M
		EPA 8260B	JAS	8	PASI-PA
30234624006	**20g/LPS + NaOH S 14 Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	LEL	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30234624007	**40g/LPS + NaOH S 14 Aq**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	MAK	2	PASI-PA
		EPA 8260B	JAS	8	PASI-PA
30234624008	**40g/LPS + NaOH S 14 Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	LEL	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30234624009	**Trip Blank Aq**	EPA 8260B	JAS	8	PASI-PA

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: Control S 14 Aq **Lab ID: 30234624001** Collected: 10/30/17 11:00 Received: 10/31/17 10:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C								
TPH (C10-C28)	**1.4**	mg/L	0.098	0.0098	1	11/05/17 08:13	11/09/17 22:13		1c
Surrogates									
o-Terphenyl (S)	56	%	17-107		1	11/05/17 08:13	11/09/17 22:13	84-15-1	2c
Gasoline Range Organics	Analytical Method: EPA 5030/8015B								
TPH (C06-C10)	**447**	ug/L	200	45.0	1		11/10/17 16:04		
Surrogates									
4-Bromofluorobenzene (S)	96	%	80-120		1		11/10/17 16:04	460-00-4	
8260B MSV	Analytical Method: EPA 8260B								
Benzene	ND	ug/L	1.0	0.24	1		11/07/17 05:09	71-43-2	
Ethylbenzene	**12.2**	ug/L	1.0	0.31	1		11/07/17 05:09	100-41-4	
Toluene	**1.2**	ug/L	1.0	0.30	1		11/07/17 05:09	108-88-3	
Xylene (Total)	**68.9**	ug/L	3.0	0.78	1		11/07/17 05:09	1330-20-7	
Surrogates									
Toluene-d8 (S)	95	%	80-120		1		11/07/17 05:09	2037-26-5	
4-Bromofluorobenzene (S)	99	%	79-129		1		11/07/17 05:09	460-00-4	
1,2-Dichloroethane-d4 (S)	97	%	80-120		1		11/07/17 05:09	17060-07-0	
Dibromofluoromethane (S)	104	%	80-120		1		11/07/17 05:09	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: Control S 14 Soil **Lab ID: 30234624002** Collected: 10/30/17 11:05 Received: 10/31/17 10:20 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546								
TPH (C10-C28)	**82.4**	mg/kg	7.6	1.2	1	11/03/17 08:49	11/04/17 05:54		
Surrogates									
o-Terphenyl (S)	64	%	30-90		1	11/03/17 08:49	11/04/17 05:54	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B								
TPH (C06-C10)	**11.0**	mg/kg	8.2	1.4	1	11/08/17 11:37	11/10/17 23:57		B
Surrogates									
a,a,a-Trifluorotoluene (S)	66	%	38-123		1	11/08/17 11:37	11/10/17 23:57	98-08-8	
4-Bromofluorobenzene (S)	101	%	84-128		1	11/08/17 11:37	11/10/17 23:57	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A								
Benzene	ND	ug/kg	4.1	1.2	1	11/03/17 10:33	11/03/17 17:59	71-43-2	1c
Ethylbenzene	**104**	ug/kg	4.1	1.2	1	11/03/17 10:33	11/03/17 17:59	100-41-4	1c
Toluene	**4.5**	ug/kg	4.1	1.2	1	11/03/17 10:33	11/03/17 17:59	108-88-3	1c
Xylene (Total)	**572**	ug/kg	12.2	3.6	1	11/03/17 10:33	11/03/17 17:59	1330-20-7	
Surrogates									
Toluene-d8 (S)	102	%	76-124		1	11/03/17 10:33	11/03/17 17:59	2037-26-5	
4-Bromofluorobenzene (S)	100	%	70-133		1	11/03/17 10:33	11/03/17 17:59	460-00-4	
1,2-Dichloroethane-d4 (S)	97	%	74-131		1	11/03/17 10:33	11/03/17 17:59	17060-07-0	
Dibromofluoromethane (S)	89	%	71-130		1	11/03/17 10:33	11/03/17 17:59	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**14.0**	%	0.10	0.10	1		11/11/17 10:25		

REPORT OF LABORATORY ANALYSIS

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: 10g/LPS + NaOH S 14 Aq **Lab ID: 30234624003** Collected: 10/30/17 11:15 Received: 10/31/17 10:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C								
TPH (C10-C28)	**2.9**	mg/L	0.65	0.065	5	11/05/17 08:13	11/10/17 17:19		1c
Surrogates									
o-Terphenyl (S)	46	%	17-107		5	11/05/17 08:13	11/10/17 17:19	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B								
TPH (C06-C10)	**254**	ug/L	200	45.0	1		11/10/17 16:24		
Surrogates									
4-Bromofluorobenzene (S)	96	%	80-120		1		11/10/17 16:24	460-00-4	
8260B MSV	Analytical Method: EPA 8260B								
Benzene	ND	ug/L	1.0	0.24	1		11/07/17 05:34	71-43-2	
Ethylbenzene	**4.4**	ug/L	1.0	0.31	1		11/07/17 05:34	100-41-4	
Toluene	ND	ug/L	1.0	0.30	1		11/07/17 05:34	108-88-3	
Xylene (Total)	**17.0**	ug/L	3.0	0.78	1		11/07/17 05:34	1330-20-7	
Surrogates									
Toluene-d8 (S)	96	%	80-120		1		11/07/17 05:34	2037-26-5	
4-Bromofluorobenzene (S)	100	%	79-129		1		11/07/17 05:34	460-00-4	
1,2-Dichloroethane-d4 (S)	97	%	80-120		1		11/07/17 05:34	17060-07-0	
Dibromofluoromethane (S)	102	%	80-120		1		11/07/17 05:34	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: 10g/LPS + NaOH S 14 Soil **Lab ID: 30234624004** Collected: 10/30/17 11:20 Received: 10/31/17 10:20 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546								
TPH (C10-C28)	**70.7**	mg/kg	8.9	1.4	1	11/03/17 08:49	11/04/17 06:42		
Surrogates									
o-Terphenyl (S)	61	%	30-90		1	11/03/17 08:49	11/04/17 06:42	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B								
TPH (C06-C10)	**25.0**	mg/kg	10.0	1.7	1	11/08/17 11:37	11/11/17 00:17		B
Surrogates									
a,a,a-Trifluorotoluene (S)	53	%	38-123		1	11/08/17 11:37	11/11/17 00:17	98-08-8	
4-Bromofluorobenzene (S)	88	%	84-128		1	11/08/17 11:37	11/11/17 00:17	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A								
Benzene	ND	ug/kg	5.0	1.5	1	11/03/17 10:33	11/03/17 18:25	71-43-2	1c
Ethylbenzene	**32.6**	ug/kg	5.0	1.5	1	11/03/17 10:33	11/03/17 18:25	100-41-4	1c
Toluene	ND	ug/kg	5.0	1.5	1	11/03/17 10:33	11/03/17 18:25	108-88-3	1c
Xylene (Total)	**148**	ug/kg	15.1	4.4	1	11/03/17 10:33	11/03/17 18:25	1330-20-7	
Surrogates									
Toluene-d8 (S)	98	%	76-124		1	11/03/17 10:33	11/03/17 18:25	2037-26-5	
4-Bromofluorobenzene (S)	100	%	70-133		1	11/03/17 10:33	11/03/17 18:25	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	74-131		1	11/03/17 10:33	11/03/17 18:25	17060-07-0	
Dibromofluoromethane (S)	91	%	71-130		1	11/03/17 10:33	11/03/17 18:25	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**25.5**	%	0.10	0.10	1		11/11/17 10:25		

Pace Analytical Services, LLC
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Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: 20g/LPS + NaOH S 14 Aq **Lab ID: 30234624005** Collected: 10/30/17 11:30 Received: 10/31/17 10:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C								
TPH (C10-C28)	**0.79**	mg/L	0.12	0.012	1	11/05/17 08:13	11/09/17 22:33		1c
Surrogates									
o-Terphenyl (S)	43	%	17-107		1	11/05/17 08:13	11/09/17 22:33	84-15-1	2c
Gasoline Range Organics	Analytical Method: EPA 5030/8015B								
TPH (C06-C10)	**90.1J**	ug/L	200	45.0	1		11/10/17 16:43		
Surrogates									
4-Bromofluorobenzene (S)	99	%	80-120		1		11/10/17 16:43	460-00-4	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3020								
Chromium	**1900**	ug/L	10.0	2.6	20	11/08/17 12:57	11/09/17 22:15	7440-47-3	
Molybdenum	**485**	ug/L	10.0	1.6	20	11/08/17 12:57	11/09/17 22:15	7439-98-7	
Selenium	**25.8**	ug/L	10.0	3.3	20	11/08/17 12:57	11/09/17 22:15	7782-49-2	
Uranium-238	**301**	ug/L	10.0	0.66	20	11/08/17 12:57	11/09/17 22:15	7440-61-1	
Vanadium	**1880**	ug/L	20.0	5.3	20	11/08/17 12:57	11/09/17 22:15	7440-62-2	
8260B MSV	Analytical Method: EPA 8260B								
Benzene	**1.0 U**	ug/L	1.0	0.24	1		11/07/17 06:12	71-43-2	
Ethylbenzene	**1.1**	ug/L	1.0	0.31	1		11/07/17 06:12	100-41-4	
Toluene	**1.0 U**	ug/L	1.0	0.30	1		11/07/17 06:12	108-88-3	
Xylene (Total)	**3.0 U**	ug/L	3.0	0.78	1		11/07/17 06:12	1330-20-7	
Surrogates									
Toluene-d8 (S)	93	%	80-120		1		11/07/17 06:12	2037-26-5	
4-Bromofluorobenzene (S)	97	%	79-129		1		11/07/17 06:12	460-00-4	
1,2-Dichloroethane-d4 (S)	102	%	80-120		1		11/07/17 06:12	17060-07-0	
Dibromofluoromethane (S)	105	%	80-120		1		11/07/17 06:12	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: 20g/LPS + NaOH S 14 Soil **Lab ID: 30234624006** Collected: 10/30/17 11:35 Received: 10/31/17 10:20 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546								
TPH (C10-C28)	**57.3**	mg/kg	8.0	1.2	1	11/03/17 08:49	11/04/17 06:52		
Surrogates									
o-Terphenyl (S)	59	%	30-90		1	11/03/17 08:49	11/04/17 06:52	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B								
TPH (C06-C10)	**13.2**	mg/kg	10	1.7	1	11/08/17 11:37	11/08/17 16:49		B
Surrogates									
a,a,a-Trifluorotoluene (S)	68	%	38-123		1	11/08/17 11:37	11/08/17 16:49	98-08-8	
4-Bromofluorobenzene (S)	84	%	84-128		1	11/08/17 11:37	11/08/17 16:49	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A								
Benzene	ND	ug/kg	4.5	1.3	1	11/03/17 10:33	11/03/17 18:50	71-43-2	1c
Ethylbenzene	**10.3**	ug/kg	4.5	1.4	1	11/03/17 10:33	11/03/17 18:50	100-41-4	1c
Toluene	ND	ug/kg	4.5	1.3	1	11/03/17 10:33	11/03/17 18:50	108-88-3	1c
Xylene (Total)	**23.9**	ug/kg	13.4	3.9	1	11/03/17 10:33	11/03/17 18:50	1330-20-7	
Surrogates									
Toluene-d8 (S)	100	%	76-124		1	11/03/17 10:33	11/03/17 18:50	2037-26-5	
4-Bromofluorobenzene (S)	95	%	70-133		1	11/03/17 10:33	11/03/17 18:50	460-00-4	
1,2-Dichloroethane-d4 (S)	99	%	74-131		1	11/03/17 10:33	11/03/17 18:50	17060-07-0	
Dibromofluoromethane (S)	93	%	71-130		1	11/03/17 10:33	11/03/17 18:50	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**17.3**	%	0.10	0.10	1		11/11/17 10:25		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: 40g/LPS + NaOH S 14 Aq **Lab ID: 30234624007** Collected: 10/30/17 11:45 Received: 10/31/17 10:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C								
TPH (C10-C28)	**3.2**	mg/L	1.0	0.10	10	11/05/17 08:13	11/10/17 17:29		1c
Surrogates									
o-Terphenyl (S)	37	%	17-107		10	11/05/17 08:13	11/10/17 17:29	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B								
TPH (C06-C10)	**157J**	ug/L	200	45.0	1		11/10/17 17:03		
Surrogates									
4-Bromofluorobenzene (S)	96	%	80-120		1		11/10/17 17:03	460-00-4	
8260B MSV	Analytical Method: EPA 8260B								
Benzene	**1.0 U**	ug/L	1.0	0.24	1		11/07/17 06:37	71-43-2	
Ethylbenzene	**2.9**	ug/L	1.0	0.31	1		11/07/17 06:37	100-41-4	
Toluene	**1.0 U**	ug/L	1.0	0.30	1		11/07/17 06:37	108-88-3	
Xylene (Total)	**2.5J**	ug/L	3.0	0.78	1		11/07/17 06:37	1330-20-7	
Surrogates									
Toluene-d8 (S)	95	%	80-120		1		11/07/17 06:37	2037-26-5	
4-Bromofluorobenzene (S)	97	%	79-129		1		11/07/17 06:37	460-00-4	
1,2-Dichloroethane-d4 (S)	100	%	80-120		1		11/07/17 06:37	17060-07-0	
Dibromofluoromethane (S)	98	%	80-120		1		11/07/17 06:37	1868-53-7	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: 40g/LPS + NaOH S 14 Soil **Lab ID: 30234624008** Collected: 10/30/17 11:50 Received: 10/31/17 10:20 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546								
TPH (C10-C28)	**46.8**	mg/kg	8.3	1.3	1	11/03/17 08:49	11/04/17 07:02		
Surrogates									
o-Terphenyl (S)	59	%	30-90		1	11/03/17 08:49	11/04/17 07:02	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B								
TPH (C06-C10)	**15.7**	mg/kg	9.3	1.6	1	11/08/17 11:37	11/08/17 17:09		B
Surrogates									
a,a,a-Trifluorotoluene (S)	63	%	38-123		1	11/08/17 11:37	11/08/17 17:09	98-08-8	
4-Bromofluorobenzene (S)	84	%	84-128		1	11/08/17 11:37	11/08/17 17:09	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A								
Benzene	ND	ug/kg	4.2	1.2	1	11/03/17 10:33	11/03/17 19:16	71-43-2	1c
Ethylbenzene	**12.7**	ug/kg	4.2	1.3	1	11/03/17 10:33	11/03/17 19:16	100-41-4	1c
Toluene	ND	ug/kg	4.2	1.2	1	11/03/17 10:33	11/03/17 19:16	108-88-3	1c
Xylene (Total)	**20.7**	ug/kg	12.7	3.7	1	11/03/17 10:33	11/03/17 19:16	1330-20-7	
Surrogates									
Toluene-d8 (S)	102	%	76-124		1	11/03/17 10:33	11/03/17 19:16	2037-26-5	
4-Bromofluorobenzene (S)	98	%	70-133		1	11/03/17 10:33	11/03/17 19:16	460-00-4	
1,2-Dichloroethane-d4 (S)	104	%	74-131		1	11/03/17 10:33	11/03/17 19:16	17060-07-0	
Dibromofluoromethane (S)	94	%	71-130		1	11/03/17 10:33	11/03/17 19:16	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**20.5**	%	0.10	0.10	1		11/11/17 10:25		

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30234624

Sample: Trip Blank Aq **Lab ID: 30234624009** Collected: 10/30/17 00:01 Received: 10/31/17 10:20 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8260B MSV	Analytical Method: EPA 8260B								
Benzene	ND	ug/L	1.0	0.24	1		11/07/17 01:47	71-43-2	
Ethylbenzene	ND	ug/L	1.0	0.31	1		11/07/17 01:47	100-41-4	
Toluene	ND	ug/L	1.0	0.30	1		11/07/17 01:47	108-88-3	
Xylene (Total)	ND	ug/L	3.0	0.78	1		11/07/17 01:47	1330-20-7	
Surrogates									
Toluene-d8 (S)	94	%	80-120		1		11/07/17 01:47	2037-26-5	
4-Bromofluorobenzene (S)	97	%	79-129		1		11/07/17 01:47	460-00-4	
1,2-Dichloroethane-d4 (S)	97	%	80-120		1		11/07/17 01:47	17060-07-0	
Dibromofluoromethane (S)	98	%	80-120		1		11/07/17 01:47	1868-53-7	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 278355 Analysis Method: EPA 8015B
QC Batch Method: EPA 5035A/5030B Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

METHOD BLANK: 1367281 Matrix: Solid
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
TPH (C06-C10)	mg/kg	ND	10.0	1.7	11/08/17 12:52	
4-Bromofluorobenzene (S)	%	98	84-128		11/08/17 12:52	
a,a,a-Trifluorotoluene (S)	%	83	38-123		11/08/17 12:52	

LABORATORY CONTROL SAMPLE: 1367282

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	mg/kg	50	48.4	97	78-140	
4-Bromofluorobenzene (S)	%			93	84-128	
a,a,a-Trifluorotoluene (S)	%			83	38-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1367283 1367284

Parameter	Units	30234629002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
TPH (C06-C10)	mg/kg	11.5 U	57.4	57.4	55.8	54.4	95	93	50-144	3	25	
4-Bromofluorobenzene (S)	%						92	91	84-128			
a,a,a-Trifluorotoluene (S)	%						81	86	38-123			

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 278698 | Analysis Method: EPA 5030/8015B
QC Batch Method: EPA 5030/8015B | Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30234624001, 30234624003, 30234624005, 30234624007

METHOD BLANK: 1368713 Matrix: Water
Associated Lab Samples: 30234624001, 30234624003, 30234624005, 30234624007

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
TPH (C06-C10)	ug/L	ND	200	45.0	11/10/17 15:24	
4-Bromofluorobenzene (S)	%	100	80-120		11/10/17 15:24	

LABORATORY CONTROL SAMPLE: 1368714

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	ug/L	1000	1000	100	76-138	
4-Bromofluorobenzene (S)	%			94	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1368715 1368716

Parameter	Units	30234859003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
TPH (C06-C10)	ug/L	ND	1000	1000	813	808	80	79	56-132	1	25	
4-Bromofluorobenzene (S)	%						92	93	80-120			

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 506646 | Analysis Method: EPA 6020
QC Batch Method: EPA 3020 | Analysis Description: 6020 MET
Associated Lab Samples: 30234624005

METHOD BLANK: 2754206 Matrix: Water
Associated Lab Samples: 30234624005

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chromium	ug/L	ND	0.50	0.13	11/10/17 14:39	
Molybdenum	ug/L	ND	0.50	0.080	11/10/17 14:39	
Selenium	ug/L	ND	0.50	0.17	11/10/17 14:39	
Uranium-238	ug/L	ND	0.50	0.033	11/10/17 14:39	
Vanadium	ug/L	ND	1.0	0.27	11/10/17 14:39	

LABORATORY CONTROL SAMPLE: 2754207

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chromium	ug/L	100	109	109	80-120	
Molybdenum	ug/L	100	105	105	80-120	
Selenium	ug/L	100	106	106	80-120	
Uranium-238	ug/L	100	103	103	80-120	
Vanadium	ug/L	100	108	108	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2754208 2754209

Parameter	Units	10409273001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chromium	ug/L	0.00076 mg/L	100	100	112	112	112	111	75-125	0	20	
Molybdenum	ug/L	1.5	100	100	111	112	109	111	75-125	1	20	
Selenium	ug/L	0.00034J mg/L	100	100	111	111	111	111	75-125	0	20	
Uranium-238	ug/L	12.6	100	100	119	119	106	106	75-125	0	20	
Vanadium	ug/L	0.0012 mg/L	100	100	111	111	110	110	75-125	0	20	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 277857 Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

METHOD BLANK: 1365209 Matrix: Solid
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Benzene	ug/kg	ND	5.0	1.4	11/03/17 11:34	
Ethylbenzene	ug/kg	ND	5.0	1.5	11/03/17 11:34	
Toluene	ug/kg	ND	5.0	1.4	11/03/17 11:34	
Xylene (Total)	ug/kg	ND	15.0	4.4	11/03/17 11:34	
1,2-Dichloroethane-d4 (S)	%	98	74-131		11/03/17 11:34	
4-Bromofluorobenzene (S)	%	97	70-133		11/03/17 11:34	
Dibromofluoromethane (S)	%	96	71-130		11/03/17 11:34	
Toluene-d8 (S)	%	100	76-124		11/03/17 11:34	

LABORATORY CONTROL SAMPLE: 1365210

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	20	17.6	88	70-130	
Ethylbenzene	ug/kg	20	19.0	95	70-130	
Toluene	ug/kg	20	18.9	94	70-130	
Xylene (Total)	ug/kg	60	56.6	94	70-130	
1,2-Dichloroethane-d4 (S)	%			93	74-131	
4-Bromofluorobenzene (S)	%			98	70-133	
Dibromofluoromethane (S)	%			99	71-130	
Toluene-d8 (S)	%			100	76-124	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 278139 — Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B — Analysis Description: 8260B MSV UST-WATER
Associated Lab Samples: 30234624001, 30234624003, 30234624005, 30234624007, 30234624009

METHOD BLANK: 1366421 — Matrix: Water
Associated Lab Samples: 30234624001, 30234624003, 30234624005, 30234624007, 30234624009

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	0.24	11/07/17 00:31	
Ethylbenzene	ug/L	ND	1.0	0.31	11/07/17 00:31	
Toluene	ug/L	ND	1.0	0.30	11/07/17 00:31	
Xylene (Total)	ug/L	ND	3.0	0.78	11/07/17 00:31	
1,2-Dichloroethane-d4 (S)	%	97	80-120		11/07/17 00:31	
4-Bromofluorobenzene (S)	%	96	79-129		11/07/17 00:31	
Dibromofluoromethane (S)	%	101	80-120		11/07/17 00:31	
Toluene-d8 (S)	%	96	80-120		11/07/17 00:31	

LABORATORY CONTROL SAMPLE: 1366422

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	18.4	92	70-130	
Ethylbenzene	ug/L	20	18.6	93	70-130	
Toluene	ug/L	20	18.5	92	70-130	
Xylene (Total)	ug/L	60	56.0	93	70-130	
1,2-Dichloroethane-d4 (S)	%			97	80-120	
4-Bromofluorobenzene (S)	%			96	79-129	
Dibromofluoromethane (S)	%			101	80-120	
Toluene-d8 (S)	%			95	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1366423 1366424

Parameter	Units	30234862003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	ND	20	20	20.6	20.4	103	102	67-121	1	30	
Ethylbenzene	ug/L	2.5	20	20	23.2	23.0	103	102	70-127	1	30	
Toluene	ug/L	ND	20	20	21.5	20.3	108	101	77-125	6	30	
Xylene (Total)	ug/L	11.2	60	60	73.0	72.1	103	102	69-128	1	30	
1,2-Dichloroethane-d4 (S)	%						94	94	80-120			
4-Bromofluorobenzene (S)	%						99	97	79-129			
Dibromofluoromethane (S)	%						99	100	80-120			
Toluene-d8 (S)	%						97	95	80-120			

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 277835 Analysis Method: EPA 8015B
QC Batch Method: EPA 3546 Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

METHOD BLANK: 1365148 Matrix: Solid
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
TPH (C10-C28)	mg/kg	ND	6.7	1.0	11/04/17 04:46	
o-Terphenyl (S)	%	73	30-90		11/04/17 04:46	

LABORATORY CONTROL SAMPLE: 1365149

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/kg	66.7	52.5	79	47-86	
o-Terphenyl (S)	%			91	30-90	ST

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1365160 1365161

Parameter	Units	30234624002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
TPH (C10-C28)	mg/kg	82.4	75.9	76	145	134	83	67	10-142	8	25	
o-Terphenyl (S)	%						65	70	30-90			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 277987 — Analysis Method: EPA 8015B
QC Batch Method: EPA 3510C — Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30234624001, 30234624003, 30234624005, 30234624007

METHOD BLANK: 1365966 — Matrix: Water
Associated Lab Samples: 30234624001, 30234624003, 30234624005, 30234624007

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
TPH (C10-C28)	mg/L	ND	0.10	0.010	11/09/17 21:42	
o-Terphenyl (S)	%	68	17-107		11/09/17 21:42	

LABORATORY CONTROL SAMPLE: 1365967

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/L	1	0.89	89	44-100	
o-Terphenyl (S)	%			92	17-107	2c

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30234624

QC Batch: 278790 Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 30234624002, 30234624004, 30234624006, 30234624008

SAMPLE DUPLICATE: 1369336

Parameter	Units	30234624002 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	14.0	14.0	0	20	

SAMPLE DUPLICATE: 1369337

Parameter	Units	30234624004 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	25.5	22.2	14	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
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Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project:	Hess Towson
Pace Project No.:	30234624

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M	Pace Analytical Services - Minneapolis
PASI-PA	Pace Analytical Services - Greensburg

SAMPLE QUALIFIERS

Sample: 30234624005

[1] Residual Chlorine detected post analysis by 8260.

Sample: 30234624007

[1] Residual Chlorine detected post analysis by 8260.

BATCH QUALIFIERS

Batch: 277857

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 277987

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

1c A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

2c Retention times shifted during the analytical sequence such that the retention times for target analytes and surrogates in samples, QC samples, and standards fell outside of their respective retention time windows. Standards and QC samples were used to aid analyte identification in samples. The peak(s) for this analyte was(were) manually identified.

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: Hess Towson
Pace Project No.: 30234624

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
ST	Surrogate recovery was above laboratory control limits. Results may be biased high.

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Hess Towson
Pace Project No.: 30234624

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
30234624002	**Control S 14 Soil**	EPA 3546	277835	EPA 8015B	277927
30234624004	**10g/LPS + NaOH S 14 Soil**	EPA 3546	277835	EPA 8015B	277927
30234624006	**20g/LPS + NaOH S 14 Soil**	EPA 3546	277835	EPA 8015B	277927
30234624008	**40g/LPS + NaOH S 14 Soil**	EPA 3546	277835	EPA 8015B	277927
30234624001	**Control S 14 Aq**	EPA 3510C	277987	EPA 8015B	278619
30234624003	**10g/LPS + NaOH S 14 Aq**	EPA 3510C	277987	EPA 8015B	278619
30234624005	**20g/LPS + NaOH S 14 Aq**	EPA 3510C	277987	EPA 8015B	278619
30234624007	**40g/LPS + NaOH S 14 Aq**	EPA 3510C	277987	EPA 8015B	278619
30234624002	**Control S 14 Soil**	EPA 5035A/5030B	278355	EPA 8015B	278379
30234624004	**10g/LPS + NaOH S 14 Soil**	EPA 5035A/5030B	278355	EPA 8015B	278379
30234624006	**20g/LPS + NaOH S 14 Soil**	EPA 5035A/5030B	278355	EPA 8015B	278379
30234624008	**40g/LPS + NaOH S 14 Soil**	EPA 5035A/5030B	278355	EPA 8015B	278379
30234624001	**Control S 14 Aq**	EPA 5030/8015B	278698		
30234624003	**10g/LPS + NaOH S 14 Aq**	EPA 5030/8015B	278698		
30234624005	**20g/LPS + NaOH S 14 Aq**	EPA 5030/8015B	278698		
30234624007	**40g/LPS + NaOH S 14 Aq**	EPA 5030/8015B	278698		
30234624005	**20g/LPS + NaOH S 14 Aq**	EPA 3020	506646	EPA 6020	507641
30234624002	**Control S 14 Soil**	EPA 5035A	277857	EPA 8260B	277866
30234624004	**10g/LPS + NaOH S 14 Soil**	EPA 5035A	277857	EPA 8260B	277866
30234624006	**20g/LPS + NaOH S 14 Soil**	EPA 5035A	277857	EPA 8260B	277866
30234624008	**40g/LPS + NaOH S 14 Soil**	EPA 5035A	277857	EPA 8260B	277866
30234624001	**Control S 14 Aq**	EPA 8260B	278139		
30234624003	**10g/LPS + NaOH S 14 Aq**	EPA 8260B	278139		
30234624005	**20g/LPS + NaOH S 14 Aq**	EPA 8260B	278139		
30234624007	**40g/LPS + NaOH S 14 Aq**	EPA 8260B	278139		
30234624009	**Trip Blank Aq**	EPA 8260B	278139		
30234624002	**Control S 14 Soil**	ASTM D2974-87	278790		
30234624004	**10g/LPS + NaOH S 14 Soil**	ASTM D2974-87	278790		
30234624006	**20g/LPS + NaOH S 14 Soil**	ASTM D2974-87	278790		
30234624008	**40g/LPS + NaOH S 14 Soil**	ASTM D2974-87	278790		

PaceAnalytical

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A
Required Client Information:

Company:	WSP Environment & Energy
Address:	13530 Dulles Technology Dr
	Suite 300, Herndon, VA 20171
Email:	pam.groff@wsp.com
Phone:	703-318-3958
Fax:	
Requested Due Date:	10 business days

Section B
Required Project Information:

Report To:	Groff, Pam
Copy To:	Michael Lee mlee@levrasystems.net
Purchase Order #:	
Project Name:	Hess Towson
Project #:	31400408, Task 3

Section C
Invoice Information:

Attention:	Environment Accounts Payable
Company Name:	WSP, Environment Accounts Payable
Address:	13530 Dulles Technology Dr, Herndon VA 20171
Pace Quote:	MSA in place
Pace Project Manager:	Penny Westrick
Pace Profile #:	7798

Regulatory Agency	
State / Location	MD

MATRIX / CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Other OT; Tissue TS

SAMPLE ID — One Character per box. (A-Z, 0-9 / , -) Sample Ids must be unique

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	START DATE	START TIME	END DATE	END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	VOC 8260 5035 Low Level T	DRO by 8015	VOC by 8260	GRO 8015	DRO by 8015	Total Metals by 200.8	Trip BLANK	Trip BLANK	Trip BLANK	Residual Chlorine (Y/N)		
1	Control S 14 Aq	W	G	10/30/17	11:00				8	X			X								X	X	X							001
2	Control S 14 Soil	S	G	10/30/17	11:05				9						X	X			X	X									+MS/MSD VOC	002
3	10g/L PS+NaOH S 14 Aq	W	G	10/30/17	11:15				9	X			X								X	X	X						+MS/MSD DRO	003
4	10g/L PS+NaOH S 14 Soil	S	G	10/30/17	11:20				5						X	X			X	X										004
5	20g/L PS+NaOH S 14 Aq	W	G	10/30/17	11:30				9	X		X	X								X	X	X	X						005
6	20g/L PS+NaOH S 14 soil	S	G	10/30/17	11:35				9						X	X			X	X									+MS/MSD VOC	006
7	40 g/L PS+NaOH S 14 Aq	W	G	10/30/17	11:45				9	X			X								X	X	X						+MS/MSD DRO	007
8	40 g/L PS+NaOH S 14 soil	S	G	10/30/17	11:50				5	~~X~~			~~X~~		X	X			X	X										008
9	Trip Blank Aq	S																												009
10	Trip Blank Soil	—																												010
11																														
12																														

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Michael D Lee	10/30/17	15:30	[signature]	10/31/17	1020	3.1 3.5	Y	Y	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Michael D Lee

SIGNATURE of SAMPLER: Michael D Lee

DATE Signed: 10/30/17

WO#: 30234624

30234624

Pittsburgh Lab Sample Condition Upon Receipt

Pace Analytical

Client Name: WSP Env. + Energy Project # 3023462 4

Label	74
LIMS Login	ANV

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other ______

Tracking #: 706025875100

Custody Seal on Cooler/Box Present: ☑ yes ☐ no Seals intact: ☑ yes ☐ no

Thermometer Used 8 Type of Ice: Wet Blue None

Cooler Temperature Observed Temp 3.1, 3.5 °C Correction Factor: 0.0 °C Final Temp: 3.1, 3.5 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: 74 10/31/17

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID Matrix: WT + SL				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	~~✓~~	✓		9. 74 10/31/17 Received LV for DRO samples 003, 005, + 007.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered			✓	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			✓	13.
Organic Samples checked for dechlorination:	✓			14.
Filtered volume received for Dissolved tests			✓	15.
All containers have been checked for preservation.	✓			16.
All containers needing preservation are found to be in compliance with EPA recommendation.	✓			
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed 74 / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):		✓		17.
Trip Blank Present:	✓			18.
Trip Blank Custody Seals Present	✓			
Rad Aqueous Samples Screened > 0.5 mrem/hr			✓	Initial when completed: / Date:

Client Notification/ Resolution:

Person Contacted: ______ Date/Time: ______ Contacted By: ______

Comments/ Resolution: ______

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

L2409672

Chain of Custody

Pace Analytical®
www.pacelabs.com

Workorder: 30234624 **Workorder Name:** Hess Towson **Owner Received Date:** 10/31/2017 **Results Requested By:** 11/14/2017

Report To	Subcontract To
Penny Westrick Pace Analytical Pittsburgh 1638 Roseytown Road Suites 2,3,4 Greensburg, PA 15601 Phone 724 850-5610	Pace Analytical Minnesota 1700 Elm Street SE Suite 200 Minneapolis, MN 55414 Phone (612)607-1700

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: HNO3	Requested Analysis: 6020 Se, Cr, V, Mo, U	LAB USE ONLY
1	20g/LPS + NaOH S 14 Aq	PS	10/30/2017 11:30	30234624005	Water	1	X	001
2								
3								
4								
5								

Transfers	Released By	Date/Time	Received By	Date/Time
1	[signature]	11/2/17 1615	[signature] PACE	11/3/17 1000
2				
3				

Comments

Cooler Temperature on Receipt 0.0 °C **Custody Seal** Y or N **Received on Ice** Y or N **Samples Intact** Y or N

****In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.*
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 30Aug2017 Page 1 of 2
	Document No.: **F-MN-L-213-rev.21**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Pace PA

Project #: **WO# : 10409672**

10409672

Courier: ☐Fed Ex ☐UPS ☐USPS ☐Client ☐Commercial ☐Pace ☐SpeeDee ☐Other:

Tracking Number: 7060 2537 6482

Custody Seal on Cooler/Box Present? ☐Yes ☑No **Seals Intact?** ☐Yes ☑No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐Bubble Wrap ☐Bubble Bags ☑None ☐Other: **Temp Blank?** ☐Yes ☑No

Thermometer Used: ☐151401163 ☑G87A9155100842

Type of Ice: ☑Wet ☐Blue ☐None ☐Samples on ice, cooling process has begun

Cooler Temp Read (°C): 0.4 **Cooler Temp Corrected (°C):** 0.0 **Biological Tissue Frozen?** ☐Yes ☐No ☑N/A

Temp should be above freezing to 6°C **Correction Factor:** -0.4 **Date and Initials of Person Examining Contents:** ME 11/3/17

USDA Regulated Soil (☑N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐Yes ☐No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐Yes ☐No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☑Yes	☐No		1.
Chain of Custody Filled Out?	☑Yes	☐No		2.
Chain of Custody Relinquished?	☑Yes	☐No		3.
Sampler Name and/or Signature on COC?	☐Yes	☐No	☑N/A	4.
Samples Arrived within Hold Time?	☑Yes	☐No		5.
Short Hold Time Analysis (<72 hr)?	☐Yes	☑No		6.
Rush Turn Around Time Requested?	☐Yes	☑No		7.
Sufficient Volume?	☑Yes	☐No		8.
Correct Containers Used? -Pace Containers Used?	☑Yes ☑Yes	☐No ☐No		9.
Containers Intact?	☑Yes	☐No		10.
Filtered Volume Received for Dissolved Tests?	☐Yes	☐No	☑N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: Wt	☑Yes	☐No		12.
All containers needing acid/base preservation have been checked? All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide) Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☑Yes ☑Yes ☐Yes	☐No ☐No ☐No	☐N/A ☐N/A ☑N/A	13. ☑HNO_3 ☐H_2SO_4 ☐NaOH Positive for Res. Chlorine? Y N Sample # 1 1/1 Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐Yes	☐No	☑N/A	14.
Trip Blank Present? Trip Blank Custody Seals Present? Pace Trip Blank Lot # (if purchased):	☐Yes ☐Yes	☐No ☐No	☑N/A ☑N/A	15.

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐Yes ☐No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: Date: 11/03/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

February 05, 2018

Pam Robertson
WSP USA
13630 Dulles Technology Drive
Suite 300
Herndon, VA 20171

RE: Project: Hess Towson
Pace Project No.: 30240919

Dear Pam Robertson:

Enclosed are the analytical results for sample(s) received by the laboratory on January 16, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Rachel D Christner

Rachel Christner
rachel.christner@pacelabs.com
724-850-5611
Project Manager

Enclosures

cc: Chris Cresci, WSP USA
Michael Lee, Terra Systems, Inc.

NELAP ACCREDITED TNI LABORATORY

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project:	Hess Towson
Pace Project No.:	30240919

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414-2485
A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas Certification #: 88-0680
California Certification #: 2929
CNMI Saipan Certification #:MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts Certification #: M-MN064
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: MN00064
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon NwTPH Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DW Certification #: 9952 C
West Virginia DEP Certification #: 382
Wisconsin Certification #: 999407970

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project:	Hess Towson
Pace Project No.:	30240919

Pennsylvania Certification IDs

Tennessee Certification #: TN2867	Virginia/VELAP Certification #: 460198
Texas/TNI Certification #: T104704188-14-8	Washington Certification #: C868
Utah/TNI Certification #: PA014572015-5	West Virginia DEP Certification #: 143
USDA Soil Permit #: P330-14-00213	West Virginia DHHR Certification #: 9964C
Vermont Dept. of Health: ID# VT-0282	Wisconsin Certification
Virgin Island/PADEP Certification	Wyoming Certification #: 8TMS-L

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SAMPLE ANALYTE COUNT

Project: Hess Towson
Pace Project No.: 30240919

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30240919001	**Control**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	LEL	3	PASI-PA
		EPA 8260B	RES	8	PASI-PA
30240919002	**Control Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	LEL	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30240919003	**10 glh PSU**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	LEL	3	PASI-PA
		EPA 8260B	RES	8	PASI-PA
30240919004	**10 glh PSU Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	LEL	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30240919005	**20 glh PSU**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	LEL	3	PASI-PA
		EPA 6020	RJS	5	PASI-M
		EPA 8260B	RES	8	PASI-PA
30240919006	**20 glh PSU Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	LEL	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30240919007	**40 glh PSU**	EPA 8015B	SEL	2	PASI-PA
		EPA 5030/8015B	LEL	3	PASI-PA
		EPA 8260B	RES	8	PASI-PA
30240919008	**40 glh PSU Soil**	EPA 8015B	SEL	2	PASI-PA
		EPA 8015B	LEL	3	PASI-PA
		EPA 8260B	JEW	8	PASI-PA
		ASTM D2974-87	GLG	1	PASI-PA
30240919009	**Trip Blank**	EPA 8260B	RES	8	PASI-PA

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: Control | **Lab ID: 30240919001** | Collected: 01/15/18 15:00 | Received: 01/16/18 11:10 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**0.85**	mg/L	0.099	1	01/22/18 12:55	01/24/18 15:16		1c
Surrogates								
o-Terphenyl (S)	46	%	17-107	1	01/22/18 12:55	01/24/18 15:16	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	**281**	ug/L	200	1		01/26/18 17:15		
Surrogates								
a,a,a-Trifluorotoluene (S)	101	%	62-126	1		01/26/18 17:15	98-08-8	
4-Bromofluorobenzene (S)	103	%	80-120	1		01/26/18 17:15	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		01/19/18 19:28	71-43-2	
Ethylbenzene	**10**	ug/L	1.0	1		01/19/18 19:28	100-41-4	
Toluene	ND	ug/L	1.0	1		01/19/18 19:28	108-88-3	
Xylene (Total)	**55.3**	ug/L	3.0	1		01/19/18 19:28	1330-20-7	
Surrogates								
Toluene-d8 (S)	103	%	80-120	1		01/19/18 19:28	2037-26-5	
4-Bromofluorobenzene (S)	97	%	79-129	1		01/19/18 19:28	460-00-4	
1,2-Dichloroethane-d4 (S)	93	%	80-120	1		01/19/18 19:28	17060-07-0	
Dibromofluoromethane (S)	96	%	80-120	1		01/19/18 19:28	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: Control Soil **Lab ID: 30240919002** Collected: 01/15/18 15:05 Received: 01/16/18 11:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**33.1**	mg/kg	8.4	1	01/17/18 18:53	01/20/18 00:27		
Surrogates								
o-Terphenyl (S)	54	%	30-90	1	01/17/18 18:53	01/20/18 00:27	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
TPH (C06-C10)	**17.6**	mg/kg	10.1	1	01/18/18 10:41	01/18/18 18:58		
Surrogates								
a,a,a-Trifluorotoluene (S)	68	%	38-123	1	01/18/18 10:41	01/18/18 18:58	98-08-8	
4-Bromofluorobenzene (S)	85	%	84-128	1	01/18/18 10:41	01/18/18 18:58	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	4.7	1	02/01/18 10:50	02/01/18 20:36	71-43-2	1c,H1, H2
Ethylbenzene	**64.4**	ug/kg	4.7	1	02/01/18 10:50	02/01/18 20:36	100-41-4	1c,H1, H2
Toluene	ND	ug/kg	4.7	1	02/01/18 10:50	02/01/18 20:36	108-88-3	1c,H1, H2
Xylene (Total)	**323**	ug/kg	14.1	1	02/01/18 10:50	02/01/18 20:36	1330-20-7	
Surrogates								
Toluene-d8 (S)	112	%	76-124	1	02/01/18 10:50	02/01/18 20:36	2037-26-5	
4-Bromofluorobenzene (S)	144	%	70-133	1	02/01/18 10:50	02/01/18 20:36	460-00-4	ST
1,2-Dichloroethane-d4 (S)	93	%	74-131	1	02/01/18 10:50	02/01/18 20:36	17060-07-0	
Dibromofluoromethane (S)	94	%	71-130	1	02/01/18 10:50	02/01/18 20:36	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**22.7**	%	0.10	1		01/18/18 08:40		

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: 10 glh PSU **Lab ID: 30240919003** Collected: 01/15/18 15:10 Received: 01/16/18 11:10 Matrix: Water

Comments: • 8260 VOA: Post-analysis testing indicates the presence of residual chlorine.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**1.1**	mg/L	0.14	1	01/22/18 12:55	01/24/18 15:25		1c,A5
Surrogates								
o-Terphenyl (S)	50	%	17-107	1	01/22/18 12:55	01/24/18 15:25	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	ND	ug/L	200	1		01/26/18 17:34		
Surrogates								
a,a,a-Trifluorotoluene (S)	105	%	62-126	1		01/26/18 17:34	98-08-8	
4-Bromofluorobenzene (S)	109	%	80-120	1		01/26/18 17:34	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		01/19/18 19:56	71-43-2	
Ethylbenzene	**4.7**	ug/L	1.0	1		01/19/18 19:56	100-41-4	
Toluene	ND	ug/L	1.0	1		01/19/18 19:56	108-88-3	
Xylene (Total)	**22.1**	ug/L	3.0	1		01/19/18 19:56	1330-20-7	
Surrogates								
Toluene-d8 (S)	100	%	80-120	1		01/19/18 19:56	2037-26-5	
4-Bromofluorobenzene (S)	99	%	79-129	1		01/19/18 19:56	460-00-4	
1,2-Dichloroethane-d4 (S)	92	%	80-120	1		01/19/18 19:56	17060-07-0	
Dibromofluoromethane (S)	95	%	80-120	1		01/19/18 19:56	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: 10 glh PSU Soil **Lab ID: 30240919004** Collected: 01/15/18 15:15 Received: 01/16/18 11:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**95.5**	mg/kg	8.6	1	01/17/18 18:53	01/20/18 00:36		
Surrogates								
o-Terphenyl (S)	51	%	30-90	1	01/17/18 18:53	01/20/18 00:36	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
TPH (C06-C10)	**14.3**	mg/kg	10.7	1	01/18/18 10:41	01/18/18 19:16		
Surrogates								
a,a,a-Trifluorotoluene (S)	30	%	38-123	1	01/18/18 10:41	01/18/18 19:16	98-08-8	S5,SR
4-Bromofluorobenzene (S)	107	%	84-128	1	01/18/18 10:41	01/18/18 19:16	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	5.4	1	02/01/18 10:50	02/01/18 21:02	71-43-2	1c,H1, H2
Ethylbenzene	ND	ug/kg	5.4	1	02/01/18 10:50	02/01/18 21:02	100-41-4	1c,H1, H2
Toluene	ND	ug/kg	5.4	1	02/01/18 10:50	02/01/18 21:02	108-88-3	1c,H1, H2
Xylene (Total)	ND	ug/kg	16.2	1	02/01/18 10:50	02/01/18 21:02	1330-20-7	
Surrogates								
Toluene-d8 (S)	104	%	76-124	1	02/01/18 10:50	02/01/18 21:02	2037-26-5	
4-Bromofluorobenzene (S)	113	%	70-133	1	02/01/18 10:50	02/01/18 21:02	460-00-4	
1,2-Dichloroethane-d4 (S)	86	%	74-131	1	02/01/18 10:50	02/01/18 21:02	17060-07-0	
Dibromofluoromethane (S)	96	%	71-130	1	02/01/18 10:50	02/01/18 21:02	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**24.0**	%	0.10	1		01/18/18 08:41		

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: 20 glh PSU **Lab ID: 30240919005** Collected: 01/15/18 15:20 Received: 01/16/18 11:10 Matrix: Water

Comments: • 8260 VOA: Post-analysis testing indicates the presence of residual chlorine.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**1.6**	mg/L	0.16	1	01/22/18 12:55	01/24/18 15:33		1c
Surrogates								
o-Terphenyl (S)	50	%	17-107	1	01/22/18 12:55	01/24/18 15:33	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	ND	ug/L	200	1		01/26/18 17:52		
Surrogates								
a,a,a-Trifluorotoluene (S)	102	%	62-126	1		01/26/18 17:52	98-08-8	
4-Bromofluorobenzene (S)	104	%	80-120	1		01/26/18 17:52	460-00-4	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3020							
Chromium	**1.1**	ug/L	0.50	1	01/19/18 10:20	01/19/18 13:42	7440-47-3	
Molybdenum	ND	ug/L	0.50	1	01/19/18 10:20	01/19/18 13:42	7439-98-7	
Selenium	**0.50**	ug/L	0.50	1	01/19/18 10:20	01/19/18 13:42	7782-49-2	
Uranium-238	ND	ug/L	0.50	1	01/19/18 10:20	01/19/18 13:42	7440-61-1	
Vanadium	ND	ug/L	1.0	1	01/19/18 10:20	01/19/18 13:42	7440-62-2	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		01/19/18 20:23	71-43-2	
Ethylbenzene	**2.6**	ug/L	1.0	1		01/19/18 20:23	100-41-4	
Toluene	ND	ug/L	1.0	1		01/19/18 20:23	108-88-3	
Xylene (Total)	**7.5**	ug/L	3.0	1		01/19/18 20:23	1330-20-7	
Surrogates								
Toluene-d8 (S)	102	%	80-120	1		01/19/18 20:23	2037-26-5	
4-Bromofluorobenzene (S)	96	%	79-129	1		01/19/18 20:23	460-00-4	
1,2-Dichloroethane-d4 (S)	91	%	80-120	1		01/19/18 20:23	17060-07-0	
Dibromofluoromethane (S)	95	%	80-120	1		01/19/18 20:23	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: 20 glh PSU Soil **Lab ID: 30240919006** Collected: 01/15/18 15:25 Received: 01/16/18 11:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**67.8**	mg/kg	8.4	1	01/17/18 18:53	01/20/18 00:54		
Surrogates								
o-Terphenyl (S)	52	%	30-90	1	01/17/18 18:53	01/20/18 00:54	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
TPH (C06-C10)	ND	mg/kg	11.9	1	01/18/18 10:41	01/18/18 19:35		
Surrogates								
a,a,a-Trifluorotoluene (S)	90	%	38-123	1	01/18/18 10:41	01/18/18 19:35	98-08-8	
4-Bromofluorobenzene (S)	91	%	84-128	1	01/18/18 10:41	01/18/18 19:35	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	4.4	1	02/01/18 10:50	02/01/18 21:28	71-43-2	1c,H1, H2
Ethylbenzene	ND	ug/kg	4.4	1	02/01/18 10:50	02/01/18 21:28	100-41-4	1c,H1, H2
Toluene	ND	ug/kg	4.4	1	02/01/18 10:50	02/01/18 21:28	108-88-3	1c,H1, H2
Xylene (Total)	ND	ug/kg	13.3	1	02/01/18 10:50	02/01/18 21:28	1330-20-7	
Surrogates								
Toluene-d8 (S)	102	%	76-124	1	02/01/18 10:50	02/01/18 21:28	2037-26-5	
4-Bromofluorobenzene (S)	108	%	70-133	1	02/01/18 10:50	02/01/18 21:28	460-00-4	
1,2-Dichloroethane-d4 (S)	89	%	74-131	1	02/01/18 10:50	02/01/18 21:28	17060-07-0	
Dibromofluoromethane (S)	94	%	71-130	1	02/01/18 10:50	02/01/18 21:28	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**22.0**	%	0.10	1		01/18/18 08:41		

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: 40 glh PSU **Lab ID: 30240919007** Collected: 01/15/18 15:30 Received: 01/16/18 11:10 Matrix: Water

Comments: • 8260 VOA: Post-analysis testing indicates the presence of residual chlorine.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH	Analytical Method: EPA 8015B Preparation Method: EPA 3510C							
TPH (C10-C28)	**0.91**	mg/L	0.32	1	01/22/18 12:55	01/24/18 15:49		1c,A5
Surrogates								
o-Terphenyl (S)	54	%	17-107	1	01/22/18 12:55	01/24/18 15:49	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 5030/8015B							
TPH (C06-C10)	ND	ug/L	200	1		01/26/18 18:29		CL
Surrogates								
a,a,a-Trifluorotoluene (S)	103	%	62-126	1		01/26/18 18:29	98-08-8	
4-Bromofluorobenzene (S)	107	%	80-120	1		01/26/18 18:29	460-00-4	
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		01/19/18 20:51	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		01/19/18 20:51	100-41-4	
Toluene	ND	ug/L	1.0	1		01/19/18 20:51	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		01/19/18 20:51	1330-20-7	
Surrogates								
Toluene-d8 (S)	98	%	80-120	1		01/19/18 20:51	2037-26-5	
4-Bromofluorobenzene (S)	98	%	79-129	1		01/19/18 20:51	460-00-4	
1,2-Dichloroethane-d4 (S)	95	%	80-120	1		01/19/18 20:51	17060-07-0	
Dibromofluoromethane (S)	97	%	80-120	1		01/19/18 20:51	1868-53-7	

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: 40 glh PSU Soil **Lab ID: 30240919008** Collected: 01/15/18 15:35 Received: 01/16/18 11:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8015 TPH Microwave	Analytical Method: EPA 8015B Preparation Method: EPA 3546							
TPH (C10-C28)	**106**	mg/kg	7.9	1	01/17/18 18:53	01/20/18 01:12		
Surrogates								
o-Terphenyl (S)	55	%	30-90	1	01/17/18 18:53	01/20/18 01:12	84-15-1	
Gasoline Range Organics	Analytical Method: EPA 8015B Preparation Method: EPA 5035A/5030B							
TPH (C06-C10)	**10.3**	mg/kg	8.9	1	01/18/18 10:41	01/18/18 19:54		
Surrogates								
a,a,a-Trifluorotoluene (S)	57	%	38-123	1	01/18/18 10:41	01/18/18 19:54	98-08-8	
4-Bromofluorobenzene (S)	84	%	84-128	1	01/18/18 10:41	01/18/18 19:54	460-00-4	
8260B MSV	Analytical Method: EPA 8260B Preparation Method: EPA 5035A							
Benzene	ND	ug/kg	4.6	1	02/01/18 10:50	02/01/18 21:55	71-43-2	1c,H1, H2
Ethylbenzene	ND	ug/kg	4.6	1	02/01/18 10:50	02/01/18 21:55	100-41-4	1c,H1, H2
Toluene	ND	ug/kg	4.6	1	02/01/18 10:50	02/01/18 21:55	108-88-3	1c,H1, H2
Xylene (Total)	ND	ug/kg	13.9	1	02/01/18 10:50	02/01/18 21:55	1330-20-7	
Surrogates								
Toluene-d8 (S)	103	%	76-124	1	02/01/18 10:50	02/01/18 21:55	2037-26-5	
4-Bromofluorobenzene (S)	108	%	70-133	1	02/01/18 10:50	02/01/18 21:55	460-00-4	
1,2-Dichloroethane-d4 (S)	87	%	74-131	1	02/01/18 10:50	02/01/18 21:55	17060-07-0	
Dibromofluoromethane (S)	95	%	71-130	1	02/01/18 10:50	02/01/18 21:55	1868-53-7	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**17.3**	%	0.10	1		01/18/18 08:41		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Hess Towson
Pace Project No.: 30240919

Sample: Trip Blank **Lab ID: 30240919009** Collected: 01/15/18 00:01 Received: 01/16/18 11:10 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
8260B MSV	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	1.0	1		01/19/18 15:19	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		01/19/18 15:19	100-41-4	
Toluene	ND	ug/L	1.0	1		01/19/18 15:19	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		01/19/18 15:19	1330-20-7	
Surrogates								
Toluene-d8 (S)	102	%	80-120	1		01/19/18 15:19	2037-26-5	
4-Bromofluorobenzene (S)	97	%	79-129	1		01/19/18 15:19	460-00-4	
1,2-Dichloroethane-d4 (S)	92	%	80-120	1		01/19/18 15:19	17060-07-0	
Dibromofluoromethane (S)	97	%	80-120	1		01/19/18 15:19	1868-53-7	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 285284 | Analysis Method: EPA 8015B
QC Batch Method: EPA 5035A/5030B | Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

METHOD BLANK: 1399218 | Matrix: Solid
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C06-C10)	mg/kg	ND	10.0	01/18/18 14:13	
4-Bromofluorobenzene (S)	%	92	84-128	01/18/18 14:13	
a,a,a-Trifluorotoluene (S)	%	99	38-123	01/18/18 14:13	

LABORATORY CONTROL SAMPLE: 1399219

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	mg/kg	50	52.6	105	78-140	
4-Bromofluorobenzene (S)	%			86	84-128	
a,a,a-Trifluorotoluene (S)	%			94	38-123	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1399220 1399221

Parameter	Units	30240931001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C06-C10)	mg/kg	32.0	41.9	41.9	50.1	51.3	43	46	50-144	2	ML
4-Bromofluorobenzene (S)	%						87	96	84-128		
a,a,a-Trifluorotoluene (S)	%						51	54	38-123		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 285887 Analysis Method: EPA 5030/8015B
QC Batch Method: EPA 5030/8015B Analysis Description: Gasoline Range Organics
Associated Lab Samples: 30240919001, 30240919003, 30240919005, 30240919007

METHOD BLANK: 1402276 Matrix: Water
Associated Lab Samples: 30240919001, 30240919003, 30240919005, 30240919007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C06-C10)	ug/L	ND	200	01/26/18 15:07	
4-Bromofluorobenzene (S)	%	101	80-120	01/26/18 15:07	
a,a,a-Trifluorotoluene (S)	%	111	62-126	01/26/18 15:07	

LABORATORY CONTROL SAMPLE: 1402277

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C06-C10)	ug/L	1000	927	93	76-138	
4-Bromofluorobenzene (S)	%			99	80-120	
a,a,a-Trifluorotoluene (S)	%			99	62-126	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1402278 1402279

Parameter	Units	30241445002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C06-C10)	ug/L	200 U	1000	1000	869	917	84	89	56-132	5	
4-Bromofluorobenzene (S)	%						98	100	80-120		
a,a,a-Trifluorotoluene (S)	%						91	93	62-126		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 518787 — Analysis Method: EPA 6020
QC Batch Method: EPA 3020 — Analysis Description: 6020 MET
Associated Lab Samples: 30240919005

METHOD BLANK: 2817901 — Matrix: Water
Associated Lab Samples: 30240919005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chromium	ug/L	ND	0.50	01/19/18 12:22	
Molybdenum	ug/L	ND	0.50	01/19/18 12:22	
Selenium	ug/L	ND	0.50	01/19/18 12:22	
Uranium-238	ug/L	ND	0.50	01/19/18 12:22	
Vanadium	ug/L	ND	1.0	01/19/18 12:22	

LABORATORY CONTROL SAMPLE: 2817902

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chromium	ug/L	100	93.0	93	80-120	
Molybdenum	ug/L	100	90.4	90	80-120	
Selenium	ug/L	100	96.1	96	80-120	
Uranium-238	ug/L	100	95.0	95	80-120	
Vanadium	ug/L	100	90.4	90	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2817903 2817904

Parameter	Units	10417265002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Chromium	ug/L	1.2	100	100	101	99.2	100	98	75-125	1	
Molybdenum	ug/L	2.3	100	100	98.8	98.3	96	96	75-125	0	
Selenium	ug/L	<0.17	100	100	101	101	101	100	75-125	1	
Uranium-238	ug/L	1.5	100	100	101	101	99	99	75-125	0	
Vanadium	ug/L	1.4	100	100	98.6	97.1	97	96	75-125	1	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 286870 | Analysis Method: EPA 8260B
QC Batch Method: EPA 5035A | Analysis Description: 8260B MSV UST-SOIL
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

METHOD BLANK: 1406634 | Matrix: Solid
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/kg	ND	5.0	02/01/18 12:40	
Ethylbenzene	ug/kg	ND	5.0	02/01/18 12:40	
Toluene	ug/kg	ND	5.0	02/01/18 12:40	
Xylene (Total)	ug/kg	ND	15.0	02/01/18 12:40	
1,2-Dichloroethane-d4 (S)	%	83	74-131	02/01/18 12:40	
4-Bromofluorobenzene (S)	%	104	70-133	02/01/18 12:40	
Dibromofluoromethane (S)	%	88	71-130	02/01/18 12:40	
Toluene-d8 (S)	%	99	76-124	02/01/18 12:40	

LABORATORY CONTROL SAMPLE: 1406635

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/kg	20	17.5	88	70-130	
Ethylbenzene	ug/kg	20	16.0	80	70-130	
Toluene	ug/kg	20	16.6	83	70-130	
Xylene (Total)	ug/kg	60	47.8	80	70-130	
1,2-Dichloroethane-d4 (S)	%			86	74-131	
4-Bromofluorobenzene (S)	%			103	70-133	
Dibromofluoromethane (S)	%			91	71-130	
Toluene-d8 (S)	%			98	76-124	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 285469 — Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B — Analysis Description: 8260B MSV UST-WATER
Associated Lab Samples: 30240919001, 30240919003, 30240919005, 30240919007, 30240919009

METHOD BLANK: 1400059 — Matrix: Water
Associated Lab Samples: 30240919001, 30240919003, 30240919005, 30240919007, 30240919009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	01/19/18 13:29	
Ethylbenzene	ug/L	ND	1.0	01/19/18 13:29	
Toluene	ug/L	ND	1.0	01/19/18 13:29	
Xylene (Total)	ug/L	ND	3.0	01/19/18 13:29	
1,2-Dichloroethane-d4 (S)	%	89	80-120	01/19/18 13:29	
4-Bromofluorobenzene (S)	%	99	79-129	01/19/18 13:29	
Dibromofluoromethane (S)	%	95	80-120	01/19/18 13:29	
Toluene-d8 (S)	%	101	80-120	01/19/18 13:29	

LABORATORY CONTROL SAMPLE: 1400060

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	20.5	102	70-130	
Ethylbenzene	ug/L	20	22.1	110	70-130	
Toluene	ug/L	20	21.4	107	70-130	
Xylene (Total)	ug/L	60	66.4	111	70-130	
1,2-Dichloroethane-d4 (S)	%			91	80-120	
4-Bromofluorobenzene (S)	%			100	79-129	
Dibromofluoromethane (S)	%			96	80-120	
Toluene-d8 (S)	%			103	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1400178 — 1400179

Parameter	Units	30240922001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Benzene	ug/L	ND	20	20	19.5	19.9	98	100	67-121	2	
Ethylbenzene	ug/L	ND	20	20	22.5	23.5	112	117	70-127	4	
Toluene	ug/L	ND	20	20	20.9	21.1	104	106	77-125	1	
Xylene (Total)	ug/L	ND	60	60	65.4	66.4	109	111	69-128	2	
1,2-Dichloroethane-d4 (S)	%						86	92	80-120		
4-Bromofluorobenzene (S)	%						100	98	79-129		
Dibromofluoromethane (S)	%						95	94	80-120		
Toluene-d8 (S)	%						105	103	80-120		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

SAMPLE DUPLICATE: 1400180

Parameter	Units	30240922001 Result	Dup Result	RPD	Qualifiers
Benzene	ug/L	ND	ND		
Ethylbenzene	ug/L	ND	ND		
Toluene	ug/L	ND	ND		
Xylene (Total)	ug/L	ND	ND		
1,2-Dichloroethane-d4 (S)	%	91	91	0	
4-Bromofluorobenzene (S)	%	101	100	0	
Dibromofluoromethane (S)	%	94	93	1	
Toluene-d8 (S)	%	101	99	2	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 285182 | Analysis Method: EPA 8015B
QC Batch Method: EPA 3546 | Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

METHOD BLANK: 1398918 | Matrix: Solid
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/kg	ND	6.7	01/19/18 23:26	
o-Terphenyl (S)	%	60	30-90	01/19/18 23:26	

LABORATORY CONTROL SAMPLE: 1398919

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/kg	66.7	48.1	72	47-86	
o-Terphenyl (S)	%			67	30-90	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1398920 1398921

Parameter	Units	30240931001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
TPH (C10-C28)	mg/kg	223	81.3	79.7	299	183	94	-50	10-142	48	M6,R1
o-Terphenyl (S)	%						42	42	30-90		

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 285556 — Analysis Method: EPA 8015B
QC Batch Method: EPA 3510C — Analysis Description: EPA 8015 TPH
Associated Lab Samples: 30240919001, 30240919003, 30240919005, 30240919007

METHOD BLANK: 1400566 — Matrix: Water
Associated Lab Samples: 30240919001, 30240919003, 30240919005, 30240919007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH (C10-C28)	mg/L	ND	0.10	01/24/18 14:54	
o-Terphenyl (S)	%	44	17-107	01/24/18 14:54	

LABORATORY CONTROL SAMPLE: 1400567

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH (C10-C28)	mg/L	1	0.61	61	44-100	
o-Terphenyl (S)	%			66	17-107	

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QUALITY CONTROL DATA

Project: Hess Towson
Pace Project No.: 30240919

QC Batch: 285258 | Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 | Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 30240919002, 30240919004, 30240919006, 30240919008

SAMPLE DUPLICATE: 1399165

Parameter	Units	30240999001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	48.5	49.3	2	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project: Hess Towson
Pace Project No.: 30240919

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M	Pace Analytical Services - Minneapolis
PASI-PA	Pace Analytical Services - Greensburg

BATCH QUALIFIERS

Batch: 285556

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

Batch: 286870

[M5] A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.

ANALYTE QUALIFIERS

1c	A matrix spike/matrix spike duplicate was not performed for this batch due to insufficient sample volume.
A5	Greater than 5% sediment in sample determined by visual observation. Aqueous portion decanted from the sediment and extracted.
CL	The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased low.
H1	Analysis conducted outside the EPA method holding time.
H2	Extraction or preparation conducted outside EPA method holding time.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.
ML	Matrix spike recovery and/or matrix spike duplicate recovery was below laboratory control limits. Result may be biased low.
R1	RPD value was outside control limits.

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QUALIFIERS

Project: Hess Towson
Pace Project No.: 30240919

ANALYTE QUALIFIERS

S5	Surrogate recovery outside control limits due to matrix interferences (not confirmed by re-analysis).
SR	Surrogate recovery was below laboratory control limits. Results may be biased low.
ST	Surrogate recovery was above laboratory control limits. Results may be biased high.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Hess Towson
Pace Project No.: 30240919

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
30240919002	**Control Soil**	EPA 3546	285182	EPA 8015B	285492
30240919004	**10 glh PSU Soil**	EPA 3546	285182	EPA 8015B	285492
30240919006	**20 glh PSU Soil**	EPA 3546	285182	EPA 8015B	285492
30240919008	**40 glh PSU Soil**	EPA 3546	285182	EPA 8015B	285492
30240919001	**Control**	EPA 3510C	285556	EPA 8015B	285874
30240919003	**10 glh PSU**	EPA 3510C	285556	EPA 8015B	285874
30240919005	**20 glh PSU**	EPA 3510C	285556	EPA 8015B	285874
30240919007	**40 glh PSU**	EPA 3510C	285556	EPA 8015B	285874
30240919002	**Control Soil**	EPA 5035A/5030B	285284	EPA 8015B	285292
30240919004	**10 glh PSU Soil**	EPA 5035A/5030B	285284	EPA 8015B	285292
30240919006	**20 glh PSU Soil**	EPA 5035A/5030B	285284	EPA 8015B	285292
30240919008	**40 glh PSU Soil**	EPA 5035A/5030B	285284	EPA 8015B	285292
30240919001	**Control**	EPA 5030/8015B	285887		
30240919003	**10 glh PSU**	EPA 5030/8015B	285887		
30240919005	**20 glh PSU**	EPA 5030/8015B	285887		
30240919007	**40 glh PSU**	EPA 5030/8015B	285887		
30240919005	**20 glh PSU**	EPA 3020	518787	EPA 6020	518889
30240919002	**Control Soil**	EPA 5035A	286870	EPA 8260B	286871
30240919004	**10 glh PSU Soil**	EPA 5035A	286870	EPA 8260B	286871
30240919006	**20 glh PSU Soil**	EPA 5035A	286870	EPA 8260B	286871
30240919008	**40 glh PSU Soil**	EPA 5035A	286870	EPA 8260B	286871
30240919001	**Control**	EPA 8260B	285469		
30240919003	**10 glh PSU**	EPA 8260B	285469		
30240919005	**20 glh PSU**	EPA 8260B	285469		
30240919007	**40 glh PSU**	EPA 8260B	285469		
30240919009	**Trip Blank**	EPA 8260B	285469		
30240919002	**Control Soil**	ASTM D2974-87	285258		
30240919004	**10 glh PSU Soil**	ASTM D2974-87	285258		
30240919006	**20 glh PSU Soil**	ASTM D2974-87	285258		
30240919008	**40 glh PSU Soil**	ASTM D2974-87	285258		

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CHAI **WO# : 30240919** cument

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30240919

Page: 1 of 1

2212398

Section A
Required Client Information:

Company:	WSP USA
Address:	13530 Dulles Tech Dr Suite 300
	Herndon VA 20171
Email To:	Pam Groff @ wsp.com
Phone:	703 709 6500
Fax:	
Requested Due Date/TAT:	std

Section B
Required Project Information:

Report To:	Michael D Lee
Copy To:	Pam Groff
Purchase Order No.:	
Project Name:	Hess Towson
Project Number:	31400408/3

Attention:	Pam Groff
Company Name:	WSP USA
Address:	13530 Dulles Tech Dr, Ste 300
Pace Quote Reference:	
Pace Project Manager:	
Pace Profile #:	

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ______

Site Location STATE: ______

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes
MATRIX / CODE
Drinking Water DW
Water WT
Waste Water WW
Product P
Soil/Solid SL
Oil OL
Wipe WP
Air AR
Tissue TS
Other OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collected Composite Start DATE	Collected Composite Start TIME	Composite End/Grab DATE	Composite End/Grab TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test	BTEX 8260 Aq	BTEX Soil	GRO Aq	GRO Soil	DRO Aq	DRO Soil	Oxy anions (Cr, Mo, Se, U, V)	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	Control	WT	C	11/15/18	15:00				6				X						X		X		X				001
2	Control Soil	SL	C	11/15/18	15:05				5						X	X				X		X		X			002
3	10 g/K PS U	WT	C	11/15/18	15:10				6				X						X		X		X				003
4	10 g/K PS U Soil	SL	C	11/15/18	15:15				5						X	X				X		X		X			004
5	20 g/K PS U	WT	C	11/15/18	15:20				7				X						X		X		X		X		005
6	20 g/K PS U Soil	SL	C	11/15/18	15:25				5						X	X				X		X		X			006
7	40 g/K PS U	WT	C	11/15/18	15:30				8				X						X		X		X				007
8	40 g/K PS U Soil	WT	C	11/15/18	15:35				13						X	X				X		X		X			008
9																											009 TB
10																											
11																											
12																											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Michael D Lee TST	11/15/18	17:05	[signature]	11/16/18	1110	1.9	Y	Y	Y

SAMPLE CONDITIONS

ORIGINAL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Michael D Lee

SIGNATURE of SAMPLER: Michael D Lee

DATE Signed (MM/DD/YY): 11/15/18 17:05

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

Pittsburgh Lab Sample Condition Upon Receipt

Pace Analytical

Client Name: WSP USA   Project # 30240919

Label BLM
LIMS Login BLM

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other ________

Tracking #: 706025387413

Custody Seal on Cooler/Box Present: ☑ yes ☐ no   Seals intact: ☑ yes ☐ no

Thermometer Used 8   Type of Ice: Wet Blue None

Cooler Temperature   Observed Temp 1.9 °C   Correction Factor: 0.0 °C   Final Temp: 1.9 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: BL 1/16/18

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID Matrix: WT + SL				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered			✓	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			✓	13.
Organic Samples checked for dechlorination:	✓			14.
Filtered volume received for Dissolved tests			✓	15.
All containers have been checked for preservation.	✓			16.
All containers needing preservation are found to be in compliance with EPA recommendation.			✓	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed BL. / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):		✓		17.
Trip Blank Present:	✓			18.
Trip Blank Custody Seals Present	✓			
Rad Aqueous Samples Screened > 0.5 mrem/hr			✓	Initial when completed: / Date:

Client Notification/ Resolution:

Person Contacted: ________ Date/Time: ________ Contacted By: ________

Comments/ Resolution: ________

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

***PM review** is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

10417535

Chain of Custody

Pace Analytical®
www.pacelabs.com

Workorder: 30240919 **Workorder Name:** Hess Towson **Owner Received Date:** 1/16/2018 **Results Requested By:** 1/30/2018

Report To	Subcontract To
Rachel Christner Pace Analytical Pittsburgh 1638 Roseytown Road Suites 2,3,4 Greensburg, PA 15601 Phone 724-850-5611	Pace Analytical Minnesota 1700 Elm Street SE Suite 200 Minneapolis, MN 55414 Phone (612)607-1700

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: HNO3	Requested Analysis: 6020 - Cr, Mo, Se, U, V	LAB USE ONLY
1	20 glh PSU	PS	1/15/2018 15:20	30240919005	Water	1	X	001
2								
3								
4								
5								

Transfers	Released By	Date/Time	Received By	Date/Time
1	Ben Mam[illegible]	1-17-18 1605	[illegible] / Pace	1/18/18 1140
2				
3				

Comments

Cooler Temperature on Receipt 0.2 °C **Custody Seal** Y or N **Received on Ice** Y or N **Samples Intact** Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.*

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 14Dec2017 Page 1 of 2
	Document No.: **F-MN-L-213-rev.22**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Pasi - Pitts

Project #:

WO# : 10417535

10417535

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number: 7060-2538-8247

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other: **Temp Blank?** ☐ Yes ☒ No

Thermometer Used: ☒ 151401163 ☐ G87A9155100842 **Type of Ice:** ☒ Wet ☐ Blue ☐ None ☐ Dry ☐ Melted

Cooler Temp Read (°C): 0.0 **Cooler Temp Corrected (°C):** 0.2 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** +0.2 **Date and Initials of Person Examining Contents:** 1/15/18 SD

USDA Regulated Soil (☒ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☐ Yes	☐ No	☒ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used?	☒ Yes	☐ No		9.
-Pace Containers Used?	☒ Yes	☐ No		
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☒ Yes	☐ No	☐ N/A	13. ☒ HNO_3 ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample # 1/1
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☒ Yes	☐ No	☐ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: **Date:**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Pace Analytical®
www.pacelabs.com

Ship To:
Pace Analytical Minnesota
1700 Elm Street SE
Suite 200
Minneapolis, MN 55414
Phone (612)607-1700

INTER_LABORATORY WORK ORDER # 30240919
(To be completed by sending lab)

Sending Project No:	30240919
Receiving Project No:	
Check Box for Consolidated Invoice:	☐
Date Prepared:	01/17/18
REQUESTED COMPLETION DATE:	**1/30/2018**

Sending Region	IR30-Pittsburgh	Sending Project Mgr.	Rachel Christner
Receiving Region	IR10-Minnesota	External Client	WSP USA
State of Sample Origin		QC Deliverable	STD REPORT

All questions should be addressed to sending project manager.

Requested Reportable Units ______ Report Wet or Dry Weight? Dry Weight Cert. Needed ______

WORK REQUESTED						
Method Description	Container Type	Quantity of containers	Preservative	Quantity of Samples	Unit Price	Amount
6020 - Cr, Mo, Se, U, V	BP3N		HNO3	1	$50.00	$50.00
					TOTAL	$50.00

Special Requirements: ______

Receiving Region Department	Acctg. Code	Totals from above	Revenue Allocation	
			Receiving Region (80%)	Client Services Dept. Sending Region (20%)
Metals	20	$50.00	$40.00	$10.00
* Custom Revenue Allocation	TOTAL	$50.00	$40.00	$10.00

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Chain of Custody Included: ☑ Yes ☐ No Return Samples to Sending Region: ☐ Yes ☑ No

Matrix: ☐ Soil ☑ Water ☐ Air ☐ Other (identify) ______

CONFIRMATION OF WORK COMPLETED

Date Completed: ______ Receiving Project Manager: ______

DISPOSITION of FORM

Original sent to the receiving lab - Copy kept at the sending lab.

When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

Pace Analytical®
www.pacelabs.com

CHA[...] WO#: 30240919 [...]cument
The Chai[...] [...]d accurately.

30240919

Page: 1 of 1

2212398

Section A
Required Client Information:

Company:	WSP USA
Address:	13530 Dulles Tech Dr Suite 300
	Herndon VA 20171
Email To:	Pam.Groff@wsp.com
Phone:	703 709 6500
Fax:	
Requested Due Date/TAT:	std

Section B
Required Project Information:

Report To:	Michael D Lee
Copy To:	Pam Groff
Purchase Order No.:	
Project Name:	Hess Towson
Project Number:	31400408/3

Section C
Invoice Information:

Attention:	Pam Groff
Company Name:	WSP USA
Address:	13530 Dulles Tech Dr, Ste 300
Pace Quote Reference:	
Pace Project Manager:	
Pace Profile #:	

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER ______

Site Location STATE: ______

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes
MATRIX / CODE
Drinking Water DW
Water WT
Waste Water WW
Product P
Soil/Solid SL
Oil OL
Wipe WP
Air AR
Tissue TS
Other OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	BTEX 8260 Aq	BTEX Soil	GRO Aq	GRO Soil	DRO Aq	DRO Soil	Oxyanions (Cr, Mo, Se, U, V)					Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	Control	WT	C	1/15/18	15:00				6				X						X		X		X								001
2	Control Soil	SL	C	1/15/18	15:05				5						X	X				X		X		X							002
3	10g/K PS U	WT	C	1/15/18	15:10				6				X						X		X		X								003
4	10g/K PS U Soil	SL	C	1/15/18	15:15				5						X	X				X		X		X							004
5	20g/K PS U	WT	C	1/15/18	15:20				7				X						X		X		X		X						005
6	20g/K PS U Soil	SL	C	1/15/18	15:25				5						X	X				X		X		X							006
7	40g/K PS U	WT	C	1/15/18	15:30				8				X						X		X		X								007
8	40g/K PS U Soil	WT	C	1/15/18	15:35				13						X	X				X		X		X							008
9																															009 TB
10																															
11																															
12																															

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Michael D Lee TST	1/15/18	17:05	[signature]	1/16/18	1110	1.9	Y	Y	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

ORIGINAL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Michael D Lee
SIGNATURE of SAMPLER: Michael D Lee
DATE Signed (MM/DD/YY): 1/15/18 17:05

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

Pittsburgh Lab Sample Condition Upon Receipt

Pace Analytical

Client Name: WSP USA   Project # 30240919

Label	BLM
LIMS Login	BLM

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other ______

Tracking #: 706025387413

Custody Seal on Cooler/Box Present: ☑ yes ☐ no   Seals intact: ☑ yes ☐ no

Thermometer Used 8   Type of Ice: Wet Blue None

Cooler Temperature   Observed Temp 1.9 °C   Correction Factor: 0.0 °C   Final Temp: 1.9 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: 7J 11/16/18

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:	✓			4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID Matrix: WT + SL				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:	✓			
Containers Intact:	✓			11.
Orthophosphate field filtered			✓	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			✓	13.
Organic Samples checked for dechlorination:	✓			14.
Filtered volume received for Dissolved tests			✓	15.
All containers have been checked for preservation.	✓			16.
All containers needing preservation are found to be in compliance with EPA recommendation.			✓	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed 7J. / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):		✓		17.
Trip Blank Present:	✓			18.
Trip Blank Custody Seals Present	✓			
Rad Aqueous Samples Screened > 0.5 mrem/hr			✓	Initial when completed: / Date:

Client Notification/ Resolution:

Person Contacted: ______________ Date/Time: ______________ Contacted By: ______________

Comments/ Resolution: ______________________________

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

ENCLOSURE C

WSP

WSP USA
13530 Dulles Technology Drive, Suite 300
Herndon, VA 20171 (703) 709-6500 • Fax (703) 709-8505

Low-Flow Groundwater Sampling Monitoring Form

Well ID	YMW-7	**Site ID:**	Hess Towson	**Sample Date:**	9/19/17
Well Diameter	2 in	**Sampling Event:**	Bench Scale Treatability Study		
Depth to Water	15.25 ft	**Decon Procedures:**	Non-phosphate soap wash with DI water rinse		
Total Well Depth	28 ft	**Samplers:**	MM	**Notes:**	
Screen Length	10 ft	**Weather Conditions:**	~~[illegible]~~ ~80		
Pump Intake	~23 ft	**Equipment:**	bladder horiba		

Stabilized: Drawdown <0.3 feet; pH ± 0.1 SU; Specific Conductance ± 3%; Temperature ± 3%; DO ± 0.2 mg/l or 10%; Turbidity ± 10% for values greater than 10 NTU; ORP ± 10 mV

Instrument Calibration Information

pH Meter Calibration			**Horiba U-52 Calibration**
pH 7.00 Std.	pH 4.01 Std.	Sl. (mV/pH)	Notes on calibration:
NA	NA	NA	Calibrated to manufacturer's specifications using calibration standard solutions
Air temp =	100 °F		

Well Purging Information Start purge: 1210 End purge: 1309 Pump Type: Bladder

Time	DTW	T (°C)	pH	ORP/Eh (mV)	Conductivity (mS/cm)	Turbidity (NTU)	D.O. (mg/l) *	Flow Rate (mL/min)	Purge Volume (L)	Comments
1218	16.18	26.52	6.43	-13	0.762	86.3	0.90	150	—	clear
1223 ~~23~~	16.34	23.81	6.70	-48	0.801	83.0	0.22	100	—	clear
1228	16.45	23.09	6.72	-55	0.815	87.0	0.00	100	—	clear
1238	16.60	22.81	6.74	-59	0.823	59.7	0.00	100	—	clear
1243	16.62	22.70	6.75	-60	0.826	57.9	0.00	100	—	clear
1248	16.63	22.70	6.75	-59	0.827	49.6	0.00	100	-	clear
1253 ~~[illegible]~~	16.73	22.68	6.76	-59	0.829	43.5	0.00	150	—	clear
1258	16.81	22.70	6.76	-59	0.830	39.5	0.00	150	—	clear
1303	16.88	22.02	6.76	-59	0.829	39.9	0.00	150	-	clear
1308	16.94 ✓	21.70 ✓	6.76 ✓	-59 ✓	0.829 ✓	38.6 ✓	0.00 ✓	150 ✓	—	clear

empty

Laboratory Analysis Information

# of Bottles	Analytes	Collection Method	Preservative	Bottle Type	Anal. Lab.	Filtered	Sample Time	Comments
3	BTEX					N	1320	
3	TPH GRO					N	1320	
2	TPH DRO					N	1320	
1	alk sulfate					N	1320	
1	sulfide					N	1320	

4L feasibility Study N 1420

WSP USA
13530 Dulles Technology Drive, Suite 300
Herndon, VA 20171 (703) 709-6500 • Fax (703) 709-8505

Low-Flow Groundwater Sampling Monitoring Form

Well ID	YMW-3	Site ID:	Hess Towson	Sample Date:	9/1/17
Well Diameter	2 in	Sampling Event:	Bench Scale Treatability Study		
Depth to Water	9.15 ft	Decon Procedures:	Non-phosphate soap wash with DI water rinse		
Total Well Depth	20 ft	Samplers:	MML	Notes:	
Screen Length	15 ft	Weather Conditions:	☼ ~80		
Pump Intake	~12 ft	Equipment:	bladder, horiba		

Stabilized: Drawdown <0.3 feet; pH ± 0.1 SU; Specific Conductance ± 3%; Temperature ± 3%; DO ± 0.2 mg/l or 10%; Turbidity ± 10% for values greater than 10 NTU; ORP ± 10 mV

Instrument Calibration Information

pH Meter Calibration			Horiba U-52 Calibration
pH 7.00 Std.	pH 4.01 Std.	SI. (mV/pH)	Notes on calibration:
NA	NA	NA	Calibrated to manufacturer's specifications using calibration standard solutions
Air temp =	100 °F		

Well Purging Information Start purge: 0940 End purge: 1101 Pump Type: Bladder

Time	DTW	T (°C)	pH	ORP/Eh (mV)	Conductivity (mS/cm)	Turbidity (NTU)	D.O. (mg/l) *	Flow Rate (mL/min)	Purge Volume (L)	Comments
0955	9.55	19.81	5.27	151	0.303	139	0.06	150	–	clear
1000	9.81	~~19.06~~	5.44	141	0.270	73.1	0.00	150	–	T=19.06 clear
1005	9.97	19.02	5.46	143	0.257	47.1	0.00	150	–	clear
1010	10.23	19.19	5.50	148	0.252	21.9	0.00	150	–	clear
1015	10.38	19.20	5.54	148	0.251	13.2	0.00	150	–	clear
1020	10.67	19.23	5.56	148	0.251	9.8	0.00	150	–	clear
1025	10.90	19.36	5.58	148	0.251	8.5	0.00	150	–	clear
1030	11.10	19.54	5.59	146	0.251	11.0	0.00	150	–	clear
1035	11.31	19.56	5.63	141	0.250	11.6	0.00	150	–	clear
1040	11.44	19.71	5.66	139	0.249	12.2	0.00	150	–	clear
1045	11.65	19.65	5.69	135	0.248	12.3	0.00	150	–	clear
1050	11.85	19.68	5.70	133	0.246	15.3	0.00	150	–	clear
1055	11.94	19.69	5.70	133	0.248	~~15.6~~	0.00	100	–	clear
1100	12.02	19.65	5.71	132	0.248	15.2	0.00	100	–	clear
✓	✓	✓	✓	✓	✓		✓	✓	–	clear

end purge

Turb: 15.6 NTU

Laboratory Analysis Information

# of Bottles	Analytes	Collection Method	Preservative	Bottle Type	Anal. Lab.	Filtered	Sample Time	Comments
3	BTEX					N	1110	
3	TPH-GRO					N	1110	
2	TPH-DRO					N	1110	
1	Alkalinity, sulfate					N	1110	
1	sulfide					N	1110	

wsp

WSP USA
13530 Dulles Technology Drive, Suite 300
Herndon, VA 20171 (703) 709-6500 • Fax (703) 709-8505

Low-Flow Groundwater Sampling Monitoring Form

Well ID	MW-4	**Site ID:**	Hess HP Tucson	**Sample Date:**	9/20/17
Well Diameter	2 in	**Sampling Event:**	Bench Scale Feasibility Study		
Depth to Water	20.8 ft	**Decon Procedures:**	Non-phosphate soap wash with DI water rinse		
Total Well Depth	25 ft	**Samplers:**	MM	**Notes:**	
Screen Length	10 ft	**Weather Conditions:**	~~83~~ ~75°F		
Pump Intake	17.5 ft	**Equipment:**			

Stabilized: Drawdown <0.3 feet; pH ± 0.1 SU; Specific Conductance ± 3%; Temperature ± 3%; DO ± 0.2 mg/l or 10%; Turbidity ± 10% for values greater than 10 NTU; ORP ± 10 mV

Instrument Calibration Information

pH Meter Calibration			Horiba U-52 Calibration
pH 7.00 Std.	pH 4.01 Std.	Sl. (mV/pH)	Notes on calibration:
NA	NA	NA	Calibrated to manufacturer's specifications using calibration standard solutions
Air temp =	100 °F		

Well Purging Information Start purge: 1022 End purge: Pump Type: Bladder

Time	DTW	T (°C)	pH	ORP/Eh (mV)	Conductivity (mS/cm)	Turbidity (NTU)	D.O. (mg/l) *	Flow Rate (mL/min)	Purge Volume (L)	Comments
1040	20.98	23.71	6.72	-52	0.750	51.3	0.36	150	—	
1045	21.00	22.98	6.86	-70	0.757	42.6	0.00	150	—	
1050	21.00	22.71	6.87	-73	0.764	34.0	0.00	150	—	
1055 ~~15~~	21.00	22.57	6.88	-76	0.768	24.3	0.00	150	—	
1100	21.04	22.55	6.88	-76	0.769	~~25.~~	0.00	150	—	turb=24.7
1105	21.04	22.50	6.88	-78	0.770	~~21.6~~	0.00	150	—	tb=24.0
1110	21.04	22.50	6.89	-78	0.771	24.0	0.00	150	—	
1115	21.04	22.51	6.89	-79	0.771	25.1	0.00	150	—	

end purge

Iron Testing Kit

Ferrous Iron Reagent mg/L

Ferrover Iron Reagent mg/L

Laboratory Analysis Information

# of Bottles	Analytes	Collection Method	Preservative	Bottle Type	Anal. Lab.	Filtered	Sample Time	Comments
3	BTEX					N	1125	
3	TPH-GRO					N	1125	
2	TPH-DRO					N	1125	
1	ALK Sulfi					N	1125	
MM 2 1	Sulfi.					N	1125	

wsp

WSP USA
13530 Dulles Technology Drive, Suite 300
Herndon, VA 20171 (703) 709-6500 • Fax (703) 709-8505

Low-Flow Groundwater Sampling Monitoring Form

Well ID	YP-1	**Site ID:**	Hess Towson	**Sample Date:**	9/20/17
Well Diameter	2 in	**Sampling Event:**	Bench Scale feasability Study		
Depth to Water	9.37 ft	**Decon Procedures:**	Non-phosphate soap wash with DI water rinse		
Total Well Depth	13 ft	**Samplers:**	MML	**Notes:**	
Screen Length	ft	**Weather Conditions:**	☼ ~75°F		
Pump Intake	ft	**Equipment:**	bladder, horiba		

Stabilized: Drawdown <0.3 feet; pH ± 0.1 SU; Specific Conductance ± 3%; Temperature ± 3%; DO ± 0.2 mg/l or 10%; Turbidity ± 10% for values greater than 10 NTU; ORP ± 10 mV

Instrument Calibration Information

pH Meter Calibration			Horiba U-52 Calibration
pH 7.00 Std.	pH 4.01 Std.	Sl. (mV/pH)	Notes on calibration:
NA	NA	NA	Calibrated to manufacturer's specifications using calibration standard solutions
Air temp =	100 °F		

Well Purging Information — Start purge: — End purge: — Pump Type: Bladder

Time	DTW	T (°C)	pH	ORP/Eh (mV)	Conductivity (mS/cm)	Turbidity (NTU)	D.O. (mg/l) *	Flow Rate (mL/min)	Purge Volume (L)	Comments
~~0824~~	~~HW~~	~~8.2 M~~								
0824	9.40	20.39	6.50	-12	1.49	226	1.26		1WV	
0830	9.40	19.65	6.85	-50	1.40	70.5	1.10		2WV	
0834	9.40	19.06	6.89	-57	1.39	195	1.16		3WV	
end purge										
Iron Testing on hach kit										
	Ferrous Iron Reagent				3.30 mg/L		(limit)			
	Ferrover Iron Reagent				3.30 mg/L		(limit)			

Laboratory Analysis Information

# of Bottles	Analytes	Collection Method	Preservative	Bottle Type	Anal. Lab.	Filtered	Sample Time	Comments
10	alk, sulfide, sulfate, BTEX, TPH-DRO, TPH-GRO					N	0845	
4	Focused feasability Study						0920	

Well volume calculation

$(13 - 9.37)\ 0.041 = 0.15$ gal

1 WV = 0.15 gal
2 WV = 0.30 gal
3 WV = 0.45 gal

ENCLOSURE D

February 6, 2018

Matt Burns and Pam Robertson
Practice Leader
Environmental
300 Trade Center, Suite 4690, Woburn, MA 01801

RE: Draft Report for In Situ Chemical Oxidation Treatability Study for Hess Towson, MD Version 1

Dear Matt and Pam:

Terra Systems, Inc. (TSI) has conducted treatability studies at over 100 sites in support of in situ chemical oxidation (ISCO) using potassium and sodium permanganate, activated persulfate, catalyzed hydrogen peroxide, or ozone, or in situ chemical reduction of volatile organics, semivolatiles organics, and metals. TSI does not perform ISCO or in situ reduction field projects, but works with environmental engineering consultants including ERM, AMEC, TRC, Moraine Environmental, URS, GZA, WSP, and others to evaluate chemical oxidant demand and effectiveness in the laboratory before the consultants go to pilot or full-scale implementation. The treatability work was directed by Michael D. Lee, Ph.D. He has over 30 years of experience in conducting treatability studies and in situ bioremediation of chlorinated solvents and hydrocarbons. He has published over 100 papers.

I have prepared this report for an ISCO treatability study for the Hess Towson, MD site contaminated with hydrocarbons including benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH) including diesel range organics or DRO C10-C28 and gasoline range organic or GRO C6-C10. The soil was analyzed in duplicate for the following parameters by Pace Laboratory of Greensburg, PA: BTEX, TPH-GRO, TPH-DRO, and moisture. Pace Laboratory was paid directly by WSP. The groundwater was analyzed for the following parameters: BTEX, TPH-DRO, TPH-GRO, and oxyanions (selenium, chromium, vanadium, molybdenum, and uranium). TSI measured the soil density, soil moisture, soil field holding capacity, and pH of the soil and groundwater and determined the quantities of 25% sodium hydroxide needed to raise and maintain the pH to 10.5 of 136 g soil and 30 mL groundwater for the following treatments: control, Peroxychem product Klozur 10 g/L sodium persulfate, 20 g/L Klozur persulfate, and 40 g/L Klozur persulfate.

A contaminant destruction evaluation was conducted with three dosages of Klozur sodium persulfate activated with sodium hydroxide, three dosages of unactivated Klozur sodium persulfate, and controls. Two replicates of each persulfate treatment were prepared in 783 mL bottles with 980 g soil with a density of 1.74 g/cm^3 and 220 mL groundwater or approximately 72% by volume soil and 28% volume groundwater. Three replicates of the control were prepared. The volumes of sodium hydroxide required to maintain the pH above 10.5 determined in the initial characterization step was added to the two sodium hydroxide amended replicates. The pH, redox potential, and persulfate of one bottle from each treatment was recorded over time. If the pH dropped below 10.5 for the sodium hydroxide amended treatments, additional 25% sodium hydroxide was added to both replicates. Two replicates of each unactivated persulfate treatment were prepared in 712 mL bottles with 980 g soil with a density of 1.74 g/cm^3 and about 220 mL groundwater or approximately 72% by volume soil and 28% volume groundwater.

1.0 SUPPLY OF SAMPLES

WSP personnel sent representative soil and groundwater samples on ice and under standard Chain-of-Custody procedures directly to TSI at the following shipping address:

Michael D. Lee, Ph.D.
Terra Systems, Inc.
130 Hickman Road, Suite 1
Claymont DE 19703
Phone: 302-798-9553
E-mail: mlee@terrasystems.net.

The following samples were supplied for the treatability studies:

- 10.7 kg (about 8 L) of groundwater from contaminated wells YP-1 and YMW-7
- 32.1 kg of contaminated soil. The soil samples were collected from within the treatment zone from MIP-2 (25-30') and MIP 8 (18-22').

The samples were collected with as little headspace as possible. The groundwater samples were collected on 9/19-20/17, shipped on 9/20/17, and received on 9/21/17. The soil samples were collected on 9/20-21/17, shipped on 9/21/17, and received on 9/22/17.

2.0 SCOPE OF WORK

A comprehensive workplan for the completion of the proposed work was drafted and submitted to WSP. The experimental design for the bench-scale treatability study consisted of four phases of work:

1 Initial compositing and characterization of the site soil and groundwater;

2 Treatment effectiveness for three loading of sodium hydroxide activated Klozur sodium persulfate, and an unamend control sampled over 14 days

3 Treatment effectiveness for three loading of un activated Klozur sodium persulfate, and an unamend control sampled over 91 days

4 Report.

Each phase of work is described in detail in the sections that follow.

2.1 Initial Characterization of Site Soils and Groundwater

Prior to beginning the actual treatability experiments, the soil and groundwater samples were composited separately. The soil was screened through a 4.5 cm screen into a 5-gallon bucket and mixed with an auger drill until homogenous. The composited soil was analyzed in duplicate for the following parameters by the Pace Laboratory: VOC and moisture (two Terra Core Kits per sample preserved with bisulfate and methanol), and TPH-DRO and TPH-GRO by 8015 (4-oz jar). The groundwater was analyzed for the following parameters: VOC (3-40 mL VOA vials preserved with hydrochloric acid), TPH-GRO (3-40 mL VOA vials preserved with hydrochloric acid), TPH-DRO (1 Liter amber glass with no preservative); and oxyanions - selenium, chromium, vanadium, molybdenum, and uranium (250 mL plastic bottle preserved with nitric acid). A trip blank for VOCs was also submitted.

TSI measured the soil density, soil moisture, soil field holding capacity, and pH of the soil and groundwater and determined the quantities of 25% sodium hydroxide needed to raise and maintain the pH to 10.5 of 136 g soil and 30 mL groundwater for the following treatments: control, Klozur 10 g/L sodium persulfate, 20 g/L Klozur persulfate, and 40 g/L Klozur persulfate. Each treatment received 1 g/L sodium azide to minimize biological losses. As the persulfate decomposes, it produces sulfuric acid and the pH drops. The pHs were monitored over an eight-day incubation period. When the pH drifted below 10.5, additional 25% sodium hydroxide was added.

2.2 Initial Characterization Results

Table 1 presents the results of the initial characterization. The groundwater contained 1,300 μg/L TPH-DRO, 4,300 μg/L TPH-GRO, no detectable chromium, molybdenum, selenium, uranium, or vanadium (detection limits 0.5 μg/L), 18.8 μg/L benzene, 359 μg/L ethylbenzene, 31.3 μg/L toluene, and 581 μg/L total xylenes with a pH of 6.5 and oxidizing ORP of 104 mV. The trip blank had no detectable BTEX. The soil contained between 99,100 and 223,000 μg/kg TPH-DRO, 53,300 to 89,300 μg/kg TPH-GRO, <244 μg/kg benzene, 909 to 1,610 μg/kg ethylbenzene, <244 μg/kg toluene, and 5,310 to 9,250 μg/kg total xylenes. The soil density was 1.74 g (the equivalent of 109 pounds per cubic foot) with a field holding capacity of 0.14 g/g soil. The soil pH was 6.5 and the redox potential 201 mV.

Table 2 shows the results of the 25% sodium hydroxide (NaOH) titrations with 136 g soil, 30 g groundwater, and 10,000, 20,000, and 40,000 mg/L Klozur sodium persulfate. The initial pH of the Control was 6.8. It took 0.25 mL 25% NaOH to raise the pH to 11.4 and pH remained above 11.3 for the remainder of the 8 days. The sodium hydroxide demand of the Control was 0.46 g/kg. The initial pH of the 10,000 mg/L persulfate treatment was 7.1. It took 0.4 mL of the 25% NaOH to raise the pH to 12.1 and pH remained above 11.3 for the remainder of the 8 days. The sodium hydroxide demand for the 10,000 mg/L persulfate treatment was 0.74 g/kg or the equivalent of 0.039 gallons of 25% sodium hydroxide per cubic foot of aquifer. The initial pH of the 20,000 mg/L persulfate treatment was 7.0. It took 0.35 mL of the 25% NaOH to raise the pH to 11.9 and pH fell below 11.0 on Day 8 and an additional 0.05 mL of 25% NaOH was added to raise the pH to 11.3. The sodium hydroxide demand for the 20,000 mg/L persulfate treatment was 0.74 g/kg or the equivalent of 0.039 gallons of 25% sodium hydroxide per cubic foot of aquifer. The initial pH of the 40,000 mg/L persulfate treatment was 6.9. It took 0.4 mL of the 25% NaOH to raise the pH to 12.5 and pH fell below 11.0 on Day 8 and an additional 0.4 mL of 25% NaOH was added to raise the pH to 11.3. The sodium hydroxide demand for the 40,000 mg/L persulfate treatment was 0.83 g/kg or the equivalent of 0.043 gallons of 25% sodium hydroxide per cubic foot of aquifer.

2.3 Site Soil Alkaline Activated Persulfate Demand and Contaminant Destruction Efficiency Testing

Two control vessels were prepared in separate 712 mL vessels containing 980 g site soil and 220 mL groundwater (ratio of 72% soil and 28% groundwater by volume). One control replicate was sampled over time and one remained unopened and undisturbed. Three loadings of Klozur sodium persulfate were added to separate 712 mL vessels containing 980 g site soil and 220 mL groundwater plus sodium hydroxide. Sodium azide (1 g/L) was added to all treatments to minimize biodegradation losses. The persulfate, sodium azide, and sodium hydroxide were added to the groundwater and mixed for several minutes with a magnetic stirrer to dissolve the persulfate, azide, and sodium hydroxide. The amended groundwater was then added to the soil to thoroughly distribute the oxidant. Sufficient groundwater was added to completely fill the bottles. The Klozur sodium persulfate loadings result in oxidant concentrations of 10, 20, and 40 g/L groundwater. The bottles with soil, groundwater, and persulfate were closed and inverted several times to mix. Periodic measurements of pH, ORP, and oxidant concentrations in the groundwater phase were made from one replicate of the treatment and control vessels after 1, 4, 7, 10, and 14 days. The oxidant concentrations were measured using a back-titration method wherein 0.4 M ferrous ammonium sulfate solution was added to a portion of the groundwater with 10 mL 25% sulfuric acid and titrated with potassium permanganate. The concentration of residual persulfate in the groundwater are correlated to the volume of permanganate solution consumed versus a blank. After 14 days, the groundwater from the unopened control and the persulfate and sodium hydroxide treatments were analyzed for pH, ORP, and oxidant concentrations. Groundwater samples from the unopened and undisturbed control and from the unopened and undisturbed persulfate and sodium hydroxide treatments were submitted to the Pace Laboratory for analysis of BTEX, TPH-DRO, and TPH-GRO. The groundwater was diluted 10-fold. The groundwater from the 20 g/L persulfate treatment was analyzed for oxyanions (Se, Cr, V, Mo, and U). After 14 days, soil samples from the unopened and undisturbed control and from the unopened and undisturbed persulfate and sodium hydroxide treatments were submitted to Pace Laboratory for analysis of BTEX, TPH-DRO, TPH-GRO, and moisture.

Table 1. Initial Characterization Results

Sample	Units	GW	Trip Blanl	Units	Soil A	Soil B	Soil Avg
TPH C10-C28 (DRO)	µg/L	1300		µg/kg	223,000	99,100	161,050
TPH C06-C10 (GRO)	µg/L	4360		µg/kg	89,300	53,300	71,300
Chromium	µg/L	<0.5		µg/kg			
Molybdenum	µg/L	<0.5		µg/kg			
Selenium	µg/L	<0.5		µg/kg			
Uranium-238	µg/L	<0.5		µg/kg			
Vanadium	µg/L	<0.5		µg/kg			
Benzene	µg/L	18.8	<1.0	µg/kg	<244	<245	<244
Ethylbenzene	µg/L	359	<1.0	µg/kg	1,610	909	1,260
Toluene	µg/L	31.3	<1.0	µg/kg	<244	<245	<244
Total Xylenes	µg/L	581	<1.0	µg/kg	9,250	5,310	7,280
% Moisture				%	13.5	16.0	15
TSI		GW					Soil
Soil Density	g/cm3						1.74
pH	SU	6.5					6.5
Redox Potential	mV	104					210
Field Holding Capacity	g/g						0.14

Table 2. 25% Sodium Hydroxide Titrations

Sample	**Control**											**Soil NaOH Demand g/kg**
Date			10/3/2017			10/4/2017	10/6/2017	10/11/2017				
Day			0			1	3	8				
Soil	g	136										
GW	g	30										
Klozur Sodium Persulfate	g	0										
Sodium Azide	g	0.05										
mL 25% NaOH			0	0.2	0.25							
pH	SU		6.8	10.4	11.4	11.9	11.8	11.3				0.46
Sample	**10,000 mg/L Klozur**											**Soil NaOH Demand g/kg**
Date			10/3/2017				10/4/2017	10/6/2017	10/11/2017			
Day			0				1	3	8			
Soil	g	136										
GW	g	30										
Klozur Sodium Persulfate	g	0.3										
Sodium Azide	g	0.05										
mL 25% NaOH			0	0.25	0.35	0.4						
pH	SU		7.1	9.2	10.5	12.2	12.1	11.9	11.3			0.74
Sample	**20,000 mg/L Klozur**											**Soil NaOH Demand g/kg**
Date			10/3/2017				10/4/2017	10/6/2017	10/11/2017			
Day			0				1	3	8			
Soil	g	136										
GW	g	30										
Klozur Sodium Persulfate	g	0.6										
Sodium Azide	g	0.05										
mL 25% NaOH			0	0.35						0.4		
pH	SU		7.0	11.9			11.3	11.0	10.1	11.3		0.74
Sample	**40,000 mg/L Klozur**											**Soil NaOH Demand g/kg**
Date			10/3/2017				10/4/2017	10/6/2017	10/11/2017			
Day			0				1	3	8			
Soil	g	136										
GW	g	30										
Klozur Sodium Persulfate	g	1.2										
Sodium Azide	g	0.05										
mL 25% NaOH			0	0.4						0.45		
pH	SU		6.9	12.5			12.1	11.6	10.2	11.3		0.83

2.4 Unactivated Persulfate Demand and Contaminant Destruction Efficiency Testing

One control vessel was prepared in a separate 712 mL vessel containing 980 g site soil and 220 mL groundwater. The control remained unopened and undisturbed. Three loadings of Klozur sodium persulfate were added to separate 712 mL vessels containing 980 g site soil and 220 mL groundwater (ratio of 72% soil and 28% groundwater by volume). Sodium azide (1 g/L) was added to all treatments to minimize biodegradation losses. The persulfate was added to the groundwater and mixed with a magnetic stirrer for several minutes to dissolve the persulfate and azide. The amended groundwater was added to the soil to thoroughly distribute the oxidant. Sufficient groundwater was added to completely fill the bottles. The Klozur sodium persulfate loadings result in oxidant concentrations of 10, 20, and 40 g/L groundwater. The bottles with soil, groundwater, and persulfate were closed and inverted several times to mix. Periodic measurements of pH, ORP, and oxidant concentrations in the groundwater phase was made from one replicate of the treatment and control vessels after 1, 4, 7, 10, 14, 36, 56, and 91 days. After 91 days, the groundwater from the unopened and undisturbed persulfate replicates and the control were analyzed for pH, ORP, and oxidant concentrations. Groundwater samples from the unopened replicate and undisturbed control and persulfate amended treatments were submitted to the chosen laboratory for analysis of BTEX, TPH-DRO, and TPH-GRO. The sample volumes needed for these analyses are shown in Table 2. The groundwater was diluted 10-fold. The groundwater from the 20 g/L persulfate treatment was analyzed for oxyanions (Se, Cr, V, Mo, and U). After 91 days, soil samples from the unopened replicate of the control and persulfate-amended treatments were submitted to Pace Laboratory for analysis of BTEX, TPH-DRO, TPH-GRO, and moisture.

3.0 RESULTS

3.1 Sodium Hydroxide Activated Persulfate Field Parameters

Table 3 presents the field parameter for the sodium hydroxide activated persulfate treatments. The pH of the Control ranged from 6.8 to 7.9 SU and the ORP mildly oxidizing from 108 to 225 mV. The pH of the 10 g/L persulfate activated with sodium hydroxide ranged from 11.1 to 12.4 SU and the ORP from -31 to 89 mV. The elevated pHs impacts the redox potential measurements. The persulfate fell from 10,000 mg/L to 6,925 mg/L from Days 1 to 4 and decreased to 3,280 mg/L in the opened bottle at Day 14. The sample from the unsampled bottle had <1,457 mg/L persulfate. The SOD of the sodium hydroxide activated 10 g/L persulfate treatment was estimated to be 1,509 mg/kg to >1,918 mg/kg with a requirement for 0.74 g sodium hydroxide/kg soil or the equivalent of 0.039 gallons of 25% sodium hydroxide per cubic foot of aquifer. The pH of the 20 g/L persulfate activated with sodium hydroxide ranged from 11.6 to 12.6 SU and the ORP from 38 to 53 mV. The persulfate fell from 20,000 mg/L to 9,963 mg/L on Day 1 to 2,065 mg/L on Day 14. The 20 g/L persulfate amended activated with sodium hydroxide treatment had an SOD estimated to be 4,026 mg/kg with a requirement for 0.74 g sodium hydroxide/kg soil or the equivalent of 0.039 gallons of 25% sodium hydroxide per cubic foot of aquifer. The pH of the 40 g/L persulfate activated with sodium hydroxide ranged from 10.9 to 12.7 SU and the ORP from 62 to 112 mV. The persulfate fell from 40,000 mg/L to 28,797 mg/L on Day 1 to between 4,495 to 22,722 mg/L on Day 14. The 40 g/L persulfate amended treatment had an SOD estimated to be 3,879 to 7,791 mg/kg with a requirement for

0.83 g sodium hydroxide/kg soil or the equivalent of 0.043 gallons of 25% sodium hydroxide per cubic foot of aquifer.

Table 3. Sodium Hydroxide Activated Persulfate Field Data

Treatment	Soil	GW	Klozur	Sodium Hydroxide	Date	Day	pH	ORP	Persulfate	
	g	g	g	g			SU	mV	mg/L	
Control 14	867	280	0	0						
Control 80	980	220	0	0						
Control Ex	980	220	0	0	10/17/2017	1	7.8	120		
					10/20/2017	4	6.9	221		
					10/23/2017	7	7.7	108		
					10/26/2017	10	7.7	221		
					10/30/2017	14	6.8	225		
					10/30/2017 Diluted 10X	14	6.9	204		
	Soil	**GW**	**Klozur**	**Sodium Hydroxide**	**Date**	**Day**	**pH**	**ORP**	**Persulfate**	**SOD**
	g	**g**	**g**	**g**			**SU**	**mV**	**mg/L**	**mg/kg**
10 g/L PS + NaOH 14	980	220	2.2	0.73		0			10,000	
10 g/L PS + NaOH Ex	980	220	2.2	0.73	10/17/2017	1	12.4	89	6,925	
					10/20/2017	4	12.7	25	6,925	
					10/23/2017	7	12.4	-1	6,317	
					10/26/2017	10	12.4	7	6,925	
					10/30/2017	14	11.9	-31	3,280	1,509
					10/30/2017 Diluted 10X	14	11.1	30	<1,457	>1.918
	Soil	**GW**	**Klozur**	**Sodium Hydroxide**	**Date**	**Day**	**pH**	**ORP**	**Persulfate**	**SOD**
	g	**g**	**g**	**g**			**SU**	**mV**	**mg/L**	**mg/kg**
20 g/L PS + NaOH 14	980	220	4.4	0.73		0			20,000	
20 g/L PS + NaOH Ex	980	220	4.4	0.73	10/17/2017	1	12.3	41	9,963	
					10/20/2017	4	12.6	38	8,748	
					10/23/2017	7	12.2	39	10,570	
					10/26/2017	10	12.0	52	10,570	
					10/30/2017	14	11.6	53	2,065	4,026
					10/30/2017 Diluted 10X	14	10.9	38	2,065	4,026
	Soil	**GW**	**Klozur**	**Sodium Hydroxide**	**Date**	**Day**	**pH**	**ORP**	**Persulfate**	**SOD**
	g	**g**	**g**	**g**			**SU**	**mV**	**mg/L**	**mg/kg**
40 g/L PS + NaOH 14	980	220	8.8	0.81		0			40,000	
40 g/L PS + NaOH Ex	980	220	8.8	0.81	10/17/2017	1	12.5	89	28,797	
					10/20/2017	4	12.7	81	27,582	
					10/23/2017	7	12.3	83	25,152	
					10/26/2017	10	12.2	83	25,152	
					10/30/2017	14	11.7	112	22,722	3,879
					10/30/2017 Diluted 10X	14	10.9	62	4,495	7,971

3.2 Unactivated Persulfate Field Parameters

Table 4 presents the field parameter for the unactivated persulfate treatments. The pH of the Control ranged from 6.8 to 7.8 SU and the ORP oxidizing from 108 to 314 mV. The pH of the 10 g/L persulfate decreased from 8.6-9.2 SU to 6.2-6.3 SU on Day 91 and the ORP from 170 to 452 mV. The persulfate fell from 10,000 mg/L to 6,925 mg/L from Day 1 and 7,533 mg/L on Day 4 to a low of 3,544 to 3,842 mg/L on Day 91. The SOD of the unactivated 10 g/L persulfate treatment was estimated to be 1,382 to 1,449 mg/kg. The pH of the unactivated 20 g/L persulfate ranged from 8.0 SU on Day 1 to a low of 5.5-5.7 on Day 91 and the ORP increased from 230-256 mV to 514 to 535 mV on Day 91. The persulfate fell from 20,000 mg/L to 14,823 mg/L on Day 1 to between 7,418 to 8.877 mg/L on Day 91. The unactivated 20 g/L persulfate had an SOD estimated to be 2,497 to 2,825 mg/kg. The pH of the unactivated 40 g/L persulfate decreased from 7.5 on Day 1 to 3.6 SU on Day 91 and the ORP increased from 325 to between 621 and 679 mV. The persulfate fell from 40,000 mg/L to 28,797 mg/L on Day 1 to between 16,060 to 19,605 mg/L on Day 91. The unactivated 40 g/L persulfate amended treatment had an SOD estimated to be 4,578 to 5,374 mg/kg.

3.3 Contaminant Concentrations

Table 5 presents the BTEX, TPH-DRO, TPH-GRO, and oxyanion concentrations in the aqueous and soil phases for each treatment.

The aqueous TPH DRO increased from 1,300 μg/L in the initial Characterization to 14,000 μg/L in the Control Day 14 sample presumably as TPH DRO partitioned from the soil phase into the aqueous phase. For the alkaline activated persulfate treatments, aqueous TPH DRO was only lower than the Control Day 14 at 7,900 μg/L in the 20 g/L Persulfate treatment. At Day 91, aqueous TPH DRO was lowest in the Control Day 91 at 8,500 μg/L followed by the 40 g/L unactivated persulfate treatment at 9,100 μg/L.

The aqueous TPH GRO increased from 4,360 μg/L in the initial Characterization to 4,470 μg/L in the Control Day 14 sample presumably as TPH GRO partitioned from the soil phase into the aqueous phase. For the alkaline activated persulfate treatments, aqueous TPH GRO was lower than the Control Day 14 in the 10 g/L persulfate, 20 g/L persulfate, and 40 g/L persulfate treatments. At Day 91, aqueous TPH GRO was detected at 1,570 μg/L in the Control Day 91 and was non-detect at <2,000 μg/L in the unactivated persulfate amended treatments.

The 20 g/L alkaline persulfate treatment had between 258 μg/L for Selenium to 19,000 μg/L Chromium compared to the initial characterization samples with <0.5 μg/L. The unactivated persulfate treatment only showed an increase to 11 μg/L dissolved chromium and 5.0 μg/L selenium with no detectable molybdenum, uranium, or vanadium (detection limits of 5 to 10 μg/L). Alkaline conditions resulted in much higher oxyanions levels than the unactivated treatments.

Table 4. Unactivated Persulfate Field Data

Treatment	Soil	GW	Klozur	Date	Day	pH	ORP		
	g	g	g			SU	mV		
Control 14	867	280	0						
Control 90	980	220	0						
Control Ex	980	220	0	10/17/2017	1	7.8	120		
				10/20/2017	4	6.9	221		
				10/23/2017	7	7.7	108		
				10/26/2017	10	7.7	221		
				10/30/2017	14	6.8	225		
				11/21/2017	36	7.4	254		
				12/11/2017	56	7.6	314		
				1/15/2018	91	7.2	230		
	Soil	**GW**	**Klozur**	**Date**	**Day**	**pH**	**ORP**	**Persulfate**	**SOD**
	g	**g**	**g**			**SU**	**mV**	**mg/L**	**mg/kg**
10 g/L PS 14	980	220	2.2		0			10,000	
10 g/L PS Ex	980	220	2.2	10/17/2017	1	8.6	230	6,925	
				10/20/2017	4	9.2	170	7,533	
				10/23/2017	7	8.0	259	6,925	
				10/26/2017	10	7.2	349	6,317	
				10/30/2017	14	6.7	305	5,710	
				11/21/2017	36	6.5	345	4,495	
				12/11/2017	56	6.4	340	6,317	
				1/15/2018	91	6.3	426	3,842	1,382
				1/15/2018	91	6.2	452	3,544	1,449
	Soil	**GW**	**Klozur**	**Date**	**Day**	**pH**	**ORP**	**Persulfate**	**SOD**
	g	**g**	**g**			**SU**	**mV**	**mg/L**	**mg/kg**
20 g/L PS 14	980	220	4.4		0			20,000	
20 g/L PS Ex	980	220	4.4	10/17/2017	1	8.0	256.0	14,823	
				10/20/2017	4	7.2	230	14,216	
				10/23/2017	7	6.9	233	12,393	
				10/26/2017	10	6.7	351	12,393	
				10/30/2017	14	6.3	284	9,963	
				11/21/2017	36	5.9	393	9,355	
				12/11/2017	56	5.9	469	11,785	
				1/15/2018	91	5.7	514	7,418	2.825
				1/15/2018	91	5.5	535	8,877	2,497
	Soil	**GW**	**Klozur**	**Date**	**Day**	**pH**	**ORP**	**Persulfate**	**SOD**
	g	**g**	**g**			**SU**	**mV**	**mg/L**	**mg/kg**
40 g/L PS 14	980	220	8.8		0			40,000	
40 g/L PS Ex	980	220	8.8	10/17/2017	1	7.5	325.0	28,797	
				10/20/2017	4	6.4	381	29,405	
				10/23/2017	7	5.8	375	27,582	
				10/26/2017	10	3.7	465	27,582	
				10/30/2017	14	4.6		24,544	
				11/21/2017	36	4.0	532	19,076	
				12/11/2017	56	3.8	498	22,722	
				1/15/2018	91	3.6	621	16,060	5,374
				1/15/2018	91	3.6	679	19,605	4,478

Table 5. Contaminant Concentrations

Treatment		Control 0	Control 14	10 g/L Persulfate + NaOH 14	20 g/L Persulfate + NaOH 14	40 g/L Persulfate + NaOH 14	Control 91	10 g/L Unactivated Persulfate 91	20 g/L Unactivated Persulfate 91	40 g/L Unactivated Persulfate 91
Day		0	14	14	14	14	91	91	91	91
Sample Recovered	g		230	106	113.5	156.1	142	105	110	144
DI Water Added	g		2070	954	1022	1405	1278	945	990	1296
Dilution			10	10	10	10	10	10	10	10
TPH C10-C28 (DRO)	µg/L	1,300	14,000	29,000	7,900	32,000	8,500	11,000	16,000	9,100
TPH C06-C10 (GRO)	µg/L	4,360	4,470	2,540	901	1570	2,810	<2,000	<2,000	<2,000
Chromium	µg/L	<0.5			19,000				11	
Molybdenum	µg/L	<0.5			4,850				<5.0	
Selenium	µg/L	<0.5			258				5.0	
Uranium-238	µg/L	<0.5			3,010				<5.0	
Vanadium	µg/L	<0.5			18,800				<10	
Benzene	µg/L	18.8	<10	<10	<10	<10	<10	<10	<10	<10
Ethylbenzene	µg/L	359	122	44	11	29	100	47	26	<10
Toluene	µg/L	31.3	12	<10	<10	<10	<3.0	<10	<10	<10
Total Xylenes	µg/L	581	689	170	<30	<30	553	221	75	<30
TPH C10-C28 (DRO)	µg/kg	161,050	82,400	70,700	57,300	46,800	33,100	95,500	67,800	106,000
TPH C06-C10 (GRO)	µg/kg	71,300	11,000	25,000	13,200	15,700	17,600	14,300	<11,900	10,300
Benzene	µg/kg	<244	<4.1	<5.0	<4.5	<4.2	<4.7	<5.4	<4.4	<4.6
Ethylbenzene	µg/kg	1,260	104	32.6	10.3	12.7	64.4	<5.4	<4.4	<4.6
Toluene	µg/kg	<244	4.5	<5.0	<4.5	<4.2	<4.7	<5.4	<4.4	<4.6
Total Xylenes	µg/kg	7,280	572	148	23.9	20.7	323	<16.2	<13.3	<13.9
Moisture	%	14.8	14.0	25.5	17.3	20.5	22.7	24.0	22.0	17.3

The aqueous benzene decreased from 18.8 μg/L in the initial Characterization to non-detect μg/L in the Control Days 14 and 91 and the alkaline persulfate and unactivated persulfate samples. Aqueous ethylbenzene decreased from 359 μg/L in the Initial Characterization sample to 122 μg/L in the Control Day 14 and 100 μg/L in the Control Day 91 samples with between <10 μg/L in the 40 g/L unactivated persulfate treatment to 47 μg/L in the 10 g/L unactivated persulfate treatment. Aqueous toluene decreased from 31.3 μg/L in the Initial Characterization sample to 12 μg/L in the Control Day 14 sample and were non-detect (<10 μg/L) in the Control Day 91 and all persulfate-amended treatments. Aqueous total xylenes increased from 581 μg/L in the Initial Characterization sample to 689 μg/L in the Control Day 14 and decreased slightly to 553 μg/L in the Control Day 91 sample. Aqueous total xylenes ranged from <30 μg/L in the alkaline 20 g/L persulfate, alkaline 40 g/L persulfate, and the unactivated 40 g/L persulfate treatment to 221 μg/L in the unactivated 10 g/L persulfate treatment.

The soil TPH DRO decreased from an average of 161,050 μg/kg in the initial Characterization to 82,400 μg/kg in the Control Day 14 sample and 33,100 μg/kg in the Control Day 91 sample. For the alkaline activated persulfate treatments, soil TPH DRO was lower than the Control Day 14 in the 10, 20, and 40 g/L Persulfate treatments. At Day 91, soil TPH DRO was lowest in the Control Day 91 at 33,100 μg/kg with between 67,800 to 106,000 μg/kg in the unactivated persulfate treatments.

The soil TPH GRO decreased from 71,300 μg/kg in the initial Characterization to 11,000 μg/kg in the Control Day 14 sample. For the alkaline activated persulfate treatments, soil TPH GRO were higher than the Control Day 14 in the 10 g/L persulfate, 20 g/L persulfate, and 40 g/L persulfate treatments. At Day 91, soil TPH GRO was detected at 17,600 μg/kg in the Control Day 91 and was non-detect at <11,900 μg/L in the unactivated 20 g/L persulfate amended treatment and ranged from 10,300 to 14,300 μg/kg in the unactivated 10 g/L and 40 g/L persulfate treatments.

The soil benzene was non-detect in the Control Days 0, 14, and 91 and the alkaline persulfate and unactivated persulfate samples. Soil ethylbenzene decreased from 1,260 μg/kg in the Initial Characterization sample to 104 μg/kg in the Control Day 14 and 64.4 μg/kg in the Control Day 91 samples with between 10.3 to 32.6 μg/kg in the alkaline activated treatments and non-detects in unactivated persulfate treatments. Soil toluene was non-detect (<244 μg/kg) in the Initial Characterization sample with 4.5 μg/kg in the Control Day 14 sample and were non-detect (<4.2 to 5.4 μg/kg) in the Control Day 91 and all persulfate-amended treatments. Soil total xylenes decreased from 7,280 μg/kg in the Initial Characterization sample to 572 μg/kg in the Control Day 14 and decreased to as low as 20.7 μg/kg in the 40 g/L alkaline persulfate treatment. The Control Day 91 sample had 323 μg/kg and with <13.4 to <16.2 μg/kg in the unactivated persulfate treatments.

Table 6 contains mass balance calculations for the soil and groundwater for TPH DRO, TPH GRO, and BTEX. Non-detect concentrations were considered zeros in the mass balance calculations. Table 7 shows the percent removal of the mass balances from the Control Day 0 (Initial Characterization) results.

Table 6 Mass Balances

		Control 0	Control 14	10 g/L Persulfate + NaOH 14	20 g/L Persulfate + NaOH 14	40 g/L Persulfate + NaOH 14	Control 91	10 g/L Unactivated Persulfate 91	20 g/L Unactivated Persulfate 91	40 g/L Unactivated Persulfate 91
TPH C10-C28 (DRO)	µg	158,115	83,832	75,666	57,892	52,904	34,308	96,010	69,964	105,882
TPH C06-C10 (GRO)	µg	70,833	11,763	25,059	13,134	15,731	17,866	14,014	0	10,094
Benzene	µg	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ethylbenzene	µg	1,313.3	128.8	41.6	12.5	18.8	85.1	10.3	5.7	0.0
Toluene	µg	6.9	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Xylenes	µg	7,262.2	712.1	182.4	23.4	20.3	438.2	48.6	16.5	0.0
BTEX	µg	8,586.5	848.0	224.1	35.9	39.1	523.3	59.0	22.2	0.0

Table 7. Percent Removal from Control Day 0

	Control 14	10 g/L Persulfate + NaOH 14	20 g/L Persulfate + NaOH 14	40 g/L Persulfate + NaOH 14	Control 91	10 g/L Unactivated Persulfate 91	20 g/L Unactivated Persulfate 91	40 g/L Persulfate Unactivated 91
TPH C10-C28 (DRO)	47.0	52.1	63.4	66.5	78.3	39.3	55.8	33.0
TPH C06-C10 (GRO)	83.4	64.6	81.5	77.8	74.8	80.2	100.0	85.7
Benzene	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ethylbenzene	90.2	96.8	99.0	98.6	93.5	99.2	99.6	100.0
Toluene	-2.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Xylenes	90.2	97.5	99.7	99.7	94.0	99.3	99.8	100.0
BTEX	90.1	97.4	99.6	99.5	93.9	99.3	99.7	100.0

The Total TPH DRO mass balance decreased from 158,115 μg in the initial Characterization to 83,832 μg in the Control Day 14 and 34,308 μg in the Control Day 91. The TPH DRO mass balance were lower than the Control Day 14 in the three alkaline persulfate treatments, but were higher than the Control Day 91 in unactivated persulfate treatments at Day 91. The Total TPH GRO mass balance decreased from 70,833 μg in the initial Characterization to 11,763 μg in the Control Day 14 and 17,866 μg in the Control Day 91. The TPH GRO mass balance were higher than the Control Day 14 in the three alkaline persulfate treatments, but were lower than the Control Day 91 in unactivated persulfate treatments at Day 91. TPH-GRO was not detected in either the aqueous or soil phase of the unactivated 20 g/L persulfate treatment. Total benzene decreased from 4.1 μg in the initial Characterization to non-detect μg/L in the Control Days 14 and 91 and the alkaline persulfate and unactivated persulfate samples. Total ethylbenzene decreased from 1,313 μg in the Initial Characterization sample to 129 μg in the Control Day 14 and 85 μg in the Control Day 91 samples with between non-detect μg in the 40 g/L unactivated persulfate treatment to 42 μg in the 10 g/L alkaline persulfate treatment. Total toluene increased from 6.9 μg in the Initial Characterization sample to 7.1 μg in the Control Day 14 sample and were non-detect in the Control Day 91 and all persulfate-amended treatments. The mass balance for total xylenes decreased from 7,262 μg in the Initial Characterization sample to 712 μg in the Control Day 14 and decreased slightly to 438 μg in the Control Day 91 sample. Total xylenes mass balances ranged from 0 μg in the unactivated 40 g/L persulfate treatment to 182 μg in the unactivated 10 g/L persulfate treatment.

Overall removals of TPH-DRO ranged from 33.0% for the unactivated 40 g/L persulfate to a maximum of 78.3% in the Control Day 91 treatment. TPH GRO reductions ranged from 64.6% in the alkaline 10 g/L persulfate treatment to 100% in the unactivated 20 g/L persulfate treatment. Benzene and toluene were reduced to below the detection limits (100%) in the alkaline persulfate, Day 91 Control, and unactivated persulfate treatments. Ethylbenzene removals ranged from 90.2% in the Control 14 to a maximum of 100% in the unactivated 40 g/L persulfate treatment. Total xylenes removals ranged from 90.2% in the Control 14 to a maximum of 100% in the unactivated 40 g/L persulfate treatment. Total BTEX removals ranged from 90.1% in the Control 14 to a maximum of 100% in the unactivated 40 g/L persulfate treatment.

4.0 CONCLUSIONS

The following conclusions can be reached from the treatability study:

- The alkaline activation required between 0.039 to 0.043 gallons of 25% sodium hydroxide solution per cubic foot of aquifer to be treated with 10 to 40 g/L of sodium persulfate.
- The unactivated persulfate persisted for longer than the alkaline activated persulfate with lower soil oxidant demands.
- The TPH-DRO destruction efficiency was higher with alkaline activation. TPH-GRO treatment efficiency was greater with the unactivated persulfate. Total BTEX removal efficiency was slightly greater with the unactivated persulfate.
- The unactivated persulfate treatments resulted in lower oxyanion levels than the alkaline activation.

- Treatment efficiencies were generally slightly higher with the 40 g/L persulfate loadings than the 10 or 20 g/L loadings with highest removal of BTEX with the unactivated 40 g/L persulfate treatment. TPH-DRO and TPH-GRO were reduced, but not as completely as BTEX.

Should you have any questions about the draft report or need additional information, please feel free to contact me.

Sincerely,
TERRA SYSTEMS, INC.

Michael D Lee, PhD.

Michael D. Lee, Ph.D.
Vice-President Research and Development

APPENDIX

C TREND GRAPHS

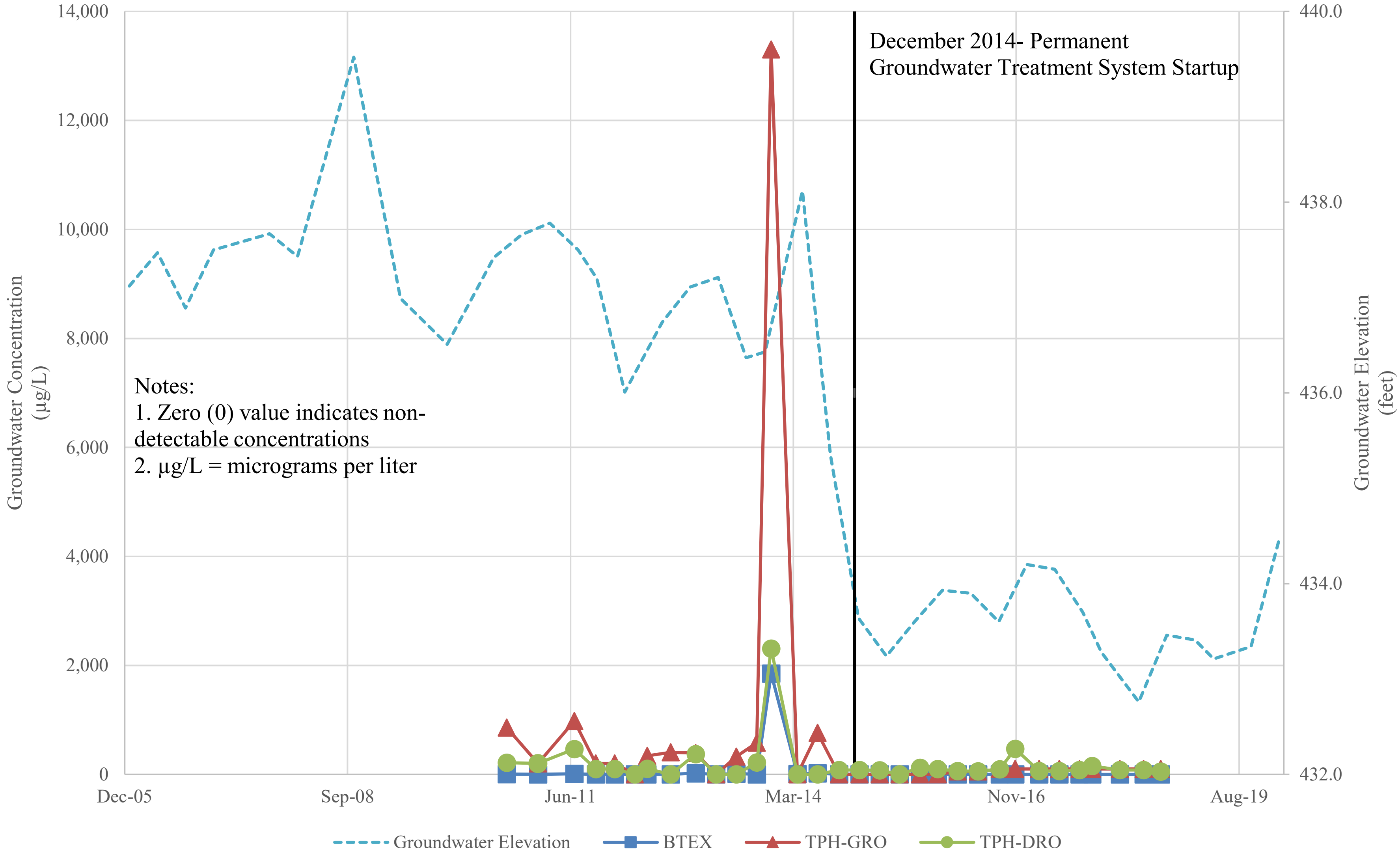

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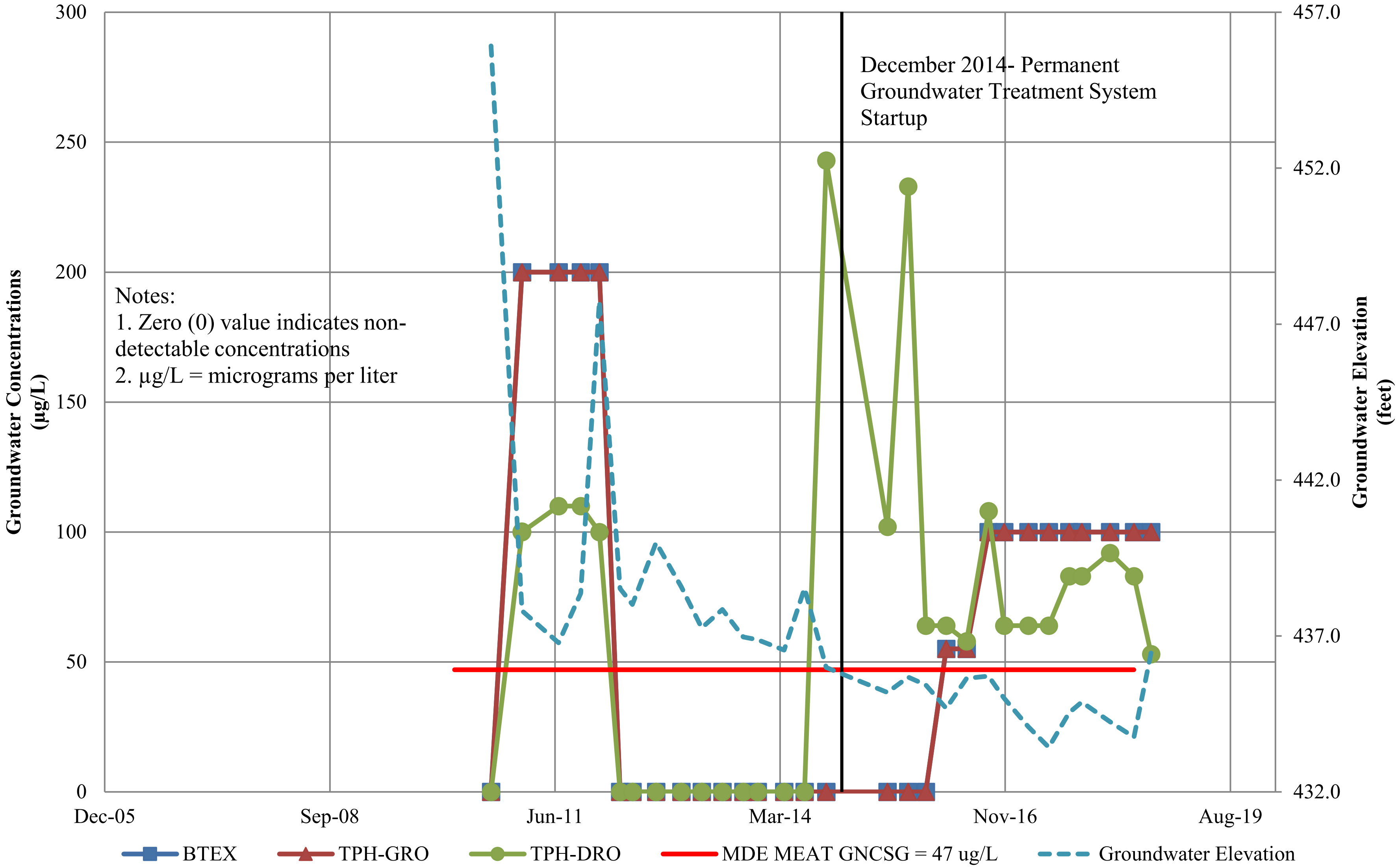
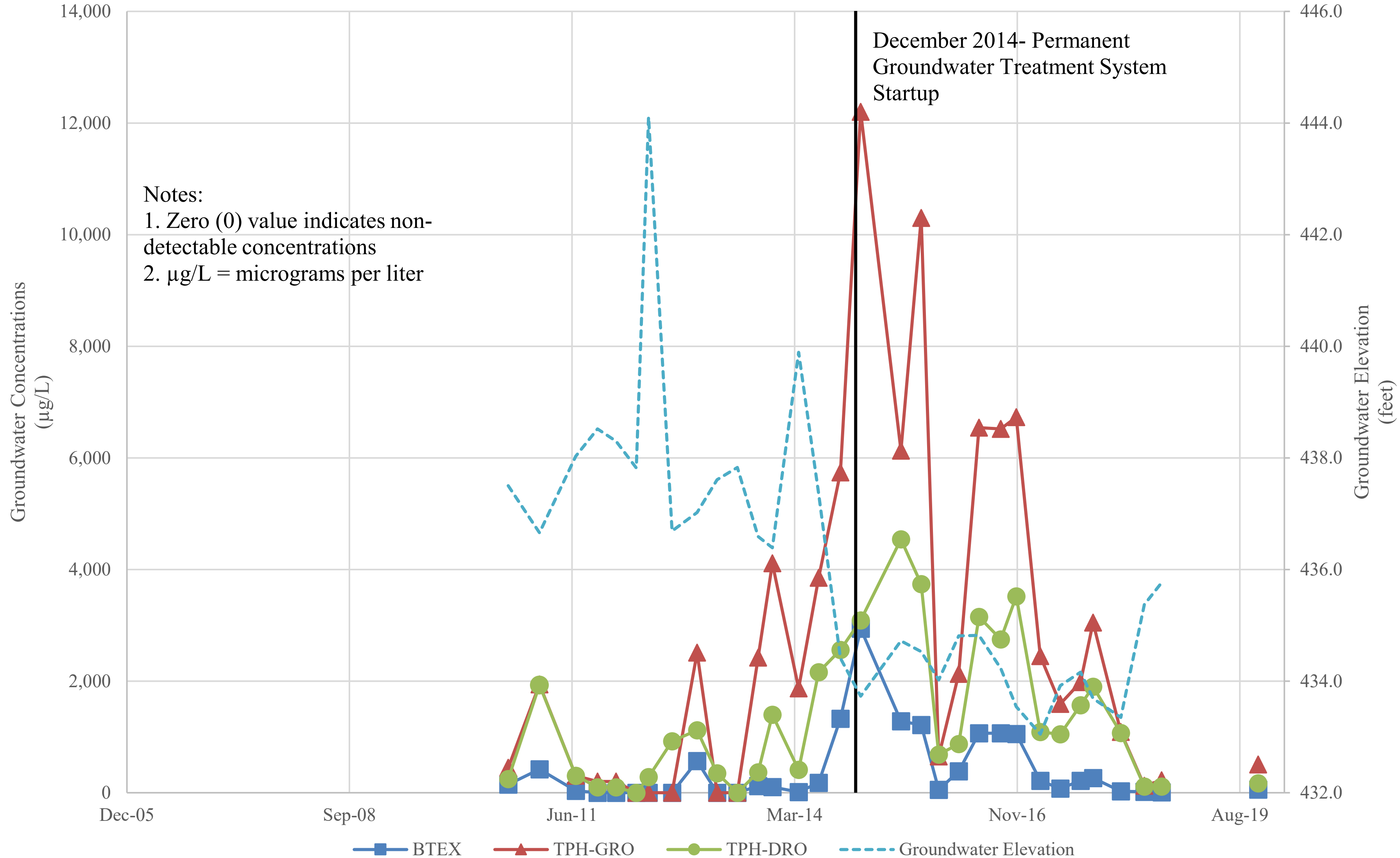
Figure C-1
MDE-4 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-2** **MW-1 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-3** **MW-4 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**

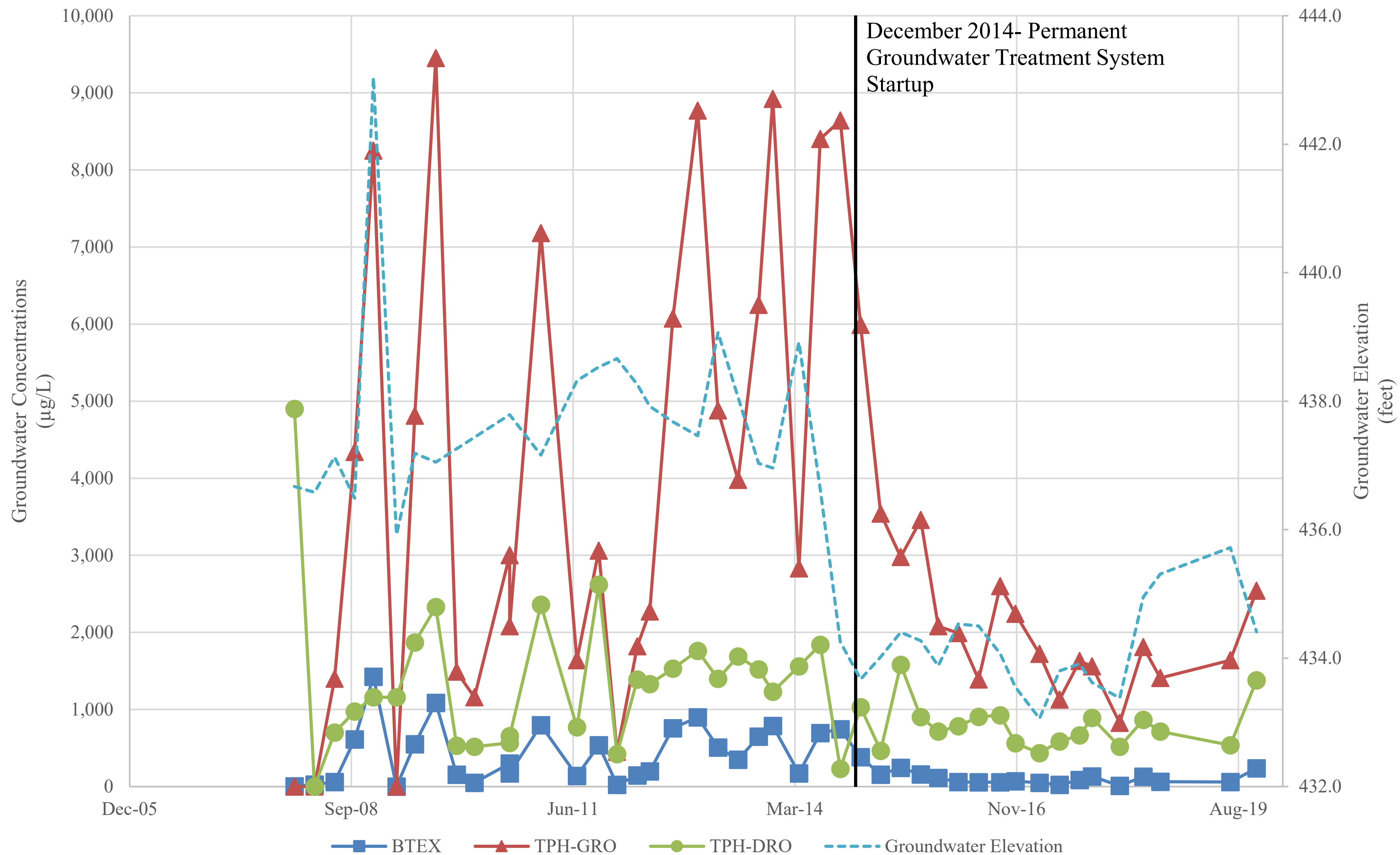


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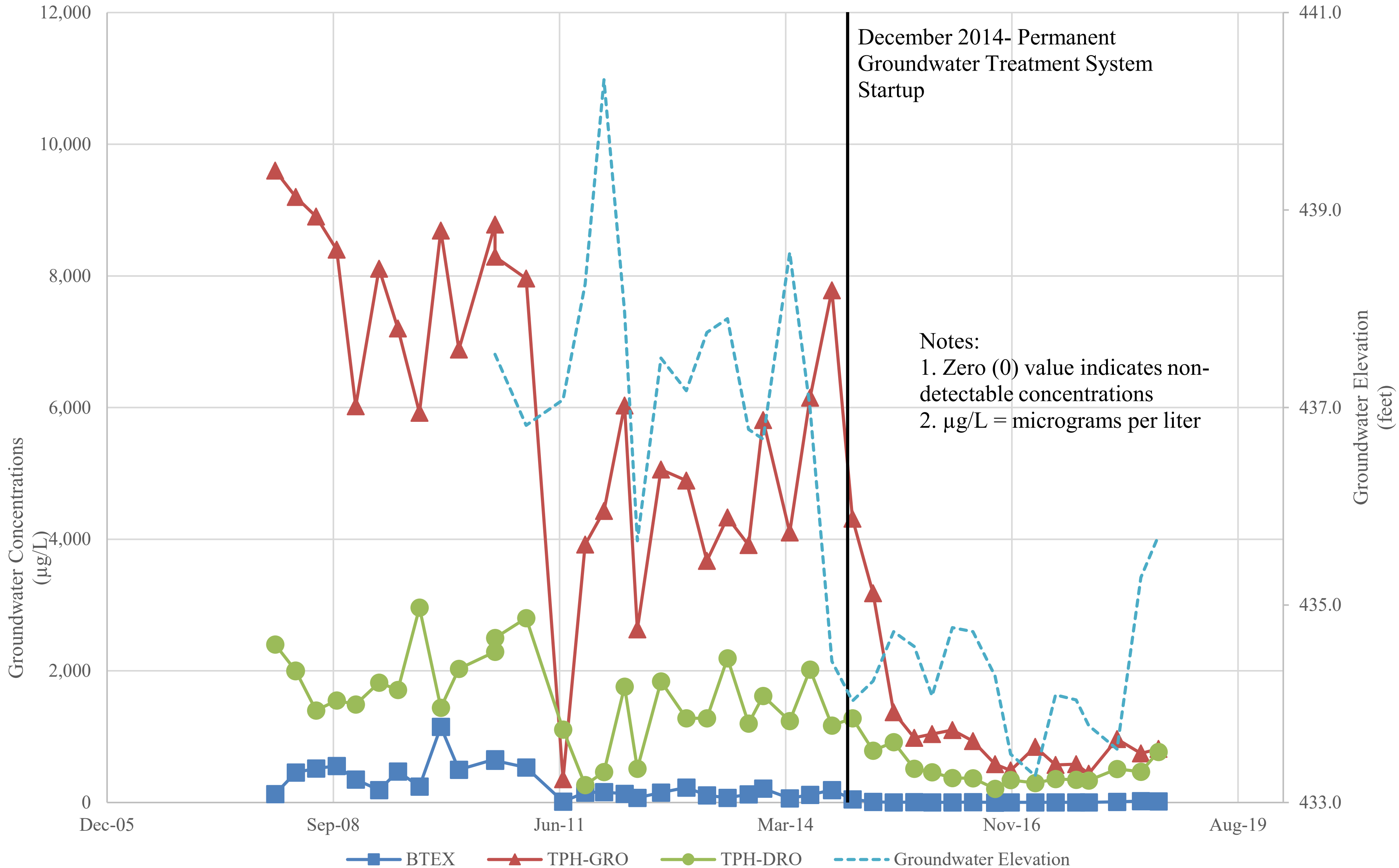
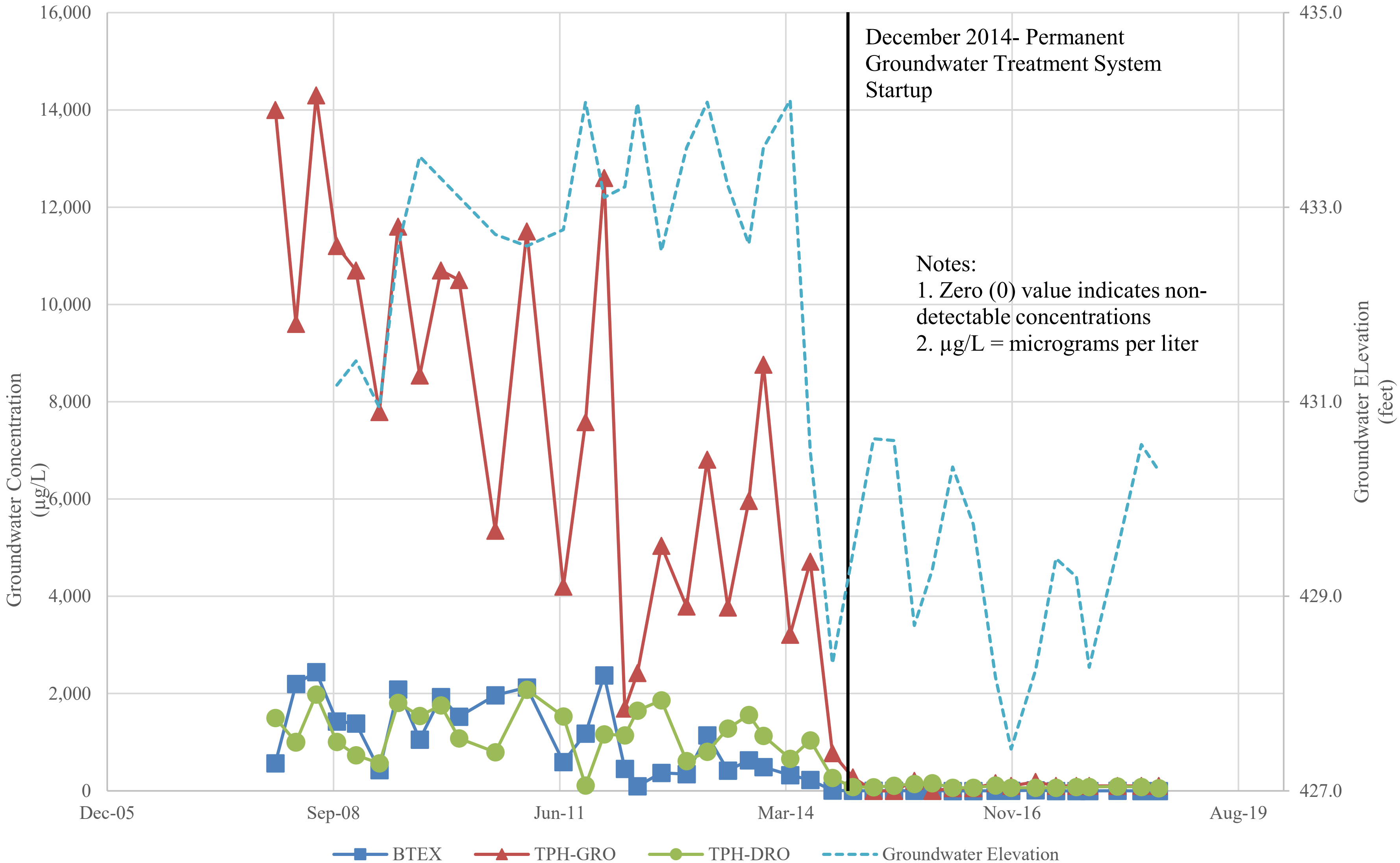
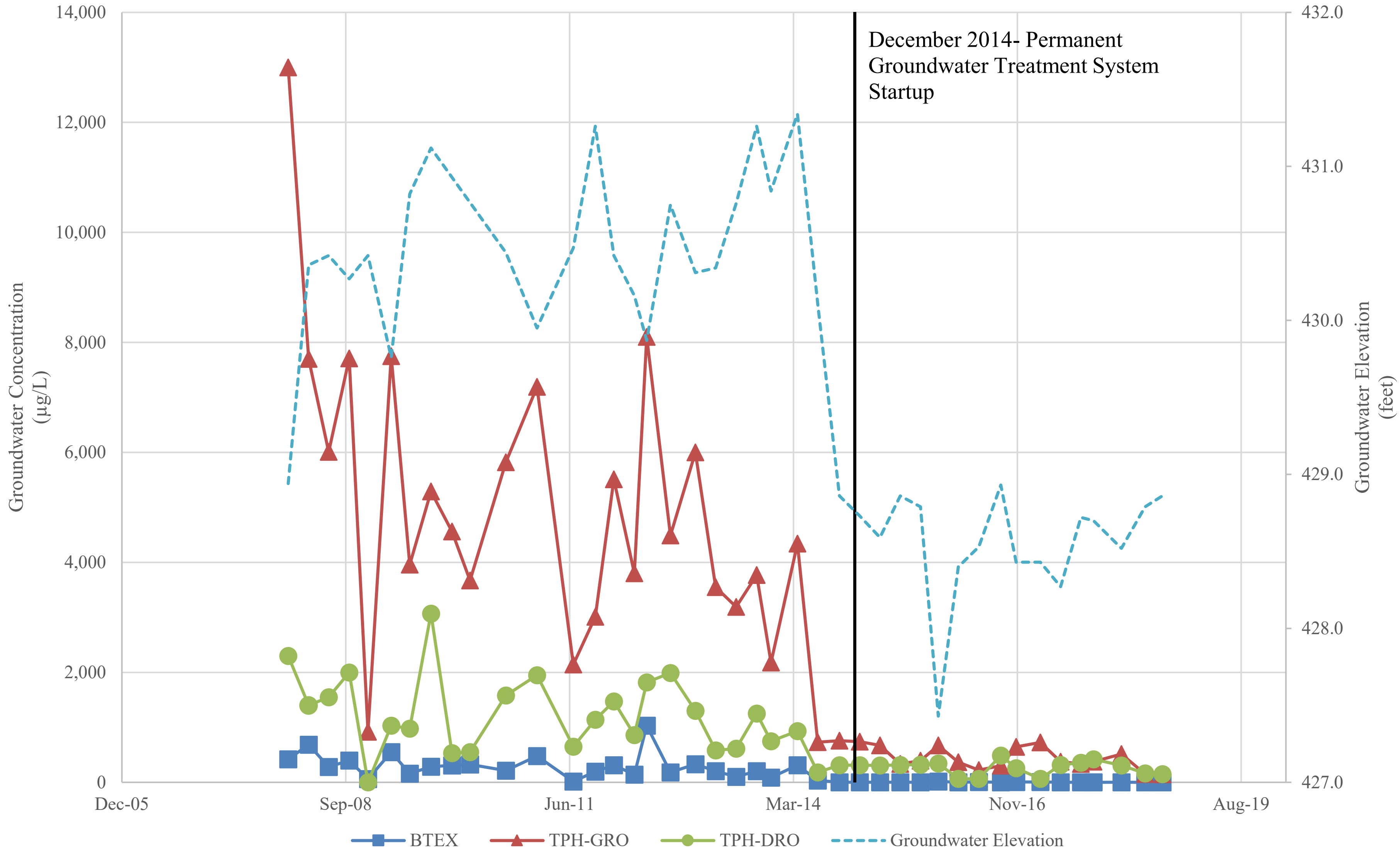
Figure C-4
MW-7 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-5** **OW-1 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-6** **YMW-1 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-7** **YMW-2 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**

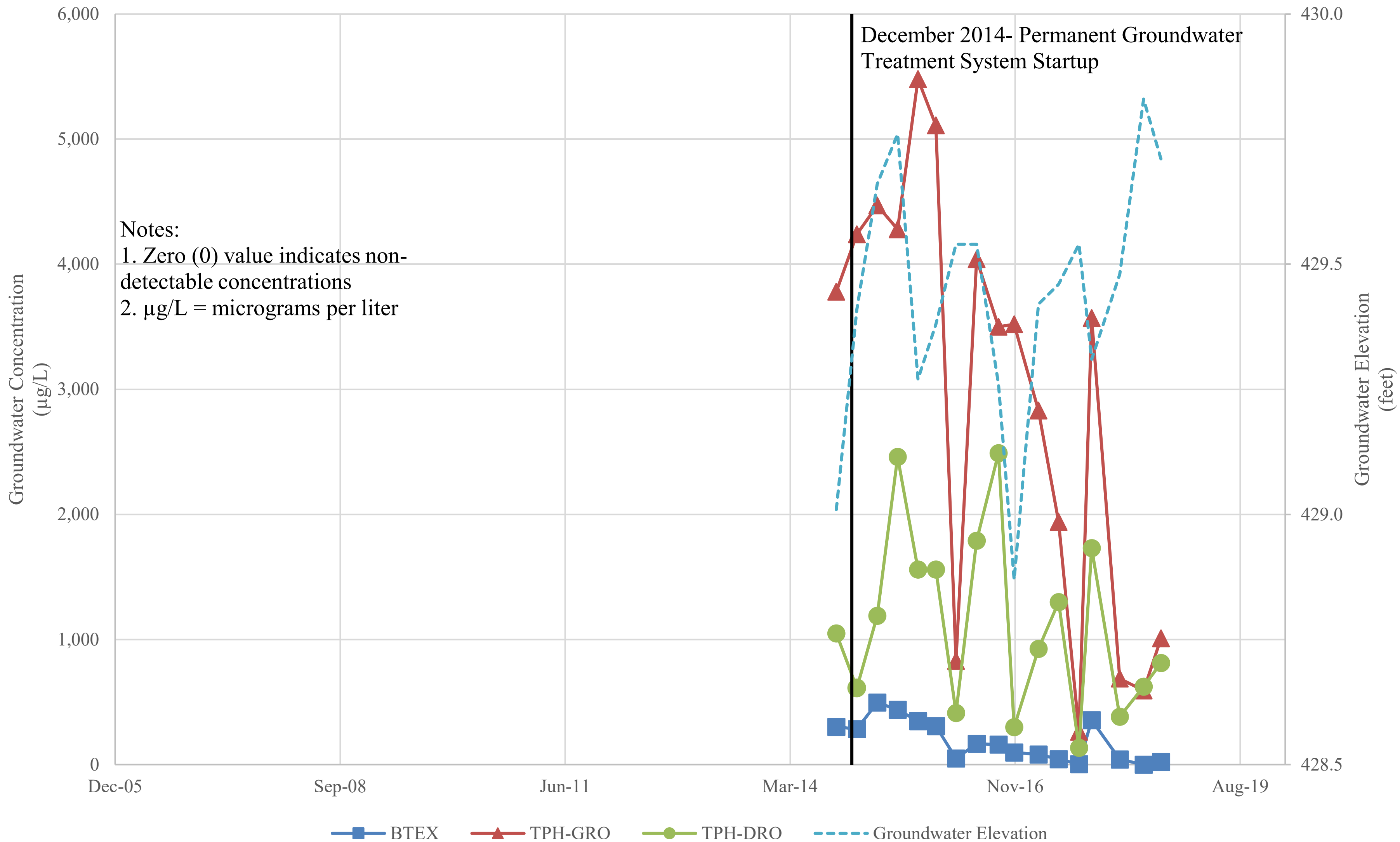


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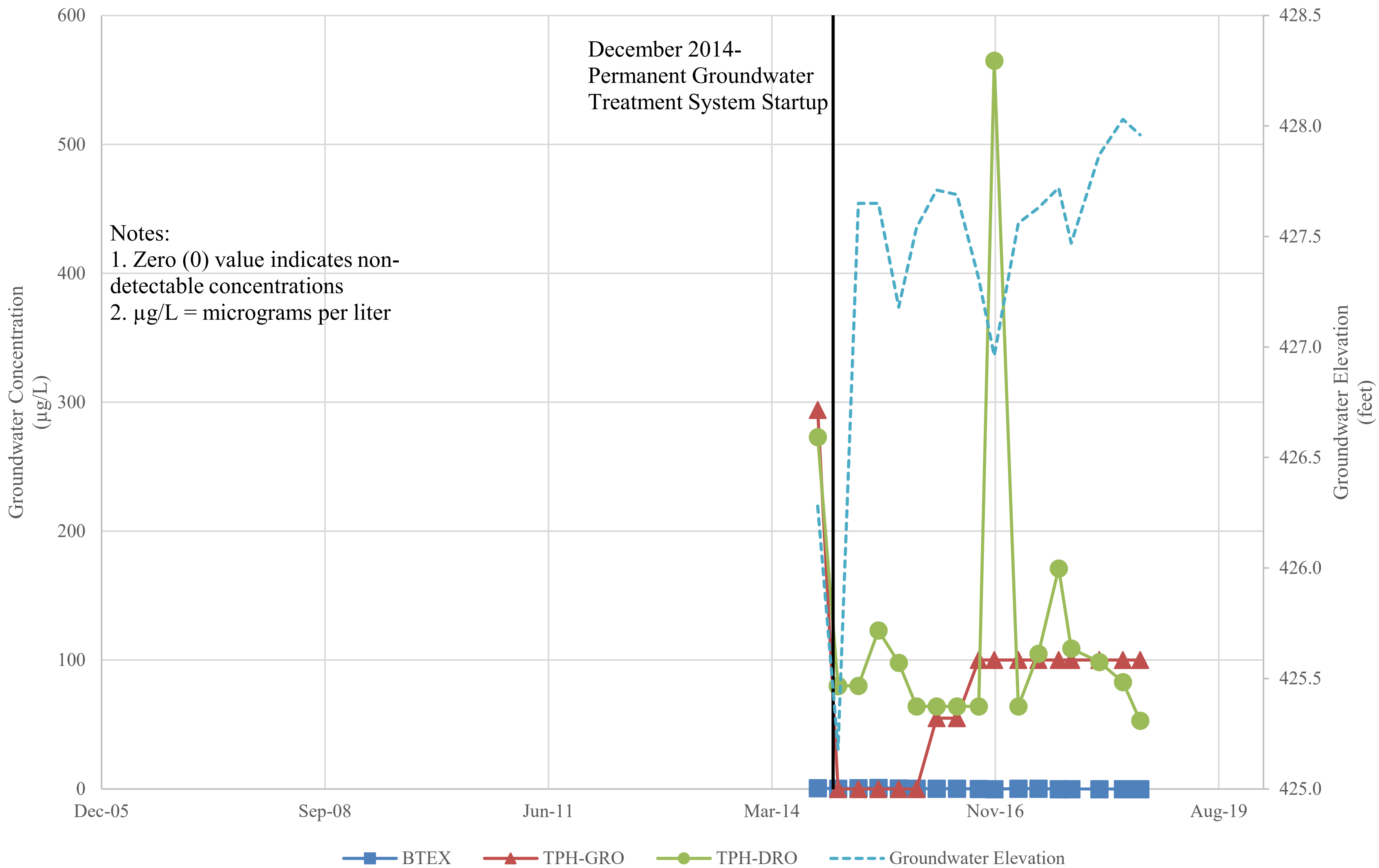
Figure C-8
YMW-4 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-9** **YMW-5 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**

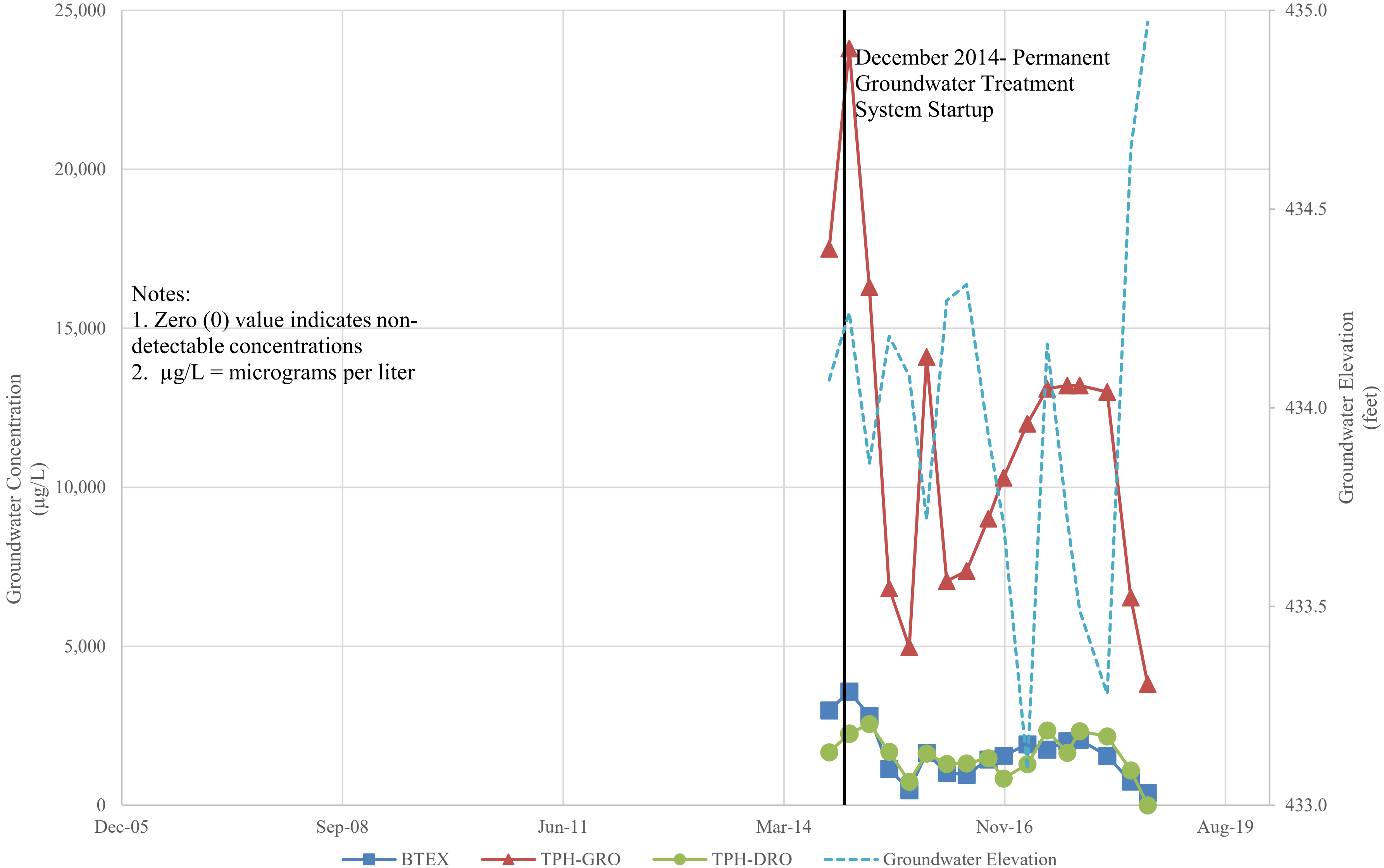


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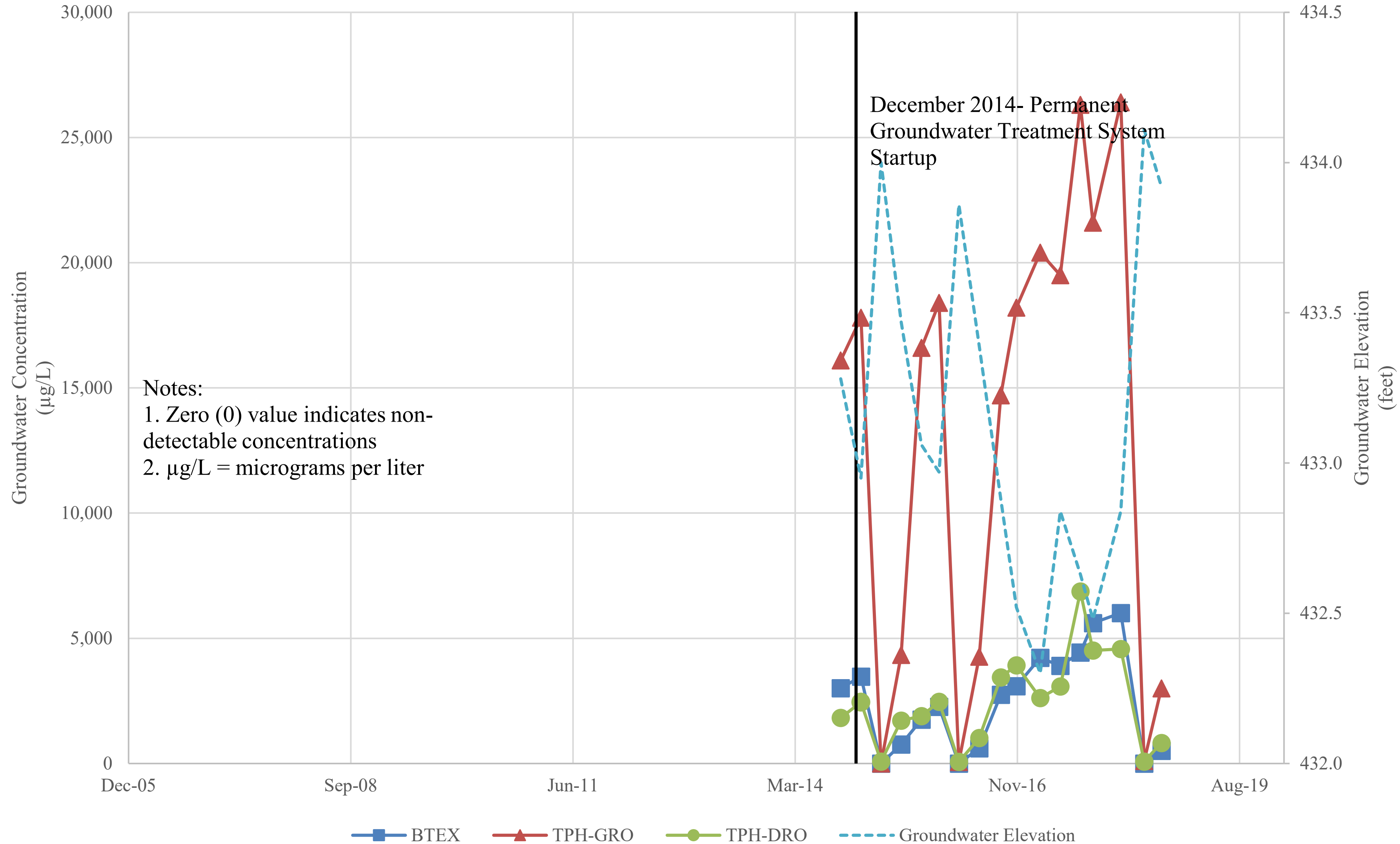
Figure C-10
YMW-7 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-11** **YMW-8 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**

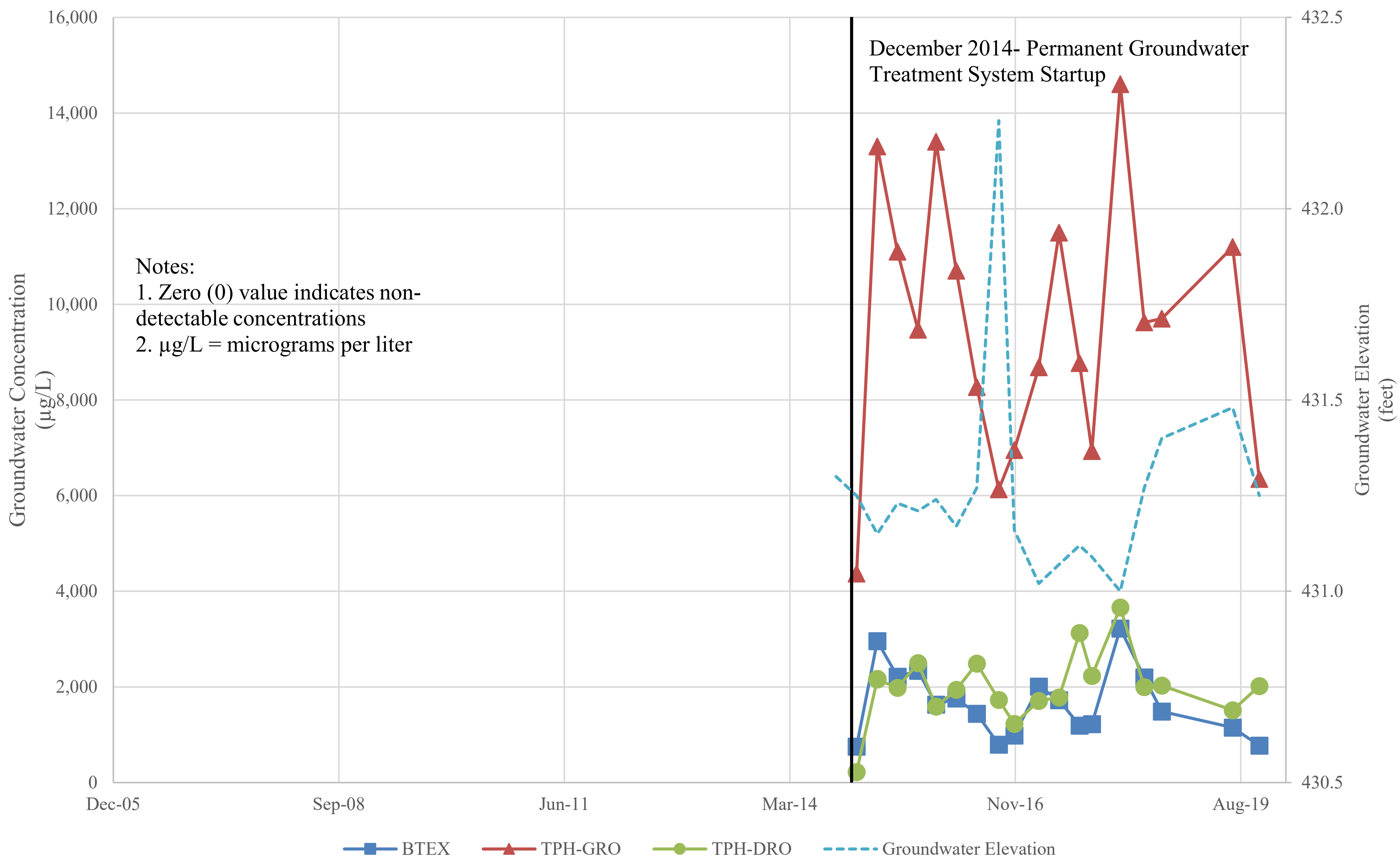


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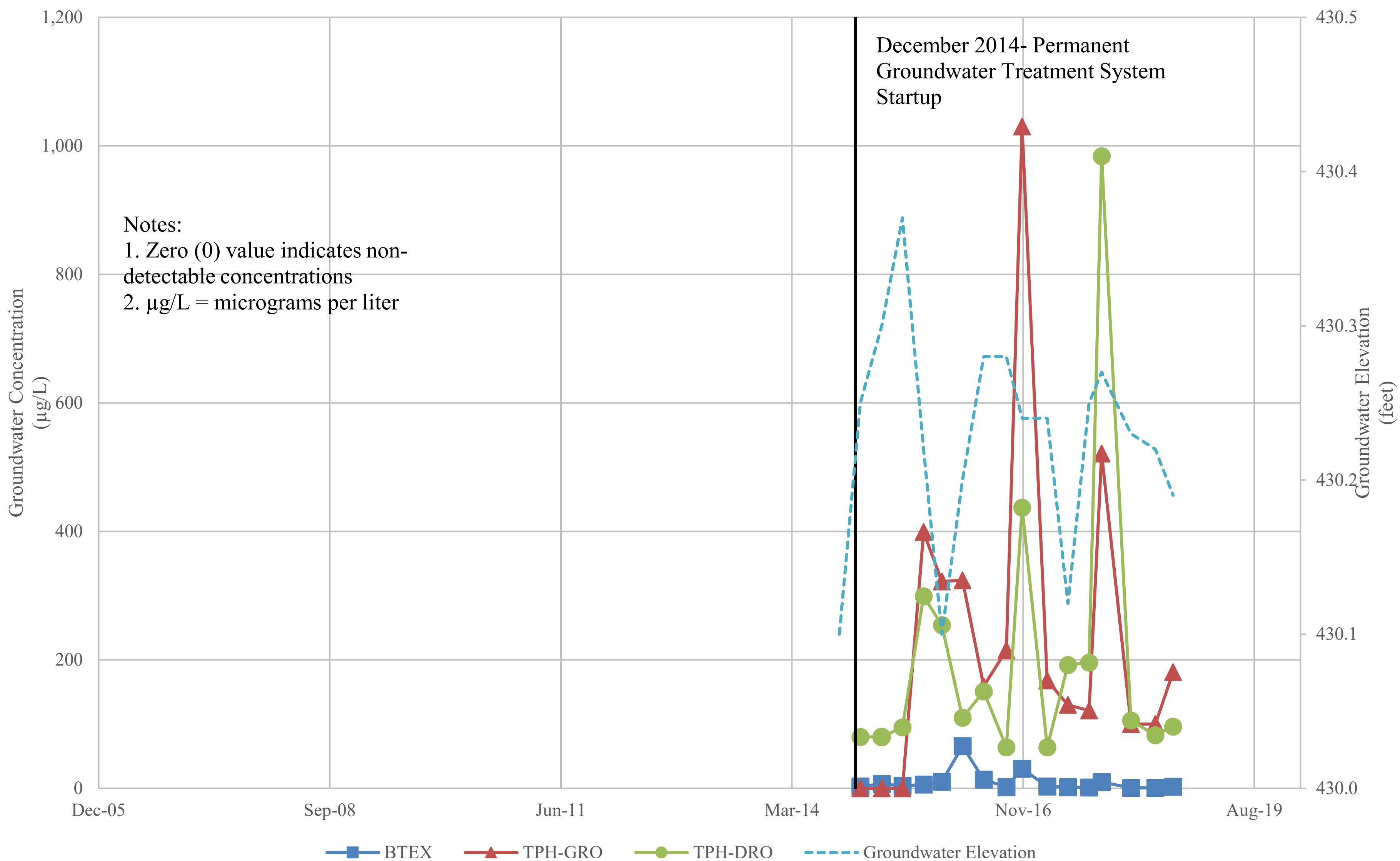
Figure C-12
YP-1 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland



WSP USA 13530 Dulles Technology Drive Suite 300 Herndon, Virginia 20171 703-709-6500	**Figure C-13** **YP-2 Historical Groundwater Concentrations and Groundwater Elevations** **Former Hess Station #20204** **Towson, Maryland**

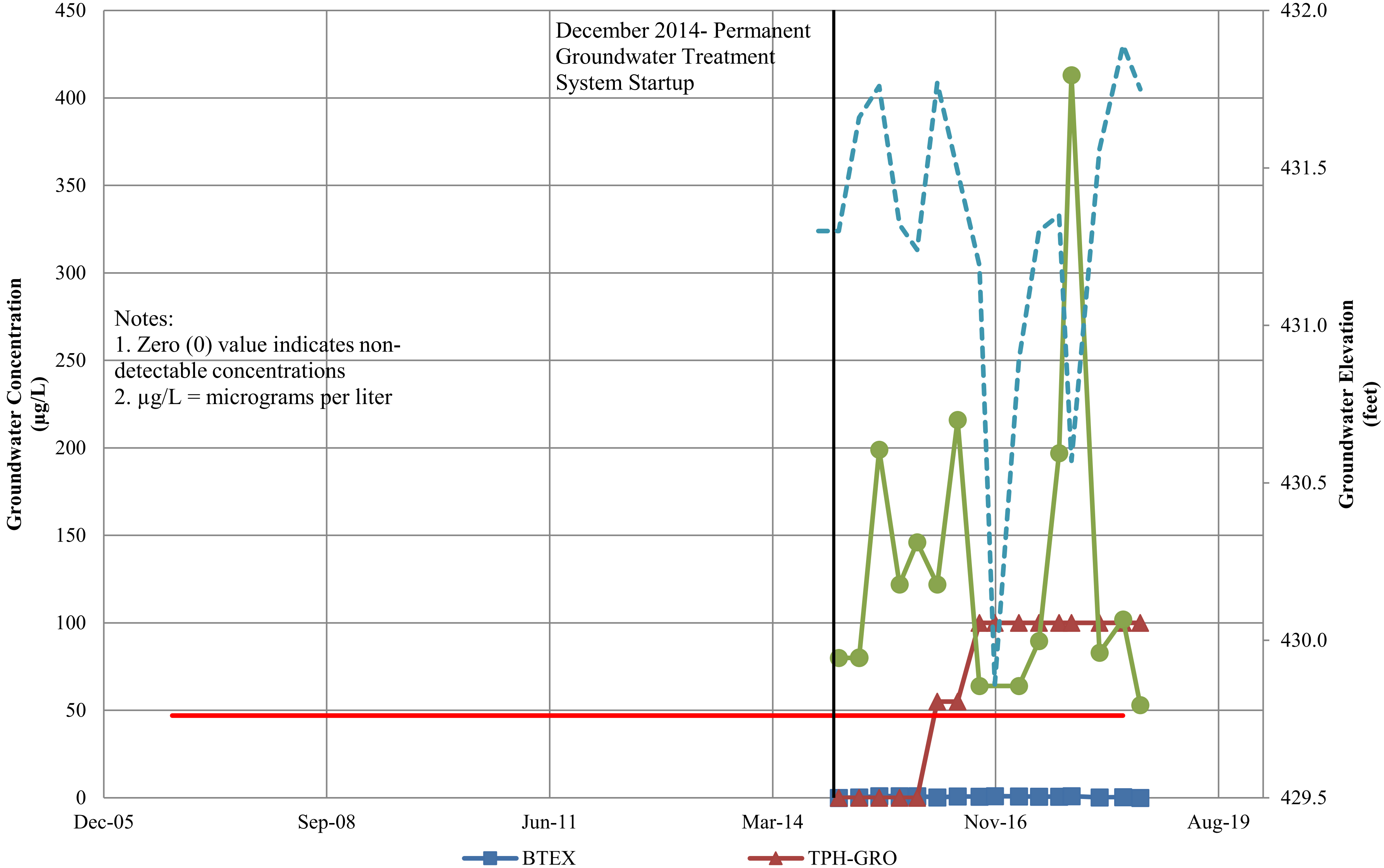


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Figure C-14
YP-3 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland

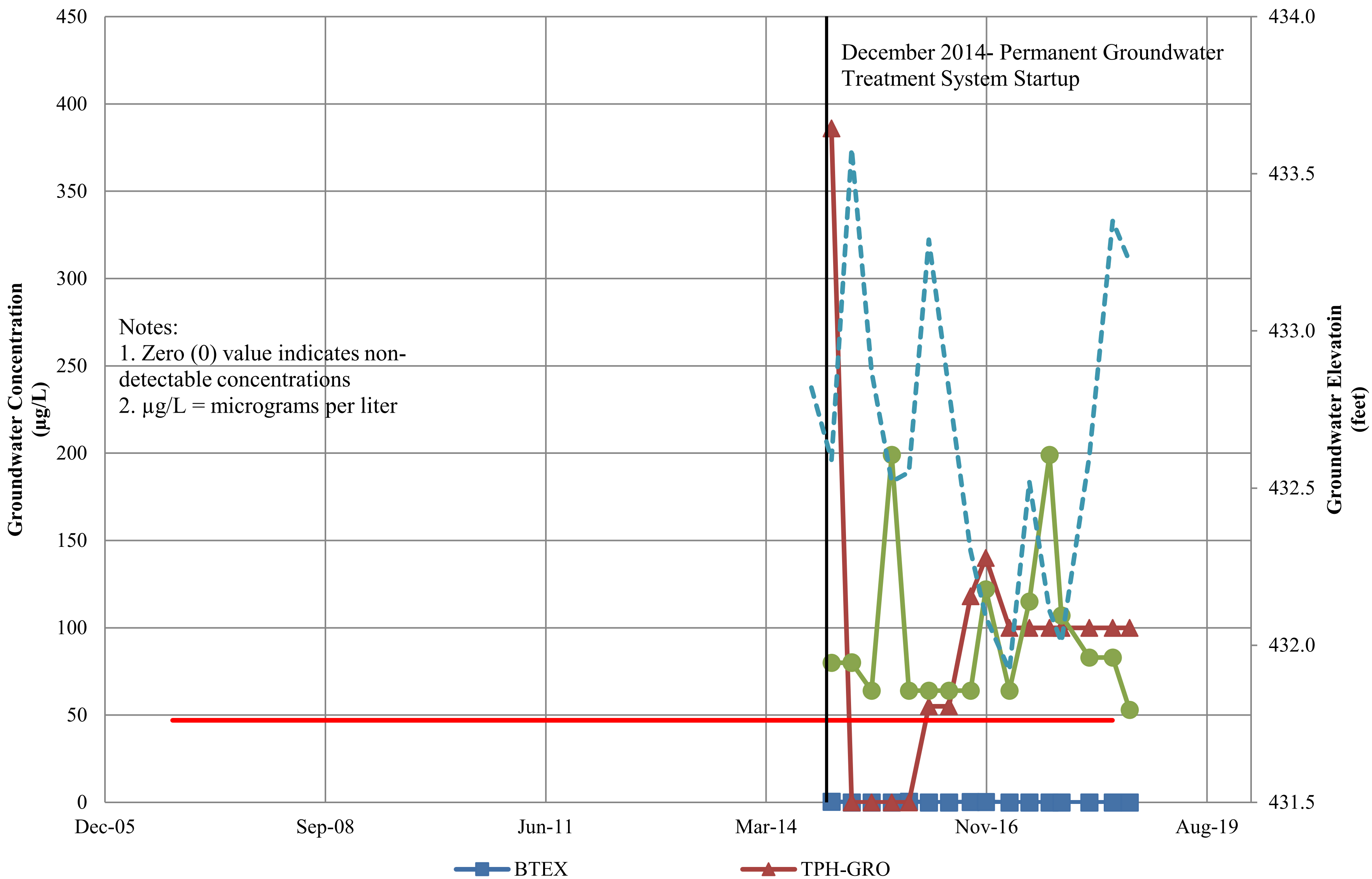

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Figure C-15
YP-4 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland

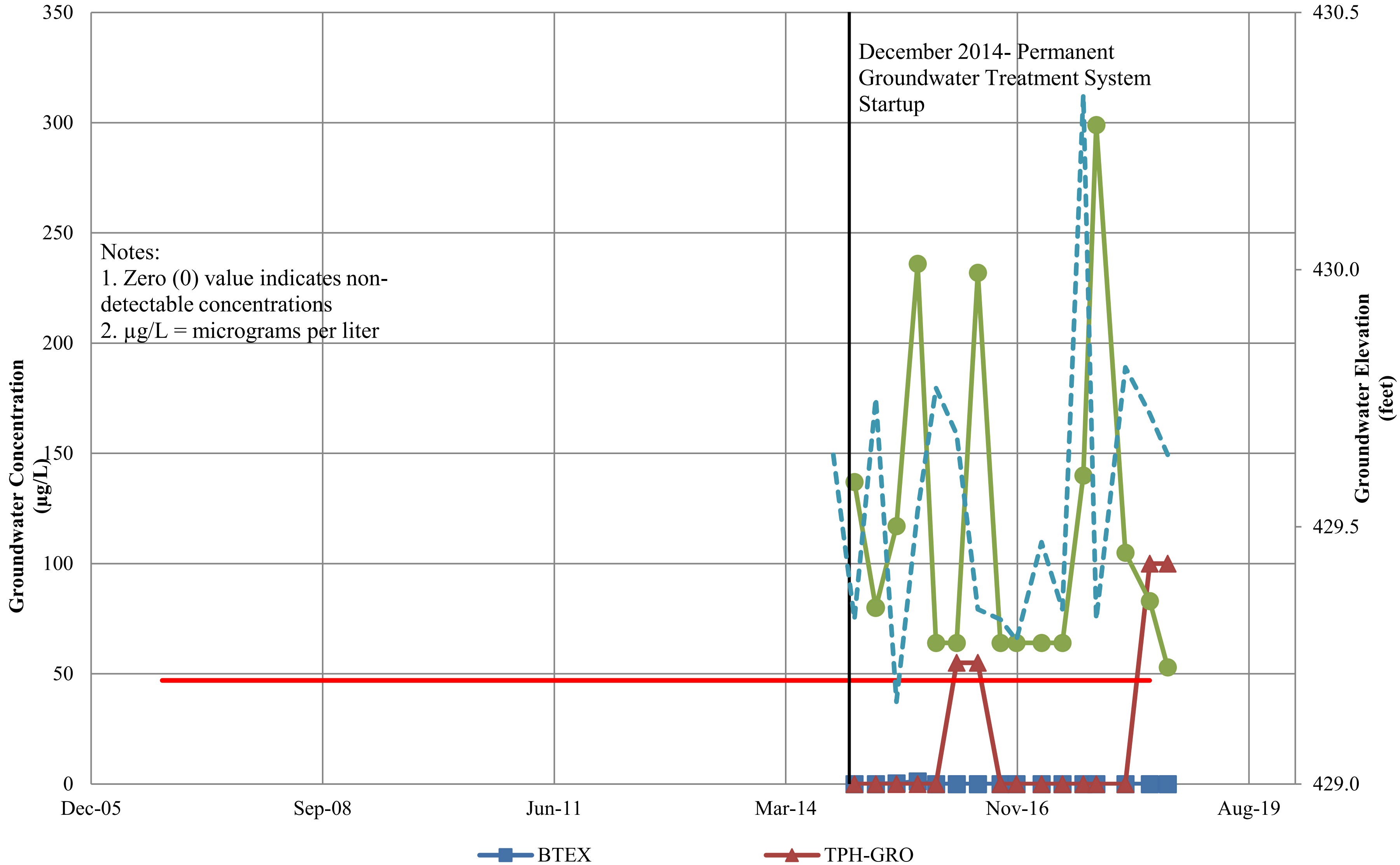

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Figure C-16
YP-5 Historical Groundwater Concentrations and Groundwater Elevations
Former Hess Station #20204
Towson, Maryland

APPENDIX

D

SAFETY DATA SHEETS

Ammonium Sulfate,

SECTION 1 : Identification of the substance/mixture and of the supplier

Product name : **Ammonium Sulfate,**

Manufacturer/Supplier Trade name:

Manufacturer/Supplier Article number: **S25176A**

Recommended uses of the product and uses restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

Supplier Details:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:

Fisher Science Education Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards identification

Classification of the substance or mixture:

Irritant
Skin irritation, category 2
Eye irritation, category 2A
Acute toxicity (oral, dermal, inhalation), category 3

Eye irrit. cat 2
Skin Sens, cat 2
STOT SE 3
AcTox Oral 4
Hazards Not Otherwise Classified - Combustible Dust

Signal word :Warning

Hazard statements:
Harmful if swallowed
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation

Precautionary statements:
Wash … thoroughly after handling
Do not eat, drink or smoke when using this product
Avoid breathing dust/fume/gas/mist/vapours/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Specific treatment (see supplemental first aid instructions on this label)
Rinse mouth
Take off contaminated clothing and wash before reuse
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
IF ON SKIN: Wash with soap and water
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

If skin irritation occurs: Get medical advice/attention
If eye irritation persists get medical advice/attention
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do.
Continue rinsing
Store locked up
Store in a well ventilated place. Keep container tightly closed
Dispose of contents/container to ...

Combustible Dust Hazard: :
May form combustible dust concentrations in air (during processing).

Other Non-GHS Classification:

WHMIS
NFPA/HMIS

NFPA SCALE (0-4)

HMIS RATINGS (0-4)

SECTION 3 : Composition/information on ingredients

Ingredients:		
CAS 7783-20-2	Ammonium Sulfate,ACS	>95 %
		Percentages are by weight

SECTION 4 : First aid measures

Description of first aid measures

After inhalation: Move exposed individual to fresh air. Loosen clothing as necessary and position individual in a comfortable position.Seek medical advice if discomfort or irritation persists.If breathing difficult, give oxygen.

After skin contact: Wash affected area with soap and water. Rinse/flush exposed skin gently using water for 15-20 minutes. Seek medical advice if discomfort or irritation persists.

After eye contact: Protect unexposed eye. Rinse/flush exposed eye(s) gently using water for 15-20 minutes. Remove contact lens(es) if able to do so during rinsing. Seek medical attention if irritation persists or if concerned.

After swallowing: Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Seek medical attention if irritation, discomfort or vomiting persists.

Most important symptoms and effects, both acute and delayed:

Irritation, Nausea,Headache, Shortness of breath.;

Indication of any immediate medical attention and special treatment needed:

If seeking medical attention, provide SDS document to physician.

Ammonium Sulfate,

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: If in laboratory setting, follow laboratory fire suppression procedures. Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition

For safety reasons unsuitable extinguishing agents:

Special hazards arising from the substance or mixture:

Combustion products may include carbon oxides or other toxic vapors.Thermal decomposition can lead to release of irritating gases and vapors.Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Advice for firefighters:

Protective equipment: Use NIOSH-approved respiratory protection/breathing apparatus.

Additional information (precautions): Move product containers away from fire or keep cool with water spray as a protective measure, where feasible.Use spark-proof tools and explosion-proof equipment.

SECTION 6 : Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Wear protective equipment. Transfer to a disposal or recovery container.Use spark-proof tools and explosion-proof equipment.Use respiratory protective device against the effects of fumes/dust/aerosol. Keep unprotected persons away. Ensure adequate ventilation.Keep away from ignition sources. Protect from heat.Stop the spill, if possible. Contain spilled material by diking or using inert absorbent.

Environmental precautions:

Prevent from reaching drains, sewer or waterway. Collect contaminated soil for characterization per Section 13

Methods and material for containment and cleaning up:

If in a laboratory setting, follow Chemical Hygiene Plan procedures.Place into properly labeled containers for recovery or disposal. If necessary, use trained response staff/contractor.Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Collect solids in powder form using vacuum with (HEPA filter)

Reference to other sections:

SECTION 7 : Handling and storage

Precautions for safe handling:

Minimize dust generation and accumulation. Wash hands after handling. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Follow good hygiene procedures when handling chemical materials. Do not eat, drink, smoke, or use personal products when handling chemical substances. If in a laboratory setting, follow Chemical Hygiene Plan.Use only in well ventilated areas.Avoid generation of dust or fine particulate.Avoid contact with eyes, skin, and clothing.

Conditions for safe storage, including any incompatibilities:

Store in a cool location. Provide ventilation for containers. Avoid storage near extreme heat, ignition sources or open flame. Store away from foodstuffs. Store away from oxidizing agents.Store in cool, dry conditions in well sealed containers. Keep container tightly sealed.Store with like hazards

SECTION 8 : Exposure controls/personal protection

Control Parameters:	, , OSHA PEL TWA (Total Dust) 15 mg/m3 (50 mppcf*) , , ACGIH TLV TWA (inhalable particles) 10 mg/m3
Appropriate Engineering controls:	Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use/handling.Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or dusts (total/respirable) below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.Use under a fume hood. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment.Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment).
Respiratory protection:	Not required under normal conditions of use. Use suitable respiratory protective device when high concentrations are present. Use suitable respiratory protective device when aerosol or mist is formed. For spills, respiratory protection may be advisable.
Protection of skin:	The glove material has to be impermeable and resistant to the product/ the substance/ the preparation being used/handled.Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
Eye protection:	Safety glasses with side shields or goggles.
General hygienic measures:	The usual precautionary measures are to be adhered to when handling chemicals. Keep away from food, beverages and feed sources. Immediately remove all soiled and contaminated clothing. Wash hands before breaks and at the end of work. Do not inhale gases/fumes/dust/mist/vapor/aerosols. Avoid contact with the eyes and skin.

SECTION 9 : Physical and chemical properties

Appearance (physical state,color):	Colorless Solid	**Explosion limit lower**: **Explosion limit upper**:	Not Determined Not Determined
Odor:	Odorless	**Vapor pressure**:	Not Determined
Odor threshold:	Not Determined	**Vapor density**:	Not Determined
pH-value:	5-6 (5% aq. sol.)	**Relative density**:	1.8
Melting/Freezing point:	280 C	**Solubilities**:	Material is water soluble.
Boiling point/Boiling range:	Not Determined	**Partition coefficient (n-octanol/water)**:	n-octanol/water: log Pow: -5.1
Flash point (closed cup):	Not Determined	**Auto/Self-ignition temperature**:	Not Determined

Evaporation rate:	Insignificant	**Decomposition temperature**:	350 C
Flammability (solid,gaseous):	Not Determined	**Viscosity**:	a. Kinematic:Not Determined b. Dynamic: Not Determined
Density: Not Determined			

SECTION 10 : Stability and reactivity

Reactivity: Nonreactive under normal conditions.
Chemical stability: No decomposition if used and stored according to specifications.
Possible hazardous reactions: None under normal processing
Conditions to avoid: Store away from oxidizing agents, strong acids or bases.Incompatible Materials.excess heat.Dust generation.
Incompatible materials: Strong acids.Strong bases.Strong oxidizing agents.
Hazardous decomposition products:sulfur dioxide.nitrogen.Ammonia.ammonium bisulfate.

SECTION 11 : Toxicological information

Acute Toxicity:		
Oral:	2840mg/kg	APS: LD50 orl-rat
Chronic Toxicity: No additional information.		
Corrosion Irritation: No additional information.		
Sensitization:		No additional information.
Single Target Organ (STOT):		No additional information.
Numerical Measures:		No additional information.
Carcinogenicity:		No additional information.
Mutagenicity:		No additional information.
Reproductive Toxicity:		No additional information.

SECTION 12 : Ecological information

Ecotoxicity Persistence and degradability: Readily degradable in the environment.
Bioaccumulative potential:
Mobility in soil:
Other adverse effects:

SECTION 13 : Disposal considerations

Waste disposal recommendations:

Product/containers must not be disposed together with household garbage. Do not allow product to reach sewage system or open water.It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Consult federal state/ provincial and local regulations regarding the proper disposal of waste material that may incorporate some amount of this product.

SECTION 14 : Transport information

UN-Number

Not Dangerous Goods

UN proper shipping name

Not Dangerous Goods

Transport hazard class(es)
Packing group:Not Dangerous Goods
Environmental hazard:
Transport in bulk:
Special precautions for user:

SECTION 15 : Regulatory information

United States (USA)

SARA Section 311/312 (Specific toxic chemical listings):

None of the ingredients is listed

SARA Section 313 (Specific toxic chemical listings):

7783-20-2 Ammonium Sulfate

RCRA (hazardous waste code):

None of the ingredients is listed

TSCA (Toxic Substances Control Act):

All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):

None of the ingredients is listed

Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for females:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for males:

None of the ingredients is listed

Chemicals known to cause developmental toxicity:

None of the ingredients is listed

Canada

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 0.1%):

None of the ingredients is listed

Canadian NPRI Ingredient Disclosure list (limit 1%):

None of the ingredients is listed

SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.Note:. The responsibility to provide a safe workplace remains with the user.The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate.However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material.It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

GHS Full Text Phrases:

Abbreviations and acronyms:
IMDG: International Maritime Code for Dangerous Goods
PNEC: Predicted No-Effect Concentration (REACH)
CFR: Code of Federal Regulations (USA)
SARA: Superfund Amendments and Reauthorization Act (USA)
RCRA: Resource Conservation and Recovery Act (USA)
TSCA: Toxic Substances Control Act (USA)
NPRI: National Pollutant Release Inventory (Canada)
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level (REACH)

Effective date : 12.28.2014
Last updated : 03.19.2015

SAFETY DATA SHEET
Klozur® SP

SDS # : 7775-27-1-12
Revision date: 2018-07-13
Format: NA
Version 1.04

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name Klozur® SP

CAS-No 7775-27-1

Synonyms Sodium Persulfate; Sodium Peroxydisulfate; Disodium Peroxydisulfate; Peroxydisulfuric acid, disodium salt; Peroxydisulfuric acid, sodium salt.

Alternate Commercial Name Klozur® Persulfate

Recommended use of the chemical and restrictions on use

Recommended Use: In situ and ex situ chemical oxidation of contaminants and compounds of concern for environmental remediation applications

Restrictions on Use No uses to be advised against were identified.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone numbers

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2B
Respiratory sensitization	Category 1
Skin sensitization	Category 1
Specific target organ toxicity (single exposure)	Category 3
Oxidizing Solids	Category 3

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Danger

Hazard Statements
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335 - May cause respiratory irritation
H320 - Causes eye irritation
H315 - Causes skin irritation
H317 - May cause an allergic skin reaction
H302 - Harmful if swallowed
H272 - May intensify fire; oxidizer

Precautionary Statements - Prevention
P261 - Avoid breathing dust.
P285 - In case of inadequate ventilation wear respiratory protection
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves/ protective clothing
P264 - Wash face, hands and any exposed skin thoroughly after handling
P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P220 - Keep/Store away from clothing/combustible materials
P221 - Take any precaution to avoid mixing with combustibles

Precautionary Statements - Response
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/ attention
P302 + P352 - IF ON SKIN: Wash with plenty of water.
P333 + P313 - If skin irritation or rash occurs: Get medical advice/ attention
P304 + P341 - IF INHALED: If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor
P301 + P312 - IF SWALLOWED: Call a POISON CENTER or doctor if you feel unwell
P330 - Rinse mouth
P370 + P378 - In case of fire: Use water spray for extinction

Precautionary Statements - Storage
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed

Hazards not otherwise classified (HNOC)
No hazards not otherwise classified were identified.

Other Information
Risk of decomposition by heat or by contact with incompatible materials

Unknown acute toxicity
0% of the mixture consists of ingredient(s) of unknown toxicity

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula $Na_2O_8S_2$

Chemical name	CAS-No	Weight %
Sodium Persulfate	7775-27-1	> 99
Sodium sulfate	7757-82-6	< 2

4. FIRST AID MEASURES

General Advice
May produce an allergic reaction.

Eye Contact
Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids intermittently. Consult a physician. If symptoms persist, call a physician.

Skin Contact
Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Get medical attention if irritation develops and persists.

Inhalation
Remove from exposure, lie down. If breathing is irregular or stopped, administer artificial respiration. Call a physician immediately.

Ingestion
Do NOT induce vomiting. Call a physician or poison control center immediately. Rinse mouth. Drink 1 or 2 glasses of water.

Most important symptoms and effects, both acute and delayed
Itching; Redness; Coughing and/ or wheezing.

Indication of immediate medical attention and special treatment needed, if necessary
Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Water. Cool containers with flooding quantities of water until well after fire is out.

Unsuitable extinguishing media
Do not use carbon dioxide or other gas filled fire extinguishers; they will have little effect on decomposing persulfate.

Specific Hazards Arising from the Chemical
Decomposes under fire conditions to release oxygen that intensifies the fire.

Flammable properties
Contact with combustible material may cause fire

Explosion data
Sensitivity to Mechanical Impact Not sensitive.
Sensitivity to Static Discharge Not sensitive.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions
Keep off any unprotected persons. Avoid contact with the skin and the eyes. Avoid breathing dust. Wear personal protective equipment.

Other
Never add other substances or combustible waste to product residues.

Environmental Precautions
Prevent material from entering into soil, ditches, sewers, waterways, and/or groundwater.

See Section 12, Ecological Information for more detailed information.

Methods for Containment Vacuum, shovel or pump waste into a drum and label contents for disposal. Avoid dust formation. Store in closed container.

Methods for cleaning up Clean up spill area and treat as special waste. Dispose of waste as indicated in Section 13.

7. HANDLING AND STORAGE

Handling Wear personal protective equipment. Use only in area provided with appropriate exhaust ventilation. Avoid dust formation. Handle product only in closed system or provide appropriate exhaust ventilation at machinery. Avoid contact with skin and eyes. Avoid breathing dust. Remove and wash contaminated clothing before re-use. Reference to other sections.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat. Do not store near combustible materials. Avoid contamination of opened product. Keep away from food, drink and animal feedingstuffs. Avoid formation and deposition of dust.

Incompatible products Acids, Alkalis, Halides, Combustible materials, Organic material, Reducing agents. Acids, alkalis, halides (fluorides, chlorides, bromides), combustible materials, reducing agents and organic compounds.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines .

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Sodium Persulfate 7775-27-1	TWA: 0.1 mg/m^3	-	-	-
Chemical name	**British Columbia**	**Quebec**	**Ontario TWAEV**	**Alberta**
Sodium Persulfate 7775-27-1	TWA: 0.1 mg/m^3	-	TWA: 0.1 mg/m^3	TWA: 0.1 mg/m^3

Appropriate engineering controls

Engineering measures Provide local exhaust or general ventilation adequate to maintain exposures below permissable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Eye protection recommended. Chemical goggles consistent with EN 166 or equivalent.

Skin and Body Protection Wear long-sleeved shirt, long pants, socks, and shoes.

Hand Protection Protective gloves: Neoprene gloves, Polyvinylchloride, Natural Rubber.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn: particulate filtering facepiece respirators.

Hygiene measures Keep away from food, drink and animal feeding stuffs. Do not eat, drink or smoke when using this product. Wash hands before breaks and after shifts. Keep work clothes separate, remove contaminated clothing - launder after open handling of product.

General information Protective engineering solutions should be implemented and in use before personal protective equipment is considered.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Crystalline solid
Physical State	Solid
Color	White
Odor	odorless
Odor threshold	Not applicable
pH	6.0 (1% solution)
Melting point/freezing point	180 °C (Decomposes)
Boiling Point/Range	Decomposes upon heating
Flash point	Not flammable
Evaporation Rate	No information available
Flammability (solid, gas)	Not flammable
Flammability Limit in Air	Not applicable
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	6.07E-30 mm Hg at 25ºC
Vapor density	No information available
Density	2.59 g/cm³ (crystal density)
Specific gravity	No information available
Water solubility	42 % @ 25 °C
Solubility in other solvents	No information available
Partition coefficient	No information available (inorganic)
Autoignition temperature	No evidence of combustion up to 600°C No evidence of combustion up to 600 °C
Decomposition temperature	> 100 °C (assume)
Viscosity, kinematic	No information available (Solid)
Viscosity, dynamic	No information available
Explosive properties	Not explosive
Oxidizing properties	oxidizer
Molecular weight	238.1
VOC content (%)	Not applicable
Bulk density	1.12 g/cm³ (loose)

10. STABILITY AND REACTIVITY

Reactivity	None under normal use condtions. Oxidizer. Contact with other material may cause fire
Chemical Stability	Stable.
Possibility of Hazardous Reactions	None under normal processing.
Hazardous polymerization	Hazardous polymerization does not occur.
Conditions to avoid	Heat. Moisture.
Incompatible materials	Acids, alkalis, halides (fluorides, chlorides, bromides), combustible materials, reducing agents and organic compounds. . Acids, Alkalis, Halides, Combustible materials, Organic material, Reducing agents.
Hazardous Decomposition Products	Oxygen which supports combustion

11. TOXICOLOGICAL INFORMATION

Product Information

Unknown acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity
LD50 Oral	Sodium Persulfate: 895 mg/kg (rat)
LD50 Dermal	Sodium Persulfate: > 10 g/kg
LC50 Inhalation	Sodium Persulfate: >5.10 mg/L (4h) (rat)
Serious eye damage/eye irritation	Irritating to eyes.
Skin corrosion/irritation	Minimally irritating.

Sensitization Sodium Persulfate:. May cause sensitization by inhalation and skin contact.

Component Information

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation	NOAEL Oral Value
Sodium Persulfate (7775-27-1)	895 mg/kg (Rat)	> 10000 mg/kg (Rabbit)	> 21.6 mg/L (Rat) 4 h	
Sodium sulfate (7757-82-6)	> 10000 mg/kg (Rat)			

Information on toxicological effects

Symptoms Symptoms of allergic reaction may include rash, itching, swelling and trouble breathing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin.
corrosivity None.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity Did not show mutagenic effects in animal experiments

Neurological effects Not neurotoxic

Reproductive toxicity This product is not recognized as reprotox by Research Agencies.
Developmental toxicity None known.
Teratogenicity Not teratogenic in animal studies.

STOT - single exposure May cause respiratory irritation.
STOT - repeated exposure Not classified.

Target organ effects Eyes, Lungs.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects

Sodium Persulfate (7775-27-1)				
Active Ingredient(s)	Duration	Species	Value	Units
Sodium Persulfate	96 h LC50	Rainbow trout	163	mg/L
Sodium Persulfate	48 h LC50	Daphnia magna	133	mg/L
Sodium Persulfate	96 h LC50	Grass shrimp	519	mg/L
Sodium Persulfate	72 h EC50	Algae Selenastrum capricornutum	116	mg/L

Persistence and degradability Biodegradability does not pertain to inorganic substances.

Bioaccumulation Does not bioaccumulate.

Mobility Dissociates into ions.

Other Adverse Effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods	This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261). It must undergo special treatment, e.g. at suitable disposal site, to comply with local regulations.
Contaminated Packaging	Empty remaining contents. Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

TDG

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

MEX

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

ICAO

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

ICAO/IATA

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

IMDG/IMO

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

ADR/RID

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

ADN

Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

15. REGULATORY INFORMATION

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories
This product is not subject to reporting under the Emergency Planning and Community Right-to-Know rule.

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA/EPCRA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

U.S. State Right-to-Know Regulations
This product contains the following substances regulated under state Right-to-Know laws:

Chemical name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sodium Persulfate		X			
Sodium sulfate	X		X		

California Proposition 65
This product does not contain any Proposition 65 chemicals

CANADA

Environmental Emergencies
This product contains no substances listed under Canada's Environmental Emergency regulations.

Canadian National Pollutant Release Inventory
This product contains no substances reportable under Canada's National Pollutant Release Inventory regulations.

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/ELINCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Sodium Persulfate 7775-27-1 (> 99)	X	X	X	X	X	X	X	X	X
Sodium sulfate 7757-82-6 (< 2)	X	X	X	X	X	X	X	X	X

Mexico

Mexico - Grade Slight risk, Grade 1

16. OTHER INFORMATION

NFPA	**Health Hazards** 1	**Flammability** 0	**Stability** 1	**Special Hazards** OX
HMIS	**Health Hazards** 1	**Flammability** 0	**Physical hazard** 1	**Special precautions** J

NFPA/HMIS Ratings Legend Special Hazards: OX = Oxidizer
Protection=J (Safety goggles, gloves, apron, combination dust and vapor respirator)

Revision date:	2018-07-13
Revision note	SDS sections updated: 3
Issuing Date:	2017-03-17

Disclaimer

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Prepared By:

PeroxyChem

End of Safety Data Sheet

Safety Data Sheet

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: **DISODIUM HYDROGEN ORTHOPHOSPHATE**

Other name(s): Anhydrous disodium phosphate; sodium orthophosphate anhydrous; disodium hydrogen phosphate anhydrous; Disodium Phosphate Food Grade

Supplier: Ixom Operations Pty Ltd
ABN: 51 600 546 512
Street Address: Level 8, 1 Nicholson Street
East Melbourne Victoria 3002
Australia

Telephone Number: +61 3 9906 3000
Facsimile: +61 3 9665 7937
Emergency Telephone: **1 800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

Based on available information, not classified as hazardous according to Safe Work Australia; NON-HAZARDOUS CHEMICAL.

Poisons Schedule (SUSMP): None allocated.

3. COMPOSITION AND INFORMATION ON INGREDIENTS

Product Description: White powder or crystals.
Used in the chemical, fertilizer , pharmaceutical and textile industries; as a food additive (buffer 339); in boiler water treatment, detergents and fireproofing wood and paper.

Components	CAS Number	Proportion	Hazard Codes
Disodium hydrogen orthophosphate.	7558-79-4	100%	-

4. FIRST AID MEASURES

For advice, contact a Poisons Information Centre (e.g. phone Australia 131 126; New Zealand 0800 764 766) or a doctor.

Inhalation:
Remove victim from area of exposure - avoid becoming a casualty. Seek medical advice if effects persist.

Skin Contact:
If skin contact occurs, remove contaminated clothing and wash skin with running water. If irritation occurs seek medical advice.

Eye Contact:
If in eyes, wash out immediately with water. In all cases of eye contamination it is a sensible precaution to seek medical advice.

Ingestion:
Rinse mouth with water. If swallowed, give a glass of water to drink. If vomiting occurs give further water. Seek medical advice.

Indication of immediate medical attention and special treatment needed:
Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:
Fine water spray, normal foam, dry agent (carbon dioxide, dry chemical powder).

Specific hazards arising from the chemical:
Non-combustible material.

Special protective equipment and precautions for fire-fighters:
Decomposes on heating emitting toxic fumes. Fire fighters to wear self-contained breathing apparatus and suitable protective clothing if risk of exposure to products of decomposition.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions/Protective equipment/Methods and materials for containment and cleaning up:
Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contact and breathing in dust. Sweep up, but avoid generating dust. Collect and seal in properly labelled containers or drums for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling:
Avoid skin and eye contact and breathing in dust. Avoid handling which leads to dust formation.

Conditions for safe storage, including any incompatibilities:
Store in a cool, dry, well ventilated place and out of direct sunlight. Store away from incompatible materials described in Section 10. Keep containers closed when not in use - check regularly for spills.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters: No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for particulates:

Dusts not otherwise classified: 8hr TWA = 10 mg/m^3

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls:
Use in well ventilated areas. If inhalation risk exists: Use with local exhaust ventilation or while wearing dust mask. Keep containers closed when not in use.

Individual protection measures, such as Personal Protective Equipment (PPE):
The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES, DUST MASK.

Wear overalls, safety glasses and impervious gloves. If determined by a risk assessment an inhalation risk exists, wear a dust mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716.
Always wash hands before smoking, eating, drinking or using the toilet.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Powder , Crystals
Colour:	White
Solubility:	Very soluble in water.
Specific Gravity:	2.10 at 20°C
Relative Vapour Density (air=1):	Not applicable
Vapour Pressure (20 °C):	Not applicable
Flash Point (°C):	Not applicable
Flammability Limits (%):	Not applicable
Autoignition Temperature (°C):	Not applicable
Boiling Point/Range (°C):	Not applicable
pH:	Not available.
Viscosity:	Not applicable

10. STABILITY AND REACTIVITY

Chemical stability: May react violently with acids.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms or effects that may arise if the product is mishandled and overexposure occurs are:

Ingestion: No adverse effects expected, however, large amounts may cause nausea and vomiting.

Eye contact: May be an eye irritant.

Skin contact: Contact with skin may result in irritation.

Inhalation: Breathing in dust may result in respiratory irritation.

Acute toxicity:
Oral LD50 (rat): 17000 mg/kg (1)

Chronic effects: No information available for the product.

12. ECOLOGICAL INFORMATION

Ecotoxicity Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Disposal methods:
Refer to local government authority for disposal recommendations.

14. TRANSPORT INFORMATION

Road and Rail Transport
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

Marine Transport
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS.

Air Transport
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS.

15. REGULATORY INFORMATION

Classification:
Based on available information, not classified as hazardous according to Safe Work Australia; NON-HAZARDOUS CHEMICAL.

Poisons Schedule (SUSMP): None allocated.

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

16. OTHER INFORMATION

(1) Safety Data Sheet - Australia Pty Ltd; 08/ 1996.

This safety data sheet has been prepared by Ixom Operations Pty Ltd Toxicology & SDS Services.

Reason(s) for Issue:
5 Yearly Revised Primary SDS
Creation in WERCS database

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since Ixom Operations Pty Ltd cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Ixom representative or Ixom Operations Pty Ltd at the contact details on page 1.

Ixom Operations Pty Ltd's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

APPENDIX

E

STANDARD OPERATING PROCEDURES

FIELD STANDARD OPERATING PROCEDURE #2

UTILITY LOCATING PROCEDURE

The purpose of this procedure is to ensure that all required and appropriate procedures are followed to locate and mark subsurface utilities (e.g., electrical lines, natural gas lines, communication lines) before initiating any intrusive field activities (e.g., drilling, test pits, trenching, excavation). The company's preference, as indicated in our subcontractor agreement templates, is for our contractors to be responsible for both public and private utility mark-outs; this includes contacting the public authority and obtaining a subcontractor for private utility locating services, if needed. Guidance for contractors to follow to conduct a utility clearance is provided in our request for proposal (RFP) template and must be included in all RFP's for intrusive field activities.

In rare circumstances, the company may choose to accept responsibility for clearing utilities, which will require a change to the language of our subcontractor agreement. This assumption of increased liability by the company requires written rationale and approval from the cognizant Regional Manager, with written concurrence from the Director of Operations, which shall be obtained prior to submitting the Request for Subcontract to Contract Administration.

For projects where the company will be responsible for clearing utilities, compliance with this procedure is mandatory. **ALL** deviations from this standard operating procedure (SOP) **MUST** be approved by the project manager and a Regional Manager, with confirmation from the Director of Operations **BEFORE** beginning intrusive work.

Field personnel have the authority and responsibility to postpone intrusive activities if a contractor has not completed utility clearances to the company's satisfaction; if sufficient information, as stipulated in this SOP, is not available; or if onsite reconnaissance identifies inconsistencies in the findings of utility locators. In these instances, field personnel must notify the project manager or the health and safety officer, or their designee, before proceeding with the proposed work; approval from a Regional Manager, with confirmation from the Director of Operations, is required before the work commences.

The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities.

2.1 ACRONYMS AND ABBREVIATIONS

HASP	health and safety plan
PSP	project safety plan
RFP	request for proposal
SOP	standard operating procedure

2.2 MATERIALS

- Utility Locating Form (Attachment 1)
- Field book
- Wood stakes
- Spray paint
- Flagging tape
- As-built drawings for sub-grade utilities (if available)
- Hand auger or post-hole digger

2.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This procedure is intended to allow the work to proceed safely and minimize the potential for damaging underground and aboveground utilities. Intrusive work includes all activities that require the company's employees or its subcontractors to penetrate the ground surface. Examples of intrusive work include, but are not limited to, hand augering, probing, drilling, injections, test pit excavations, trenching, and remedial excavations.

This SOP assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1).

2.4 PRE-FIELD MOBILIZATION PROCEDURES

Regardless of who is responsible for completing these activities (company or a contractor), public rights-of-way and private property must be cleared of buried utilities and overhead utilities must be identified before any intrusive work can begin. The first step in this process is notifying the state public utility locating service of the planned work. These services provide a link between the entities performing the work and the various utility operators (e.g., the water company, the electric company, etc.). All of the public utility locating service call centers in the United States have been streamlined under a single "Call Before You Dig" phone number: 811. However, the appropriate state or provincial call center (http://call811.com/811-your-state) will need to be contacted.

Please note, some state or provincial laws require that the person who will actually be conducting the intrusive work must be the person who places the call to the public utility locating service. This means that the company cannot make this call on the contractor's behalf; the contractor must place the call in those states where required. If there is any doubt about the requirements for the state where a project is located, the relevant state authority must be contacted (http://call811.com/811-your-state).

When the appropriate call center is contacted, information regarding the site (e.g., location, nearest cross street, township, etc.) and work activity (e.g., drilling, excavation) will need to be provided to the operator to aid in locating the likely utilities at the work site. The information provided on the Utility Locating Form (Attachment 1) must be recorded (by the contractor or the company) and a completed copy of this form must be maintained as part of the project file. Be aware that several states, including California, require that the proposed drilling locations be marked with white spray paint before contacting the locating services.

The following information must accompany the field team at all times during the field project:

- The utility clearance ticket number
- The ticket's legal dig date
- The ticket's expiration date
- Utility providers that were contacted

The ticket number serves as a point of reference for both the utility service providers and for the company or contractor should follow up (e.g., renewing the ticket) with the locating service be required. The legal dig and expiration dates reflect the times when it will be legal to perform the proposed work. The legal dig date reflects the lead time necessary, typically between 48 and 72 hours after you call, for the utility service providers to mark the utilities in you work area. Be sure to include this delay when scheduling your work. Most utility clearance tickets expire about 2 weeks after the legal dig date. If your work is delayed beyond the expiration date, the 811 utility locating service will need to be called again and the ticket renewed. The renewed ticket will have a new legal dig date that incorporates the same lead-time (48 to 72 hours) as the original ticket.

The locating service will also provide the caller with a list of utility companies that will be notified. Compare this list with utilities generally expected at all sites (e.g., sewer, water, gas, communication, and electric). Some utilities (e.g., sewer, water, cable television) may not be included. If any expected utilities are absent from the contact list, the utilities **MUST** be contacted directly for clearance before the start of intrusive activities. All contacts should be recorded on the Utility Locating Form.

2.4.1 PRIVATE UTILITY LOCATORS AND OTHER SOURCES

Public utility service providers will generally mark their underground lines within the public right-of-way up to the private property boundary. A public utility locating service must be contacted prior to any intrusive work, regardless of whether the intrusive work is located on public or private property. However, be aware that most public utility locating services will not locate utilities on private property. If your work is to be conducted on private property, a private utility locating service **MUST** be used to clear the work area. These companies typically use a variety of methods (e.g., electromagnetic detectors, ground-penetrating radar, acoustic plastic pipe locator, trace wire) to locate utilities in the work area, including those that may be buried beneath onsite buildings. Psedudoscientific methods (e.g., dowsing, divining, witching) are not acceptable utility locating methods.

For all operating facilities and to the extent possible for closed facilities, identify a site contact familiar with the utilities on the property (e.g., plant manager, facility engineer, maintenance supervisor), and provide this individual with a site plan showing the proposed locations of all soil borings, monitoring wells, test pits, and other areas where intrusive activities will be conducted. These individuals often have knowledge of buried structures or process-specific utilities that may not be identified by the private utility locator. This is particularly important for work performed inside industrial buildings where reinforced concrete and other metallic components of the structure may interfere with the scanning devices used by the private utility locator. Ask the site contact for all drawings concerning underground utilities in the proposed work areas for future reference.

Keep in mind that no intrusive work may be done before the legal dig date provided by the state utility locating service and no digging, drilling, or other ground-breaking activities may be begin until all utilities on the list have been marked and visually verified in the work area (see below). It is **NOT ACCEPTABLE** to rely solely on as-built drawings or verbal utility clearances from the site contact (these should be used as guides only). A private locator may not be necessary in rare instances; however, nonconformity with the private locate requirement must be approved by the project manager **AND** a Regional Manager, with confirmation from the Director of Operations.

2.5 SITE MOBILIZATION PROCEDURES

Upon arrival, the first step in determining if you are clear of buried and overhead utilities is to locate all of the proposed drilling and trenching locations and mark them with (white) spray paint, stakes, or other appropriate markers. This will help you judge distances from marked drilling and trenching locations to underground and overhead utilities and minimizes any potential misunderstandings regarding the locations between you, the subcontractors (drillers, excavators, private utility locator), and the site contact.

Once you have the proposed work areas marked, verify that ALL utility companies listed by the state public utility locating service, and any contacted directly by the company or the contractor, have either marked the underground lines in the specified work areas or have responded (via telephone, facsimile, or e-mail) with “no conflict.” Document on the Utility Locating Form (Attachment 1) and in the field book as each utility mark is visually confirmed. When receiving verbal clearances by telephone from utility companies, or their subcontractors, it is imperative that you verify the utilities that are being cleared, particularly when dealing with subcontractors that may be marking more than one utility.

Review all available as-built utility diagrams and plans for your general work area and conduct a site walk to identify potential areas where underground lines may be present; include the site contact in these activities. It is a good idea to survey your surroundings during the walk to identify any features that may indicate the presence of underground utilities, such as linear depressions in the ground, cuts in concrete or asphalt, old road cuts, catch basins, or manholes. Keep in mind that many sewer lines can be offset from catch basins. The presence of aboveground utilities, such as parking lot lights or pad-mounted transformers, is also a good indicator of buried electrical lines. Check these items against the Utility Locating Form checklist and discuss the locations with the private utility locating service.

2.5.1 SAFE WORKING DISTANCES AND HAND CLEARING

A minimum of 5 feet clearance must exist between utilities and proposed drilling locations, and a minimum of 6 feet between utilities and proposed trenching locations. Be aware that some clients, states and localities (e.g., New York City, Long Island) may require greater minimum working distances, depending on the utility (e.g., for high pressure gas mains). A minimum distance of 15 feet must be maintained by heavy equipment (e.g., excavator buckets, drill rig towers and rods) from overhead power lines and a safe distance of 25 feet must be maintained from high-tension overhead power lines. In the event that work must be conducted within 25 feet of high tension wires, the lines must be wrapped and insulated by the local utilities. Increase these minimum distances whenever possible to offer additional assurance that buried or overhead utilities will not be encountered.

If a utility conflict is identified within the minimum safe clearance distance, adjust the proposed location(s) using the criteria given above. It is recommended to have the private utility locator sweep a relatively large area (e.g., a 20-foot circle around a proposed drilling location) to provide room for adjustment should the proposed drilling or excavation area need to be moved to avoid a buried utility. Subsurface work within five feet of a confirmed or suspected utility or other subsurface structure must be done by nondestructive clearing techniques to the point where either the utility/structure is visually located and exposed, or in the case of soil borings, where the bottom depth of the structure is surpassed and drilling may begin.

Uncertainty may exist in some circumstances (e.g., inside a building) even after the area has been swept for utilities. In these cases, advance the first few feet of a soil boring (or probe the area for excavation) using a hand auger or post-hole digger. If hand digging is unable to penetrate the subsurface soils, soft dig or air knife equipment service providers may be retained to clear the location. This equipment applies high pressure air to penetrate, loosen, and extract subsurface soils in the borehole, thereby safely exposing any utilities. If using either hand digging or soft digging, the probe hole should be advanced a minimum of 5 feet below ground surface at each proposed drilling or excavation location. Complete a sufficient number of probe holes so that the area is cleared for the proposed intrusive activity (i.e., use several holes for a proposed excavation). The use of hand digging or soft digging methods **does not** replace the need for state and private utility locating services.

Protect and preserve the markings of approximate locations of facilities until the work activities are completed. If the markings of utility locations are destroyed or removed before excavation commences or is completed, stop work. Notify the utility company, utility protection service, or the utility locating service to inform them that the markings have been destroyed. Do not continue work until the utilities have been re-marked.

2.5.2 EXPANDED WORK AREAS AND TICKET RENEWAL

Many projects begin with well-defined work areas only to expand quickly as the investigation or remediation progresses. If the scope of intrusion expands or includes new onsite or offsite area(s), you will need to review the existing ticket and work performed by the private utility locator to determine whether work can progress into the new area safely. It may be necessary, depending on the scope, to contact (or for the Contractor to contact) the state locating service and request another clearance for the new area(s) of investigation and retain a private locating service. Remember, the new request will provide a new legal dig date before which NO INTRUSIVE WORK CAN BEGIN. Additionally, if a clearance ticket will expire while the work is ongoing (typically after 2 weeks), a new clearance must be requested before the first ticket expires so that work can continue uninterrupted. Refer to the Utility Locating Form (Attachment 1) for the legal dig date time frame required by the state locating service.

2.5.3 UTILITY DAMAGE

It is possible, even if you followed all of the procedures outlined in this SOP, to damage an underground or overhead utility. Assuming it can be done safely, quickly turn off the drilling or excavating equipment, or move the equipment from the damaged line. Avoid contact with escaping liquids, live wires, and open flames. Abandon the equipment, evacuate the personnel from the area, and maintain a safe perimeter if there are any concerns about safety. If a fiber optic cable is damaged, do not handle the cable or look into the end of the cable as serious eye damage may occur. Once personnel are in a secure location, immediately notify the facility operator or site contact and 811; additionally, send an immediate alert or notification via iSMS and send an email to SafetyTeam@wsp.com. You should also, as applicable, contact your immediate supervisor, human resources and sector management in accordance with company policy. If the damaged utility has the potential to cause, or is causing, dangerous conditions, immediately notify the local emergency response number listed in your HASP or PSP.

** This form is mandatory for all intrusive work, regardless of who is responsible for the public and/or private locate.

Utility Locating Form

Project Name	**Project No. and Task**	**Work being done for (Company or Individual Name)**	**Project Manager**
Office Address	**Office Phone**	**Field Contact**	**Field Contact Phone**
Project Location: Street Address	**City/Township**	**County**	**State**

Nearest Intersecting Street
Description of Work Area (street working on, which side of street, how far in which direction from nearest intersecting street; etc.)

Type of Work	**Explosives (Y/N)**	**Directional Borings (Y/N)**	**Dig Locations Marked (Y/N)**	**Mark Type (e.g., stake)**

Scheduled Work Start (Date & Time)	**Estimated Work Stop Date**	**One-call Phone Number/Website Address**	**One-call Service Name**
Call/Web Notification Made By (Name, Title and Company)		**Date & Time of Call/Web Notification**	**Operator Name**
Ticket No.	**Legal Dig Date**	**Ticket Expiration Date**	**Ticket Renewal Date**

Utilities Notified		**Complete After Receiving Notification (e.g., e-mail, facsimile) from Utilities or Subcontractor**		
		Utilities Present (Y/N)	**Onsite Meeting (Y/N; if "Y" Date & Time)**	**Contact Name and Phone**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Form Completed By (Signature)	
	(e-mail completed page 1 to Project Manager)

** This form is mandatory for all intrusive work, regardless of who is responsible for the public and/or private locate.

Utility Locating Form

Private Utility Locator Information			
Company	**Contact Name**	**Phone**	**E-mail**
Who Contracted Locator?		**Scheduled Start (Date & Time)**	**Contract Executed (Y/N/NA)**

Onsite Visual Confirmation of Utilities			
Marking Color	**Utility Type and Visual Clues**	**Cleared or Marked (Y/N)**	**No Markings - Comments**
Blue	Potable water: fire hydrant, manholes; water meter, ASTs, interior connections, hose bib, valve box		
Yellow	Gas, oil steam, petroleum: gas meter, manholes; yellow bollards, interior connections, valve box		
Red	Electric power lines, lighting cables, parking lot lights, overhead lines (telephone poles), conduits: interior connections, underground vaults, manholes, transformers/switchgear, conduit on buildings		
Green	Sewer and drain lines: underground vaults, manholes, drain grates, leach field, sand mound, no evidence of sanitary sewer (for septic system)		
Orange	Communication, alarm or signal lines, cables or conduits: red/orange bollards, telephone poles, interior connections; manholes; conduit on buildings		
Purple	Reclaimed water, irrigation, and slurry lines: sprinkler heads, hose bibs		
Pink	Survey markings		
White	Proposed locations for excavation and drilling		

Project Manager Notified of any Conflicts? (Y/N)
Notes:

Marks Verified By (Signature)	
	(scan and save to client file)

FIELD STANDARD OPERATING PROCEDURE #3

SAMPLE PACKAGING AND SHIPMENT PROCEDURE

Shipping samples is a basic but important component of field work. The majority of field activities include the collection of environmental samples. Proper packing and preservation of those samples is critical to ensuring the integrity of our work product. The user is advised to read the entire standard operating procedure (SOP) and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

3.1 ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
IATA	International Air Transport Association
HASP	Health and safety plan
PPE	Personal protective equipment
PSP	Project safety plan
SOP	Standard operating procedure

3.2 MATERIALS

- Suitable shipping container (e.g., plastic cooler)
- Chain-of-custody forms
- Custody seals
- Sample container custody seals (as necessary)
- Mailing address labels (as necessary)
- Shipping form (with account number, as necessary)
- Tape (e.g., strapping, clear packing)
- Permanent marker
- PPE
- Bubble wrap or other packing material

Temperature-preserved samples:

- Large plastic garbage bag
- Wet ice
- Heavy-duty zipper-style plastic bags
- Universal sorbent materials

Note: Some materials will be supplied by the laboratory, while others are must be supplied by the sampler. Confirm supplier of materials prior to mobilizing to the field.

3.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field standard operating procedures, and the Quality Management System.

This SOP is designed to provide the user with a general outline for shipping samples and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample collection and quality assurance procedures (SOP 4), and investigation derived waste management procedures (SOP 5).

Most environmental samples are classified non-hazardous materials due to unknown characteristics and hazardous classes, however environmental samples can meet the definition of U.S. Department of Transportation (DOT) hazardous materials when shipped by air, ground, or rail from a project site to the laboratory (e.g., free product, samples preserved with a hazardous material [TerraCore® samplers]). As such, field staff must work with their assigned company compliance professional to determine whether the sample shipment is subject to any specific requirements (e.g., packaging, marking, labeling, and documentation) under the DOT hazardous materials regulations.

3.4 SAMPLE SHIPMENT PROCEDURES

The two major concerns in shipping samples are incidental breakage during shipment and complying with applicable DOT and courier requirements for hazardous materials shipments.

> **NOTE: Many couriers, including Federal Express and United Parcel Service, have requirements that the company register with them before shipping hazard materials. In most cases, it is the sampling location, not the company office address, which needs to be registered. Therefore, each project will likely have unique requirements. Please contact your company compliance professional to determine whether or not you will be required to register for your shipment.**

Protecting the samples from incidental breakage can be achieved using "common sense." Pack all samples in a manner that will prevent them from moving freely about in the cooler or shipping container. Do not allow glass surfaces to contact each other. When possible, repack the sample containers in the same materials that they were originally received in from the laboratory. Cushion each sample container with plastic bubble wrap, styrofoam, or other nonreactive cushioning material. A more detailed procedure for packing environmental samples is presented below.

3.4.1 NON-HAZARDOUS MATERIAL ENVIRONMENTAL SAMPLES

The first step in preparing your samples for shipment is securing an appropriate shipping container. In most cases, the analytical laboratory will supply the appropriate container for bottle shipment, which can be used to return samples once they have been collected. Be sure that the container is large enough to contain the samples plus a sufficient amount of packing materials, and if applicable, enough wet ice to maintain the samples at the preservation temperature (usually 4 degrees Celsius). Use additional shipping containers as needed so that sample containers are protected from breakage due to overcrowding. Do not use lunch-box sized coolers or soft sided coolers, which do not offer sufficient insulation or protection from damage.

3.4.1.1 TEMPERATURE-PRESERVED SAMPLE CONTAINER PREPARATION

Temperature-preserved samples should be shipped to the laboratory in an insulated container (e.g., cooler). If using a plastic cooler with a drain, securely tape the inside of the drain plug with duct tape or other material to ensure that no water leaks from the cooler during shipment. Place universal sorbent materials (e.g., sorbent pads) in the bottom of the insulated container. The amount of sorbent material must be sufficient to absorb any condensation from the wet ice and a reasonable volume of water from melted wet ice (if a bag were to rupture) or a damaged (aqueous) sample container.

The next step is to line the insulated container with a large, heavy-duty plastic garbage bag. If shipping breakable sample containers (e.g., glass), place bubble wrap or other packing materials on the bottom of the container. Place the samples, including a temperature blank, on the packing materials with sufficient space to allow for the addition of more bubble wrap or other packing material between the sample containers. Place large or heavy sample containers on the bottom of the cooler with lighter samples placed on top to minimize the potential for breakage. Place all sample containers in the shipping container right-side up. Do not overfill the cooler with samples; room must be left for a sufficient volume of wet ice. Wet ice must be double-bagged in heavy-duty zipper-style plastic bags (1 gallon-sized, or less); properly seal both bags before placing in the insulated container. Place the bags of ice on top of or between the samples. Place as much ice as possible into the cooler to ensure the samples arrive at the lab at the required preservation temperature, even if the shipment is delayed. Fill any remaining space in the container with bubble wrap or other packing material to limit the airspace and minimize the shifting of the sample containers and in-transit melting of ice. Securely close the top of the heavy-duty plastic bag and knot or seal with tape.

3.4.1.2 NON-TEMPERATURE-PRESERVED SAMPLE CONTAINER PREPARATION

Non-temperature-preserved samples should be shipped to the laboratory in a durable package (e.g., hard plastic container or cardboard box). If shipping breakable sample containers (e.g., glass), place bubble wrap or other packing materials on the bottom of the container. Place the samples on the packing materials with sufficient space to allow for the addition of more bubble wrap or other packing material between and on top of the sample containers. Place large or heavy sample containers on the bottom of the container with lighter samples placed on top to minimize the potential for breakage. Place all sample containers within the shipping container right-side up. Fill any remaining space in the container with bubble wrap or other packing material to limit the airspace and minimize the shifting of the sample containers and in-transit melting of ice.

3.4.1.3 CONTAINER SHIPMENT

Samples in the container should be cross-checked against the chain-of-custory before signing off on the form and sealing the cooler. Place the original chain-of-custody form (i.e., laboratory copy) into a heavy-duty zipper-style plastic bag, affix/tape the bag to the shipping container's inside lid, and then close the shipping container; as required, include return shipping labels for the laboratory to return company-owned coolers. Only one chain-of-custody form is required to accompany one of the shipping containers per sample shipment; the other coolers in the shipment do not need to include chain-of-custody forms, unless required by the project. At this point, sample shipment preparations are complete if using a laboratory courier.

Once the shipping container is sealed, shake test the shipping container to make sure that there are no loose sample containers. If loose sample containers are detected, open the shipping container, repack the contents, and reseal the shipping container. If sending the sample shipment through a commercial shipping vendor, place two signed and dated chain-of-custody seals on alternate sides of the shipping container lid so that it cannot be opened without breaking the seals. Securely fasten the top of the shipping container shut with clear packing tape; carefully tape over the custody seals to prevent damage during shipping.

Affix a mailing label with the ship to and return to addresses to the top of the shipping container using clear shipping tape. Use the pre-printed return mailing label from the laboratory, if provided, or complete a new mailing label from the shipping carrier. Ship environmental samples to the contracted analytical laboratory using an appropriate delivery schedule. **Note: Samples can be shipped for Saturday delivery once the lab has been verified to be open and receiving samples on the weekend.**

Verify whether the shipment cost should be billed to the sender or recipient, and ensure the internal billing reference section on the mailing label includes either the laboratory's billing reference number, if the shipment is billed to the laboratory, or the project billable number, if the shipment is billed to WSP.

Declare the value of samples on the shipping form for insurance purposes, if applicable. When shipping samples to a lab, identify a declared value equal to the carrier's default value ($100); additional fees will be charged based on a higher value declared. Our preferred carrier, Federal Express, will only reimburse for the actual value of the cooler and its contents if a sample shipment is lost; they will not reimburse for the cost of having to re-collect the samples. [Please note: if you are shipping something other than samples, such as field equipment, declare the replacement value of the contents.]

Record the tracking numbers from the shipping company forms (i.e., the airbill number) in the field book and retain a copy of the shipping airbill. On the expected delivery date, confirm sample receipt by contacting the laboratory or tracking the package using the tracking number; provide this confirmation information to the project manager.

> **NOTE: Most shipping carriers adhere to transit schedules with final pickup times each day; these schedules are subject to change and vary by service location. If shipping containers are dropped off at a service location after the final pickup time, transit to the laboratory will not be initiated until the following day, and samples may not be properly preserved. Therefore, confirm transit schedules in advance of each sampling event, and ensure samples are delivered to the carrier before the final pickup time of the day.**

3.4.2 HAZARDOUS MATERIALS SAMPLES

Employees rarely ship hazardous materials due to DOT shipping requirements. If you find that your samples could be considered a DOT hazardous material, first coordinate with the assigned company compliance professional and project manager to make a hazardous material classification and, if necessary, establish the necessary protocols and to receive the appropriate training/certification.

> **NOTE: Employees shipping samples regulated as hazardous materials or exempt hazardous materials by air must have International Air Transport Association (IATA) training. IATA training is a separate training required in addition to DOT hazardous materials training for such shipments. Most of our employees do not have IATA training and therefore, anyone who needs to ship by air MUST consult with a company IATA-trained compliance professional.**

FIELD STANDARD OPERATING PROCEDURE #4

SAMPLE COLLECTION AND QUALITY ASSURANCE PROCEDURE

The purpose of this procedure is to assure that sample volumes and preservatives are sufficient for analytical services required under U.S. Environmental Protection Agency (EPA) or other agency approved protocols. This operating procedure describes sample identification procedures, sampling order for select analytes, quality control and quality assurance (QA/QC) sampling procedures, and custody documentation. The user is advised to read the entire standard operating procedure (SOP) and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

4.1 ACRONYMS AND ABBREVIATIONS

ºC	degrees Celsius
COC	chain-of–custody [form]
DI	laboratory-grade, analyte-free deionized water
DOT	US Department of Transportation
EDD	electronic data deliverable
EPA	US Environmental Protection Agency
HASP	health and safety plan
ID	identification [number]
MS/MSD	matrix spike and matrix spike duplicate
MSA	master services agreement
PPE	personal protective equipment
PSP	project safety plan
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
SOP	standard operating procedure
VOCs	volatile organic compounds

4.2 MATERIALS

- Field book
- Indelible (waterproof) markers or pens
- PPE
- Sampling containers and labeling/shipping supplies

- Deionized (DI) water
- Cleaned or dedicated sampling equipment

4.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company's SOPs. Employees are also strongly advised to review relevant state and federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for collecting environmental and quality assurance samples and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), investigation derived waste management procedures (SOP 5), and equipment decontamination (SOP 6). This SOP does not cover investigation planning, nor does it cover the analysis of the analytical results. These topics are more appropriately addressed in a site-specific work plan or a dedicated quality assurance project plan (QAPP). This SOP does not include an special handling requirements for specific parameters such as low-level mercury or per- and polyfluoroalkyl substances. These requirements should be included in the QAPP.

4.4 SAMPLE IDENTIFICATION PROCEDURES

All sample containers (e.g., glass bottles, plastic jars, foil bags, plungers, etc.) should be identified by an affixed sample label. Unless otherwise approved by your project manager or specified in your site-specific work plan/QAPP, information on the sample container labels must include the site/project name, project/task number, unique alpha-numeric sample identification (ID) number, sample collection date, time of collection using the military or 24-hour clock system (i.e., 0000 to 2400 hours), analytical parameters, preservative, and the initials of the sampling personnel. Employees are advised to use pre-printed waterproof mailing labels (e.g., Avery® 5xxx-series Waterproof Address Labels) for all sample identification. Electronic label templates are available.

The sample identification (ID) number must, unless otherwise approved by your project manager or specified in your site-specific work plan/QAPP, follow the company's naming protocol. This protocol was developed to aid in determining the type of sample collected (e.g., soil, groundwater, vapor, etc.), the sample location, and, where appropriate, the sample depth. This protocol was also designed to ensure consistency across the company.

Construct sample IDs in the following format:

SB-10A (4-6)

Where, in this example:

- SB = the first two or three characters will define the sample type (see list of approved prefixes below); in this case, a soil boring
- 10A = the next two or three alpha-numeric digits (separated by a dash from the sample type identifier) indicate the location of the boring on the site; in this case, boring number 10A
- (4-6) = the depth the sample was collected, with the first number (including decimals, if necessary) indicating the top of the sample interval (in feet) and the second number indicating the bottom of the sample interval (in feet); not all sample types will include depth information.

Additional label information may be added after the last character of the sample ID number (e.g., sample date, underground storage tank number, area of concern number, “Area” number, client identifier, etc.). Separate any additional information from the required portion of the sample name by dash(es).

Sample Prefix	Permitted Use
AA	Ambient outdoor air sample
CC	Concrete core/chip sample
CS	Confirmation/verification soil sample collected from an excavation
HA	Soil sample collected with a hand auger
IAB	Indoor air sample – basement
IAC	Indoor air sample – crawl space
IAF	Indoor air sample – first floor
MW	Soil sample collected from a monitoring well borehole or a groundwater sample collected from a monitoring well
PZ	Groundwater sample collected from a piezometer
SB	Soil sample collected from boreholes that will not be converted to monitoring wells
SED	Sediment sample
SG	Soil gas sample other than a sub-slab sample (e.g., sample collected from a temporary or permanent polyvinyl chloride sample point or stainless steel screen implant)
SL	Sludge sample
SS	Surface soil sample collected using hand tools (e.g., trowel, spoon, etc.) and typically at depths less than 2 feet below ground surface
SSV	Sub-slab vapor sample
SW	Surface water sample
TC	Tree core sample
TP	Soil sample collected from a test pit
WC	Waste characterization sample
WP	Wipe sample
WW	Wastewater

4.5 SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

The first step in sample collection is to verify that the correct number and type of sample containers were provided, and that each contains the appropriate preservatives for the proposed project (i.e., check against the sampling plan requirements outlined in the site-specific QAPP or, for those projects without a site-specific QAPP, the laboratory Task Order). Inspect all containers and lids for flaws (cracks, chips, etc.) before use. Do not use any container with visible defects or discoloration. Report non-receipt and any discrepancies of specific types of sample containers to the team leader or project manager immediately. Make arrangements to have missing or additional sampling containers provided on an expedited basis.

Precautions must be taken to prevent cross-contamination and contamination of the environment when collecting samples. Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact with gloves soiled during collection of the previous sample. The gloves must not contact the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised. ***In no case should gloved hands be used as a sampling device: always use the appropriate sampler to move the sample from the sampling device to the laboratory-supplied containers.***

Sample collection must follow all appropriate SOPs, state and federal regulations, or guidance, for the collection of environmental samples; the recommended order of sample collection is:

- Geochemical measurements (e.g., temperature, pH, specific conductance)
- Volatile organic compounds (VOCs)
- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Per- and Polyfluoroalkyl substances
- Total metals
- Dissolved metals
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

Fill the sample bottles to the appropriate level for the parameter analyzed including eliminating head space, as appropriate. Collected samples that require thermal preservation must be immediately (within 15 minutes) placed in a cooler with wet ice and maintained at a preservation temperature of 4° Celsius (ºC).

4.6 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field quality assurance/quality control (QA/QC) samples may include equipment blanks, trip blanks, temperature blanks, duplicates, matrix spike and matrix spike duplicate samples, field blanks, and split samples. The project manager or QAPP must specify the type and frequency of QA/QC sample collection. The QA/QC sample identification number must, unless otherwise approved by your project manager or specified in your site-specific work plan, follow the company's naming protocol as discussed in the sections below. QA/QC samples must be clearly identified on our copy of the chain-of-custody (COC) form (described below) and in the field book. Failure to properly collect and submit required QA/QC samples can result in invalidation of an entire sampling event.

Several blanks, discussed below, require laboratory-grade analyte-free, deionized water (DI) be used. Only if all options to obtain laboratory-grade DI have been exhausted should store-grade distilled water be used to prepare blanks. If store-grade distilled water is used, be sure to record the source and lot number in the field book.

Collect, preserve, transport and document split samples using the same protocols as the related samples.

4.6.1 EQUIPMENT BLANKS

Equipment blanks, or rinsate blanks, are used to document contamination attributable to using non-dedicated equipment (i.e., equipment that must be decontaminated after each use). Collect equipment blanks in the field at a rate of one per type of sampling equipment per day, unless otherwise specified. If the site-specific work plan or QAPP indicates that an equipment blank is to be collected from dedicated sampling equipment, collect the equipment blank in the field before sampling begins. If field decontamination of sampling equipment is required, prepare the equipment blanks after the equipment has been used and field-decontaminated at least once.

Prepare equipment blanks by filling or rinsing the pre-cleaned equipment with DI and collecting the rinsate in the appropriate sample containers. Record the type of sampling equipment used to prepare the blank and how the equipment blank was generated in the field book. Decontamination of the equipment following equipment blank procurement is not required.

The samples must be labeled, preserved, and filtered (if required) in the same manner as the environmental samples. Have the equipment blanks analyzed for all the analytes for which the environmental samples are being analyzed, unless otherwise specified. Designate equipment blanks using "EB", followed by the date, and in the order of equipment blanks collected that day. For example, the first equipment blank collected on July 4, 2015, would be designated EB070415-1.

4.6.2 TRIP BLANKS

Trip blanks are used to document VOC contamination attributable to shipping and field handling procedures. Trip blanks are only required when analyzing samples for VOCs. The blanks are prepared by the analytical laboratory and shipped along with the empty sample containers. These pre-filled blanks should accompany the environmental sample containers wherever they are stored onsite (i.e., keep the trip blank sample bottles in the same shipping container used to ship and store VOC sample bottles during the sampling event). Never open the laboratory-supplied trip blank sample bottles. Only as a last resort, store-grade distilled water, can be poured into empty VOC sample bottles to generate event-specific trip blanks (or augment the laboratory-supplied ones, if they are provided in insufficient numbers).

The trip blanks, even those provided by the analytical laboratory, should be labeled in the field like other environmental samples collected during the investigation activities. Identify trip blanks using the prefix "TB", followed by the date. For example, the trip blank shipped with a cooler of samples on July 4, 2019, would be designated TB070419-1. If a second trip blank is needed on that same day, the designation would be TB070419-2. A minimum of one trip blank should accompany each shipping container of VOC samples, unless more stringent project requirements are in place. The number of trip blanks needed per shipment can be minimized by shipping all the VOC samples in the same shipping container (if possible).

4.6.3 FIELD BLANKS

The field blank is analogous to the trip blank in that it is designed to assess and document any contamination to the environmental samples that can be attributable to the (ambient) field conditions. Not all projects require the use of field blanks. Their use, if required, and the frequency of collection (often 1 blank per 10 or 20 environmental samples collected) is detailed in the QAPP and the site-specific work plan. The sample is collected by pouring DI water into empty glassware at the site during the sampling event. The intent is to expose the field blank to the same conditions in the atmosphere as those present when the environmental samples were collected.

Identify field blanks using the prefix "FB", followed by the date. For example, the field blank shipped collected on August 22, 2019, would be designated FB082219. If a second field blank is needed on that same day, the designation would be FB082219-2. At least one field blank should be collected for each analytical parameter identified in the sampling event.

4.6.4 TEMPERATURE BLANKS

Temperature blanks are used to determine if the samples are at the appropriate temperature for preservation at the time the sample container (cooler) is received by the analytical laboratory. The temperature is determined by measuring the temperature blank, which provides a proxy for the temperature of the sample container upon arrival at the laboratory. These temperature blanks are typically provided by the laboratory and should be included in each sample cooler used to ship and store the sample bottles during the sampling event. If laboratory-provided temperature blanks are not available, fill a clean, unpreserved sample bottle with potable, DI, or store-grade distilled water and identify the bottle as a temperature blank.

4.6.5 DUPLICATES

Duplicate samples, which are used for measuring the variability and documenting the precision of the sampling process, should be collected at a rate of at least 1 duplicate per 20 environmental samples collected, unless specific project requirements (as detailed in a QAPP) are in place. Be sure that the location selected for duplication has sufficient sample volume and is within the area of contamination, if known. Under no circumstances can equipment or trip blanks be used as duplicates.

Collect each duplicate sample at the same time, from the same sample aliquot, and in the same sampling order (i.e., volatile organic compounds, then semivolatile organic compounds, then inorganics, etc.) as the corresponding environmental sample. Sample bottle aqueous duplicate samples, for example, should be alternately filled with the environmental sample bottles (i.e., the actual sample bottle and the bottle to be used for the duplicate) from the same sampling device. If the sampling device does not hold enough volume to fill the sample containers, fill the first container with equal portions of the sample, and pour the remaining sample into the next sample containers. Obtain additional sample volume and pour the first portion into the last sample container, and pour the remaining portions into the first containers. Continue with these steps until all containers have been filled.

Duplicate samples will be assigned arbitrary sample ID and a false collection time so that they are not identified as duplicates by the laboratory (i.e., submit the duplicates samples as *blind* to the lab). The blind duplicate sample "location designation" will be left up to the project manager; however, in no case will "Dup" be allowed to appear in the sample name. The duplicate samples should be analyzed for the same analytes as the original environmental sample. Be sure to record the sampling method, duplicate sample ID, the false time, and the actual time of collection in the field notebook. The duplicate should also be indicated in separate documentation, such as on our carbon copy of the chain-of-custody (i.e., the yellow copy), and not on the original chain-of-custody that accompanies the samples to the laboratory.

4.6.5 MATRIX SPIKE AND MATRIX SPIKE DUPLICATES

Matrix spike and matrix spike duplicate samples (i.e., MS/MSD samples) are used to determine the bias (accuracy) and precision of an analytical method for a specific sample matrix. Many of the company's projects require the collection of MS/MSD samples; however, laboratory generated MS/MSD samples are sufficient for some projects (as detailed in the QAPP or site-specific work plan). Collect MS/MSD samples at a rate of 1 MS and 1 MSD (i.e., 2 samples) for every 20 environmental samples, unless more stringent project requirements (as detailed in a QAPP) are in place. Clearly convey the MS/MSD identity to the laboratory by adding "MS" or "MSD" after the sample name (e.g., MW-01MS) and/or in the comments section of the chain-of-custody on the same line as the parent sample. Under no circumstances can equipment or trip blanks be used as MS/MSD samples.

4.6.6 SPLIT SAMPLES

Split samples may be collected as a means of determining compliance or as an added measure of quality control. Split samples measure the variability between laboratories and not the variability of sample collection and laboratory procedures (i.e., they are not equivalent to duplicate samples). The split samples must be subsamples of the same parent material used for the environmental sample: soil should be collected from the same in-place material (for VOCs) or, for non-discrete samples, the same mixing vessel after homogenization. Collect aqueous split samples using the same alternating bottle approach detailed in the duplicate sample description above. These procedures will ensure that the split samples are valid and are representative of the environmental sample collected as part of the investigation.

Collecting split samples of soil, sediment, waste, and sludge is not recommended because the homogenization necessary for a true split sample in these matrices is not possible and the resulting laboratory results would not be comparable.

Spilt samples should have the same sample location designation (e.g., MW-01, SB-03 (4-6), but are differentiated from each other by inserting the laboratory analyzing or the agency/consultant collecting the sample after the sample location (e.g., MW-01-WSP and MW-01-EPA).

4.7 CUSTODY DOCUMENTATION

Sample custody protocols are used to demonstrate that the samples and sample containers were handled and transferred in such a manner as to prevent tampering. Legal COC begins when the pre-cleaned sample containers are dispatched to the field from the laboratory and continues through sample analysis and eventual disposal of the sample and sample containers. Maintaining custody requires that samples must be in the actual possession or view of a person who is authorized to handle the samples (e.g., sample collector, laboratory technician, etc.), secured by the same person to prevent tampering, or stored in a designated secure area.

It is a good idea to limit, to the extent possible, the number of individuals who physically handle the samples. Samples must be placed in locked storage (e.g., locked vehicle, locked storeroom, etc.) when not in the possession or view of authorized personnel. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper indications in place (i.e., custody seals).

The COC form is used to trace sample possession from the time of collection to receipt at the analytical laboratory. It is recommended that the company's COC be used rather than the laboratory-supplied COC form to ensure that all necessary data are recorded. Submit one COC form per sample shipment, unless more stringent project requirements are in place (as detailed in the QAPP or site-specific work plan). The COC needs to have a unique COC number (pre-printed on the form), accompany all the samples, and include all appropriate project-specific information, such as:

- Project number, name, and location
- Sampler's printed name(s) and signature(s)
- Sample identification number
- Date and time (using the 24-hour clock) of collection
- Sample matrix (e.g., soil, aqueous, solid, etc.)
- Total number of containers per sample
- Parameters requested for analysis including number of containers per analyte.
- Remarks (e.g., irreducible headspace, field filtered sample, expected concentration range, specific turn-around time requested, etc.)
- Signatures of all persons involved in the chain of possession in chronological order
- Requested turn-around-time
- Name and location of analytical laboratory
- Custody seal numbers
- Shipping courier name and tracking information
- Internal temperature of shipping container upon shipment to laboratory, as needed
- Internal temperature of shipping container upon delivery to laboratory
- Employee contact information

Affix custody seals to all storage and shipping container closures when transferring or shipping sample container kits or samples to an off-property party. Place the seal so that the closure cannot be opened without breaking the seal. In the field book, record the time, date and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container. Affix new custody seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FIELD STANDARD OPERATING PROCEDURE #6

DECONTAMINATION PROCEDURE

The decontamination procedures outlined in this standard operating procedure (SOP) are designed to ensure that all sampling equipment is free from the analytes that could potentially interfere with sample results. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

6.1 ACRONYMS AND ABBREVIATIONS

DI	deionized water
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SOP	standard operating procedure

6.2 MATERIALS

- Field book
- PPE
- Polyethylene sheeting and/or garbage bags
- Laboratory-grade non-phosphate detergent[1] (e.g., Luminox® or Liquinox®)
- Cleaning reagents, as needed (e.g., isopropyl alcohol, methanol, hexane, nitric acid)
- Potable water
- Deionized (DI) water
- Containers (e.g., plastic buckets)
- Bristle brushes
- Aluminum foil
- Spray bottles
- Paper towels
- Pressurized steam cleaner (e.g., steam jenny), as needed
- Waste collection containers (e.g., drums), as needed
- Decontamination pad, as needed

6.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

[1] Not all laboratory-grade detergents are phosphate free. Be sure to verify the detergent's phosphate content before use.

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company's SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for decontamination and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), and investigation-derived waste management procedures (SOP 5). All decontamination references must be available for consultation in the field, including:

— Company's SOPs
— Applicable state and federal guidelines or procedures
— Manufacturer's manuals
— Project-specific work plan, PSP and/or HASP, and QAPP

6.4 GENERAL PROCEDURES

The cleaning and decontamination procedures described below are designed to ensure that the equipment used for sample collection is free of analytes that could potentially alter the analytical results. These procedures are primarily targeted at preventing the incidence of cross-contamination (i.e., compounds of interest being transferred on the sampling equipment from one sample to another) in order to produce high quality, representative sample results. As with all analytical sampling, the effectiveness of the cleaning procedures must be demonstrated with the collection of equipment blanks; equipment blank sample collection procedures and frequency are discussed in SOP 4.

6.4.1 EQUIPMENT AND REAGENT SELECTION

It is important for employees to evaluate the expected types of contamination before mobilization to a site. State programs (or the U.S. Environmental Protection Agency [EPA], depending on the site) may require more stringent decontamination procedures than those listed in this SOP, specify the types and grades of various cleaning detergents and reagents (e.g., acids and solvents), or allow the use of phosphate-containing detergents, such as Liquinox® liquid detergent (preferred[2]) or the powdered Alconox®. Decontamination equipment (e.g., spray bottles, brushes, etc.) should be constructed of non-reactive, non-leachable materials (e.g., metal, glass, Teflon®-coated, polyethylene, etc.) which are compatible with the reagents and solvents being used for decontamination.

Many of the cleaning reagents (e.g., nitric acid, hexane, methanol) are U.S. Department of Transportation (DOT) hazardous materials and must be shipped using a ground delivery service. The Safety Data Sheets (SDSs) for any hazardous cleaning reagents to be used onsite must be reviewed before the commencement of work, and the potential hazards and protective measures to be employed must be addressed in the HASP. Do not use decontamination liquids that have been improperly stored (e.g., unsealed containers).

In specific cases, it may be necessary to steam clean the field equipment before proceeding with the decontamination steps presented in Section 6.5 (e.g., hollow stem augers). Generally, the company's subcontractors are responsible for bringing or building a decontamination pad, if necessary, to contain the spray from a steam jenny. As possible, decontamination pads should be constructed on a level, paved surface in an area known or believed to be free of surface contamination, and should be of sufficient size to contain the decontamination water. Equipment that is steam cleaned should be placed on racks or saw horses and not on the floor of the

[2] Liquinox® liquid detergent, manufactured by Alconox, Inc., is phosphate-free and does not contribute to nutrient loading or algae blooms in the environment.

decontamination pad. Decontamination water should be removed from the decontamination pad frequently to minimize the potential for leaks or overflow.

Consult and involve the company's compliance professionals for storage procedures and disposal requirements of cleaning reagents, detergents, wastes, and other decontamination-related materials.

6.4.2 OTHER CONSIDERATIONS

In preparing for decontamination, you should perform the following activities (with all observations and measurements noted in the field book):

— Perform a quick reconnaissance of the site to identify a decontamination (pad) area and evaluate the accessibility to and safety of the location.
— If working in a hazardous waste exclusion area, the decontamination area should be located in the contaminant reduction zone.
— Record a description of the decontamination (pad) area.

Survey the breathing zone around the decontamination area with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate. When decontaminating equipment, it is important to find a suitable location away from any sources of cross-contamination that could compromise the integrity of the decontamination. As possible, position the decontamination area away from fuel-powered equipment, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling).

6.5 DECONTAMINATION PROCEDURES

The decontamination procedures described below are a four- to nine-step process, depending on the the applicable federal or state guidelines, the project-specific work plan, or the QAPP. Sampling activities must be initiated with clean, decontaminated equipment. Decontaminate all non-dedicated equipment that contacts the sample directly (e.g., spoons, trowels, pumps), before and between each sample location and sampling interval. record decontamination procedures in the field book. Disposable, single use items, such as bailers or tubing, do not require decontamination.

The decontamination process includes the following four basic steps:

1. Physical removal of soil or debris
2. Wash with non-phosphate detergent, such as Liquinox®, and nylon brush
3. Potable water rinse
4. Laboratory-supplied deionized (DI), analyte-free water rinse (distilled water can be used as a substitute, if necessary)

The first step is to remove as much soil or other debris from the sampling device as possible near the sampling area to limit the spread of potentially-contaminated materials into clean areas of the site. Containerize all soil or debris in DOT-compliant containers in accordance with SOP 5 or the project-specific work plan. Dispose of all wastes in conformance with the project-specific work plan and applicable regulations.

Cleaning and decontamination should occur at a designated area(s) (i.e., decontamination pad) on the site. If gross contamination or an oily film or residue is observed on the equipment, use a steam jenny or wash by hand, using a brush, to remove the particulate matter or surface film. Heavy oils or grease may be initially removed with paper towels soaked with isopropyl alcohol.

The physical removal of debris process is followed by soaking (a simple dunk of the equipment is insufficient) and hand scrubbing the equipment with a solution of potable water and non-phosphate detergent (mixed to the manufacturer's instructions) followed by a potable water rinse. If not using a decontamination pad, the most common set-up uses multiple 5-gallon plastic buckets (or equivalent) for washing and rinsing. The decontamination containers should be labeled as to their contents and pertinent information from original source, such as the date opened or transferred, and the expiration date (as well as any applicable hazardous labels), placed on polyethylene sheeting (to contain drips of decontamination fluids during the decontamination process), and sealed when not in use to prevent accidental release of the fluids. If decontaminating sealed submersible pumps, pump both the non-phosphate detergent wash fluid and the potable water rinse through the pump body itself (usually done in separate buckets) to ensure that the internal components are thoroughly cleaned. Replace the detergent solution and rinse water at least daily or when it becomes oily or silty.

Next, place the DI water for the rinse in a small spray bottle or pour over the equipment after the potable water rinse.

Typically, this level of decontamination (i.e., steps 1 through 4) is sufficient.

Following Steps 1 through 4, additional decontamination (steps 5 through 9) may be required by the applicable federal or state guidelines, the project-specific work plan, or the QAPP. Typically, these decontamination steps are performed when sampling for inorganics or oil-related substances using non-motorized equipment. These steps include:

5. 10% nitric acid rinse (if metals are part of the analyses)
6. Laboratory-supplied DI water rinse
7. Pesticide-grade solvent rinse (e.g., acetone [preferred], hexane, or isopropyl alcohol)
8. Air dry (solvent must evaporate)
9. Laboratory-supplied DI water rinse

Isopropyl alcohol is the recommended solvent for organic contaminants because it is readily available and is not a DOT hazardous material; where possible, lab-grade isopropyl alcohol should be used . However, other solvents (e.g., hexane and methanol) may be more effective in removing certain contaminants, such as oils or polychlorinated biphenyls, but any waste generated using these solvents must be managed accordingly. Solvents are never used for decontamination if sampling for volatiles organic compounds.

Handle the solvents and acid with care and store unused chemicals in their original, labeled, protective containers when not in use. It is a good idea to transfer small quantities of each solution into labeled, laboratory-grade spray bottles, which offer a convenient and controllable way to rinse the equipment. The equipment can then be rinsed over a 5-gallon plastic bucket or other suitable container placed on plastic sheeting as with the first part of the cleaning process. Nitric acid rinses must be used only on non-carbon steel sampling devices. Do not spray acid or solvent into pumps.

Decontamination steps used at sites where radioactive materials are contaminants of concern are similar with a few special considerations. Radiation contamination monitoring is used to help locate contamination and guide the success of the decontamination process. The liberal use of water and fluids as a decontamination agents are minimized, where practicable, because of the expense that can be incurred with disposing of radioactively contaminated decontamination water. Containerized decontamination wastes must be evaluated for radioactive content and disposed of appropriately depending on their content.

6.6 HANDLING DECONTAMINATED EQUIPMENT

Handle any decontaminated equipment using clean gloves to prevent re-contamination. Place the equipment away (preferably upwind) from the decontamination area once the process has been completed on clean plastic sheeting to allow it to air-dry. Once the equipment is dry, protect it from re-contamination by securely wrapping and sealing with aluminum foil (shiny side out) or clean, disposable plastic bags (inorganics only). Plastic bags may be wrapped directly around wet or dry equipment except when the expected contaminants include volatile and extractable organics; under those circumstances, allow the equipment to completely dry or wrap it in aluminum foil.

All sampling equipment must be decontaminated at the end of the investigation (i.e., prior to departure from the site). Label each piece of equipment with the date of decontamination, the initials of personnel performing the decontamination, and the type of decontamination solution(s) used. Containerize all decontamination fluids, and other disposable decontamination materials in DOT-compliant containers in accordance with SOP 5 or the project-specific work plan. Dispose of all wastes, including open and unused solvents or acids, in conformance with the project-specific work plan and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #7

WATER QUALITY MONITORING EQUIPMENT PROCEDURE

The procedures outlined in this Standard Operating Procedure (SOP) are designed to ensure that water quality monitoring equipment is calibrated and used properly. Specifically, this SOP addresses the short-term or discrete-measurement use of portable water quality monitoring equipment for the collection of physical, chemical, or biological field measurements. Common field parameters include temperature, pH, specific conductance (SC), turbidity, oxidation-reduction potential (ORP), and dissolved oxygen (DO). The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

7.1 ACRONYMS AND ABBREVIATIONS

DI	deionized water
DO	dissolved oxygen
°F	degrees Fahrenheit
HASP	health and safety plan
IDW	investigation derived waste
mg/l	milligrams per liter
mV	millivolts
NTU	nephelometric turbidity units
ORP	oxidation-reduction potential
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SC	specific conductance
SDS	safety data sheets
SOP	standard operating procedure
SU	standard units
µS/cm	microsiemens per centimeter
(mS/cm)	millisiemens per centimeter

7.2 MATERIALS

- Field book
- PPE
- Water quality meter
- Flow-through cell, as appropriate
- Display/logger
- Communication cables
- Calibration cup or beaker

- Calibration reagents and standard solutions, as appropriate
- Deionized water (DI) or distilled water
- Decontamination supplies

7.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for preparing water quality monitoring equipment for use and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), investigation derived waste (IDW) management procedures (SOP 5), and equipment decontamination (SOP 6). This SOP does not cover the selection of water quality monitoring equipment, nor does it cover water quality monitoring equipment-specific instructions. These topics require a significant amount of planning and are more appropriately addressed in a project-specific work plan. Be sure to review the project-specific work plan or Quality Assurance Project Plan (QAPP) and any applicable state and federal guidelines or calibration procedures. The sampler should be familiar with the use and calibration of all sampling and monitoring equipment. All sampling references must be available for consultation in the field, including:

- Company's SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan, PSP and/or HASP, and QAPP

7.4 GENERAL EQUIPMENT HANDLING AND MANAGEMENT PROCEDURES

Multi-parameter water quality meters are typically bundled in a single housing unit known as a sonde. These types of units offer a single, convenient device that is capable of measuring most or all of the parameters monitored during a typical sampling event. Individual parameter water quality meters are available and, in some cases, offer a higher degree of accuracy, although the difficulty in deploying multiple meters for most tasks relegates them to specialty use.

Field personnel must consult their assigned company compliance professionals for assistance in proper use, storage, and disposal of all calibration standard solutions.

The manufacturer's recommendations and instructions vary from one instrument to the next; however, all types of water quality monitoring equipment share common handling and management procedures designed to ensure the integrity of the measurements collected. Based on these procedures, the user should:

- Follow the manufacturer's instructions for transportation, assembly, operation, calibration, and maintenance specific to your equipment. The manufacturer's instructions should be followed explicitly in order to obtain accurate results.
- Keep either the sensor guard or transportation/calibration cup installed when not in use to avoid damaging the sensors. Some sensors require a small amount of water in the transportation/calibration cup; follow the manufacturer's recommendations.
- Inspect the sensors to be sure that they are clean, installed properly and are not damaged.

- Ensure that all equipment is in proper working condition, and that batteries are properly charged before using the equipment for field testing measurements.
- Protect instruments that are sensitive to static electricity.
- Record manufacturer name and model number for each instrument used in the field book.
- Calibrate the instrument, as close to the time of use as possible, and repeat at the frequency suggested by the project-specific work plan, QAPP, or manufacturer. All calibration records must be maintained in the project files.
- Protect the instrument from direct sunlight, precipitation, and extremely hot or cold temperatures.
- Store cables only after they are clean, dry, and neatly coiled – do not bend or crimp cables, and attach any provided storage caps.
- Protect cables from abrasion or unnecessary tension when in use.
- Unless otherwise instructed by the manufacturer, decontaminate water quality monitoring equipment using a non-phosphate detergent solution with a small, nonabrasive brush, cotton swab or cloth, followed by a thorough DI water rinse.

7.5 CALIBRATION PROCEDURES

Water quality monitoring equipment must be inspected and the sensors calibrated before use. Calibration frequency is dependent upon project specifications, instrument performance, and manufacturer's recommendations; repeat the calibration procedures as directed in the project-specific work plan, QAPP, or manufacturer's guidance. Consult the manufacturer's guidelines before beginning the calibration process and contact the manufacturer's technical support if problems or questions arise. Maintain all calibration records in the project files.

Conduct the following procedures to ensure proper calibration and record observations in the field book:

- Complete field calibration in an area sheltered from wind, dust, and temperature/sunlight fluctuations such as inside a room or vehicle in which the ambient temperature of the standards is maintained at a temperature greater than 40 degrees Fahrenheit (°F) and less than 100°F, unless otherwise specified by the manufacturer.
- Use standard calibration solutions in accordance with the project-specific work plan, QAPP, or manufacturer's guidance. Allow water quality monitoring equipment to equilibrate to the air temperature for at least 15 minutes after being powered on, or for the specified time period recommended by the manufacturer.
- Record the brand, concentration, lot numbers and expiration dates of standard solutions in the field book.
- Handle standard solutions in a manner that prevents their dilution or contamination. Do not use expired standard solutions. Do not reuse standard solutions or pour solutions back into the bottle; ensure that proper chain-of-custody has been followed for standard solutions stored at a site.
- Ensure that the water quality monitoring equipment has been set to display or record the appropriate measurement units, as available – be sure to record the units of measure in the field book or field form.
- Unless otherwise instructed by the manufacturer, use the calibration cup that comes with the instrument for calibration.
- Use the recommended volume of standard solution when filling the calibration cup (e.g., the standard solution must cover the temperature sensor, as most sensors require temperature compensation).
- Be careful not to over tighten the calibration cup; many calibration cups have vents that allow their equilibration with ambient pressure.
- Rinse sensors thoroughly with DI water after use of each standard solution, followed by a rinse with the next standard solution to be used.
- Wait for readings to stabilize (approximately 30 seconds under normal conditions) before adjusting and saving the calibration point.
- If calibration fails to meet criteria, follow the manufacturer's instructions for corrective action to adjust instrument performance and note any indication of a substandard calibration.
- If the instrument does not start up, meet the requirements above, or calibrate properly, the instrument should not be used.
- Document the time, date, serial number (or other identifier) and calibration status for each instrument.

7.5.1 SPECIFIC CONDUCTANCE

Specific conductance, or, more commonly conductivity, measures the ability of water to conduct an electric current. It is generally reported in either microsiemens per centimeter (μS/cm) or millisiemens per centimeter (mS/cm); be sure to note the units used in the field book. Natural waters, including groundwater, commonly exhibit SC below 1 μS/cm. Elevated SC measurements (i.e., greater than 500 μS/cm) are a proxy for the amount of dissolved solids, which may be indicative of inadequate well development, grout contamination (or an inadequate grout seal), or contamination.

When calibrating water quality monitoring equipment for SC:

- If not specified in the project-specific work plan, choose a SC standard solution recommended by the instrument manufacturer; otherwise, select a standard that is similar to the anticipated conductivity of the water being sampled.
- The presence of air bubbles in conductivity electrodes will cause erroneous readings and incorrect calibration. Transmission lines, alternating-current electrical outlets and radio-frequency noise sources may cause interference; check with the instrument manufacturer's specifications for troubleshooting procedures.

7.5.2 DISSOLVED OXYGEN

Dissolved oxygen measurements are used to assess the water quality with respect to certain metals (the amount of oxygen can control the valence state of metals) and, more typically, biological activity. Concentrations of DO in groundwater under ambient conditions generally range from 1 to 4 milligrams per liter (mg/l). Erratic or elevated (greater than 4 mg/l) DO readings may indicate equipment maintenance issues, such as a fouled sonde, torn membrane, a sensor out of calibration range; or inappropriate monitoring procedures that are causing excessive agitation and aeration of the water column. The meters are sensitive to atmospheric interference: *ex situ* measurements (i.e., those measured outside of the well itself) should only be collected using a flow-through cell.

Dissolved oxygen meters vary widely in their sensitivity. Select the type of DO sensor (i.e., the polarographic [or Clark cell] sensor or the luminescent [optical] sensor) that is most appropriate for the scope of work detailed in the project-specific work plan. The guidance below is for the more common polarographic sensor; consult the manufacturer's guidance for maintenance and calibration procedures specific to optical DO meters.

- Check the DO membrane for bubbles, wrinkles or tears. If necessary, install a new membrane and replace worn or stretched O-rings. Manufacturer guidance generally specifies membrane replacement should be completed at least 3 to 4 hours before use.
- Most manufacturers recommend that the sensor be allowed to equilibrate to the temperature of the water-vapor-saturated air before calibration, as specified in the manufacturer's instructions.
- Fill the calibration cup with less than 1/8 inch of water, or as recommended by the manufacturer.
- Remove any water droplets from the sensor without wiping the membrane. Water droplets on the sensor can cause a temperature compensation error in the DO calibration.
- Do not submerge or wet the sensor when loosely attaching the calibration cup.
- Enter the barometric pressure and wait for readings to stabilize before adjusting and saving the calibration point.

7.5.3 PH

The effective concentration (or activity) of hydrogen ions on a numerical scale known as pH, which is expressed as the negative base-10 logarithm of the hydrogen-ion activity in moles per liter. Natural (uncontaminated) waters typically exhibit a pH ranging from 5 to 9 Standard Units (SU). Deviation of pH from background may indicate the presence of groundwater contamination or well construction problems.

Typically, a two-point calibration is used for pH (i.e., a zero-point and span calibration[s]):

- If not specified in the project-specific work plan, select a 7 SU buffer (zero-point) plus a second pH buffer (4 SU or 10 SU) that brackets the range of expected pH.
- If applicable, calibrate the conductivity and DO sensors before calibrating the pH sensor. This helps prevent cross-contamination of the conductivity sensor from pH buffer solutions (pH buffers have much higher conductivities than most environmental waters).
- Allow time for the pH and temperature sensors to equilibrate to the temperature of the buffer and stabilize before adjusting and saving the calibration point. Record the temperature reading and use the chart provided by the buffer manufacturer to determine the true pH of the buffer at that temperature and adjust the calibration reading to that value.
- Repeat the calibration process with the second buffer.

7.5.4 OXIDATION-REDUCTION POTENTIAL

Oxidation-reduction potential is a numerical index of the intensity of the oxidizing or reducing conditions within an aqueous solution. Oxidizing conditions are indicated by positive potentials and reducing conditions are indicated by negative potentials. These values are frequently used when evaluating the biodegradation capacity of a system. The ORP of natural (uncontaminated) waters typically ranges from +500 to -100 millivolts (mV). The meters for ORP, like those for DO, are sensitive to atmospheric interference and must be measured using a flow-through cell. Avoid touching the sensors during calibration and measurement as calibration can be affected by static electricity.

A one-point calibration, at a known temperature, is used to calibrate the ORP sensor:

— Fill the calibration cup with enough standard solution (i.e., ZoBell's solution) to completely cover the temperature and ORP sensors.
— Allow time for the ORP and temperature sensors to equilibrate to the temperature of the buffer and stabilize before adjusting and saving the calibration point. Record the temperature reading and use the chart provided by the manufacturer to determine the true ORP of the solution at that temperature and adjust the calibration reading to that value.

7.5.5 TURBIDITY

Turbidity is the presence of suspended mineral and organic particles in a water sample. Turbid water may indicate inadequate well construction, development or improper sampling procedures, such as purging at an excessive rate that exceeds the well yield. Purging and sampling in a manner that minimizes turbidity is particularly important when analyzing for total metals and other hydrophobic compounds, such as polychlorinated biphenyls, which may exhibit artificially elevated concentrations in high-turbidity samples due to their adsorption to colloidal material. Generally, the turbidity of *in situ* groundwater is very low (at or below 10 nephelometric turbidity units, NTUs); however, some groundwater zones may have natural turbidity higher than 10 NTUs.

Standard turbidity solutions are not necessarily interchangeable. Serious calibration errors can result from using inappropriate standards. Use only those standard turbidity solutions that are prescribed for the sensor by the instrument manufacturer.

Turbidity consists of a zero-point calibration and a span calibration(s):

— Fill the calibration cup to the reference line with DI or a zero-point standard.
— Allow time for the turbidity sensors to stabilize before adjusting and saving the calibration point.
— Record the temperature and use the chart provided by the manufacturer to determine the true turbidity of the standard and adjust the calibration reading to that value.
— Repeat the calibration process with the standard span calibration standard(s).

7.6 EQUIPMENT USE PROCEDURES

The monitoring equipment is ready to use once the calibration has been completed. The specific use of the device will be dictated by the project-specific work plan or QAPP; however, all projects should follow these general procedures during use:

— Charge instrument batteries per the manufacturer's instructions, as necessary.
— Ensure that instrument is warmed up and the measured value(s) on the water quality monitoring equipment are equilibrated (i.e., readings are representative of the solution, not ambient air) before recording in the field book.
— Biological growth or debris in the water can foul sensors; as possible, avoid inserting the sonde in areas that will result in having to stop and clean algae, sediment, or debris from the sensors (e.g., do not place on bottom of a well or streambed).
— If continuous monitoring is required, follow the manufacturer's instructions for performing continuous data logging events.

For flow through cells:

— Inspect the integrity of the flow-through cell and O-rings.
— Connect the discharge tubing to the bottom of the flow-through cell using properly-sized tubing and fittings. Connect the effluent tubing to the top of the flow-through cell and secure the end of the tubing into the designated groundwater purge container.
— Shield the flow-through cell from direct sunlight to minimize changes in the temperature.

- Do not record any measurements until all the air from the flow-through cell and the effluent tubing has been displaced and the sensors have equilibrated. The presence of air bubbles in the flow-through cell will result in highly biased readings.
- Do not collect samples for laboratory analysis from the groundwater in the flow-through cell.

7.7 CLOSING NOTES

Once field activities are complete, secure the site in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly manage all PPE and IDW in conformance with SOP 6, the project-specific work plan, and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #11

GROUNDWATER SAMPLING PROCEDURE

Groundwater sampling procedures outlined in this Standard Operating Procedure (SOP) are designed to ensure that collected samples are representative of current site conditions. These procedures can be applied to permanently or temporarily installed monitoring wells, direct-push sample points, water supply wells with installed plumbing, extraction wells for remedial groundwater treatment systems, and excavations where groundwater is present. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

11.1 ACRONYMS AND ABBREVIATIONS

ID	inside diameter
DI	deionized
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DTW	depth-to-water
HASP	health and safety plan
IDW	investigation-derived waste
l/min	liters per minute
LNAPL	light non-aqueous phase liquid
mg/l	milligrams per liter
mV	millivolts
NAPL	non-aqueous phase liquid
NTU	nephelometric turbidity unit
ORP	oxygen reduction potential
PID	photoionization detector
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SOP	standard operating procedure
SU	standard units
TD	total depth
TOC	top-of-casing
VOCs	volatile organic compounds

11.2 MATERIALS

- Field book
- PPE
- Air quality monitoring equipment (e.g., photoionization detector [PID]) with calibration reagents and standards, as needed
- Electronic water level indicator or interface probe
- Water quality meter(s) with a flow-through cell, and calibration reagents and standards, as needed
- Field test kits, as needed
- Adjustable wrench or manhole wrench, as needed
- Well key(s), as needed
- Power supply, as needed
- Sampling containers and labeling/shipping supplies
- Deionized (DI) water
- Container(s) for water storage (e.g., bucket, drum)
- Pump or bailers, tubing, and associated lanyard materials
- Filters, as needed
- Decontamination supplies

11.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe, consistent manner; are in accordance with federal and state guidance; and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for conducting groundwater sampling and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), utility location (SOP 2), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), investigation derived waste (IDW) management procedures (SOP 5), equipment decontamination (SOP 6), and use and calibration of all sampling and monitoring equipment (SOPs 7 and 8). This SOP does not cover investigation planning, nor does it cover the analysis of the analytical results. These topics are more appropriately addressed in a project-specific work plan. Before groundwater sampling, be sure to review the project-specific work plan or quality assurance project plan (QAPP) and any applicable state and federal guidelines or sampling procedures. All sampling and monitoring references must be available for consultation in the field, including:

- Company SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan, PSP and/or HASP, and QAPP

11.4 GENERAL PROCEDURES

Although the techniques used to sample groundwater are varied, most sampling events can be broken down into a three-step sequence:

1. Gauging: The measurement of the water column height (i.e., total well depth less depth-to-water) within the well.

2 Purging: The removal of stagnant water from the well bore to ensure that samples collected are representative of groundwater conditions in the water-bearing zone surrounding the well.
3 Sample Collection: After purging, the collection of aliquots of groundwater in method-specific, preserved (as needed) containers.

The procedures and equipment that are used to accomplish these steps are project-specific and should be discussed by the project team before arriving onsite. All types of groundwater sampling, however, regardless of the equipment used, share common handling and management procedures that are designed to ensure the integrity of the samples collected. These procedures include:

- The use of new, disposable, decontaminated, or dedicated sampling equipment
- The use and rotation of the appropriate PPE
- Selection of a suitable sampling location and staging area

Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact with gloves soiled during collection of the previous sample. The gloves must not contact the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised. ***Gloved hands should not be used as a sampling device; always use the appropriate equipment to move the sample from the sampling device to the laboratory-supplied containers.***

11.5 EQUIPMENT SELECTION

Collect all samples using either new, disposable equipment or properly decontaminated sampling equipment. Groundwater purging and sampling equipment should be selected based on the analytical requirements of the project and the project-specific conditions (e.g., well diameter, depth to water, dissolved constituents, etc.) likely to be encountered. The equipment should be constructed of non-reactive, non-leachable materials (e.g., stainless steel, Teflon®, Teflon®-coated steel, polyethylene, polypropylene, etc.) that are compatible with the chemical constituents at the site. Note that project or regulatory guidance may limit the type of equipment for groundwater sampling.

Consider the following when choosing groundwater purging and sampling equipment:

- the diameter and depth of the well
- the depth to groundwater
- the volume of water to be withdrawn
- the sampling and purging technique
- the volume of sample required
- the analytes of interest

Select the decontamination procedures based on the types of sampling to be performed and media encountered; decontamination may require multiple steps or differing cleaning methods (see SOP 6 for decontamination procedures). In no case, should disposable, single-use materials be used to collect more than one sample.

11.6 PRE-SAMPLING CONSIDERATIONS

You should perform the following activities in preparing for sampling with all observations and measurements noted in the field book and on the project-specific groundwater monitoring log, if appropriate:

- Perform a quick reconnaissance of the site to identify sampling locations and evaluate the accessibility to the sampling location.
- Record the approximate ambient air temperature, precipitation, wind (direction and speed), tide, and other field conditions. In addition, any site-specific conditions or situations that could potentially affect the samples at the sample locations should be recorded.
- Record temporary sampling locations with respect to approximate distance to and direction from at least one permanent feature.
- Survey the breathing zone around the sampling location with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate.
- Install the pump, tubing, passive sampler or other appropriate sampling equipment to the depth prescribed in the project-specific work plan or QAPP.

- Containerize and manage purge water in accordance with the project-specific work plan.

It is important to minimize any sources of cross-contamination that could compromise the integrity of the groundwater samples. Consider the following:

- Position fuel-powered equipment away from the sample collection area, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling, decontamination) that could influence the sample. This is particularly important when screening samples in the field for volatile organic compounds with a PID but should not be limited to the active sample collection.
- Establish a secure sample staging area in an uncontaminated area of the site.

11.7 GAUGING PROCEDURES

All wells should be opened to the atmosphere in advance of sampling to allow any pressure differentials, which could artificially raise or depress the water column in the well, to dissipate. The wells should be inspected to ensure that the protective casing is intact and has not been damaged. Remove the well covers and all standing water around the top of the well casing (for flush mounted-protective covers), as necessary, before opening the inner well cap or plug. Unlock and carefully remove well cap and allow the well to stand undisturbed for a minimum of 15 minutes, or as required by the project-specific work plan, before conducting any down-hole testing or measurements. If required by the HASP, survey the open well casing and the breathing zone around the wellhead with a PID to ensure that the level of PPE is appropriate.

11.7.1 GROUNDWATER LEVEL AND TOTAL DEPTH MEASUREMENT PROCEDURES

Depth to water (DTW) and total depth (TD) measurements are collected prior to sampling and are used to determine the volume water to be purged from the well (if using techniques other than no-purge or low flow sampling). The DTW measurements are also used after the field event to establish the groundwater elevation, flow direction, and gradient. Unless otherwise directed, do not place any objects inside the casing of private water wells; accordingly, DTW and TD measurements should not be collected at private water wells. Measurements of TD are not required for low flow and no-purge sampling applications and should not be measured before sampling the well.

Water level measurements must be collected within the shortest interval possible from all the wells to be gauged during the event before beginning any purge and sampling procedures at the site. This will ensure a nearly instantaneous snapshot of the water levels before the formations are disturbed by pumping or acted upon by other outside influences, such as tides, precipitation, barometric pressure, river stage, or intermittent pumping of production, irrigation, or supply wells.

Record the following observations and measurements (and the time when they were collected) in the field book:

- Measure the casing inside diameter (ID) and record in inches
- Measure the DTW with an electronic water level indicator (or an interface meter, if non-aqueous phase liquid [NAPL] is potentially present – see procedures below) from the top-of-casing (TOC) at the surveyor's mark, if present, and record the depth (to the nearest 0.01 foot) in feet below TOC
- If no mark is present, measure from the north side of the casing and mark the measuring point with a knife, metal file (if the inner casing is metal) or indelible marker for future reference
- Measure the TD from TOC at the surveyor's mark or north side of the casing, as appropriate.

Measuring the depth of deep wells with long water columns can be problematic due to tape buoyancy and weight effects or sediment in the bottom of the well casing. Care must be taken, and proper equipment selection must be used in these situations to ensure accurate measurements. Multiple TD measurements in silt-laden wells can provide a more precise assessment of the bottom depth.

11.7.2 GAUGING WELLS WITH NON-AQUEOUS PHASE LIQUID

If NAPL is potentially present at the site, the DTW and NAPL thickness measurements are collected using an interface meter capable of distinguishing between the NAPL and the groundwater, or a weighted tape coated with the appropriate reactive indicator paste for the suspected NAPL. Measuring NAPL thicknesses must be done with care to avoid agitating the liquids and generating an emulsion. This is particularly the case for light NAPL (LNAPL; those having a density less than water), which are typically viscous oils that cling to the probe. Oil coating the probe can result in thickness measurements that are biased high (i.e., overestimate the thickness of the NAPL).

Conduct the following procedures to ensure an accurate measurement of the NAPL thickness:

- For LNAPL, slowly lower the electronic interface probe in the well casing until the electronic tone indicates the probe is at the top of the LNAPL layer; measure the depth below the TOC to the nearest 0.01 foot.
- To gauge the NAPL thickness, advance the probe slowly through the layer until the electronic tone indicates top of the water column and then slowly bring the probe back up to the bottom of the LNAPL. Repeat this process several times to ensure an accurate measurement of the bottom of the LNAPL layer (which can include bubbles and an emulsion layer).
- For dense NAPL (DNAPL), advance the probe through the water column until the tone indicates the top of the DNAPL layer; record the depth below TOC.
- To gauge the DNAPL thickness, advance the probe through the layer to the bottom of the well.

11.8 GROUNDWATER PURGING PROCEDURES

Purging is a process whereby potentially stagnant water is removed allowing the collection of samples that are representative of groundwater conditions in the water-bearing zone. The water in a well bore that has not been purged may be different than the surrounding formation due to exposure to ambient air. There are several purging (and no-purge) methods that may be used, depending on specific conditions encountered (e.g., DTW, hydraulic conductivity of the formation, etc.) and the sampling requirements. The purge/no purge options are described below.

- *Multiple Volume Purge:* Traditional well purging technique that relies on the withdrawal of the volume of the well bore and the surrounding filter pack (if present); three to five well volumes are typically removed using pumps or bailers. This methodology relies on equipment that is easy to obtain and use and is generally accepted in most states as an appropriate purging method.
- *Temporary Well Purge:* A variation of the multiple volume purge technique that often uses inertia lift pumps, peristaltic pumps, or bailers to remove water from a temporary well or discrete groundwater sampler (e.g., a groundwater profiler or direct-push screen point sampler). This is a less stringent technique that is typically done to minimize the turbidity of the samples, which can be high due to the lack of a well filter pack.
- *Private Water Well or In-Place Plumbing Purge:* A variation on the multiple volume purge technique whereby a tap or faucet is opened on a fixed water supply pipe and is allowed to remain open until the potentially stagnant water within the well casing and other components of the system (e.g., fixed piping, pressure tanks, etc.) has been removed and groundwater representative of the water-bearing zone is discharged at the tap.
- *Low Flow (Minimal Drawdown/Low Stress) Purge (and Sampling):* A modified purging technique that establishes an isolated, discrete, horizontal flow zone directly adjacent to the pump intake; this method requires the pump to be placed within a screened-interval or open borehole. Pumping rates are typically 0.1 to 0.5 liters per minute (l/min) or less to minimize the stress on the surrounding formation and reduce the geochemical alteration of the groundwater caused by pumping.
- *No-Purge/Passive Sampling Techniques:* These techniques use specialized equipment, such as trap-style samplers or permeable diffusion bags, to sample the undisturbed water column within a screened interval or open borehole. This methodology assumes that the water in the well is representative of the surrounding formation. This approach is well suited for some volatile organic compounds (VOCs), metals, and hydrophobic compounds, depending on the sampling device used.

11.8.1 CALCULATING ONE PURGE VOLUME

Multiple volume purging techniques require that a ***minimum*** of three well volumes of water must be removed before sample collection. The actual amount of water removed may be greater than the three volumes, depending on geochemical parameter stabilization (the field measurement of these parameters is discussed below).

Calculate the volume of water in a well or boring using the following equation:

$$\textbf{Volume (gallons)} = \textbf{(TD – DTW) x ID}^{2} \textbf{ x 0.041}$$

where:

TD = total depth (feet)

DTW = depth to water (feet)

ID = inner diameter (inches)

Alternately, the volume of water in a well or boring may also be calculated by multiplying the water column height by the gallons per foot of water for the appropriate well or boring diameter:

ID	Gallons per foot of water	Gallons per three water columns
1-inch	0.04	0.12
2-inch	0.16	0.48
3-inch	0.37	1.11
4-inch	0.65	1.98

Calculate the total volume of the pump, associated tubing and container for in situ measurements (flow-through cell), using the following equation:

Volume (in gallons) = P + ((0.0041)*D2*L) + fc

where:

P = volume of pump (gallons)
D = tubing diameter (inches)
L = length of tubing (feet)
fc = volume of flow-through cell (gallons)

11.8.2 MULTIPLE VOLUME PURGE PROCEDURES

Begin purging at a rate that will not cause excessive turbulence and drawdown in the well; commonly less than 1 gallon per minute for a typical 2-inch diameter monitoring well. You may need to observe the water elevation after the pump is started and adjust the flow rate to minimize the amount of drawdown in the well casing. The objective is to remove the stagnant water in the casing and surrounding filter pack or open borehole allowing water from the surrounding water-bearing zone to enter the well for sampling with as little disturbance as possible. Excessive pump rates or well dewatering can result in higher turbidity, potential volatilization, and geochemical alteration of dissolved parameters.

Typically collect geochemical parameters (i.e., pH, specific conductance, dissolved oxygen [DO], oxygen-reduction potential [ORP], and temperature) at a minimum frequency of once for every well volume of water removed during the purge process. Record the measurements in the field book along with any other pertinent details, such as the visual quality of the water (e.g., color, odor, and presence of suspended particulates) and the approximate withdrawal rate (this can be estimated using a calibrated container and stopwatch). Review the geochemical measurements to ensure that readings have stabilized (after the minimum purge volume has been achieved). This is a proxy for determining that you are purging formation water rather than potentially stagnant water in the casing. Stabilization occurs when at least three consecutive measurements are within the following tolerances:

Multiple Volume Purge Stabilization Parameters	
pH	± 0.1 standard units (SU)
Specific Conductance	± 3%
Temperature	± 3%
Dissolved Oxygen (DO)	± 0.2 milligrams per liter (mg/l) or 10% (flow-through cell only)
Turbidity	± 10% for values greater than 10 nephelometric turbidity units (NTU)
Oxygen Reduction Potential (ORP)	± 10 millivolts (mV; flow-through cell only)

Parameter stabilization that does not occur within five well volumes may require you consult your project manager to decide whether to collect a sample or to continue purging. Wells with extremely slow recharge may also be problematic. Purging these wells, in some cases, may result in dewatering the well before the minimum purge can be completed. Allow wells or borings purged dry to recharge to a level of approximately 90% of the static (pre-purge) water elevation and proceed immediately to sample collection. If recovery exceeds 2 hours, sample as soon as sufficient sample volume is available, in accordance with applicable regulations.

11.8.3 LOW FLOW PURGE PROCEDURES

Low flow purging and sampling is used to obtain representative groundwater samples without removing all the water within the well. The protocol uses relatively low pumping rates (i.e., less than 0.5 l/min) to establish an isolated zone around the inlet of the pump where flow is horizontal (i.e., from the water bearing zone) rather than from the stagnant water in the well casing above and below the pump. Selection of an appropriate pump is critical to establishing the flow zone: it must be well suited for both low pumping rates and the analytes being sampled. Bailers are not appropriate for low flow sampling.

The set-up for low flow sampling includes positioning the pump at the appropriate depth within the casing such that the pump inlet is within the screened section of the well. Slowly lower the pump, where appropriate, and tubing into the water column to avoid agitating the water column; use of a lanyard is recommended (i.e., do not use the extraction tubing to lift or lower the pump). Secure the pump and/or tubing at the wellhead once the specified sampling depth has been achieved and record the depth in the field book. Avoid contacting the bottom of the well by using pre-cut tubing at the appropriate length or by lowering the pump/tubing simultaneously with an electronic water level indicator. Once the pump/tubing has been inserted and secured, allow the water levels to return to static conditions before initiating the purge.

The discharge tubing must be connected to an in-line flow-through cell equipped with a multi-parameter real-time water quality meter. The flow-through cell minimizes the exposure of the groundwater to ambient air, which can influence DO and ORP measurements.

Start the pump and maintain a steady flow rate that results in a stabilized water level (less than 0.3 feet of drawdown or as specified in the project-specific work plan). The pumping rate may need to be adjusted depending on the response of the water levels in the well. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment. Purging should not exceed 0.5 l/min.

During purging, monitor and record the flow rate and geochemical parameters at 30 seconds to 5-minute intervals (depending on the hydraulic conductivity of the aquifer, diameter of the well, and pumping rate). Stabilization occurs once the following criteria have been met over three successive measurements made at least three minutes apart:

Low Flow Purge Stabilization Parameters	
Water Level Drawdown	<0.3 feet
pH	± 0.1 SU
Specific Conductance	± 3%
Temperature	± 3%
DO	± 0.2 mg/l or 10% (flow-through cell only)
Turbidity	± 10% for values greater than 10 NTU
ORP	± 10 mV (flow-through cell only)

Record any other notable observations in the field book (e.g., groundwater color).

11.8.4 NO-PURGE SAMPLING TECHNIQUES

Several alternate sampling devices are available, such as equilibrated grab samplers, passive diffusion samplers, and other in situ sampling devices, that will allow sample collection without purging the well. These devices may be particularly useful for sampling low permeability geologic materials, assuming the device is made of materials compatible with the analytical parameters, meets data quality objectives, and has been properly evaluated.

No-purge grab or trap samplers are placed in the well before sampling and typically remain closed (i.e., no water is allowed into the sampler during insertion) until the sampler is activated. This allows the sampler device to equilibrate with the surrounding groundwater (to prevent adsorption to the sampler materials) and for the groundwater to recover and re-establish the natural flow after the disturbance caused by the sampler insertion into the well. Typical equilibration times depend on the well recovery rates and the type of sampler used. Samples recovered using the no-purge devices are either transferred to containers at the well head or the sampler itself is shipped to the laboratory for analysis. Examples of equilibrated grab samplers include HydraSleeve™, Snap Sampler™, and Kemmerer samplers.

Equilibration time for diffusion samplers are generally dictated by the diffusion rate through the permeable membrane and, thus, are less sensitive to changes induced within the well during deployment. Most diffusion bag samplers have a minimum equilibration time of 14 days prior to sample collection. The samplers may be deployed for an extended period (e.g., three months or longer), although the continuous exchange between the sampler and the well water means that the sampler will likely reflect only the conditions in the few days preceding the sample collection.

11.8.5 TEMPORARY WELL PURGE PROCEDURES

Procedures used to purge temporary groundwater monitoring wells differ from permanent wells because temporary wells are installed for immediate sample acquisition. Wells of this type may include open bedrock boreholes, standard polyvinyl chloride well screen and riser placed in open boreholes, or drilling rod-based sampling devices (e.g., Wellpoint®, Geoprobe® screen point or Hydropunch® samplers). Purging temporary wells of this type may not be necessary because stagnant water is typically not present. However, if water is used in the drilling process, purging would be necessary. Purging can minimize the turbidity in the sample, which can be significant due to the disturbance caused by the sampler installation and to rinse the sampling system with groundwater. The exception is for groundwater profiling applications (e.g., using a Waterloo Profiler®) where a more rigorous purge is used (using the multiple volume purge techniques described above) to limit the potential for cross-contamination between sample intervals.

11.8.6 PRIVATE WATER WELL OR IN-PLACE PLUMBING PURGE PROCEDURES

The configuration and construction of private water wells varies widely and access points for obtaining groundwater samples may be limited. WSP personnel should coordinate with the property owner or site representative to access functioning ports and valves to avoid causing any inadvertent damage.

Collect the groundwater sample as close to the well as possible (e.g., from a sample port at the well head) to ensure the sample is representative. Ideally, the sample should be collected upstream of the piping and treatment equipment (e.g., particulate filter, water softener, carbon filters, ultra-violet lights), heating unit, or storage tanks. The following potential sampling locations are presented in order of preference:

- Sampling port or spigot near the well head or piping system prior to entry into the storage tank
- Sampling port or spigot at storage tank
- Sampling port or spigot downstream of the pressure tank or holding tank but upstream of any water treatment equipment
- Tap or faucet

If purging from a tap or faucet, try to remove any aerators, filters, or other devices from the tap before purging and work with the property owner or site representative to bypass any water treatment systems. Document where the sample was collected and any steps that were taken to minimize the potential alteration of the water sample in the field book.

Purge the system by opening the tap or spigot and allowing the water to run for several minutes. Observe and record the purge rate for the system. The minimum purge volume must be more than the combined volume of the pump, tanks, piping, etc. Review the geochemical measurements (after the minimum purge volume has been removed) to ensure that readings have stabilized using the same procedures as those used for the multiple volume purge detailed above. Purge the system for a minimum of 15 minutes if the minimum volume is unknown. Sample only after the geochemistry parameters have stabilized and no there are no suspended particles (e.g., iron or rust) visible. Record the final purge volume in the field book and any water quality observations.

11.9 GROUNDWATER SAMPLE COLLECTION PROCEDURES

Collect groundwater samples as soon as possible after the geochemical parameters indicate representative groundwater is present. As practically possible, reduce the pump flow rate, but maintain a flow rate high enough to deliver a smooth stream of water without splashing or undue agitation. Collect samples directly from the tubing as it exits the well bore; do not sample on the downstream side of flow-through cells or any other instrumentation. If using a bailer for sample collection, lower and raise the bailer slowly and smoothly to minimize the disturbance to the water within the well.

Collect groundwater samples in order of volatilization sensitivity with organic compounds sampled first followed by inorganic compounds:

- VOCs
- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Per- and Polyfluoroalkyl substances
- Total metals
- Dissolved metals (see filtering procedures below)
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

Collect quality assurance/quality control samples in accordance with SOP 4 and the project-specific work plan or QAPP.

As necessary, conduct field tests or screening in accordance with the project-specific work plan and manufacturer's specifications for field testing equipment. Field samples must be directly transferred from the sampling equipment to the container that has been specifically prepared for that given parameter; intermediate containers should be avoided. If field chemical preservation is required, check the pH preservation by pouring a small portion of sample onto a pH test strip Adjust pH with additional preservative, if necessary.

Record the sample depth interval, if applicable, in the field book. Note the volume, phases, odor, and color of the groundwater.

11.9.1 GROUNDWATER FILTRATION PROCEDURES

Filtered groundwater samples are sometimes used for field kit analyses and should only be collected for laboratory analysis after approval from the appropriate regulatory agency or project manager. The filtered samples can be collected by attaching the in-line filter directly to the outlet tubing for a pressurized bailer, a submersible pump or a peristaltic pump. Intermediate containers can be used with a peristaltic pump if the well is too deep to use the pump to recover the sample directly. The intermediate container should be unpreserved laboratory-supplied glassware to avoid any cross-contamination during the filtering process.

Filtered samples using pumps should use the following procedures:

- Use a variable speed peristaltic pump with the in-line filter fitted on the outlet end of the tubing and the pump inlet tubing into the intermediate container holding the unpreserved groundwater sample; or,
- If a submersible pump is used to collect the groundwater sample, attached the in-line filter to the outlet end of the tubing (do not allow the groundwater to pass through flow-through cells or any other instrumentation while sampling)

Once the filter is connected:

- Turn on the pump and maintain a flow rate high enough to deliver a smooth stream of water without splashing or undue agitation. Hold the filter upright with the inlet and outlet in the vertical position and pump groundwater through the filter until all atmospheric oxygen has been removed and the minimum volume of water has been flushed through the filter, in accordance with the manufacturer's specifications
- Collect the filtered samples by placing the filtered output directly into the sample container
- If sediment is visible in the sample container after filtration, filter break-through has occurred and the sampling and filtering process should be repeated
- Discard the tubing and filter appropriately

Record sample filtration in the field book.

11.9.2 NON-AQUEOUS PHASE LIQUID SAMPLING PROCEDURES

Non-aqueous phase liquid is typically sampled to identify the compound, usually through an analytical "fingerprint" analysis. If samples are to be collected, the sampling options and techniques should be discussed with the assigned WSP compliance professional and project manager to ensure that the NAPL is either not considered to be a hazardous material for shipping to the laboratory or is properly shipped by qualified personnel using appropriate shipping containers (SOP 3). Samples of NAPL should be collected using the same procedures as above and placed in the appropriate laboratory-supplied containers, packed on ice, and shipped to the analytical laboratory using procedures outlined in SOP 3.

11.9.3 SAMPLE LABELING AND PREPARATION FOR SHIPMENT

Groundwater samples for offsite laboratory analysis should be prepared as follows:

1. Clean the outside of the sample container, if necessary
2. Affix a sample tag or label to each sample container and complete all required information (sample number, date, time, sampler's initials, analysis, preservatives, place of collection)
3. Place clear tape over the tag or label (if non-waterproof labels are used), as needed
4. If needed, preserve samples immediately after collection by placing them into an insulated cooler filled with bagged wet ice to maintain a temperature of approximately 4°Celcius
5. Record the sample designation, date, time, and the sampler's initials in the field book and on a sample tracking form, if appropriate
6. Complete the chain-of-custody forms with appropriate sampling information, including:
   - location
   - sample name
   - sample collection date and time
   - number of sample containers

- analytical method
- field filtration status

7 Secure the sample packing and shipping in accordance with proper procedures

Do not ship hazardous waste samples without first consulting a WSP compliance professional.

11.10 CLOSING NOTES

Secure and restore the site once sampling is completed. This may include locking permanent monitoring wells, staging the IDW, and disposing of (in conformance with applicable regulations) sampling expendables, such as plastic sheeting, tubing, and PPE. All locations where temporary wells or other sampling devices (e.g., profilers or direct-push equipment) should be marked with spray paint, stakes, or other appropriate method for future reference or survey, including collecting Global Positioning System coordinates and photographs, in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly manage all PPE and investigation-derived wastes in conformance with SOP 6, the project-specific work plan, and applicable regulations.

APPENDIX

F

RELEASE MONITORING AND RESPONSE PLAN

Persulfate Release Prevention
Persulfate Injection at 1613 East Joppa Road, Towson

The following steps will be taken to monitor potential persulfate migration and water quality impacts in the groundwater collection system at Ridgely Manor Park and prevent downstream water quality impacts.

Before conducting the injections, establish an on-call arrangement with an emergency response contractor in case groundwater entering the collection system is significantly impacted by persulfate injection and needs to be recovered to prevent discharge to surface water.

Materials:
- PPE
- Field book
- Crowbar or alternate tool to open manhole covers
- Pocket knife or scissors
- Water sampling equipment (peristaltic pump with tubing and power supply [battery])
- Inflatable plugs or caps for 6-inch manhole discharge pipes (one for MH-23 discharge, and one for MH-21 discharge, if necessary).
- Lime/limestone for pH adjustment in the manholes, if necessary
- Water quality meter and calibration equipment for pH and ORP measurements
- Field test kits for iron, and persulfate testing
- Sample containers for field tests
- Distilled water
- Waste containers for water with test kit reagents and solid waste (tubing, test kit materials).
- Decontamination supplies
- Monitoring Program (CAP Addendum Table 1)

Emergency Contacts
- Pam Robertson, WSP 703-709-6500 (o) or 571-217-3621 (c)
- Dave Sarr, WSP 703-709-6500 (o) or 571-217-3628 (c)
- Ellen Jackson, MDE 410-537-3482 (o) or 410-365-6717 (c)

1. Manhole Monitoring Procedures Before Injection
    a. Locate and open collection lateral cleanouts to make sure they are accessible, then close them.
    b. Confirm operation of the groundwater treatment system, including the submersible pump in MH-21.
    c. Collect field measurements of pH, ORP, iron and persulfate from MH-21 and MH-23 to establish baseline levels, then close manholes MH-21.
    d. Place inflatable plug in the discharge (western wall) pipe in MH-23 but do not inflate, or place cap on the discharge.
    e. Ensure lime/limestone is available for pH adjustment if necessary (‘baskets’ or socks to place in manholes).

2. Begin Injections
    a. Start injections in IP-1 (farthest from collection system).
    b. Injections in IP-2 may begin while IP-1 injection is underway.
    c. Complete IP-1 and IP-2 injections before injecting material into IP-3.
    d. Inflate plug (or install cap) in the MH-23 discharge pipe before beginning injection in IP-3.

3. Procedures to Monitor Manholes During Injection (separate from wells)
    a. Measure pH and ORP in MH-23 at minimum 2-hour interval during IP-1 and IP-2 injections.
    b. Measure pH and ORP in MH-23 at 1-hour interval during IP-3 injection.
    c. If pH in MH-23 decreases by 1 standard units (SU) or more, or if ORP increases by 200 mV or more, double frequency of pH and ORP testing and begin testing for persulfate and iron with colorimetric field test kits.
    d. If the pH action level is triggered in MH-23 (see below), begin monitoring of water in MH-21 and the treated groundwater discharge.
    e. Contact Pam Robertson or Dave Sarr (WSP) by telephone if any action level is triggered.

MH-23 pH Action Levels

- At pH 5.5 SU – Reduce injection rate
- At pH 5 SU – Inflate plug or place cap in the MH-23 discharge pipe (if not already done). Place lime/limestone in MH-23 and downgradient manholes (MH-22, MH-21)
- At pH 4.5 SU – Stop injections and implement contingency plan for MH-21 pH adjustment system

MH-23 Persulfate Action Levels

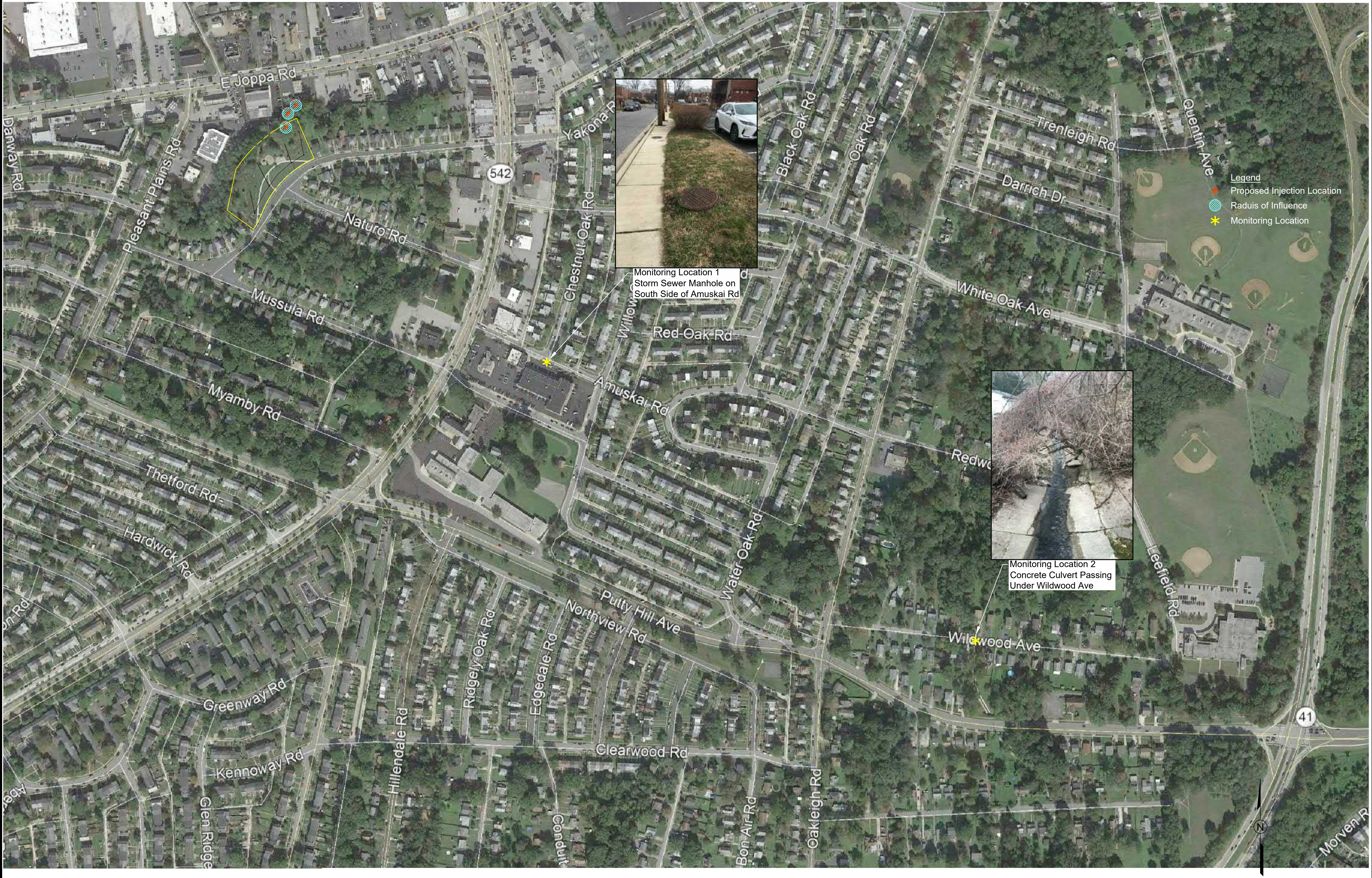
- Target persulfate in groundwater concentration is 20 grams per liter (g/l).
- Action level for monitoring is 2 g/l persulfate (1 g/l is test kit detection limit)
- At 2 g/l – Reduce injection rate
- At 5 g/l – Inflate plug in the MH-23 discharge pipe, if not already inflated, or confirm cap on discharge pipe is stopping flow. Place lime/limestone in MH-23 and downgradient manholes (MH-22, MH-21).
- At 10 g/l – Stop injections

4. Post-Injection Manhole Monitoring Procedures
    a. Continue monitoring pH and ORP of water in MH-23 (and persulfate and iron, if necessary) for at least 2 hours following the end of injections, using the procedures specified in Step 3.
    b. If a pH or persulfate action level is triggered in MH-23, leave the discharge pipe plugged for at least 8 additional hours. Otherwise, remove the plug.
    c. Once plug is removed in MH-23, monitor pH of the water in MH-21 and of the treated groundwater discharge. If an action level is triggered (see Step 3), plug the discharge end at MH-21 and continue monitoring every 2 hours. Alternately, conduct water quality monitoring at two downstream locations (see Step 5) and implement the contingency plan to add pH adjustment step to the treatment system (See Step 6).
    d. If no action level is exceeded, close and secure all manholes. Conduct daily monitoring of MH-21 and MH-23 for one week and bi-monthly monitoring for three months as listed in Table 1.

e. Purged groundwater with a pH greater than 5 s.u. and persulfate concentration less than 5 g/l will be discharged to the groundwater collection system and processed through the on-site GAC treatment system. Purged groundwater that does not meet these criteria will be drummed and characterized for offsite treatment and disposal with other liquid IDW. Spent tubing, used PPE, and sample containers will be decontaminated and disposed of as general trash.

5. Contingency Plan for Downstream Water Quality Monitoring
   a. If groundwater entering MH-21 has a pH less than 4.5 or persulfate concentration greater than 5 g/l, conduct water quality monitoring at the two locations shown in Figure F-1.

6. Contingency Plan to Add pH Adjustment to Treatment System
   a. If groundwater entering MH-21 has a pH less than 4.5, a calcite pH neutralizing filter containing NSF Standard 60 certified calcite media (APEC Water Systems Whole House Calcite Low pH Neutralizing Filter or equivalent) will be installed in the water treatment vault. Two filter housings will be installed in parallel downstream of the GAC units to raise the pH of treated water.



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Checked: CC 2/19/2020
Approved: 2/19/2020
DWG Name: 314V1965-001

RIDGELY MANOR PARK
TOWSON, MARYLAND
PREPARED FOR
HESS CORPORATION
WOODBRIDGE, NEW JERSEY

Figure F–1
CONTINGENCY MONITORING LOCATIONS

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