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Enbridge Line 6B MP 608 Releases

Marshall, MI

Evaluation of Potential Impact of Released Oil on Groundwater used for Drinking Water

(Hydrogeological Evaluation Report)

Prepared: October 30, 2010

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List of Acronyms

AMSL – above mean sea level

ATSDR – Agency for Toxic Substances and Disease Registry

bgs – Below Ground Surface

BTEX - Benzene, Toluene, Ethylbenzene and Xylene

CERCLA - Comprehensive Environmental Response Compensation and Liability Act

Company – Enbridge Energy, Limited Partnership

DCE - Dichloroethylene

DRO – Diesel Range Organics

gpm – Gallons Per Minute

FOIA – Freedom of Information Act

GRO – Gasoline Range Organics

HSP – Health and Safety Plan

MDNRE – Michigan Department of Natural Resources and Environment

MP – Mile Post

NAPL – Non-aqueous Phase Liquid

PNA – Polynuclear Aromatic Hydrocarbons

PCB – Polychlorinated Biphenol

PVC – Poly Vinyl Chloride

QAPP – Quality Assurance Project Plan

RI/FS – Remedial Investigation/Feasibility Study

RPDIA – Response Plan for Downstream Impacted Area

SAP – Sampling and Analysis Plan

SAR – Source Area Response Plan

SARA - Superfund Amendments and Reauthorization Act

SARCR – Source Area Response Completion Report

SCAT – Shoreline Clean-up Assessment Technique

SOPs – Standard Operating Procedures

SVOCs – Semi-volatile Organic Compounds

TCE - Trichloroethylene

TDL – Target Detection Limit

TDS – Total Dissolved Solids

TMB – Trimethylbenzene

TPH – Total Petroleum Hydrocarbons

USCOAE – United States Corps of Army Engineers

USCS – Unified Soil Classification System

U.S. EPA – Unites States Environmental Protection Agency

U.S. FWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

VOCs – Volatile Organic Compounds

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1.0 Introduction

On July 26, 2010, Enbridge Energy, Limited Partership ("Company") discovered a release of heavy crude oil from Line 6B, a 30-inch diameter line, just west of milepost 608 in the vicinity of its pump station located in Marshall, Calhoun County, Michigan (N1/2, Section 2, T3S, R6WLatitude: 42.2395273 Longitude: -84.9662018). The crude oil originated from the Cold Lake deposit in Alberta, Canada. The oil is designated "heavy" due to its thickness or viscosity. Heavy crude is composed of hydrocarbons, resins, asphaltenes and inorganic fractions. Other light-petroleum fractions, or diluents, were added to the heavy crude to facilitate pumping of the media over long distances. Line 6B is located in an undeveloped rural area, south of Marshall. The Studied Area Location Map is shown on **Figure 1**.

1.1 Background

The release entered Talmadge Creek and subsequently the Kalamazoo River at a time when the river was above flood stage. As a result, oil migrated down the Kalamazoo River and impacted flood plain areas including the shoreline, bank areas, and some overbank areas, upstream of the Morrow Lake Dam. In addition, submerged oil settled in portions of the river bottom upstream from the Morrow Lake Dam. Evaluations performed through the Shoreline Clean-up Assessment Technique (SCAT) process and through evaluations of river sediments, documented the conditions along the river. The SCAT process included manual removal of tarred soil, oiled debris, and pooled oil through low-pressure/high-volume flushing and absorption methods with downstream snare and boom capturer, under the direction of the United States Environmental Protection Agency (U.S. EPA). The results of the SCAT process is documented in the "Oil Recovery Report - Kalamazoo River" dated September 20, 2010.

Response activities completed and/or on-going since the release include, but are not limited to:

- Shut-down of pipeline and closing of isolation valves;
- Installation and operations of flumes (underflow weirs) downgradient of the release area;
- Installation and operation of oil and water containment and recovery systems;
- Development of a system of Mile Post (MP) markers to label all divisions of the river for study;

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- Development of plans for remediation of source area (Source Area Response (SAR) Plan) and of downstream impacts (Response Plan for Downstream Impacted Area (RPDIA);
- Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP);
- Sediment and surface water sampling;
- Source Area Response activities as documented in the Source Area Response Completion Report (SARCR);
- Downstream excavation of impacted soil;
- Air monitoring and sampling;
- Sampling and analysis of private and public drinking water wells;
- Shoreline Assessment Technique (SCAT) process; and
- Characterization and remediation activities for submerged oil.

1.2 Purpose and Overview

The purpose of this report, *Evaluation of Potential Impact of Released Oil on Groundwater used for Drinking Water (Hydrogeological Evaluation Report)* is to present the findings from the evaluation of short-term and long-term impacts of the released oil on groundwater that has a potential to be a source of drinking water. This report has been prepared in response to the Supplement to Order for Compliance under Section 311(c) of the Clean Water Act signed on September 23, 2010 (September 23, 2010 Supplement to the Order). The scope of work was conducted in accordance with the final work plan, "Enbridge Line 6B MP 608 Pipeline Release Marshall, Michigan, Supplement to the Sampling and Analysis Plan Referred to as "Work Plan for Evaluating the Potential Impact of Released Oil on Groundwater used for Drinking Water" (Groundwater Evaluation Work Plan), October 3, 2010. This work plan was conditionally approved by U.S. EPA on October 5, 2010.

1.3 Site Setting

The Site Study Area consists of a 38 mile long stretch of river, flood plain and associated areas as shown on **Figure 1** that starts from the release area (milepost 608 in the vicinity of its pump station located in Marshall, Michigan) downstream to the Morrow Dam. The first two miles of impact includes Talmadge Creek. The other 36 miles is along the Kalamazoo River. Land adjacent to the Site is primarily agricultural and woodlands, however, the river also traverses along residential properties and through the urban area of Battle Creek.

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Along the stretch of the study the geologic setting is variable but primarily consists of a layer of glacial drift with permeable sands and gravels that contain some clay units overlying bedrock. The upper bedrock consists of Marshall Sandstone in the Marshall Formation (Michigan Department of Environmental Quality, Geological Survey Division, 1987). Groundwater is present in the glacial drift and the underlying bedrock. According to the local health department and Michigan Department of Natural Resources and Environment (MDNRE) Wellogic Database, many residential wells are screened in the bedrock, while others are screened in the permeable sands and gravels above the bedrock.

The Kalamazoo River's role in the water cycle is that of a conduit through which surface water and groundwater drain to Lake Michigan. Available regional groundwater flow data (derived primarily from the United States Geological Survey (USGS) along the Kalamazoo River supports the preliminary conclusion that the river is dominantly a gaining river (http://gwmap.rsgis.msu.edu/viewer.htm). However, certain constraints may cause water from the Kalamazoo River to flow into the surrounding groundwater. Four examples of such constraints are: (1) abrupt increases in the water level of the river during floods which may cause a temporary reversal of the flow, (2) abrupt drops in water levels in the river across dams which can cause localized areas where surface waters flow through the ground around a dam; (3) pumping wells with high discharge rates located adjacent to the river; (4) storm water flow near urban areas where precipitation is channeled directly to the river with minimal groundwater recharge due to surface coverings. These conditions were used to develop goals for assessing oil impact of the river.

1.4 Goals

The primary goal of this study was to determine whether the Kalamazoo River is gaining or losing water at select locations where crude oil was identified during the SCAT process near potable wells. Additional goals included a review of publically available information related to the Kalamazoo River, regional geology and hydrogeology, and investigations and studies previously performed in the Study Area. The evaluation focused on the potential for river water to migrate and transport potential crude oil constituents to groundwater and subsequently drinking water at select locations where crude oil was identified during the SCAT process near potable wells and localized groundwater hydraulics might be complex due to the river configuration (for example tight meandering curves) or at Ceresco Dam. The study did not include long-term monitoring, or a comprehensive study of the whole river

and every outfall. Rather the study focused on eight select areas where the potential for risk to groundwater is the greatest. This report presents the results of these findings.

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2.0 Historical Information on the Kalamazoo River

Section 2.0 presents publically available information related to the Kalamazoo River, regional geology and hydrogeology, and investigations and studies previously performed in the investigative areas. Review and presentation of this information was one of the goals of the work plan.

2.1 Kalamazoo River

The Kalamazoo River is a tributary of Lake Michigan and is classified as a navigable water of the United States, within the regulatory jurisdiction of the United States Corps of Army Engineers (USCOAE) Detroit District. The jurisdictional cut-off of the navigable water is at Allegan Dam, approximately 31.5 miles above the confluence with Lake Michigan (USACOE, 2010).

The Kalamazoo River is approximately 123 miles long from the headwaters to the confluence at Lake Michigan. The headwaters originate at Round Lake for the North Branch of the Kalamazoo River, near Hanover, and Mosherville, for the South Branch of the Kalamazoo River. The North and South branches of the Kalamazoo River converge in Albion, Michigan. The main tributaries of the Kalamazoo River include: Talmadge Creek, Rice Creek, Battle Creek River, Wabascon Creek, Gun River, and Rabbit River. Other tributaries are also present. The Kalamazoo River's watershed drains an area of approximately 2,020 square miles, covering portions of ten counties in southern Michigan: Allegan, Barry, Eaton, Van Buren, Kalamazoo, Calhoun, Jackson, Hillsdale, Kent, and Ottawa counties. The drainage basin topography consists of gently rolling hills and the topographic relief is 686 feet from the headwaters to Lake Michigan (Wikipedia, 2010a; Rachol et al., 2005).

The river is classified as a sixth order warm-water stream supporting sport-fish, including trout, sunfish, perch, pike, and other species (Rachol et al. 2005; Wesley, 2005). In 2005, a fishery assessment was performed on the Kalamazoo River by the State of Michigan's Fisheries Division, which is further discussed in Section 2.6. Land-cover within the Kalamazoo River drainage basin is dominated by agricultural (53%) and forested land (27.4%) (Vogelmann et al., 2001). Much of the Kalamazoo River basin was originally forested land and grassland during pre-settlement (early to mid-1800's) times (Comer, 1998).

Within the Kalamazoo River basin, precipitation averages 35.7 inches annually, with greater than 50% of the rainfall occurring from April to September. During winter the average seasonal snowfall is 79.7

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inches (Knapp, 1987). A total of twenty-three (USGS) stream-gauging stations are located on the Kalamazoo River drainage basin from Albion to New Richmond, Michigan (Rachol et al., 2005). The Kalamazoo River has a median flow of 352 cubic feet per second at Marshall, Michigan from 2002 - 2009 (USGS, 2010a). By comparison, the river has a median stream flow of 778 cubic feet per second at Battle Creek, Michigan (USGS, 2010b).

Wesley (2005) demarcated the river into five sections: Mouth (from Lake Michigan to Allegan Dam), Lower (Allegan Dam to Otsego), Middle (Otsego to Battle Creek), Upper (Battle Creek to Homer, Albion and Moscow), and the Headwaters (Homer, Mosherville, and Moscow areas). The eight investigative target areas lie within the Upper and Middle portions of the Kalamazoo River (**Figure 2**). The investigative target area locations are defined as follows:

- Target Area 1 Mile Post 2.25 to 3.25
- Target Area 2 Mile Post 5.50 to 6.00
- Target Area 3 Mile Post 15.00 to 15.50
- Target Area 4 Mile Post 22.50 to 23.00
- Target Area 5 Mile Post 26.50 to 27.25
- Target Area 6 Mile Post 34.00 to 34.75
- Target Area 7 Mile Post 36.00 to 36.25
- Target Area 8 Mile Post 36.75 to 37.25

Dams, diversion structures, and channelization have affected sediment deposition along the Kalamazoo River since human settlement in the mid-1880's (Rachol et al., 2005). A total of 111 dams are present along the Kalamazoo River watershed (Wesley, 2005). Within the investigative target areas along the Kalamazoo River, two dams are present at the community of Ceresco and at Morrow Lake. Target Area 2 is located at Ceresco Dam and Target Area 8 is located at Morrow Lake. Numerous environmental studies have been performed at sites along the Kalamazoo River (Simard, 2003) and are summarized in **Appendix A**.

2.2 Regional Geological Setting

Within the investigative area, the primary bedrock units are Mississippian in age and include the Marshall Sandstone throughout the Kalamazoo River basin in Calhoun County, and the Coldwater

Shale in portions of Kalamazoo County (Dorr and Eschman, 1970; WMU, 1981). Depth to bedrock varies within the investigative area from ground surface to approximately 200 feet below ground surface (approximately 700 to 900 feet above mean sea level (amsl)). Within the Kalamazoo River basin, the bedrock topography ranges from approximately 1100 feet amsl near the headwaters to 400 feet amsl near Lake Michigan (WMU, 1981). The bedrock units have a slight dip to the northeast (Vanlier, 1966).

The Marshall Sandstone consists of an upper Napoleon sandstone member and the lower Marshall Sandstone. The upper member is recognizable only in exposures in the southern part of the Michigan basin, including the investigative area. The Napoleon sandstone is locally considered an unconfined aquifer (Apple and Reeves, 2007). Erosional terraces of Marshall Sandstone outcrop at various locations along the Kalamazoo River, including at Ceresco Dam.

The upper surface of the Marshall Sandstone is an erosional contact, which is typically weathered, friable, fractured, and surficially irregular. At depth, the sandstone is a massive bedded unit and grain-size generally decreases with depth (Apple and Reeves, 2007). Generally, the Marshall Sandstone is sparsely fossiliferous, sometimes cross-bedded and rippled, very fine- to coarse-grained sandstone of buff, tan, or gray color. Interbeds of siltstone, sandy shale and shale, are also present at depth. The lower Marshall is mostly fine-grained sandstone with some very fine sand intervals. It is fossiliferous and generally flat-bedded (USGS, 2010c; Apple and Reeves, 2007).

Quaternary geology of the Kalamazoo River watershed from Morrow Lake to Marshall is mapped as glacial outwash sand and gravel and postglacial alluvium (Wesley, 2005; Rachol, et al., 2005). The predominant glacial feature of the area is the Tekonsha Moraine, extending generally parallel to the Kalamazoo River from Morrow Lake, in Kalamazoo County, eastward into the river's headwaters in Jackson and Hillsdale Counties. The Tekonsha Moraine is composed of coarse-textured sandy till, with thin clay layers and discontinuous horizons of sand and gravel (Passero, 1978; Deutsch et al., 1960; Apple and Reeves, 2007).

Glacial geology within the Kalamazoo River basin is described as complex, and lithostratigraphic correlation can be difficult due to lateral and vertical heterogeneity of glacial deposits with a complex depositional history. Modern alluvial sediments present along the river further add complexity and can be difficult to differentiate from glacio-fluvial outwash (Apple and Reeves, 2007).

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The main soils types of the Kalamazoo River basin are loam, sand, and muck (Rachol et al, 2005). Within the investigative area the predominant general surficial soil types are sandy loam, fine sand, and sandy clay loam. Wetland areas containing muck are also present.

2.3 Regional Hydrogeology

The Kalamazoo River basin consists of an assortment of glacial outwash sands, coarse end-moraine deposits (sands and gravel), fine end-moraine deposits, ice contact material (sorted sands and gravel), clayey till, lake plain deposits, and post-glacial and modern alluvium. Most of the glacial geology is made up of permeable outwash (41%), whereas lacustrine deposits in the basin are less frequent (6%) (Wesley, 2005). These glacial deposits affect groundwater movement and the behavior of streams and rivers. The Kalamazoo River basin, which is dominated by well-drained outwash, coarse end-moraine deposits, and ice contact deposits have higher groundwater yields compared to basins with less permeable deposits (Bent, 1971).

In these well-drained soils, with Great Lakes temperate climate, a large amount of precipitation and snow-melt percolates to the groundwater and ultimately flows to the Kalamazoo River and associated tributaries and wetlands. In poorly-drained soils, such as fine till deposits, infiltration capacities are low, so most precipitation reaches the river basin as surface runoff. Outwash is the predominant depositional material in the basin, and contributes to moderately high groundwater deliveries to the river system (Wesley, 2005).

Rice Creek, Battle Creek River, and Wabascon Creek are main tributaries feeding the Kalamazoo River along the Study Area. These waterways primarily drain glacial outwash sand and gravel, and postglacial alluvium. Rice Creek drains coarse end moraines and coarse till plains with moderate topographic relief over outwash plains. The result is groundwater flow proximal to the confluence of the Kalamazoo River, near Marshall, Michigan. The Battle Creek River drains medium to fine-textured till plains and low-to-moderate relief end-moraines. Wabascon Creek, midway between Battle Creek and Augusta, Michigan, near Target Area 4, drains from a mixture of moderate-relief coarse end-moraines, coarse till plains, and outwash plains.

In the investigative area, the glacial aquifer consists primarily of outwash and morainal deposits. Hydraulic conductivities of these soils are extremely variable. The estimated hydraulic conductivities of glacial soils at the Verona Well field, in Battle Creek, are 110 ft/day (channel deposits), 70 ft/day

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(outwash), 30 ft/day (inter-bedded outwash), and 15 ft/day (till) (Grannemann and Twenter, 1985). Hydraulic conductivities determined during this investigation fall within the published values. The slug test data are further discussed in Section 5.

2.4 United States Geological Survey Studies

Numerous studies along the Kalamazoo River watershed have been prepared by the USGS (USGS, 2010d). Some available studies pertinent to the investigation are presented.

Rachol *et al* (2007), USGS, Lansing, Michigan, prepared "Historical and Simulated Changes in Channel Characteristics of the Kalamazoo River, Plainwell to Otsego, Michigan" in cooperation with U.S. Environmental Protection Agency, Region V, and the Michigan Department of Environmental Quality (MDEQ) now MDNRE. The study was completed to better understand the potential effects of construction and decommissioning of dams on the Kalamazoo River, and to simulate potential channel changes that could result if dams were removed. The study focused on an 80-mile reach from Morrow Dam to the river mouth at Lake Michigan (areas downstream from the investigative areas presented in this report).

The study is significant in identifying that dam impoundments are potentially contaminated-sediment sinks, and that dams can regulate the downstream migration of contaminant-impacted sediments through adjustment of impounded water levels, and incising of bottom-sediments, erosion, avulsion, and transport of sediments. Historical channel change at the mouth of Morrow Lake (Target Area 8) is presented in Appendix C10 of the USGS report (Rachol et al., 2007).

According to a review of a Michigan State University Interactive Map Viewer (http://gwmap.rsgis.msu.edu/), the USGS has three observation wells near the confluence of the Kalamazoo River and Morrow Lake, one observation well north of Augusta, and one observation well north of the Kalamazoo River, near Target Area 4. These wells are summarized below:

USGS Station ID	Location	Lat	Long	Depth (feet)	Depth to Water Range (feet below LS)	Dates
#421614085270801	Miller Drive at Morrow Lake	42.2705979	-85.452223	27	6 to 13.5	1987 - 2005
#421616085262801	Galesburgh Rest Area	42.2711534	-85.441112	47.7	20.8 to 21.6	1987 - 1988
#421713085264601	E. Michigan Avenue, North of Morrow Lake	42.2878196	-85.445279	29	13.2 to 16	1987 - 2005
#422056085211701	N. 42cnd St. North of Augusta	42.3489291	-85.354723	34.8	9.8 to 12	1987 - 2005

USGS Station ID	Location	Lat	Long	Depth (feet)	Depth to Water Range (feet below LS)	Dates
#422207085175501	Michigan Ave, north of Kalamazoo River, near Area 4.	42.3675398	-85.29861	62.5	1.2 to 3.65	1987 - 2002

Review of hydrographs for these observation wells indicates fluctuating water levels, especially at Morrow Lake (USGS Station 421614085270801). Based upon data recorded in 2005, the high water level was approximately 6 feet below ground surface (bgs) in mid-January and March, and low water level was approximately 11 feet below ground surface (bgs) in mid-October and mid-April. USGS hydrographs are included in **Appendix B**.

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3.0 Investigation Methods

This section presents the methodology of the study relative to the potential for impacted surface water to impact groundwater and subsequently adjoining potable water wells. To complete this study, eight target areas were defined as previously described. In addition, this study summarizes the results of the potable well sampling.

3.1 Target Areas of Investigation

Eight target areas were selected and evaluated along the Kalamazoo River as part of the investigation. The target areas were selected based on river conditions, hydrogeologic principles, location of potentially vulnerable potable wells, distribution of crude oil observed during the SCAT process, and submerged oil observations. The investigations in each target area were designed to accomplish the following objectives:

- Determine if the Kalamazoo River is gaining or losing at each target area at the time of the study;
- Determine if drinking water aquifer is impacted, or has the potential to be impacted, by released oil;
- Generate information on the hydrogeologic conditions along the Kalamazoo River such as the direction of hydraulic gradients, at the time of the study, and the hydraulic characteristics of the aquifer near the river;
- Install monitoring wells for long term monitoring, and

Monitoring well locations were situated within the target areas based partially on access constraints. The eight target areas, shown in **Figure 2**, were identified for hydrogeological evaluation based on the following criteria:

- Proximity of historic pooled or submerged oil relative to potable wells;
- Areas with potential for demonstrating losing stream characteristics such as at retention areas such as dams (ie. the Ceresco Dam);

- Locations identified where gaining conditions may be less pronounced such as association with tighter meanders in the river, and

- Additional areas near potable wells.

3.2 Point of Reference

Approximately 38 linear miles of surface water and adjacent floodplains have been impacted from the crude oil release. As a method of reference to all areas associated with the crude oil release, a mile post system was developed from the release area to the Morrow Dam area. Due to the level of detail needed to reference each area of the river, the mile posts have been divided into quarter sections (ie. MP 4.25) with a reference to the left (L) or right (R) bank with the downstream flow of the river. The table below summarizes the eight Target Areas of study and their location (mile post), purpose, and number of monitoring wells installed within each of the eight Target Areas.

Target Area	Mile Post Range	Purpose/Objectives	Wells
1	2.25 to 3.25	• Develop conceptual site model (south side) • Document vertical and horizontal gradient near the edge of the river • Document groundwater chemistry	3
2	5.50 to 6.00	• Evaluate groundwater flow at Ceresco Dam on both sides of river. • Document groundwater chemistry	9
3	15.00 to 15.50	• Evaluate if submerged oil impacted groundwater quality. • Document vertical and horizontal gradient near the edge of the river. • Document groundwater chemistry	3
4	22.50 to 23.00	• Evaluate if submerged oil impacted groundwater quality. • Document vertical and horizontal gradient near the edge of the river • Document groundwater chemistry	3
5	26.50 to 27.25	• Evaluate impact of tight river bends on adjacent groundwater flow. • Document the vertical gradient and groundwater chemistry.	3
6	34.00 to 34.75	• Evaluate impact of tight river bends on adjacent groundwater flow. • Document the vertical gradient and groundwater chemistry.	6
7	36.00 to 36.25	• Evaluate if submerged oil impacted groundwater quality. • Documents vertical and horizontal gradient near the edge of the river.	3

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Target Area	Mile Post Range	Purpose/Objectives	Wells
		• Document groundwater chemistry.	
8	36.75 to 37.25	• Evaluate if submerged oil is migrating to groundwater. • Document vertical and horizontal gradient near the edge of the river • Document groundwater chemistry.	3

The specific study/drilling locations at each of the target areas were selected based on accessibility within the target areas only. Specific drilling locations are depicted in **Figures 3 through 10.**

Target Area 1 is located upstream away from any historic submerged oil to assess hydraulic conditions near the confluence of Talmadge Creek with the Kalamazoo River.

Target Area 2 is the area of the Ceresco Dam. This area was chosen due to the change in the water level across the face of the dam and the potential for this abrupt change in hydraulic head along the river to cause groundwater to flow outward around the dam.

Four target areas (Areas 3, 4, 7, 8) were selected where submerged oil had been identified along sections of the Kalamazoo River. In these areas, the goal of the groundwater investigation was to investigate surface water/groundwater communication and assess if the oil had impacted groundwater and adjacent potable wells.

Two target areas (Areas 5 and 6) are located on tight meanders within the Kalamazoo River. This study evaluated how tight meanders influenced groundwater and surface water communication in these areas.

3.3 Residential Well Sampling

Residential well sampling was initiated by Enbridge after the release to monitor water quality at potable wells located near the impacted waterways. Wells within 200 feet of the impacted waterway were identified through a combination of direct visual observations of the properties, communication with property owners, communication with local health departments in Kalamazoo and Calhoun Counties, communication with Michigan Department of Community Health, and searching for well locations through publically available sources of information such as Michigan's Well Logic system (http://www.michigan.gov/deq/0,1607,7-135-6132_6828-16124--,00.html). Initially, potable wells

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were sampled when owners called in to Enbridge. Soon after the spill, this was converted into a formal process where Enbridge identified wells within 200 feet of the banks of the river. During October, the program expanded to include wells within 200 feet of the high water mark from the storm event that occurred at the time of the spill. The residential water wells have been sampled every other week for metals, total petroleum hydrocarbons (TPH)-oil range organics (ORO), TPH-gasoline ranged organics (GRO), TPH diesel range organics (DRO), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and polychlorinated byphenols (PCBs). The location of the residential water wells that have been identified within the 200-foot buffer of the high water mark are shown in **Appendix C.**

The initial well water sampling parameter list for the first two sampling events is presented in Table 4.4 of the approved SAP. Many of these parameters are not constituents of crude oil that impacted the site including, but not limited to, arsenic, lead, and PCBs. Once two sampling events at each identified well have no detected constituents related to crude oil, a modified sampling program will be proposed and implemented based upon sampling frequencies.

The results of the residential water sampling is uploaded to SCRIBE nightly and is available to the U.S. EPA, MDNRE, Michigan Department of Community Health, Kalamazoo County Health Department, and Calhoun County Health Department. A summary of the residential well sampling program as of October 26, 2010 is:

- 155 total wells were entered in the sampling program;
- 3 wells in the program could not be sampled because access had not been granted by the owner's representative;
- 27 wells were sampled on one occasion (these were recently added wells); and
- 98 wells were sampled two or more times.

The results of the residential water sampling completed as of October 26, 2010 are presented in **Appendix D**. The data indicate no detections of benzene, ethyl benzene, or TPH in any of the drinking water wells within the program. Two wells have exhibited detectable values of toluene and p,m-xylene. Other constituents potentially related to oil that have been detected in the drinking water

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wells include iron (present in most wells), nickel (present in two wells), and naphthalene (present in one sample).

One well reported detectable values of toluene on two sample dates including September 1st during the response phase and October 3 for a re-sample (0.3 and 1.0 ug/L, respectively). This property maintains a polyvinyl chloride (PVC) constructed well with observable PVC glue, of which toluene is a known VOC ingredient. The target detection limit (TDL) for toluene is 1 ug/L. The detectable values are not believed to be of concern as the values are well below the Michigan Part 201Residential Drinking Water Criterion for toluene (790 ug/L, aesthetic). One well displayed a detection for p,m-xylene (0.2 ug/L), also well below the Part 201 Criterion (280 ug/L, aesthetic). Additional sampling performed at this well did not exhibit detectable values of p,m-xylene. The TDL for p,m-xylene is 2 ug/L. As such, this additional hydrocarbon detection is not believed to be of concern or related to the crude oil spill.

Appendix C includes a table displaying the maximum and minimum concentrations of both iron and nickel by township as found in the MDNRE-supplied potable water well data. The Michigan Part 201Residential Drinking Water Criteria for iron and nickel are 0.300 mg/L and 0.100 mg/L, respectively. The minimum and maximum concentrations for iron found among the townships located within the 200-foot buffer are 0.01 to 16 mg/L. Data collected from potable water wells within the program range from 0.02 mg/L to 6.71 mg/L, well within the range of the MDNRE–supplied data. Maximum and minimum concentrations for nickel found among the MDNRE data range from 0.001 to 0.01 mg/L. Nickel concentrations displayed during the residential monitoring program range from 0.005 mg/L to 0.043 mg/L, slightly greater than that of the county data, but not exceeding criterion. It is unlikely that these detections are related to the crude oil spill.

Other constituents detected in potable wells potentially related to oil include naphthalene, present in one sample at 0.1 ug/L. Part 201Residential Drinking Water Criteria for naphthalene is 520 ug/L with a Michigan target detection limit of 5 ug/L. The concentration of naphthalene exhibited at this well is below that of the criterion and the target detection limit, and is unlikely to be related to the crude oil release.

The sampling program of these residential wells closest to the impacted waterways documents that crude oil constituents have not impacted the groundwater that is actually captured by these potable

wells. Although iron has been detected in most wells and nickel in some wells, both are a naturally occurring element and is not attributed to the impacts from the release.

3.4 SAP and QAPP

This hydrogeological study was performed following the methods and procedures outlined in the approved SAP and the QAPP. The SAP was finalized on August 17, 2010 and documents the sampling/analysis and quality assurance programs. In addition, the Drinking Water Well Supplement to the Sampling and Analysis Plan was finalized on September 27, 2010 and was prepared in response to US EPA's Supplement to the Order for Compliance under Section 311(c) of the Clean Water Act (the Order) dated September 23, 2010.

The QAPP was finalized on August 15, 2010. This QAPP provides documentation and direction on the organization, objectives, planned activities, specific quality assurance/quality control procedures for the Company's Response Project. Addendums to the QAPP include the September 3, 2010, Standard Operating Procedures for Check Valve Sampling and Sediment Logging.

3.5 Environmental Sites and Freedom of Information Act (FOIA) Search

Additional studies were reviewed and an on-line literature search performed through Google™ Scholar and U.S.EPA's STORET Database (U.S. EPA, 2010) to evaluate other potential site-specific scenarios where contaminants identified in the Kalamazoo River (or other river systems) impacted groundwater and drinking water wells. No studies were identified along the Kalamazoo River where dissolved contaminants found in the river migrated to drinking water sources.

Studies proximal to the investigative area are presented below.

Albion-Sheridan Township Landfill (ASTL) Site

The Agency for Toxic Substances and Disease Registry (ATSDR) performed a Public Health Assessment at the Albion-Sheridan Township Landfill (ASTL) site, in Sheridan Township, Michigan (ATSDR, 1997). This site is located near Albion, approximately 20 miles upstream of the Study Area. The site is summarized because of biota sampling performed near Ceresco Dam. In July 1987, the MDNR collected fish for tissue analyses from the Ceresco Impoundment, approximately 20 miles downstream from the ASTL site. The collected fish included nine carp, one

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largemouth bass, and one smallmouth bass. The highest PCB concentration found was in one of the carp (0.24 ppm) in a skin-off fillet sample. ATSDR concluded that PCBs identified in the carp were at concentration commonly found in fish from Michigan waters, even in areas with no known PCB source.

ATSDR noted that contaminants (elevated concentrations of iron, sodium, potassium, lead, magnesium, calcium, ammonia, total chromium, copper, and zinc) originating on the ASTL site could reach the Kalamazoo River and its associated wetlands via discharge of contaminated groundwater or surface runoff. ATSDR also noted that there was no record of any municipal or private water supply using water directly from the Kalamazoo River.

Other Sources of Contaminant Impact

Anthropogenic and natural sources of contamination exist within the Kalamazoo River basin and associated glacial deposits and bedrock. PNAs are present in crude oil from the Line 6B release; however PNAs are relatively insoluble in water (Neff, 1979). PNAs tend to adsorb onto solid phases in aquatic environments because of their hydrophobic nature and low water solubilities (Neff 1979; NRCC 1983; Eisler 1987).

PNAs are classified by the U. S. EPA as a pollutant of concern under the Lake Michigan Lakewide Management Plan, including Lake Michigan tributaries. PNAs are a group of compounds formed during the incomplete burning of fossil fuels, garbage, or other organic substances. Sources include vehicle exhaust, burning coal, forest fires and agricultural burning, asphalt roads, fossil fuels (crude oil and refined products) and tar.

3.6 Other Studies and Investigations

Michigan Part 201 sites of environmental contamination referenced by Wesley (2005) and as part of a Freedom of Information Act (FOIA) Search are presented in this section. Wesley (2005) identified 189 sites within the Kalamazoo River watershed as being regulated under Part 201 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Many of these sites are deemed to have high potential for migration of groundwater contaminants to the Kalamazoo River, especially in areas with high groundwater flows (Wesley, 2005). A total of 22 sites are listed as sites under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of

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1980, as amended and the Superfund Amendments and Reauthorization Act (SARA) of 1986. These sites are summarized by river Section in tables in **Appendix A**. Many of these sites are located outside of the Study Area from Marshall to Morrow Lake.

Sites within the study area having potentially similar contaminants as the Enbridge release include those sites with benzene, toluene, ethylbenzene and xylene (BTEX), some metals, and those that are not specifically categorized by pollutants. These sites include:

Environmental Site	**Location / City**	**Relevant Pollutant**
Calhoun Co Road Commission	Marshall	BTEX
Clark Oil APEX Oil	Marshall	Benzene, Toluene
Consumers Energy	Marshall	PNAs
Residential Well 23 Mile Road	Marshall	Benzene, Toluene, Xylene
American Fibrit	Battle Creek	Heavy Manufacturing / Pollutant not defined
Battle Creek Adventist Hospital	Battle Creek	PNAs
Battle Creek Aquatic Center	Battle Creek	Metals, BTEX, PNAs
Calhound Co Road Commission	Battle Creek	Benzene, Toluene
Cereal City Landfill	Battle Creek	Benzene
East Columbia	Battle Creek	BTEX
Global Paint and Ink	Battle Creek	Xylene
GT Western Railroad	Battle Creek	Diesel Fuel
Kelloggs Kelpaco	Battle Creek	BTEX
Kendall Street	Battle Creek	PNAs
McLeieer Oil	Battle Creek	BTEX, PNAs, Metals
Michigan Paperboard Corp.	Battle Creek	Ethylbenzene, toluene, xylene, naphthalene
Quad L Corp.	Battle Creek	Ethylbenzene, toluene, xylene
Shay Motor Company	Battle Creek	Benzene, toluene

In addition to the sites identified above, a FOIA Search was performed at the MDNRE, Kalamazoo District on several dates in October 2010. A total of 86 sites were identified, evaluated summarized in **Appendix A**. The majority of sites identified are located in Battle Creek, Michigan. The following sites are located within 2,000 feet of the Kalamazoo River or one of the Target Areas:

K-Mart, 200 Capital Avenue SW, Battle Creek

This is a closed Part 213 Site located 1,200 feet northwest of Target Area 3. Historically, BTEX and PNAs were identified at the site. However, impact was not identified in groundwater because groundwater was not encountered during site investigation activities.

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Kellogg Foundation, 55 Hamblin Avenue, Battle Creek

This is a closed Part 213 Site located 1,500 feet north of Target Area 3. Historically, petroleum compounds were a concern at the site due to a spill, but no impacts were found in any media. The groundwater flows northwest toward the junction of the Kalamazoo and Battle Creek Rivers. Groundwater is approximately 15-16 feet bgs. This site is upgradient of Target Area 3 (north of the Kalamazoo River) and provides additional supportive documentation that groundwater flow in the vicinity of Target Area 3 is toward the Kalamazoo River.

Leatherman Oil, 455 Upton Avenue, Battle Creek

This is a Part 213 site located 2 miles north of Target Area 3, just south of the Kalamazoo River. Historically, BTEX, lead, and naphthalene were identified at the site in the soil and groundwater. The groundwater is 11-12 feet bgs and flows north-northeast toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity of Target Area 3 is toward the Kalamazoo River.

Neighborhoods, Inc., W 482 Van Buren, Battle Creek

This is a closed Part 213 site located 7,200 feet north-northwest of Target Area 3 and 1,000 ft northeast of the Kalamazoo River. Historically, lead was identified in site soils but not groundwater. The groundwater is approximately 37 feet bgs, and flows southwest toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity of Target Area 3 is toward the Kalamazoo River.

P.S. Food Mart, 1344 E Columbia Avenue, Battle Creek

This is a Part 213 site located 500 feet north of the Kalamazoo River and 8,000 feet southeast of Target Area 3. Historically, BTEX has been identified in soil and groundwater at the site. The groundwater flows northeast (away from the Kalamazoo River) at a gradient of approximately 0.01 foot/foot. Groundwater is approximately 37-39 feet bgs.

Former Sears Roebuck, 170 Capital Avenue, Battle Creek

This is a closed Part 213 site located 1,000 feet southwest of the Kalamazoo River and 2,000 feet northwest of Target Area 3. Historically, BTEX and PNAs were identified in the soil. Groundwater is approximately 18 feet bgs. No information is available regarding groundwater flow direction.

Trumbull Service Station, 94 North Avenue, Battle Creek

This is a Part 213 site located 1,000 feet northwest of the Kalamazoo River and 4,000 feet north-northeast of Target Area 3. Historically, BTEX and PNAs were identified in the soil and groundwater. The groundwater flows south-southwest, generally towards the Kalamazoo River. Groundwater is approximately 28 feet bgs. This site provides additional supportive documentation that groundwater flow in the vicinity of Target Area 3 is toward the Kalamazoo River.

Wagner-Flook Builders Inc, 235 Hamblin Avenue, Battle Creek

This is a closed Part 213 Site located less than 100 feet west of the Kalamazoo River and 4,000 feet north-northwest of Target Area 3. Historically, PNAs were identified in the soil. No information is available regarding groundwater flow direction.

W.K. Kellogg Institute, 2 Hamblin Avenue, Battle Creek

This is a closed Part 213 site located 1,000 feet northeast of the Kalamazoo River and 0.5 mile northeast of Target Area 3. Historically, BTEX, Methyl-Tert-Buthyl-Ether (MTBE), and lead were identified in the soil and groundwater. No information is available regarding groundwater flow direction.

Augusta Total Retail, 301 E Michigan Avenue, Augusta

This is a closed Part 213 site located 1.25 miles southwest of Target Area 5, but 600 feet north of the Kalamazoo near the confluence of Augusta Creek. Historically, petroleum compounds were identified in the soil and groundwater. The groundwater flows east-southeast toward the Kalamazoo River at a gradient of 0.001 foot/foot and a flow velocity of 32 feet/year. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

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Eaton Corp-Springfield, 463 N. 20th Street, Springfield

This is a Part 201 site located 2.25 miles northwest of Target Area 3 and approximately 2,500 feet south of the Kalamazoo River. Historically, chromium, mercury, and trichloroethylene (TCE), were identified in the groundwater. The groundwater flows northeast toward the Kalamazoo River at a gradient of 0.0072 foot/foot and a velocity of 3.2 feet/day. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

A.K. Zinn/K&M Salvage, 160 S. Kendall, Battle Creek

This is a Part 201 site located 1 mile northwest of Target Area 3, and approximately 1,200 feet south of the Kalamazoo River. Historically, VOCs, chromium, lead, and mercury were identified in the soil and groundwater. The groundwater flows north-northeast toward the Kalamazoo River at a gradient of 0.0033 foot/foot and a velocity of 0.94 feet/day. Groundwater is approximately 14-17 feet bgs. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

W. Dickman/Kellogg Property, Intersection of Brady and W. Dickman, Battle Creek

This is a Part 201 site located 3.25 miles northwest of Target Area 3 and 4 miles southeast of Target Area 4, along the Kalamazoo River. Historically, various metals and PNAs were identified in the soil and groundwater. The groundwater is approximately 22 – 34 feet bgs. Review of Remedial Investigation and Feasibility Study (RI/FS) notes that assumed flow is north toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Former Springfield Elementary School, 383 N 20th Street, Springfield

This is a Part 201 site located 2 miles northwest of Target Area 3. Historically, arsenic, mercury, lead, and selenium were identified in the soil. No water was encountered at the site.

City of Battle Creek, Equipment Division, 350 W Michigan Avenue, Battle Creek

This is a Part 213 site located 500 feet north of the Kalamazoo River. Historically, BTEX and Trimethylbenzenes (TMBs) were identified in the soil and groundwater. The groundwater flows southwest at a gradient of 0.006 foot/foot and a velocity of 0.04 feet/day. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

City of Battle Creek, Police Division, 20 N Division, Battle Creek

This is a Part 213 site located 1,100 feet north of the Kalamazoo River and 400 feet south of the Battle Creek River. Historically, BTEX was identified in the soil and groundwater. The groundwater flows north-northwest toward the Battle Creek River. Groundwater is approximately 9-16 feet bgs.

Battle Creek Gas Com, 165 S Monroe Street, Battle Creek

This is a Part 213 site located less than 500 feet east of the Kalamazoo River, but within the confluence of the Battle Creek River. Historically, BTEX was identified in the soil and groundwater. The groundwater is 10-12 feet bgs and flows north-northwest at a gradient of 0.01 foot/foot and a velocity of 0.10 feet/day. Groundwater flow direction is influenced by the confluence of the Kalamazoo River and the Battle Creek. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Former Gas Station, 170 Capital Avenue, Battle Creek

This is a Part 213 site is located 200 feet southwest of the Kalamazoo River and 1500 feet northwest of Lower Mill Pond. Historically, PNAs were identified in the soil. Groundwater is approximately 18 feet bgs. No information is available regarding groundwater flow.

Kellogg Institute/BC Transit, 2 Hamblin Avenue/75 Beacon Street, Battle Creek

This is a Part 213 site located 500 feet east of the Kalamazoo River. Historically, BTEX, TMBs, and PNAs were identified in the soil and groundwater. The groundwater flows west-southwest toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Bell Auto Sales, 169 E Michigan Avenue, Galesburg

This is a closed Part 201/213 site located 1500 feet north of the Kalamazoo River. Historically, BTEX and TMBs were identified in the groundwater. The groundwater flows south toward the

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Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Titus Construction Company, 12105 E Michigan Avenue, Galesburg

This is a Part 201 site located 300 feet south of the Kalamazoo River. Historically, BTEX was identified in the soil and groundwater. The groundwater flows north-northwest toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Michigan Paperboard, 79 Fountain Street, Battle Creek

This is a Part 201/213 site located less than 500 feet west of the Kalamazoo River. Historically, BTEX and isopropanol were identified in the soil. No information is available regarding groundwater flow.

Western Michigan Refrigeration Warehouse, 1400 S 35th Street, Galesburg

This is a Part 201/213 site located 0.25 mile south of the Kalamazoo River. Historically, BTEX and naphthalene were identified in the groundwater. The groundwater flows northwest toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Texaco, 1540 S 35th Street, Galesburg

This is a Part 201/213 site located 0.25 mile south of the Kalamazoo River. Historically, BTEX, naphthalene, TMBs, and PNAs were identified in the soil and groundwater. The groundwater is approximately 10 feet bgs and flows north toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Mikes Tire Service, 144 W Michigan Avenue, Galesburg

This is a Part 201 site located 0.25 mile north of the Kalamazoo River. Historically, BTEX, TCE, and carbon tetrachloride were identified in the soil and groundwater. The groundwater flows west-southwest at 0.00148 feet/day, towards the Kalamazoo River.

Galesburg-Augusta School, 600 W Michigan Avenue, Galesburg

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This is a Part 201 site located 900 feet west of the Kalamazoo River. Historically, BTEX, and naphthalene were identified in the soil and surface water. The groundwater is 5.5 to 9.5 feet bgs and flows north away from the Kalamazoo River.

Davis Oil C-Store, 6 E Michigan Avenue, Galesburg

This is a Part 201 site located 1,000 feet north of the Kalamazoo River. Historically, BTEX was identified in the soil and groundwater. The groundwater is approximately 9 feet bgs and flows south towards the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Davis Oil #2, 45 W Michigan Avenue, Galesburg

This is a Part 201 site located 1,000 feet north of the Kalamazoo River. Historically, BTEX was identified in the soil and groundwater. The groundwater flows south-southeast toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

60 N 12th Street, Springfield

This is a Part 201 site located 1,000 feet south of the Kalamazoo River. Historically, arsenic, lead, and benzo(a)pyrene were identified in the soil. Groundwater is approximately 22 feet bgs. No information is available regarding groundwater flow.

Ronan & Kunzl Main Site, 500 S Kalamazoo, Marshall

This is a Part 201 site located 500 feet north of the Kalamazoo River, several thousand feet upstream from Target Area 1. The site is included due to proximity to the Kalamazoo River. Historically, Dichloroethylene (DCE), TCE, and barium were identified in the groundwater. The groundwater flows south, toward the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

Calhoun County Road Commission-Marshall Facility, 13300 15 Mile Road, Marshall

This is a Part 201 site located 1.5 miles northeast of Target Area 1. This site is included because it is approximately 1,500 feet north of the Kalamazoo River. Historically, chlorinated VOCs, sodium, and chloride were identified in the groundwater. The groundwater flows southwest and southeast, toward

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the Kalamazoo River. This site provides additional supportive documentation that groundwater flow in the vicinity is toward the Kalamazoo River.

3.7 Evaluation of Production and Municipal Wells

Industrial/Agricultural production wells and Municipal Supply water wells are located near the Study Area. Pumping wells in vicinity of the Kalamazoo River could potentially influence groundwater flow and direction. This section summarizes potential influences of municipal wells in the study area. A listing of Municipal wells are presented in **Appendix E**.

The Kalamazoo River watershed is rated highest in the State of Michigan in regards to groundwater withdrawals. It also has the second highest number of wells in glacial deposits and bedrock in Michigan. Most of the water withdrawal used is for industrial (43%), public (34%), irrigation (11%), domestic, commercial, agricultural and mining use (12% combined).

Based upon a review of the RS&GIS Interactive Map Viewer, municipal well fields are located near the study area at the following locations and communities:

- Marshall, Michigan, four wells set 100 feet bgs, for combined pumping capacity of 4,840 gallons per minute (gpm);
- Pennfield Township, two wells set 240 and 220 feet bgs, for combined pumping capacity of 2,400 gpm;
- Battle Creek – Verona Well Field, 20 wells set 120 to 150 feet bgs, for a combined pumping capacity of 20,394 gpm;
- Bedford Hills, Michigan, 3 wells set approximately 180 feet bgs, for a combined flow of 5,289 gpm;
- Augusta, Michigan, two wells set approximately 110 feet bgs, for a combined pumping capacity of 1,360 gpm;
- Galesburg, Michigan, two wells set approximately 65 feet bgs, for a combined pumping capacity of 1,500 gpm;
- Kalamazoo Pumping Station at Morrow Lake, one well (depth unknown) pumping at a capacity of 2,600 gpm.

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Wells located in Marshall are located on Rice Creek, approximately 2.6 miles upstream and northeast of the confluence of Talmadge Creek. Due to the distance from the Kalamazoo River, pumping from the wells in Marshall are not likely to affect the Kalamazoo River.

Wells located in Pennfield Township are 3.2 miles northeast of the Kalamazoo River. Due to the distance from the Kalamazoo River, pumping from the wells in Pennfield Township do not affect the Kalamazoo River.

The Verona Well Field draws water primarily from the Battle Creek tributary of the Kalamazoo River. Because it is located approximated 2.5 to 3 miles northwest of the Kalamazoo River and wells are screened in the Marshall sandstone, pumping likely does not influence groundwater movement near the closest study Target Area 3.

Wells in Bedford Falls are located approximately 1.3 miles northeast of the Kalamazoo River and several miles from Target Area 4. Due to the distance from the Kalamazoo River, pumping from the wells in Bedford Falls are not likely to affect the Kalamazoo River.

Municipal wells in Augusta are located adjacent to the Kalamazoo River and 0.75 miles east of Study Area 5. The wells are part of a sampling program that includes potable wells within 200 feet of the high water mark. All collected samples had no detectable concentrations of crude oil constituents. The results are included in **Appendix D**. Studies performed in support of the Wellhead Protection Program Plan concluded that the aquifer in which the Village's municipal wells were screened was not directly influenced by the Kalamazoo River, and the municipal well's influence did not extend significantly beneath the Kalamazoo River (Fleis & VandenBrink, 2002).

The well at Morrow Lake is adjacent to Morrow Lake and approximately one-half mile west of Target Area 8. The well was temporarily taken offline as a precautionary measure from the crude oil spill; however, the well is currently being tested at various pumping rates following a reactivation plan approved by the MDNRE. The phases of the plan are outlined below.

- Phase 1 was intitiated by pumping the well to waste and collecting samples for VOCs and PNAs. The pumping was started on October 11th and ran for 72 hours. Water water samples were collected on hours 1, 12, 24, 48, and 72. Preliminary data indicate there have been no detections of VOCs and PNA parameters.

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- If no impacts are noted in the validated data from phase 1 the well will be pumped for a maximum of 12hours/day at a maximum output of 628,000 gal/day. This output will be sampled on a daily basis for 30 days. This phase is anticipated to occur in the November/December 2010 time frame.
- Based on no impacts from phase 2, the maximum pumping rate will be increased to 837,000 gal/day, 12 hours/day, with weekly sampling. This is anticipated to occur in the January-March 2011 time frame.
- Based on no impacts noted in phase 3, the maximum pumping rate will be increased to 930,000 gal/day, 12 hours/day, This is anticipated to occur in April, 2011.
- Based on no impacts noted in phase 4, the well will be returned to full operation as needed in May 2011.

It is anticipated that the well will be added to the potable well sampling program.

3.8 Well-Head Protection

Based on a review of the Michigan State University Interactive Map Viewer (http://gwmap.rsgis.msu.edu/), there are five Wellhead Protection Areas along the Kalamazoo River between Marshall and Morrow Lake. The Wellhead protection areas are presented in **Appendix E**.

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4.0 Methods

The following methodologies were used to implement the scope of work proposed in the October 3, 2010 "Supplement to the Sampling and Analysis Plan Referred to as Work Plan for Evaluating the Potential Impact of Released Oil on Groundwater used for Drinking Water". Due to the tight timeline, however, some deviations from the Work Plan were presented during an October 5, 2010 meeting with U.S. EPA. These deviations are discussed in Section 4.6.

4.1 Drilling and Well Installation

Sonic drilling technologies were used to install the monitoring wells during the investigation. This method was chosen because sonic drilling allows for continuous observation of soil cores, reduces volume of soil cuttings, and can penetrate bedrock if it is encountered. Soils were logged by a geologist, using the Unified Soil Classification System (USCS). Screened intervals were selected based on anticipated groundwater depths and a review of the sonic core for evidence of saturated zones and fractures in the bedrock. Boring logs are presented in **Appendix F**.

The monitoring wells were constructed of 2-inch diameter, schedule 40, poly vinyl chloride (PVC) casing, with five- or 10-foot long factory-slotted (10-slot) screens. Five-foot long screens were used in the deep monitoring wells and were placed a minimum of 15 feet below the bottom of the shallow screen. In some cases the deep well screens were placed below an underlying confining unit. As a result, water levels rose above the screened interval.

The wells were installed with an annular sand pack that extended a minimum of 1 foot above the top of the well screen. Bentonite grout was placed from the top of the sand pack to 1 foot below the ground surface. The wells were finished with locking caps and bolt-down, flush mount covers. Well construction forms are provided in **Appendix F**.

All monitoring wells were developed to remove fines from the screen interval. The wells were initially developed by removing the greater of three casing volumes or 55 gallons. After subsequent discussions with the U.S. EPA, a vac truck was used to remove an additional amount of water added during drilling which was equivalent to 50 gallons per 10 feet of submerged well.

All monitoring wells and staff gauges were surveyed to the US State Plane 1983 Michigan South

Zone 2113 coordinate system and the North American Datum 1983 international feet. The survey coordinates and elevations are summarized in **Table 1**. Horizontal locations were surveyed to the nearest foot and vertical elevations to the nearest hundredth of a foot.

4.2 Water Level Measurements

Water level measurements were collected from all monitoring wells and staff gauge locations on October 18, 2010, October 20, 2010, and October 22, 2010. The staff gauge locations were located on permanent structures (primarily bridges) that were located as close to each Target Area as possible. Temporary staff gauges located at the surface water sampling locations were considered; however the difficulty in accessing the locations and the temporary nature of the structures (potential for moving between measurements) lead to the use of the permanent structures. A decontaminated oil/water interface probe was used to measure liquid levels to the nearest 0.01 foot. A summary of the water levels is provided in **Table 1**.

4.3 Slug-Testing

Hydraulic conductivity testing was performed on 2 monitoring wells at each of the 8 target areas. A decontaminated PVC slug was used to rapidly change the water levels in the wells while recording the change in water level using an In-Situ Level Troll 700®. Slug testing was conducted using a rising head test on 1 shallow and 1 deep monitoring well at each Target Area. Falling head tests were also performed where the screen was submerged, generally in the deep monitoring well. The hydraulic conductivity testing was intended to provide further information on the potential for groundwater communication with the river and in development of a conceptual site model for future investigations. Data was analyzed using commercially-available curve matching software and applicable hydrogeological solutions (Bouwer and Rice, 1976; or Butler, 1998). A summary table and outputs of the slug tests are provided in **Appendix G**.

4.4 Water Sampling and Analysis

Two types of water samples were collected from each of the 8 Target Areas. Groundwater samples were collected from the monitoring wells and surface water samples were collected from the river. Due to the limited duration of this study, only one round of samples was collected for this study.

The river samples were collected from established surface water sampling locations. This strategy

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assisted with the evaluation of whether surface water is venting to groundwater (James, 2002). Data collected as part of the analyses included a major element analyses that was used to construct stiff diagrams that show relationships between the chemistry of the river water and the groundwater. The surface water samples were collected using a peristaltic pump and disposable tubing. Field parameters, including dissolved oxygen, oxidation reduction potential, conductivity, pH, temperature and turbidity were recorded.

Groundwater samples were collected using Low-Flow Minimum Drawdown techniques as described by Puls & Barcelona (1996) as defined in the SAP. The fields parameters listed above were measured during sampling, as provided in the Low-Flow Minimum Drawdown technique. Groundwater samples were collected a minimum of three days after well development. Groundwater samples were analyzed for the parameters in **Table 2**.

All water samples were placed directly into sample bottles provided by the laboratory and sent via laboratory courier under chain-of-custody to the laboratory. The samples were analyzed for the parameters indentified in **Table 2**.

4.5 Data Validation

Laboratory reports were provided by the ALS Holland, Michigan facility with Level II QC data packages containing summaries of batch quality control results. Data validation was performed based on quality control criteria and guidance specified in the U.S. EPA SW846 reference methods, the U.S. EPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), U.S. EPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan referred to as Work Plan for Evaluating the Potential Impact of Released Oil on Groundwater Used for Drinking Water (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate. Level 2 data validation reports, including worksheets and summarized tables of qualified data, are provided in **Appendix D**. Level 4 data validation of 10 percent of the data is still onging.

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4.6 Deviations from Work Plan

Discussions were held with the U.S. EPA on October 5, 2010 and October 7, 2010, regarding implementing deviations to the October 3, 2010 revision of the "Work Plan for Evaluating the Potential Impact of Released Oil on Groundwater Used for Drinking Water". It was agreed that deviations to the work plan would be necessary to address site-specific conditions.

The following methodologies were a deviation from the work plan.

- Shallow wells were screened to intersect the water table to detect Light Non-Aqueous Phase Liquids, if present. To account for variations in the water table, the screen length in the shallow monitoring well was increased to 10 feet instead of 5 feet in length.
- At cluster well locations, the top of the screen of the deep monitoring wells was set 15-20 feet below the bottom of the shallow well screen. At locations where the aquifer thickness did not allow 15-20 feet of separation between the well screens (a confined layer was encountered) the deep well screen was set below the confined layer.
- Each deep well boring was advanced below the deep well screen to provide additional hydrogeologic information until the first was encountered: 2 feet into a confined layer, component bedrock, or 100 feet in depth.
- A vacuum truck was used periodically for deep well development.

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5.0 Results

The results section has been divided into the eight Target Areas. The results are featured separately because there is a large distance between areas, flow patterns along the river are different, and the geology and geomorphology varies from area to area.

5.1 Target Area 1

Target Area 1 is located on the south side of the Kalamazoo River between Mile Posts MP 2.25 and MP 3.25 (**Figure 3**). Most of the Target Area consists of residential properties with potable wells. Due to limited site access, the Target Area investigation was conducted just to the east of the residential area near Mile Post MP-2.50. No historic submerged oil is present in the vicinity of Target Area 1; however, SCAT-identified areas are located along both sides of the River as shown on **Figure 3**. The monitoring wells were installed linearly, and perpendicular to the river so that a hydraulic gradient could be developed as to whether the river is gaining or losing at Target Area 1.

As presented in the Target Area 1 geologic cross-section (**Figure 11**), the upper 120 feet (greatest depth explored) consists of unconsolidated sediments consisting primarily of sand with an increasing thickness towards the south. The cross-section trends north-south from the Kalamazoo River through MWKR0250L01 (deep well) through MWKR0250L02 (shallow well) and terminates at upgradient well MWKR0250L03. In general, the stratigraphy consists of a sand sequence from approximately 887 feet amsl to 810 feet amsl, with some interbedded clay lenses. In the deep soil boring, a lower till was intercepted at a depth of approximately 810 ft amsl. The till is described as silty clay to clayey silt, with some fine-to-medium sand and rounded gravel. The till was moist to wet. It is not known if the till is laterally continuous in the area.

In-situ hydraulic conductivity tests were conducted at one shallow (MWKR0250L02) and one deep well (MWKR0250L01). The results are summarized below and in **Appendix G**.

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Type of Soil Around Screen (USCS)	Depth Summary (Screen Interval, bgs)
MWKR0250L01	Falling	1.33E-02	33.89	SP	Deep/74.5-79.5 ft
MWKR0250L01	Falling	4.79E-03	12.17	SP	Deep/74.5-79.5 ft
MWKR0250L01	Rising	4.81E-03	12.21	SP	Deep/74.5-79.5 ft
MWKR0250L01	Rising	4.51E-03	11.46	SP	Deep/74.5-79.5 ft
MWKR0570L02	Rising	4.97E-03	12.62	SP/CL	Shallow/14-24 ft
MWKR0570L02	Rising	6.23E-03	15.81	SP/CL	Shallow/14-24 ft

The mean hydraulic conductivity value is 15.03 ft/day (5.92×10^{-3} cm/sec). These values are consistent with published values (Todd and Mays, 1980).

5.1.1 Hydraulic Gradient

Groundwater and surface water elevation data were collected from wells and nearest staff gauge on October 18, 20 and 22, 2010. The staff gauge is located approximately 2,500 feet upstream. The elevation data, presented in **Table 1** and summarized on **Figure 3**, demonstrate that groundwater is flowing towards the river. The furthest well from the river (MWKR0250L03) has a groundwater elevation approximately 11 feet higher than the well (MWKR0250L02) located immediately adjacent to the river. In addition, the vertical gradient is upward at the well cluster (MWKR0250L02 /L01 (for purposes of clarity the individual wells in each Target Area may be referred to using their last three reference numbers). This further suggests groundwater discharges to surface water at Target Area 1. While the closest staff gauge surface water elevation was slightly higher than the groundwater elevation in the closest well (L02), the staff gauge is approximately ½ mile upstream and, as a result, would be expected to have a higher surface elevation.

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5.1.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from Target Area 1 on October 14, 2010 from all three monitoring wells. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGC10141640BRH1	MWKR0250L01	Deep/74.5-79.5 ft
WGC10141505BRH1	MWKR0250L02	Shallow/14-24 ft
WGC10141810BRH1	MWKR0250L03	Deep/40-45 ft

The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 3**.

Analytical results from the groundwater samples indicate that no PNAs or VOCs were detected in any of the groundwater samples collected from Target Area 1. Dissolved and total iron, a naturally occurring analyte, was detected at concentrations ranging from 0.37 to 1.9 mg/L at each of the monitoring wells.

Given that no other crude oil constituent was detected, and the total iron concentration was the greatest at upgradient well MWKR0250L03 and iron is a naturally occurring analyte, it is likely that the total iron exceedences are not related to the oil release at Target Area 1. This is supported by the water well data collected from residential wells (0.02 to 6.71 mg/L) and MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L) (**Appendix C**).

5.1.3 Major Cations / Anions

The major ion data are used to construct Piper and Stiff diagrams, which provide a visual representation of groundwater. Concentrations are converted to milliequivalents per liter (meq/L), which take into account the molecular weight and electron charge of the ion species. For Piper

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diagrams, the meq/L are converted to percentage of the total charge and plotted. Each point represents the ratio of the ions present in the water sample. Cations (calcium, magnesium, potassium, and sodium) and anions (bicarbonate alkalinity, chloride, and sodium) are plotted on the separate triangles. These points are projected to the diamond that presents the dominant ion configuration for the water sample. Water samples may plot in similar locations on a Piper diagram but have different concentrations.

Stiff diagrams are plots of the meq/L of major ions. The shape of the Stiff diagram varies depending on the dominant cation and anion and the size corresponds to the total dissolved solids (TDS) content of the water sample. Therefore, the size of the Stiff diagram increases as TDS increases. Small, diamond-shaped Stiff diagrams are typical of fresh water that has had minimal contact with soil or rock. Stiff diagrams are compiled by Target Area in **Appendix H**.

For groundwater samples, slight differences in the shapes of Stiff diagrams and sample locations on Piper diagrams may be an indication that water in wells has not fully equilibrated with formation water. Installation of monitoring wells typically has a short-term affect on groundwater chemistry. Therefore, evaluations presented in this summary are preliminary.

As indicated on the Piper and Stiff diagrams, groundwater characteristics exhibited calcium-bicarbonate type and were similar to surface water near this location. Groundwater at deeper well MWKR0250MWL01 is most similar to surface water. Groundwater at wells MWKR0250L02 and L03 are also calcium-bicarbonate type but with greater TDS (Stiff diagrams are larger). These two wells also have relatively large concentrations of sodium and chloride, particularly MWKRO0250L03, which is farther from the riverbank than the other, co-located wells.

A surface water sample (WSC10151555DJJ1) was collected from Target Area 1 on October 15, 2010 at SWKRO250L01. The surface water sample location is shown on **Figure 3** and the analytical data are summarized in **Table 4**

The surface water is almost uniformly calcium-bicarbonate type water. Dividing the Piper diagrams into four diamonds along the 50 percent lines, the points for these water samples are in the right-hand diamond with greater than 50 percent calcium (Ca) + magnesium (Mg) and greater than 50 percent

bicarbonate (HCO3). The similarity in surface water samples is demonstrated by the tight cluster of points on the Piper diagram.

The similarity in surface water samples is demonstrated by the tight cluster of points on the Piper diagram (**Appendix H** of Piper diagram with surface water only). Because all surface water samples were collected over a period of two days, this is not unexpected. This tight cluster of surface water chemistry demonstrates the stability of the surface water major ion chemistry as it flows through this section of the Kalamazoo River.

While surface water is fully oxygenated and slightly alkaline (pH 8.4), shallow groundwater appears to be depleted in oxygen (dissolved oxygen ranging from 0.3 to 1.5 mg/L) and slightly acidic to neutral (pH 6.2 to 7.1). Groundwater at well MWKRO0250L01 (deep monitoring well) is most similar to surface water.

5.1.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- The horizontal and vertical gradient data indicate that groundwater is flowing toward the Kalamazoo River and therefore the Kalamazoo River is a gaining river at Target Area 1.
- PNAs and VOCs were not detected in the three groundwater samples, indicating that residual oil has not migrated to groundwater .
- It is likely that the total iron exceedances are not related to the oil release at Target Area 1 because iron is a naturally occurring analyte, the total iron concentration was the greatest at upgradient well L03, and iron was detected at similar concentrations in nearby potable water wells.
- The concentrations of detected analytes within surface water are within the range of concentrations detected in groundwater, with the exception of the sodium, iron, and chloride concentrations which have lower concentrations than the groundwater samples.
- The groundwater and surface water Piper and Stiff diagrams indicate that cation/anion chemistry of the groundwater and surface water are similar (uniformly calcium-bicarbonate-type water).

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- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring well MWKR0250L02 prior to detection in a potable well.

5.2 Target Area 2

Target Area 2 is located between Mile Posts MP 5.50 and MP 6.00 in the Ceresco Dam area (**Figure 4**). At this location, both sides of the Ceresco Dam area were evaluated for localized groundwater flow and the potential impact of released oil on groundwater. Most of the investigation was conducted near MP 5.75 for accessibility. The Ceresco Dam area was chosen as a Target Area because it is an area of elevated surface water resulting from the dam's water retention and because of the presence of residential properties with potable wells. Fourteen potable wells were identified within the Target Area boundary. In addition, historic submerged oil has been identified. On the north side of the river (right side going downstream), two transects of monitoring wells were placed perpendicular to the river. A third transect was placed on the south side. This investigation strategy was developed to determine if the elevated water from the dam caused losing conditions.

Figures 12 and 13 present cross-sections of the Target Area. Cross-section trends southwest to northeast from the south side of Kalamazoo River at MWKR0580L03, MWKR0580L02 MWKR0580L01 across the Kalamazoo River to wells MWKR580R01, MWKR580R02 and MWKR580R03 on the north side of the Kalamazoo River. The second cross-section trends west to east on the north side of the Kalamazoo River from MWKR0580R03, MWKR0580R02 and MWKR0580R01 to MWKR0570R01and MWKR0570R02. The wells clustered at MWKR0580R01 were advanced into heavily weathered sandstone. There was evidence of water saturation noted during drilling and therefore, after discussions with the U.S. EPA and MDNRE representatives, wells were installed to intersect the saturated zone. However, water at these wells did not recover to a point that the wells could be sufficiently developed or sampled. As a result, these wells could not be used to evaluate groundwater flow at Target Area 2.

With the exception of MWKR0570R02, the monitoring wells were screened primarily within the sandstone. MWKR0570R02 was screened in sand and gravel above the sandstone. The cross-sections demonstrate that the stratigraphy generally consists of sand and gravel, with interbedded

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layers of clay and silt, to the top of the weathered sandstone on the north side of the Kalamazoo River. The top of the weathered sandstone on the north side of the Kalamazoo River varies from approximately 857 to 878 ft amsl, with the highest elevations northwest of the Kalamazoo River at MWKR0570R01 and MWKR0570R02). The bedrock surface elevation slopes to the south and east to approximately 864 ft amsl, with the exception of an anomalous topographic high at MWKR0580L02 as shown on the SW-NE cross-section (**Figure 12**). Above the weathered sandstone south of the Kalamazoo River, interbedded gravel and silt are predominately present (MWKR0580L01, MWKR0580L02, MWKR0580L03) indicating a fluvial depositional environment. The lower bedrock elevation near surface water channels is typical for glacial fluvial environments in southern Michigan.

In-situ hydraulic conductivity tests were conducted at a well screened in sandstone and another in the unconsolidated aquifer the results are summarized below and in **Appendix G**.

Monitoring Well ID	**Type of Test**	**Hydraulic Conductivity (cm/sec)**	**Hydraulic Conductivity (ft/day)**	**Type of Soil Around Screen (USCS)**	**Depth Summary (Screen Interval, bgs)**
MWKR0570R01	Falling	1.21E-01	343.90	Sandstone	Shallow/19-34 ft
MWKR0570R01	Falling	7.82E-02	221.80	Sandstone	Shallow/19-34 ft
MWKR0570R01	Rising	1.05E-01	296.30	Sandstone	Shallow/19-34 ft
MWKR0570R01	Rising	1.17E-01	331.40	Sandstone	Shallow/19-34 ft
MWKR0570R02	Rising	3.48E-02	98.61	SP/GW	Shallow/4-14 ft
MWKR0570R02	Rising	3.48E-02	98.61	SP/GW	Shallow/4-14 ft

The mean hydraulic conductivity of the sandstone and unconsolidated aquifer is 294.18 ft/day (1.04 x 10^{-1} cm/sec) and 98.61 ft/day (6.12 x 10^{-2} cm/sec), respectively. These values are consistent with published values (Todd and Mays, 1980).

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5.2.1 Hydraulic Gradient

Static water measurements were obtained from the monitoring wells and staff gauge on October 18, 20, and 22, 2010. The staff gauge is located on the backwater behind Ceresco Dam.

Groundwater and surface water elevation data presented in **Table 1** and **Figure 4** demonstrate that groundwater is flowing away from the Kalamazoo River. The furthest well from the north side of the river (MWKR0570R03) has a ground water elevation approximately 1 foot lower than the recorded level from the staff gauge above the dam. On the south side of the river, the furthest well (MWKR0580L03) has a groundwater elevation approximately 4 feet lower than the staff gauge. The vertical gradient is also downward in the well cluster located at MWKR0580L01 and MWKR0580L02. The observation of a losing water body at this location was anticipated due to the restricted water flow from the dam.

5.2.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from six of the nine monitoring wells in Target Area-2 on October 13 and 15, 2010. Groundwater samples could not be collected from wells MWKR0580R01 through MWKR0580R03 since sufficient water was not available in the well screen. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGC10150950DJJ1	MWKR0570R01	Shallow/ 19-34 ft
WGC101501120DJJ1	MWKR0570R02	Shallow/4-14 ft
WGC10130900BAW1	MWKR0570R03	Shallow/9-19 ft
WGC10151310DJJ1	MWKR0580L01	Deep/41-46 ft
WGC10131435DJJ1	MWKR0580L02	Shallow/16-26 ft
WGC10131220BAW1	MWKR0580L03	Shallow/15-25 ft

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The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 4**.

PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area indicating that the released oil and submerged oil on the south bank has not affected groundwater in the vicinity of the Kalamazoo River. Dissolved and total iron, a naturally occurring analyte, was detected in four samples and ranged in concentration from 0.30 to 15 mg/L. These detections are at or exceed the Part 201 Residential Drinking Water Criterion 0.3 mg/L). As discussed above, iron is a naturally occurring analyte and it is probable that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. The detected iron concentrations are above the maximum detected Enbridge potable water well data (0.02 to 6.71 mg/L). The detected iron concentrations are also above the MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L) (**Appendix C**).

Dissolved and total vanadium was also detected in three samples and ranged in concentration from 0.0062 – 0.47 mg/L. These detections exceed the Part 201 Residential Drinking Water Criteria (0.0045 mg/L).

Given that total iron and total vanadium concentrations were the greatest in the monitoring well located farthest from the River (MWKR0580L03), and no other crude oil related parameters were detected, it is likely that the iron and vanadium exceedances are not related to the oil release.

5.2.3 Major Cations / Anions

The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. A surface water sample (WSC10151448DJJ1) was collected from Target Area 2 on October 15, 2010 at SWKR0570R01. The surface water sample location is shown on **Figure 4** and summary of the analytical results are provided in **Table 4**. The surface water is calcium-bicarbonate-type water

Monitoring wells were completed in the sandstone bedrock except for MWKR0570R02, which is screened in glacial alluvium. With the exception of MWKR0570R03, groundwater has calcium-

bicarbonate chemistry and is similar in water chemistry and TDS to surface water, as demonstrated by the Stiff diagrams (**Appendix H**). Groundwater at well MWKR0570R03, which is farther from the riverbank, has a calcium-sodium-bicarbonate chemistry. The similarity in water chemistry for wells closer to the river may support the idea that the dam causes local losing conditions adjacent to the river.

5.2.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- PNAs and VOCs were not detected in the six groundwater samples indicating the oil organic constituents have not impacted groundwater.
- Although the total and/or dissolved iron and vanadium concentrations exceed the Part 201 Residential Drinking Water Criteria, the maximum iron and vanadium concentrations occur in the well farthest from the River (MWKR0580L03).
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring wells MWKR0570R01, MWKR0570R02, and MWKR0570R03 prior to detection in a potable well.

Groundwater elevations demonstrate that groundwater is locally flowing away from the Kalamazoo River (losing river) due to the elevated surface water behind the Ceresco Dam. Groundwater flow away from the River behind the dam is anticipated based on the hydraulic influence a dam has on local hydraulic conditions. Since there is no indication of migration of petroleum –related compounds into the groundwater, risk to potable wells is unlikely. However, in order to provide a level of assurance that residential wells will not be impacted, additional monitoring will be recommended for this Target Area.

5.3 Target Area 3

Target Area 3 is located between Mile Post MP 15.00 and MP 15.50 in a low-lying area along the east bank of the Kalamazoo River (**Figure 5**). The Target Area is predominately low lying, flat, flood plain which is bordered by the Kalamazoo River to the west and I-194 interstate Highway to the east. Riverside Drive is immediately adjacent to the river on the west side. Burnham Street bisects the

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Target Area from east to west with a bridge crossing the river. Historic submerged oil was observed immediately south of Burnham Street and additional SCAT-identified areas are located south of Burnham Street. No potable wells are located in the Target Area.

Figure 14 shows a cross-section of Target Area 3. The cross-section is from the east side of the river. As shown, the stratigraphy consists of approximately 7 feet of fill underlain by approximately 59 feet of silty sand that grades into a courser fine to medium sand with gravel to approximately 66 ft bgs (765.6 ft amsl). At this horizon, the stratigraphy changed to gray sandy silt with gravel. The gradations observed suggest the upper sandy soils were deposited in a fluvial environment and the lower silty clay is a glacial till. At MWKR0580R03, the soils below the fill contain organic material (roots) and had a "swampy" odor.

In-situ hydraulic conductivity tests were conducted at one deep and one shallow well as the results are summarized below and in **Appendix G**.

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Type of Soil Around Screen (USCS)	Depth Summary (Screen Interval, bgs)
MWKR1525R01	Falling	7.82-02	221.80	SM	Deep/30-35 ft
MWKR1525R01	Falling	1.26-01	356.20	SM	Deep/30-35 ft
MWKR1525R01	Rising	7.32-02	207.50	SM	Deep/30-35 ft
MWKR1525R01	Rising	1.21-01	344.20	SM	Deep/30-35 ft
MWKR1525R02	Rising	1.17-02	33.27	SM	Shallow/4-14 ft
MWKR1525R02	Rising	1.60-02	45.32	SM	Shallow/4-14 ft

The mean hydraulic conductivity of the shallow and deep unconsolidated soils are 38.8 ft/day (1.37 x 10^{-2} cm/sec) and 274 ft/day (9.67x 10^{-2} cm/sec), respectively. These values are consistent with published values Todd and Mays, 1980).

5.3.1 Hydraulic Gradient

Static water measurements were obtained from the three monitoring wells and one staff gauge (SGTA-3) on October 18, 20, and 22, 2010. The results are presented on **Table 1**. Based on the groundwater elevations of the monitoring wells, groundwater is flowing towards the Kalamazoo River from MWKR1525R03 to MWKR1525R01as shown on **Figure 5**. The surface water elevations at the staff gauge location (SGTA-3 825.96 to 825.95 ft amsl) was approximately 2.7 feet higher than the monitoring wells (823.15 to 823.24 ft amsl). The monitoring wells are located in a low-lying area within the flood plain, so a hydraulic gradient toward the wells would not be unexpected. Over the three events, the horizontal hydraulic gradient between MWKR1525R03 and MWKR1525R02 varied from 0.0004 to 0.0023 ft/ft. These low horizontal gradients are expected since the wells were installed in a low-lying area adjacent to the River. The vertical gradient was assessed at MWKR1525R01 and MWKR1525R02. There was a downward gradient on October 18, and no gradient during the October 20, and 22 gauging events. This suggests static hydraulic conditions in Target Area 3.

5.3.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from three monitoring wells in Target Area 3 on October 16, 2010. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGC101601000DJJ1	MWKR1525R01	Deep/30-35 ft
WGC101601000DJJ1	MWKR1525R02	Shallow/4-14 ft
WGC101601000DJJ1	MWKR1525R02 duplicate sample	Shallow/4-14 ft
WGC101601000DJJ1	MWKR1525R03	Shallow/4-14 ft

A surface water sample (WSC10151448DJJ1) was collected from Target Area 3 on October 15, 2010 at SWKR0570R01.

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The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 5**.

Analytical results from the groundwater samples indicate that PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area 3. Dissolved and total iron, a naturally occurring analyte, was detected at concentrations ranging from 0.42 to 26.0 mg/L at each of the monitoring wells.

Total and dissolved iron concentrations exceed the Part 201 Residential Drinking Water Criterion (0.3 mg/L) for each of the Target Area 3 monitoring wells. As discussed above, iron is a naturally occurring analyte and it is probable that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. The maximum detected iron concentrations exceed the maximum Enbridge potable water well data (0.02 to 6.71 mg/L). The detected iron concentrations also exceed the MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L) (**Appendix C**).

5.3.3 Major Cations / Anions

A surface water sample (WSC10151712DJJ1) was collected from Target Area 3 on October 15, 2010 at SWKR1525R01. The surface water sample location is shown on **Figure 5** and summary of the analytical results are provided in **Table 4**.

The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. Groundwater has a calcium-bicarbonate chemistry and is similar in water chemistry to surface water. As demonstrated by Stiff diagrams (**Appendix H**), bicarbonate concentrations in groundwater at wells MWKR1525R01 and R02 are about twice the concentration in surface water. Bicarbonate concentration in groundwater at well MWKR1525R03 is intermediate between surface water and groundwater at wells MWKR1525R01 and MWKR1525R02; sodium and chloride are also more elevated in groundwater at well MWKR1525R03.

The differences in groundwater composition may indicate limited communication and local input. MWKR1525R03 is screened near ground surface (4 to 14 ft bgs) and a “swampy odor” was noted

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during drilling. The Target Area may be affected by runoff from deicing agents which may contribute sodium and chloride. Elevated bicarbonate in groundwater at wells MWKR1525R01 and -R02 indicates groundwater at these locations is not continuous with surface water or with groundwater at nearby well MWKR1525R03.

5.3.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- The direction of groundwater flow is away from the Kalamazoo River based on the staff gauge elevations and towards the River based on the groundwater elevations of the monitoring wells although the horizontal hydraulic gradient is low;
- The static vertical gradient at the shallow/deep well cluster suggest equilibrium conditions at Target Area 3;
- PNAs and VOCs were not detected in groundwater samples indicating the oil organic constituents have not impacted groundwater.
- Although the total and/or dissolved iron are above the Part 201 Residential Drinking Water Criterion for each of the groundwater samples, iron is a naturally occurring analyte and no other crude oil constituents were detected.
- The groundwater and surface water Piper and Stiff diagrams indicate that cation/ion chemistry of the groundwater and surface water are similar (calcium-bicarbonate-type water); however, there were differences (bicarbonate, calcium, sulfate, sodium, and chloride) in groundwater composition that may indicate limited communication and local input.
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring wells MWKR1525R02 and MWKR1525R03 prior to detection in a potable well.

5.4 Target Area 4

Target Area 4 is located between Mile Posts MP 22.50 and MP 22.75 on the west side of the Kalamazoo River as shown on **Figure 6**. The main purpose of the investigation in this area was to evaluate groundwater flow and evaluate the impact of the identified submerged oil area as shown on

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Figure 6. In addition, 10 residential wells were located north of the historic submerged oil in the Target Area.

Figure 15 shows cross-section view and stratigraphy at Target Area 4. The cross-section trends northwest to southeast on the north side of the Kalamazoo River from MWKR2275R01 to MWKR2260R01/ MWKR2260R02). This cross-section is north of an oxbow bend in the Kalamazoo River.

The stratigraphy consists of sand from ground surface to approximately 805 ft amsl, grading to a silty sand from 805 ft amsl to approximately 773 ft amsl. The Marshall Sandstone was encountered at approximately 773 ft amsl, or approximately 37 feet bgs. Shallow wells MWKR2260R02 and MWKR2275R01are screened in the upper unconsolidated sand and the deep well MWKR2260R01 is screened approximately 20 feet below the top of the Marshall Sandstone.

In-situ hydraulic conductivity tests were conducted at one well screened in sandstone and one well screened in the unconsolidated aquifer the results are summarized below and in **Appendix G**.

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Type of Soil Around Screen (USCS)	Depth Summary (Screen Interval, bgs)
MWKR2260R01	Rising	6.17E-03	17.49	Sandstone	Deep/50-55 ft
MWKR2260R02	Falling	4.16E-03	11.79	SP	Shallow/22-27
MWKR2260R02	Rising	5.32E-03	15.08	SP	Shallow/22-27

The mean hydraulic conductivity of the sandstone and unconsolidated aquifer is 13.3 ft/day ($4.70\ 10^{-3}$ cm/sec). The bedrock hydraulic conductivity is lower than what was found in other areas and the region; however, fracturing of the bedrock (which varies considerably) significantly influences the hydraulic conductivity. The hydraulic conductivity of the unconsolidated formation is consistent with published values (Todd and Mays, 1980).

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5.4.1 Hydraulic Gradient

Static water measurements were obtained from the three monitoring wells and one staff gauge (SGTA-4) on October 18, 20, and 22, 2010. The staff gauge is located approximately 2,500 feet east (upstream), at Custer Drive.

The water elevation results are presented on **Table 1**. Based on the groundwater elevations of the monitoring wells, groundwater is flowing towards the Kalamazoo River from MWKR2275R01 to MWR2260R02 as shown on **Figure 6**. The surface water elevations at SGTA-4 (795.99 to 795.92 ft amsl) were lower than the monitoring wells (799.24 to 796.84 ft amsl); suggesting groundwater flow to the river. Since the staff gauge is located up stream of the monitoring well locations, the river elevation at the monitoring well location is likely lower.

Over the three October measurement events, the horizontal hydraulic gradient between MWKR2275R01 and MWR2260R02 was uniformly 0.01 ft/ft. The vertical gradient was assessed at MWKR2260R01 and MWKR2260R02. The vertical gradient was upward from 1.97 to 1.98 on October, 18, 20, and 22. This further suggests that groundwater is discharging to surface water (gaining river) in Target Area 4.

5.4.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from three monitoring wells in Target Area 4 on October 16 and 17, 2010. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGD10171520TAS1	MWKR2260R01	Deep/50-55 ft
WGD10171540RWS1	MWKR2260R02	Shallow/22-27 ft
WGD10161730BRH1	MWKR2275R01	Shallow/20-25 ft

The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 6**.

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PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area 4 indicating that the released oil and submerged oil has not affected groundwater in the vicinity of the Kalamazoo River. Total and/or dissolved iron, a naturally occurring analyte, were detected at concentrations (0.42 to 32 mg/L) exceeding the Part 201 Residential Drinking Water Criteria (0.3 mg/L) in two of the groundwater samples. Total vanadium was also detected at one well (MWKR2275R01) at a concentration of 0.11 mg/L which is above the Part 201 Residential Drinking Water Criteria of 0.0045 mg/L.

Iron and vanadium are naturally occurring analytes, and it is probable that the iron and vanadium exceedances are not related to the oil release at Target Area 4. The maximum iron concentration at MWKR2275R01 is of higher concentration (32 mg/L) than the Enbridge potable water well data (0.02 to 6.71mg/L) and the MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L). Since MWKR2275R01 is upgradient from the other two monitoring wells, the iron is probably naturally occurring. Vanadium was also only detected in this upgradient well. In addition, groundwater at MWKR2260R01 had the most elevated turbidity and concentrations of total iron and total vanadium. Iron and vanadium were not detected in filtered samples of groundwater. Vanadium is often associated with iron minerals (World Health Organization, 1988).

5.4.3 Major Cations / Anions

A surface water sample (WSC10151448DJJ1) was collected from Target Area 4 on October 15, 2010 at SWKR0570R01. The surface water sample location is shown on **Figure 6** and a summary of the analytical results are provided in **Table 4**.

The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. Groundwater and surface water is calcium-bicarbonate type. Stiff diagrams indicate that TDS is slightly less in groundwater at wells MWKR2260R01 and MWKR2260R02 than in surface water. Chloride, sulfate, and sodium are more elevated in groundwater at well MWKR2260R01.

Chloride, sulfate, and sodium are more elevated in groundwater at upgradient well MWKR2275R01. This likely indicates that wells further from the river are less influenced by river water chemistry. This may be caused by salting of upgradient roads.

5.4.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- The horizontal and vertical gradient data indicates that groundwater is flowing toward Kalamazoo River and the Kalamazoo River is a gaining stream.
- The groundwater analytical data indicates that crude oil constituents (PNAs and VOCs) are not present in groundwater thus indicating that residual oil from the submerged oil and SCAT areas has not migrated to groundwater.
- Naturally occurring iron, which was also detected in the crude oil, was detected in all three groundwater samples above the Part 201 Residential Drinking Water Criteria ; however, it is probable that the iron exceedances are not related to the oil release since the highest concentrations were found in the upgradient well. Although the iron concentrations were above the residential well concentrations and the public health department data, the turbidity of the samples may have increased the iron concentrations due to increased particulates. Similarly, vanadium only detected in the upgradient well with elevated turbidity.
- The cation and anion data evaluation via Stiff and Piper diagrams indicate that the chemistry of the surface water and groundwater are of similar type (calcium-bicarbonate type) supporting that the groundwater is discharging to surface water and thus the Kalamazoo River is a gaining stream. The elevated chloride, sulfate, and sodium concentrations in the upgradient well MWKR2275R01 likely indicates that wells further from the river are less influenced by river water chemistry. This may be due to roadway salting of upgradient roads.
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring well MWKR2260R02 prior to detection in a potable well.

5.5 Target Area 5

Target Area 5 is located between Mile Posts MP 26.75 and MP 27.25 at a tight meander on the west side of the Kalamazoo River as shown on **Figure 7**. The main purpose of the investigation in this area

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was to evaluate groundwater flow in the vicinity of a tight bend in the Kalamazoo River and potential impact from the crude oil release. Historic submerged oil is present in the vicinity of Target Area 5 as shown on **Figure 7**. In addition, one potable well is located within 100 feet of the monitoring wells in the Target Area.

Figure 16 shows a cross-sectional view and stratigraphy at Target Area 5. The cross-section trends from the southwest to the northeast and traverses an oxbow bend in the Kalamazoo River. Both alluvium, glacial deposits and bedrock are represented in the figure. Three monitoring wells were installed in Target Area 5, MWKR2680R01 located to the northeast, and a two-well cluster (MWKR2700R01/R02) located in a southwesterly direction. In general, a few feet of fill was encountered at wells MWKR2680R01 and MWKR2700R02 in the middle of the oxbow. A thin (approximately 2 feet thick) silty clay horizon is present at MWKR2700R01 at an elevation of 786 ft amsl and at MWKR2680R01 at approximately the same elevation. The silty clay is green to gray in color and a "swamp" odor was noted at MWKR2700R01. The silty clay layer is underlain by a sand sequence to approximately 765 ft amsl. The sandy unit is underlain be a 5-foot thick clayey silt layer which overlies the Marshall Sandstone at an elevation of approximately 761ft amsl. The depositional environment for the upper stratigraphy is interpreted to be fluvial and glaciofluvial with flood plain silty clays sitting on top of point-bar sands and channel deposits near the surface. These fluvial deposits are underlain by glacial till (silty clay).

In-situ hydraulic conductivity tests were conducted at two monitoring wells; one from the shallow and deep unconsolidated aquifers as described below.

Monitoring Well ID	**Type of Test**	**Hydraulic Conductivity (cm/sec)**	**Hydraulic Conductivity (ft/day)**	**Type of Soil Around Screen (USCS)**	**Depth Summary (Screen Interval, bgs)**
MWKR2700R01	Falling	1.26E-01	358.20	Sandstone	Deep/32-37 ft
MWKR2700R01	Falling	8.03E-02	227.50	Sandstone	Deep/32-37 ft
MWKR2700R01	Rising	1.91E-01	541.70	Sandstone	Deep/32-37 ft
MWKR2700R01	Rising	1.12E-01	316.80	Sandstone	Deep/32-37 ft
MMWKR2700R01	Rising	8.18E-02	23.20	SM	Shallow/2-12 ft

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Type of Soil Around Screen (USCS)	Depth Summary (Screen Interval, bgs)
MWKR0570R02	Rising	6.22E-02	17.63	SM	Shallow/2-12 ft

The geomean hydraulic conductivity of the sandstone and unconsolidated aquifer is 344 ft/day (1.21 x 10^{-1} cm/sec) and 20.2 ft/day (7.13 x 10^{-3} cm/sec), respectively. These values are consistent with published values (Todd and Mays, 1980).

5.5.1 Hydraulic Gradient

Static water measurements were obtained from the three monitoring wells and one staff gauge (SGTA-5) on October 18, 20, and 22, 2010. The staff gauge is located approximately 1.5 miles southwest (down stream) of the monitoring wells.

The water elevation results are presented on **Table 1** and shown on **Figure 7**. Based on the October groundwater elevations of the monitoring wells (MWKR2680R01 and MWKR2700R02, screened from 2 to 12 feet in the unconsolidated soils, and MWKR2700R01 screened in the Marshall Sandstone), shallow groundwater is flowing from MWKR2680R01 to MWKR2700R02, which is roughly parallel to the river channel and consistent with the southwesterly river flow. This shows that at this tight meander bend the shallow groundwater flow did not conform to follow the flow of the river as it did in Target Area 4.

Over the three October measurement events, the horizontal hydraulic gradient between MWKR2680R01 to MWR2700R02 was negligible (0.0001 to 0.0004 ft/ft). The vertical gradient was assessed at MWKR2270R01 and R02. The vertical gradient was upward from 0.01 to 0.09 on October, 18, 20, and 22. This further suggests groundwater discharge to surface water (gaining river) at Target Area 5.

5.5.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from three monitoring wells in Target Area 5 on October 16, 2010. A summary of the samples collected is provided below:

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Sample ID	MW ID	Depth Summary (Screen Interval)
WGD10161345DJJ1	MWKR2680R01	Shallow/2-12 ft
WGD10161405BRH1	MWKR2700R01	Deep/32-37 ft
WGD101615055BRH1	MWKR2700R02	Shallow/2-12 ft

The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 7**.

PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area 5 indicating that the oil released has not affected groundwater in the vicinity of the Kalamazoo River. Dissolved and total iron, a naturally occurring analyte, was detected at concentrations ranging from 0.66 to 4.4 mg/L at each of the monitoring wells.

Total and dissolved iron concentrations are above the Part 201 Residential Drinking Water Criteria (0.3 mg/L) for each of the Target Area 5 monitoring wells. As discussed above, iron is a naturally occurring analyte and it is probable that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. The detected concentrations are below the maximum detected Enbridge potable water well data (0.02 to 6.71 mg/L). The detected concentrations are also below the maximum MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L) (**Appendix C**).

5.5.3 Major Cations / Anions

A surface water sample (WSD10161450DJJ1) was collected from Target Area 5 on October 16, 2010 at SWKR2700R01. The surface water sample location is shown on **Figure 7** and summary of the analytical results are provided in **Table 4**.

The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. The water chemistry, as indicated on the Piper and Stiff diagrams (**Appendix H**), has a calcium-bicarbonate chemistry, similar to surface water at this and the other surface water locations. Stiff diagrams indicate that TDS is less

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in groundwater at the two shallow wells MWKR2680R01 and MWKR2700R02 than in surface water or the bedrock well. The groundwater and surface water samples varied in concentrations for sodium, magnesium, sulfate, and chloride. Concentrations of these parameters were higher in surface water than in groundwater.

5.5.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- The horizontal and vertical gradient data indicates that groundwater is flowing toward the Kalamazoo River and the Kalamazoo River is a gaining stream although, as expected, the horizontal gradient is minimal at the tight meandered bend.
- The groundwater analytical data indicate that crude oil constituents (PNAs and VOCs) are not present in groundwater thus indicating that residual oil has not migrated to groundwater.
- The cation and anion data evaluation via Stiff and Piper diagrams indicate that the chemistry of the surface water and groundwater are of similar chemistry (calcium-bicarbonate) supporting that the groundwater is discharging to the Kalamazoo River (gaining river).
- Naturally occurring iron was detected in groundwater samples above the Part 201 Residential Drinking Water Criterion; however, it is likely that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. In addition, the detected iron concentrations are below the maximum Enbridge potable water well data and MDNRE-supplied potable well data.
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring wells MWKR2680R01 and MWKR2700R02 prior to detection in a potable well.

5.6 Target Area 6

Target Area 6 is located between Mile Posts MP 34.00 and MP 34.75 at a tight meander on the east side of the Kalamazoo River as shown on **Figure 8**. The main purpose of the investigation in this area was to evaluate groundwater flow in the vicinity of a tight bend in the Kalamazoo River. No

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submerged oil or SCAT areas are present in the vicinity of Target Area 6. Seven residential wells are located within the boundary of the Target Area.

Figure 17 shows a cross-sectional view and stratigraphy at Target Area 6. The cross-section trends from the southeast to the northwest, along Climax Dr and is located to the west of an oxbow bend in the Kalamazoo River. Alluvial and glacial deposits are represented in the figure. Six monitoring wells were installed in Target Area 6, with a two-well cluster to the northwest (MWKR3460L01 and L02) and a four well cluster to the southeast (MWKR3450L04, MWKR3450L03, MWKR3450L01, and MWKR3450L02). At the MWKR3450 monitoring wells, fill was generally encountered to a depth of 5 ft bgs and was underlain by a clay and silt layer, approximately 5 feet thick, to approximately 10 to 12 ft bgs (780 ft to 775 ft amsl). At MWKR3450L01 the clay and silt horizon is underlain by a thick sand sequence from approximately 775ft amsl to 700ft amsl. A gravelly silt glacial till was encountered from 700 ft to approximately 640ft amsl.

In-situ hydraulic conductivity tests were conducted at two monitoring wells; one from the shallow and one from the deep unconsolidated aquifers as described below.

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Type of Soil Around Screen (USCS)	Depth Summary (Screen Interval, bgs)
MWKR3450L03	Falling	4.54E-03	12.87	SM	Deep/72-77 ft
MWKR3450L03	Rising	4.35E-03	12.32	SM	Deep/72-77 ft
MWKR3450L04	Rising	9.27E-03	26.28	SP	Shallow/2-12 ft

The mean hydraulic conductivity of the unconsolidated aquifer is 16.1 ft/day (5.68×10^{-3} cm/sec). This value is consistent with published values (Todd and Mays, 1980).

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5.6.1 Hydraulic Gradient

Static water measurements were obtained from the six monitoring wells and one staff gauge (SGTA-6) on October 18, 20, and 22, 2010. The staff gauge is located approximately 1,000 feet northwest (upstream) of the monitoring wells.

The results are presented on **Table 1** and shown on **Figure 8**. Based on the October groundwater elevations of the shallow monitoring well clusters (MWKR3460L02, MWKR3450L02 and MWKR3450L04; screened from 6 to 12 ft, 7 to 12 feet and 2 to 12 feet) the shallow groundwater is predominantly flowing from MWKR3460L02 to MWKR3450L02, toward the Kalamazoo River; although the hydraulic gradient was minimal. This shows that at this tight meander bend the shallow groundwater flow did not conform to follow the flow of the river as it did in Target Area 4. In addition, the groundwater elevations in Target Area 6 are approximately 0.3 feet higher than the stream gauge SGTA-6; this also indicates that groundwater is discharging to surface water at Target Area 6.

Over the three October measurement events, the horizontal gradient hydraulic gradient between the northern and shallow well clusters was negligible (0.00005 to 0.0002 ft/ft). The vertical gradient was assessed between MWKR3450L02 (7-12 ft bgs), MWKR3450L03 (72-77 ft bgs) and MWKR3450L01 (137-147 ft bgs). The lower well L01 was a flowing artesian well indicating a strong upward vertical gradient. The vertical gradient between L02 and L03 was upward from 0.14 to 0.15 on October, 18, 20, and 22. This also further suggests groundwater discharge to surface water (gaining river) at Target Area 6.

5.6.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from six monitoring wells in Target Area 6 on October 15 and 17, 2010. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGE10171245RWS1	MWKR3450L01	Deep/137-142 ft
WGE10151405BAW1	MWKR3450L02	Shallow/7-12 ft

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGE10171100RWS1	MWKR3450L03	Deep/72-77 ft
WGE10171240TAS1	MWKR3450L04	Shallow/2-12 ft
WGE10151530BAW1	MWKR3460L01	Shallow/7-12 ft
WGE10171041TAS1	MWKR3450L02	Shallow/2-12 ft
WGE10171041TAS2	MWKR3450L02	Shallow/2-12 ft

The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 8**.

PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area 6 indicating that the oil released has not affected groundwater in the vicinity of the Kalamazoo River. Dissolved and total iron, a naturally occurring analyte, was detected at concentrations ranging from 0.37 to 5.0 mg/L at each of the monitoring wells.

Total and dissolved iron concentrations are above the Part 201 Residential Drinking Water Criterion (0.3 mg/L) for each of the Target 6 monitoring wells. As discussed above, iron is a naturally occurring analyte and it is probable that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. The detected iron concentrations are below the maximum detected Enbridge potable water well data (0.02 to 6.71 mg/L). The detected iron concentrations are also below the maximum MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L) (**Appendix C**).

5.6.3 Major Cations / Anions

A surface water sample (WSE10171136BRH1) was collected from Target Area 6 on October 17, 2010 at SWKR3460L0. The surface water sample location is shown on **Figure 8** and summary of the analytical results are provided in **Table 4**.

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The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. The water chemistry, as indicated on the Piper and Stiff diagrams (**Appendix H**), is calcium-bicarbonate, similar to surface water at this and the other surface water locations. The groundwater samples varied in TDS concentrations with the two deepest wells having relatively more magnesium, less sulfate, and lower TDS than other wells, as indicated by the Piper and Stiff diagrams. For the four shallow wells, cation and anion concentrations are most similar for wells located in close proximity. Surface water bicarbonate concentrations are lower and chloride and sulfate concentrations are higher than at groundwater wells.

5.6.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- The horizontal and vertical gradient data indicate that groundwater is flowing toward Kalamazoo River, indicating the Kalamazoo River is a gaining river.
- The groundwater analytical data indicates that crude oil constituents (PNAs and VOCs) are not present in groundwater, demonstrating that residual oil has not migrated to groundwater.
- The cation and anion data evaluation via Stiff and Piper diagrams indicate that the chemistry of the surface water and groundwater are of similar chemistry (calcium-bicarbonate) supporting that the groundwater is discharging to the Kalamazoo River.
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring wells MWKR3460L01 and MWKR3450L02 and L04 prior to detection in a potable well.

Naturally occurring iron was detected in groundwater samples above the Part 201 Drinking Water Criterion; however, it is likely that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. In addition, the detected iron concentrations are below the maximum Enbridge potable water well data and MDNRE-supplied potable well data.

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5.7 Target Area 7

Target Area 7 is located between Mile Posts MP 36.00 and MP 36.25, within a bend on the south side of the Kalamazoo River as shown on **Figure 9**. The main purpose of the investigation in this area was to evaluate groundwater flow in the vicinity of a bend in the Kalamazoo River and evaluate the potential impact of the historic submerged oil. Five residential wells are located within the boundary of the Target Area.

Figure 18 shows a cross-sectional view and stratigraphy at Target Area 7. The cross-section trends from the north to the south and is located to the south of the bend in the Kalamazoo River, and east of Morrow Lake. Three monitoring wells were installed in Target Area 7, with a two-well cluster (MWKR3620L01, deep, and MWKR3620L02, shallow) and another shallow well to the south (MWKR3620L03). Fill and glacial deposits are represented in the cross section. Fill was encountered at all three wells and extends from ground surface to approximately 780 ft amsl. The fill is approximately 3 to 7 feet in thickness. The fill is underlain by a thick 50-foot sand sequence, that grades coarser with depth, to approximately 730 ft amsl. Gravelly silt, a glacial till, was encountered at 730 ft amsl.

In-situ hydraulic conductivity tests were conducted at two monitoring wells; one from the shallow and deep zone of the unconsolidated aquifer above the glacial till as described below.

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Type of Soil Around Screen (USCS)	Depth Summary (Screen Interval, bgs)
MWKR3620L01	Falling	2.49E-02	70.50	SP	Deep/34.8-39.8 ft
MWKR3620L01	Rising	4.75E-02	134.80	SP	Deep/34.8-39.8 ft
MWKR3620L02	Rising	4.80E-03	13.62	SM	Shallow/10.5-15.5 ft
MWKR3620L02	Rising	4.27E-03	12.11	SM	Shallow/10.5-15.5 ft

The mean hydraulic conductivity of the shallow and deep aquifer values are 12.8 ft/day (4.53×10^{-3} cm/sec) and 97.5 ft/day (3.44×10^{-2}), respectively. These values are consistent with published values (Todd and Mays, 1980).

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5.7.1 Hydraulic Gradient

Static water measurements were obtained from the three monitoring wells and one staff gauge (SGTA-7TA8) on October 18, 20, and 22, 2010. The staff gauge is located approximately 1,000 feet northwest (down stream), at the 35th Street Bridge.

The water elevation data are presented on **Table 1** and shown on **Figure 9**. Based on the October groundwater elevations of the shallow monitoring wells (MWKR3620L02 and MWKR3620L03) the shallow groundwater is flowing from MWKR3620L03 to MWKR3620L02, towards the Kalamazoo River. In addition the groundwater elevations in Target Area 7 are approximately 0.4 feet higher than the stream gauge SGTA-7TA8; this also indicates that groundwater is discharging to surface water (gaining river) at Target Area 7.

Over the three October measurement events, the horizontal gradient hydraulic gradient between the northern and shallow wells was consistently 0.0025 ft/ft. The vertical gradient was assessed between MWKR3620L02 (10.5- 15.5 ft bgs) and - MWKR3620L01 (34.8-39.8 ft bgs). The vertical gradient ranged from neutral on October 18 to upward 0.01 and 0.02 on October 20 and 22. The upward gradient, although slight, further suggests groundwater discharge to surface water at Target Area 7.

5.7.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from three monitoring wells in Target Area 7 on October 14 and 15, 2010. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGE10141445BAW1	MWKR3620L01	Deep/34.8-39.8 ft
WGE10151050BAW1	MWKR3620L02	Shallow/10.5-15.5 ft
WGE10151050BAW2	MWKR3620L02	Shallow/10.5-15.5 ft
WGE1015935BAW1	MWKR3620L03	Shallow/4.9-14.9 ft

The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 3** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 9**.

PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area 7 indicating that the released oil and submerged oil on the south bank has not affected groundwater in the vicinity of the Kalamazoo River. Dissolved and total iron, a naturally occurring analyte, was detected only at one well (0.36 and 2.1 mg/L). These detections are above the Part 201 Residential Drinking Water Criterion (0.3 mg/L). As discussed above, iron is a naturally occurring analyte and it is probable that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. The detected iron concentrations are below the maximum detected Enbridge potable water well data (0.02 to 6.71 mg/L). The detected iron concentrations are also below the maximum MDNRE-supplied analytical data from potable wells in Marshall, Emmett, Battle Creek, Bedford, Ross, Charleston, and Comstock Townships (0.01 to 10.3 mg/L) (**Appendix C**).

5.7.3 Cations / Anions

A surface water sample (WSE10151200BAW1) was collected from Target Area 7 on October 15, 2010 at SWKR3690L01. The surface water sample location is shown on **Figure 9** and summary of the analytical results are provided in **Table 4**.

The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. The water chemistry, as indicated on the Piper and Stiff diagrams, is calcium-bicarbonate for groundwater at the wells located close to the riverbank, and sodium-bicarbonate for groundwater at well MWKR3620L03 located about 150 ft from the River. This was the only well with sodium-bicarbonate chemistry and may represent the influence of road salt on roads upgradient from Target Area 7. Alternately, the apparent water chemistry may be an analytical anomaly, as the cation charge is about 15 percent greater than the anion charge at this location.

TDS is variable among the sample locations and is lower in groundwater at shallow well MWKR3620L02, located near the riverbank, than in the nearby surface water sample. Groundwater at the deeper well (MWKR3620L01) is most similar in major ion composition to surface water.

5.7.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

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- The horizontal and vertical gradients indicate that groundwater is flowing towards the Kalamazoo River, indicating the Kalamazoo River is a gaining river.
- The upward vertical gradient is further evidence of a gaining river.
- The groundwater analytical data indicate that crude oil constituents (PNAs and VOCs) are not present in groundwater, demonstrating that residual oil has not migrated to groundwater.
- The cation and anion data evaluation via Stiff and Piper diagrams indicate that the chemistry of the surface water and groundwater are generally of similar chemistry.
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring well MWKR3620L02/ MWKR3620L03 prior to detection in a potable well.

Naturally occurring iron was detected in one groundwater sample above the Part 201 Drinking Water Criterion; however, it is likely that the iron exceedances are not related to the oil release as no other crude oil constituents were detected. In addition, the detected iron concentrations are below the maximum Enbridge potable water well data and MDNRE-supplied potable well data.

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5.8 Target Area 8

Target Area 8 is located between Mile Posts MP 36.75 and MP 37.25, within the Morrow Lake Delta as shown on **Figure 10**. The main purpose of the investigation is this area was to evaluate groundwater flow and evaluate the impact of the historic submerged oil area as shown on **Figure 10**. In addition, four potable wells are located within the Target Area boundary.

Figure 19 shows a cross-sectional view and stratigraphy at Target Area 8. This cross-section generally trends south to north on the south side of the Kalamazoo River, at the mouth of Morrow Lake. Alluvial and glacial deposits are represented in the figure. The cross-section includes wells MWKR3680L03, MWKR3680L02, and MWKR3680L01. All wells are screened in the unconsolidated aquifer; however, L01 was screened from at depth (30-35 ft bgs) and L02 and L03 were screened from 3 to 13 ft bgs.

A thick 65-foot sequence of sand was encountered from ground surface to approximately 715 ft amsl and coarsens with depth. The sand is underlain by a 10-foot thick sand and gravel layer to approximately 683 ft amsl and then grades to silty sand to 689 ft amsl. The silty sand is underlain by a silty glacial till. The soils were deposited in a fluvial or glacial fluvial environment.

In-situ hydraulic conductivity tests were conducted at two monitoring wells; one from the shallow and deep zone of the unconsolidated aquifer above the glacial till as described below.

Monitoring Well ID	**Type of Test**	**Hydraulic Conductivity (cm/sec)**	**Hydraulic Conductivity (ft/day)**	**Type of Soil Around Screen (USCS)**	**Depth Summary (Screen Interval, bgs)**
MWKR3680L01	Falling	2.49E-02	143.40	SP	Deep/30-35 ft
MWKR3680L01	Rising	8.81E-02	249.70	SP	Deep/30-35 ft
MWKR3620L02	Rising	8.69E-03	24.65	SM	Shallow/3-13 ft
MWKR3620L02	Rising	1.03E-03	29.20	SM	Shallow/3-13 ft

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The mean hydraulic conductivity of the shallow and deep aquifer values are 189 ft/day (6.67x 10-2 cm/sec) and 26.8 ft/day (9.46x10-3), respectively. These values are consistent with published values (Todd and Mays,1980).

5.8.1 Hydraulic Gradient

Static water measurements were obtained from the three monitoring wells and one staff gauge (SGTA-7TA8) on October 18, 20, and 22, 2010. The staff gauge is located approximately 1,000 feet east (upstream), at the 35th Street Bridge.

The results are presented on **Table 1** and shown on **Figure 10.** Based on the October groundwater elevations of the shallow monitoring wells (MWKR3680L02 and - MWKR3680L03) the shallow groundwater is flowing from MWKR3620L03 to MWKR3620L02, toward the Kalamazoo River. In addition the groundwater elevations in Target Area 8 are approximately 0.6 feet higher than the stream gauge SGTA-7TA8; this also indicates that groundwater is discharging to surface water at Target Area 8.

Over the three October measurement events, the horizontal gradient hydraulic gradient between the northern and shallow wells varied from 0.0007 to 0.0012 ft/ft. The vertical gradient was assessed between MWKR3680L02 (3 to 13ft bgs) and MWKR3680L01 (30-35 ft bgs). The vertical gradient ranged from downward 0.01 on October 18 and 22 and upward 0.05 on October 20, 2010. These data indicate a potential for variable surface water and groundwater interaction at Target Area 8.

5.8.2 Presence of Crude Oil Constituents in Groundwater

Groundwater samples were collected from three monitoring wells in Target Area 8 on October 14 2010. A summary of the samples collected is provided below:

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGE10141020BRH1	MWKR3680L01	Deep/30-35 ft
WGE10141200BRH1	MWKR3680L02	Shallow/3-13 ft
WGE10141200BRH1	MWKR3680L02	Shallow/3-13 ft

Sample ID	MW ID	Depth Summary (Screen Interval, bgs)
WGE10141015BAW1	MWKR3680L03	Shallow/3-13 ft

The analytical results, methods, and comparison to Part 201 Residential Drinking Water Criteria are summarized in **Table 2** and the analytical laboratory reports are provided in **Appendix D**. The monitoring well locations are shown on **Figure 10**.

PNAs and VOCs were not detected in any of the groundwater samples collected from Target Area 8 indicating that the released oil and submerged oil has not affected groundwater in the vicinity of the Kalamazoo River. Total iron, a naturally occurring analyte, was detected only at one well (0.30 mg/L). This detection is not above the Part 201 Residential Drinking Water Criterion (0.3 mg/L).

5.8.3 Cations / Anions

A surface water sample (WSE10141155BAW1) was collected from Target Area 8 on October 14, 2010 at SWKR3690L01. The surface water sample location is shown on **Figure 10** and summary of the analytical results are provided in **Table 4**.

The surface water and groundwater cations and anions chemistry were compared to evaluate the hydraulic communication between the surface water and groundwater. The water chemistry, as indicated on the Piper and Stiff diagrams (**Appendix H**), is calcium-bicarbonate but variable in TDS. TDS is lower in groundwater sampled at the three wells compared to the nearby surface water sample. TDS in groundwater at the shallow well near the riverbank (MWKR3680L02) is the lowest of the wells sampled for this evaluation.

5.8.4 Summary

Lines of evidence that demonstrate minimal risk to potable wells as a result of the crude oil release include:

- The horizontal gradient indicate that groundwater is flowing toward s the Kalamazoo River, indicating the Kalamazoo River is a gaining river; however, the vertical gradient was inconclusive with both downward and upward gradients.

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- The groundwater analytical data indicate that crude oil constituents (PNAs and VOCs) are not present in groundwater, demonstrating that residual oil has not migrated to groundwater.
- The cation and anion data evaluation via Stiff and Piper diagrams show that the chemistry of the surface water and groundwater are of similar chemistry (calcium-bicarbonate).
- Potential crude oil constituents migrating from the Kalamazoo River via groundwater would be detected in shallow monitoring well MWKR3680L02 and MWKR3680L03 prior to detection in a potable well.

6.0 Discussion

The purpose of this study was to evaluate the potential impacts of the released crude oil on groundwater that is a potential source of potable water. Groundwater immediately adjacent to portions of the Kalamazoo River has the potential to be impacted from the released crude oil. Risk to potable wells was assessed based on multiple lines of evidence developed from publically available information, analytical results from direct samples of potable wells adjacent to the river, and the results of investigations conducted at the eight Target Areas along the Kalamazoo River.

Multiple lines of evidence indicate that the Kalamazoo River is predominantly a gaining river and crude oil impacts to potable water were not evident in the results of the investigation. The potential risk of impact to potable water along the Kalamazoo River is minimal as summarized below:

- Groundwater gradients from 6 of the 8 Target Areas indicate that groundwater is discharging to the Kalamazoo River (gaining river). The groundwater gradient at Target Area 3 is both away and towards the Kalamazoo River in an area where no potable wells were identified. The gradient at Target Area 2 (Ceresco Dam area) is away from the River (losing river) over the area near the impounded water upstream of the Ceresco Dam.

- At the majority of the Part 201 Sites of Contamination located within 2,000 feet of the Kalamazoo River that have groundwater flow direction data, the documented direction of groundwater movement is towards the Kalamazoo River, indicating that the Kalamazoo

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River is predominantly a gaining river. Sites where flow is away from the river generally involve a perched aquifer or another surface water body that is closer.

- The analytical results of the sampled potable wells within 200 feet of the Kalamazoo River's high water level indicate that crude oil constituents have not impacted the potable wells. Although iron has been detected in most wells, it is a naturally occurring element and is not attributed to the impacts from the release.

- The analytical results of the sampled monitoring wells at the eight Target Areas indicate that crude oil constituents have not impacted groundwater. The nearest monitoring wells range from approximately 20 feet to 700 feet from the Kalamazoo River with most wells less than 50 feet away. Organic crude oil constituents were not detected in any of the monitoring wells. Although iron and vanadium were detected in some samples; their occurrence is likely attributable to background groundwater quality in the area since elevated iron concentrations were detected in the residential wells as well as in groundwater samples collected in the area by the public health departments. In addition, at several target areas the highest concentrations of iron and vanadium were found in the upgradient wells.

- At Ceresco Dam, Target Area 2, the groundwater flow direction is away from the Kalamazoo River (losing river) and the vertical gradient is downward adjacent to the impoundment upstream from the dam. The abrupt change in water level across the face of the dam creates a hydraulic gradient that can locally cause this flow direction and the downward vertical gradient in this area.

- At Target Area 5, located at a tight meandered bend of the River, the shallow groundwater flow is to the southwest, parallel to the Kalamazoo River channel; however the upward vertical gradient demonstrates the groundwater is still rising from lower formations.

- Surface water and groundwater samples collected during this investigation have almost uniformly calcium-bicarbonate chemistry. The similarity of the major element chemistry of the groundwater and surface water samples is consistent with the conceptual model where the sample event for this study was during base flow conditions for the river when

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ground water flow in the river is dominated by groundwater flow into the river. The only area where sharp differences in major element chemistry was observed is for the upgradient groundwater sample collected from Target Area 7 – the major element chemistry for this sample (sodium-bicarbonate) may be due to roadway salting of upgradient roads and is not attributable to any recharge of the groundwater from surface water.

The conceptual site model presented in the work plan has not significantly changed based on the results of the study (**Figure 20**). Geology along the Kalamazoo River consists of a layer of glacial drift (unconsolidated material) with permeable sands and gravels that may also contain some clay units. This glacial drift unit is underlain by bedrock that includes the Marshall Sandstone of the Marshall Formation (Michigan Department of Environmental Quality, Geological Survey Division, 1987). Groundwater is present in the glacial drift and the underlying bedrock. Many residential wells are screened in the bedrock, while others are screened in the permeable sands and gravels above the bedrock.

The Kalamazoo River's role in the water cycle is that of a conduit through which surface water and groundwater drain to Lake Michigan. Groundwater and surface drainage near the Kalamazoo River dominantly flow towards the River. As expected, altered groundwater flow occurs where there are abrupt drops in water levels in the river across dams such as at Ceresco Dam at Target Area 2 where the groundwater locally flows away from the river. At Target Area 3, the low-lying ground surface results in a mixed flow direction, with flow away from the river adjacent to the Kalamazoo River, but flow towards the river at a distance from the river. Also, shallow groundwater flow was documented to migrate with the flow of the river at tight meanders (Target Area 5).

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7.0 Recommendations

Results from the Hydrogeological Investigation indicated that the Kalamazoo River is primarily a gaining river where groundwater is flowing into the river. As a result, the potential for crude oil constituents to be transported into the groundwater system is unlikely. A possible exception is at Target Area 2 where the Ceresco Dam water level is higher than the surrounding groundwater causing the groundwater to locally flow (at least seasonally) away from the Kalamazoo River (losing river). In this area, the monitoring wells did not detect hydrocarbons in the groundwater adjacent to the river or in the shallow groundwater farther from the river or the deeper groundwater.

Based on these results, the following recommendations are made:

- Conduct quarterly water level gauging from all monitoring wells to evaluate seasonal groundwater flow patterns;
- Conduct quarterly sampling of select monitoring wells, located closest to the river, that will serve as sentinel monitoring points between the river and potable wells.
- Conduct monthly liquid level gauging for three months and then quarterly, of all monitoring wells at the Ceresco Dam area (Target Area 2) since this area demonstrated the greatest potential for river water migration to groundwater. In addition, collect groundwater sampling monthly at select monitoring wells, located closest to the river;
- Bias the spring and summer quarterly water levels and sampling events for shortly after a high water event in the river to evaluate recharge to the river; and
- Prepare quarterly reports presenting findings and recommendations from each monitoring event.

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Tables

TABLE 1
WATER ELEVATIONS
Hydrogeological Investigation
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

													Observation Date	10/18/2010			10/20/2010			10/22/2010		
Division	Area	Type	Location	Easting	Northing	Ground Elevation (ft amsl)	Measure Point Elevation (ft amsl)	Screen Aquifer	Screen Top Depth (ft bgs)	Screen Top Elevation (ft amsl)	Screen Bottom Depth (ft bgs)	Screen Bottom Elevation (ft amsl)		Depth To Water (ft)	Water Elevation (ft)	Note	Depth To Water (ft)	Water Elevation (ft)	Note	Depth To Water (ft)	Water Elevation (ft)	Note
C	Target Area 1	Staff Gauge	SG 15 MILE ROAD	12952410.8	277034.1	-	882.53	-	-	-	-	-		9.3	873.23		9.13	873.4		9.28	873.25	
C	Target Area 1	MW	MWKR0250L01	12951049.1	276724.8	891.83	891.5	UC	74.5	817.33	79.5	812.33		16.64	874.86		16.58	874.92		16.6	874.9	
C	Target Area 1	MW	MWKR0250L02	12951039.5	276721.4	891.6	891.24	UC	14	877.6	24	867.6		18.61	872.63		18.63	872.61		18.66	872.58	
C	Target Area 1	MW	MWKR0250L03	12951051.8	276492.5	896.3	895.94	UC	40	856.3	45	851.3		12.2	883.74		12.25	883.69		12.32	883.62	
C	Target Area 2	Staff Gauge	SG CERESCO	12935458.28	281252.4	-	876.46	-	-	-	-	-		7.89	868.57		7.9	868.56		7.89	868.57	
C	Target Area 2	Staff Gauge	SGTA2	12935294.2	281431.9	-	879.45	-	-	-	-	-		21.28	858.17		21.29	858.16		21.24	858.21	
C	Target Area 2	MW	MWKR0570R01	12936148.1	281319.4	875.62	875.34	BR	29	846.62	34	841.62		7.49	867.85		7.54	867.8		7.59	867.75	
C	Target Area 2	MW	MWKR0570R02	12936140.2	281326.4	875.32	874.93	UC	4	871.32	14	861.32		6.97	867.96		7.02	867.91		7.09	867.84	
C	Target Area 2	MW	MWKR0570R03	12936213.6	281478.8	882.4	881.97	BR	9	873.4	19	863.4		14.24	867.73		14.27	867.7		14.34	867.63	
C	Target Area 2	MW	MWKR0580L01	12935474.8	281086.7	883.97	883.35	BR	41	842.97	46	837.97		19.99	863.36		20.03	863.32		20.1	863.25	
C	Target Area 2	MW	MWKR0580L02	12935471.5	281081.2	883.77	883.16	BR	16	867.77	26	857.77		19.61	863.55		19.64	863.52		19.73	863.43	
C	Target Area 2	MW	MWKR0580L03	12935464.8	281038.1	884.18	883.78	BR	20	864.18	25	859.18		19.47	864.31		19.51	864.27		19.56	864.22	
C	Target Area 2	MW	MWKR0580R01	12935894.3	281433.5	885.65	885.32	BR	10	875.65	20	865.65		18.32	867		18.37	866.95		18.42	866.9	
C	Target Area 2	MW	MWKR0580R02	12935892.8	281534.7	887.82	887.5	BR	10	877.82	20	867.82		19.25	868.25	Static water level elevation below the screen	19.25	868.25	Static water level elevation below the screen	19.25	868.25	Static water level elevation below the screen
C	Target Area 2	MW	MWKR0580R03	12935847.6	281706.9	892.95	892.62	BR	16	876.95	26	866.95		26.03	866.59	Static water level elevation below the screen	26.03	866.59	Static water level elevation below the screen	26.04	866.58	Static water level elevation below the screen
C	Target Area 3	Staff Gauge	SGTA3	12900847.4	295639.3	-	838.35	-	-	-	-	-		12.39	825.96		12.4	825.95		12.39	825.96	
C	Target Area 3	MW	MWKR1525R01	12901627.4	295799.8	831.6	831.38	UC	30	801.6	35	796.6		8.19	823.19		8.23	823.15		8.32	823.06	
C	Target Area 3	MW	MWKR1525R02	12901625.6	295798.2	831.66	831.31	UC	4	827.66	14	817.66		8.12	823.19		8.16	823.15		8.25	823.06	
C	Target Area 3	MW	MWKR1525R03	12901730.6	295791.8	831.43	831.01	UC	4	827.43	14	817.43		7.77	823.24		7.77	823.24		7.7	823.31	
D	Target Area 4	Staff Gauge	SGTA4	12877622.6	311387.1	-	814.31	-	-	-	-	-		18.32	795.99		18.37	795.94		18.39	795.92	
D	Target Area 4	MW	MWKR2260R01	12873865.1	314746.9	810.32	809.96	BR	55	755.32	60	750.32		11.1	798.86		11.12	798.84		11.14	798.82	
D	Target Area 4	MW	MWKR2260R02	12873867.3	314743.6	810.02	809.63	UC	22	788.02	27	783.02		12.74	796.89		12.76	796.87		12.79	796.84	
D	Target Area 4	MW	MWKR2275R01	12873707.9	314922.7	815.19	814.72	UC	20	795.19	25	790.19		15.48	799.24		15.51	799.21		15.53	799.19	
D	Target Area 5	Staff Gauge	SGTA5	12858743.1	305947.8	-	796.87	-	-	-	-	-		11.12	785.75		11.21	785.66		11.25	785.62	
D	Target Area 5	MW	MWKR2680R01	12862834.7	310490.6	791.59	791.26	UC	2	789.59	12	779.59		3.87	787.39		3.92	787.34		3.93	787.33	
D	Target Area 5	MW	MWKR2700R01	12862693.4	310364.2	790.98	790.65	BR	32	758.98	37	753.98		3.33	787.32		3.33	787.32		3.4	787.25	
D	Target Area 5	MW	MWKR2700R02	12862695.2	310360.9	790.93	790.64	UC	2	788.93	12	778.93		3.33	787.31		3.4	787.24		3.44	787.2	
E	Target Area 6	Staff Gauge	SGTA6	12843253.19	289111.09	-	789.99	-	-	-	-	-		11.08	778.91		11.07	778.92		11.12	778.87	
E	Target Area 6	MW	MWKR3450L01	12842415.7	288548	783.02	782.64	UC	137.2	645.82	147.2	635.82		-		Flowing	-		Flowing			Flowing
E	Target Area 6	MW	MWKR3450L02	12842419.9	288543.5	782.99	782.68	UC	7	775.99	12	770.99		3.4	779.28		3.43	779.25		3.41	779.27	
E	Target Area 6	MW	MWKR3450L03	12842413.1	288551	783.05	782.65	UC	72	711.05	77	706.05		3.22	779.43		3.25	779.4		3.24	779.41	
E	Target Area 6	MW	MWKR3450L04	12842425.1	288538.3	783.07	782.57	UC	2	781.07	12	771.07		3.29	779.28		3.33	779.24		3.35	779.22	
E	Target Area 6	MW	MWKR3460L01	12842307.1	288685	783.67	783.31	UC	6.8	776.87	11.8	771.87		4.02	779.29		4.05	779.26		4.03	779.28	
E	Target Area 6	MW	MWKR3460L02	12842309.6	288681	783.7	783.19	UC	2	781.7	12	771.7		3.9	779.29		3.93	779.26		3.93	779.26	
E	Target Area 7	MW	MWKR3620L01	12836877.8	284792.5	787.41	786.97	UC	34.8	752.61	39.8	747.61		11.32	775.65		11.26	775.71		11.35	775.62	
E	Target Area 7	MW	MWKR3620L02	12836874.6	284793.9	787.42	786.97	UC	10.5	776.92	15.5	771.92		11.32	775.65		11.27	775.7		11.37	775.6	
E	Target Area 7	MW	MWKR3620L03	12836831.2	284673.8	787.23	786.84	UC	4.9	782.33	14.9	772.33		10.89	775.95		10.84	776		10.93	775.91	
E	Target Area 7+8	Staff Gauge	SGTA7TA8	12835904.8	286128.3	-	787.01	-	-	-	-	-		11.75	775.26		11.71	775.3		11.8	775.21	
E	Target Area 8	MW	MWKR3680L01	12834380.5	284322.8	781.68	781.3	UC	30	751.68	35	746.68		5.43	775.87		5.35	775.95		5.44	775.86	
E	Target Area 8	MW	MWKR3680L02	12834381.3	284318.7	781.82	781.47	UC	3	778.82	13	768.82		5.59	775.88		5.57	775.9		5.6	775.87	
E	Target Area 8	MW	MWKR3680L03	12834384.4	284184.4	782.3	781.92	UC	3	779.3	13	769.3		5.94	775.98		5.86	776.06		5.94	775.98	

MW = Monitoring Well
UC = Unconsolidated Well
BR = Bedrock Well
ft amsl = feet above mean sea level
ft bgs = feet below ground surface
- = not applicable

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TABLE 2
SAMPLING ANALYSIS SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

Target Area	Monitoring Well/ Surface Water Identifier	Northing (feet)	Easting (feet)	Well Screened Interval (feet below ground surface)	Unconsolidated (UC) or Bedrock (BR) Well	PNAs	VOCs	Metals	Chloride	Sulfate	Bicarbonate	Carbonate	Field Parameters
Target Area 1	MWKR0250L01	276724.8	12951049.1	74.5 - 79.5	UC	X	X	X	X	X	X	X	X
Target Area 1	MWKR0250L02	276721.4	12951039.5	14.0 - 24.0	UC	X	X	X	X	X	X	X	X
Target Area 1	MWKR0250L03	276492.5	12951051.8	40.0 - 45.0	UC	X	X	X	X	X	X	X	X
Target Area 1	SWKR0250L01	276779.2	12951011.9					X	X	X	X	X	X
Target Area 2	MWKR0570R01	281319.4	12936148.1	29.0 - 34.0	BR	X	X	X	X	X	X	X	X
Target Area 2	MWKR0570R02	281326.4	12936140.2	4.0 - 14.0	UC	X	X	X	X	X	X	X	X
Target Area 2	MWKR0570R03	281478.8	12936213.6	9.0 - 19.0	BR	X	X	X	X	X	X	X	X
Target Area 2	MWKR0580L01	281086.7	12935474.8	41.0 - 46.0	BR	X	X	X	X	X	X	X	X
Target Area 2	MWKR0580L02	281081.2	12935471.5	16.0 - 26.0	BR	X	X	X	X	X	X	X	X
Target Area 2	MWKR0580L03	281038.1	12935464.8	15.0 - 25.0	BR	X	X	X	X	X	X	X	X
Target Area 2	SWKR0570R01	281279.2	12936125.9					X	X	X	X	X	X
Target Area 3	MWKR1525R01	295799.8	12901627.4	30.0 - 35.0	UC	X	X	X	X	X	X	X	X
Target Area 3	MWKR1525R02	295798.2	12901625.6	4.0 - 14.0	UC	X	X	X	X	X	X	X	X
Target Area 3	MWKR1525R03	295791.8	12901730.6	4.0 - 14.0	UC	X	X	X	X	X	X	X	X
Target Area 3	SWKR1525R01	295711.8	12900900.2					X	X	X	X	X	X
Target Area 4	MWKR2260R01	314746.9	12873865.1	55.0 - 60.0	BR	X	X	X	X	X	X	X	X
Target Area 4	MWKR2260R02	314743.6	12873867.3	22.0 - 27.0	UC	X	X	X	X	X	X	X	X
Target Area 4	MWKR2275R01	314922.7	12873707.9	20.0 - 25.0	UC	X	X	X	X	X	X	X	X
Target Area 4	SWKR2260R01	314697.5	12873942.8					X	X	X	X	X	X
Target Area 5	MWKR2680R01	310490.6	12862834.7	2.0 - 12.0	UC	X	X	X	X	X	X	X	X
Target Area 5	MWKR2700R01	310364.2	12862693.4	32.0 - 37.0	BR	X	X	X	X	X	X	X	X
Target Area 5	MWKR2700R02	310360.9	12862695.2	2.0 - 12.0	UC	X	X	X	X	X	X	X	X
Target Area 5	SWKR2700R01	310330.1	12862594.5					X	X	X	X	X	X
Target Area 6	MWKR3450L01	288548	12842415.7	137.2 - 147.2	UC	X	X	X	X	X	X	X	X
Target Area 6	MWKR3450L02	288543.5	12842419.9	7.0 - 12.0	UC	X	X	X	X	X	X	X	X
Target Area 6	MWKR3450L03	288551	12842413.1	72.0 - 77.0	UC	X	X	X	X	X	X	X	X
Target Area 6	MWKR3450L04	288538.3	12842425.1	2.0 - 12.0	UC	X	X	X	X	X	X	X	X
Target Area 6	MWKR3460L01	288685	12842307.1	6.8 - 11.8	UC	X	X	X	X	X	X	X	X
Target Area 6	MWKR3460L02	288681	12842309.6	2.0 - 12.0	UC	X	X	X	X	X	X	X	X
Target Area 6	SWKR3460L01	288902.3	12842130.1					X	X	X	X	X	X
Target Area 7	MWKR3620L01	284792.5	12836877.8	34.8 - 39.8	UC	X	X	X	X	X	X	X	X
Target Area 7	MWKR3620L02	284793.9	12836874.6	10.5 - 15.5	UC	X	X	X	X	X	X	X	X
Target Area 7	MWKR3620L03	284673.8	12836831.2	4.9 - 14.9	UC	X	X	X	X	X	X	X	X
Target Area 7	SWKR3630L01	284875.4	12836808.2					X	X	X	X	X	X
Target Area 8	MWKR3680L01	284322.8	12834380.5	30.0 - 35.0	UC	X	X	X	X	X	X	X	X
Target Area 8	MWKR3680L02	284318.7	12834381.3	3.0 - 13.0	UC	X	X	X	X	X	X	X	X
Target Area 8	MWKR3680L03	284184.4	12834384.4	3.0 - 13.0	UC	X	X	X	X	X	X	X	X
Target Area 8	SWKR3690L01	284525.3	12834223.6					X	X	X	X	X	X

** Field parameters are temperature, pH, conductivity, ORP, turbidity
Elevation units: Feet NAVD88
Coordinate System: MI State Plane South NAD83 HARN, international feet

FOOTNOTES
GROUNDWATER ANALYTICAL SUMMARY
HYDROGEOLOGICAL INVESTIGATION
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

Drinking Water Criteria promulgated within the administrative rules for Part 201 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

(A) = Criterion is the state of Michigan drinking water standard established pursuant to section 5 of 1976 PA 399, MCL 325.1005.
(B) = Background, as defined in R 299.5701(b), may be substituted if higher than the calculated cleanup criterion. Background levels may be less than criteria for some inorganic compounds.

(E) = Criterion is the aesthetic drinking water value.

(I) = Hazardous substance may exhibit the characteristic of ignitability.

(M) = Calculated criterion is below the analytical target detection limit, therefore, the criterion defaults to the target detection limit.

(Q) Criteria for carcinogenic polycyclic aromatic hydrocarbons were developed using relative potential potencies to benzo(a)pyrene.

(S) Criterion defaults to the hazardous substance-specific water solubility limit.

(AA) Comparison to these criteria may take into account an evaluation of whether the hazardous substances are adsorbed to particulates rather than dissolved in water and whether filtered groundwater samples were used to evaluate groundwater.

TDL = Target Detection Limit

Bold font indicates chemical detected above laboratory detection limit

Shading indicates a criteria exceedance.

U = The analyte was analyzed, but was not detected above the reported sample quantitation limit.

R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control critiera. The presence or absence cannot be verified.

J- = The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.

UJ = The analyte was note detected above the reported sample quantitiation limit. However, the reported quantatation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample

TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 1	Target Area 1	Target Area 1	Target Area 2	Target Area 2	Target Area 2
					Division	C	C	C	C	C	C
					Location	MWKR0250L01	MWKR0250L02	MWKR0250L03	MWKR0570R01	MWKR0570R02	MWKR0570R03
					Screen Zone	UC	UC	UC	BR	UC	BR
					Date	10/14/2010	10/14/2010	10/14/2010	10/15/2010	10/15/2010	10/13/2010
					Sample	WGC10141640BRH1	WGC10141505BRH1	WGC10141810BRH1	WGC10150950DJJ1	WGC10151120DJJ1	WGC10130900BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
Field Parameters											
DISSOLVED OXYGEN	FIELD	Not applicable	percent		NA	-	-	-	3.22	47.9	-
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l		NA	0.34	1.49	0.32	-	-	-
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts		NC	-378.2	-136.3	-55.7	69.1	217.3	-
pH	FIELD	Not applicable	su		(E)	6.42	7.09	6.22	7.24	7.22	-
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm		NC	0.686	1.041	1.412	0.662	0.576	-
TEMPERATURE	FIELD	Not applicable	deg c		NC	13.55	14.47	11.91	11.62	13.61	-
TURBIDITY	FIELD	Not applicable	ntu		NC	10.8	32.7	24.1	0.91	0.39	-
Inorganics (Metals)											
BARIUM	SW6020A	Dissolved	mg/l	0.1	2 (A) (B)	**0.18**	< 0.10 U	**0.11**	< 0.10 U	< 0.10 U	< 0.10 U
CALCIUM	SW6020A	Dissolved	mg/l	1	NC	**74**	**110**	**130**	**91**	**77**	**75**
IRON	SW6020A	Dissolved	mg/l	0.2	0.3 (E) (B)	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U	***0.49***
MAGNESIUM	SW6020A	Dissolved	mg/l	1	400 (B)	**22**	**27**	**32**	**27**	**22**	**18**
NICKEL	SW6020A	Dissolved	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 UJ
POTASSIUM	SW6020A	Dissolved	mg/l	1	NC	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Dissolved	mg/l	1	120	**30**	**59**	**110**	**11**	**10**	**75**
VANADIUM	SW6020A	Dissolved	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	**0.0062**
BARIUM	SW6020A	Total	mg/l	0.1	2 (A) (B)	**0.20**	**0.11**	**0.12**	< 0.10 U	< 0.10 U	< 0.10 U
CALCIUM	SW6020A	Total	mg/l	1	NC	**78**	**110**	**140**	**95**	**80**	**77**
IRON	SW6020A	Total	mg/l	0.2	0.3 (E) (B)	***1.9***	***0.41***	***0.37***	< 0.20 U	< 0.20 U	***10***
MAGNESIUM	SW6020A	Total	mg/l	1	400 (B)	**22**	**28**	**32**	**28**	**23**	**19**
NICKEL	SW6020A	Total	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	**0.025**
POTASSIUM	SW6020A	Total	mg/l	1	0	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	1	120	**30**	**62**	**120**	**11**	**11**	**72**
VANADIUM	SW6020A	Total	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	**0.034**
Polynuclear Aromatic Hydrocarbons (PNAs)											
2-METHYLNAPHTHALENE	SW8270	Not applicable	ug/l	5	260	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHENE	SW8270	Not applicable	ug/l	5	1300	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHYLENE	SW8270	Not applicable	ug/l	5	52	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ANTHRACENE	SW8270	Not applicable	ug/l	5	43 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
BENZO(A)ANTHRACENE	SW8270	Not applicable	ug/l	1	2.1 (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(A)PYRENE	SW8270	Not applicable	ug/l	1	5 (A) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(B)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1.5 (S, AA) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(G,H,I)PERYLENE	SW8270	Not applicable	ug/l	1	1 (M); 0.26 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(K)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1 (M); 0.8 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHRYSENE	SW8270	Not applicable	ug/l	1	1.6 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
DIBENZ(A,H)ANTHRACENE	SW8270	Not applicable	ug/l	2	2 (M); 0.21 (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 1	Target Area 1	Target Area 1	Target Area 2	Target Area 2	Target Area 2
					Division	C	C	C	C	C	C
					Location	MWKR0250L01	MWKR0250L02	MWKR0250L03	MWKR0570R01	MWKR0570R02	MWKR0570R03
					Screen Zone	UC	UC	UC	BR	UC	BR
					Date	10/14/2010	10/14/2010	10/14/2010	10/15/2010	10/15/2010	10/13/2010
					Sample	WGC10141640BRH1	WGC10141505BRH1	WGC10141810BRH1	WGC10150950DJJ1	WGC10151120DJJ1	WGC10130900BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
FLUORANTHENE	SW8270	Not applicable	ug/l	1	210 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
FLUORENE	SW8270	Not applicable	ug/l	5	880	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
INDENO(1,2,3-C,D)PYRENE	SW8270	Not applicable	ug/l	2	2 (M); 0.022 (S) (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
NAPHTHALENE	SW8260	Not applicable	ug/l	5	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
NAPHTHALENE	SW8270	Not applicable	ug/l	1	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
PHENANTHRENE	SW8270	Not applicable	ug/l	2	52	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
PYRENE	SW8270	Not applicable	ug/l	5	140 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Volatile Organic Compounds (VOCs)											
1,2,3-TRIMETHYL BENZENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
1,2,4-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	63 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,3,5-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	72 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZENE	SW8260	Not applicable	ug/l	1	5 (A) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CYCLOHEXANE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
CYMENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 UJ	< 5.0 U
DIMETHYL BENZENE	SW8260	Not applicable	ug/l	3	280 (E) (I)	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
ETHYLBENZENE	SW8260	Not applicable	ug/l	1	74 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
ISOPROPYLBENZENE	SW8260	Not applicable	ug/l	5	800	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
N-PROPYLBENZENE	SW8260	Not applicable	ug/l	1	80 (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
SEC-BUTYLBENZENE	SW8260	Not applicable	ug/l	1	80	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
TOLUENE	SW8260	Not applicable	ug/l	1	790 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHEMISTRY											
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	**250**	**340**	**380**	**300 J-**	**260 J-**	**240**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	< 10 U	< 10 U	< 10 U	R	R	< 10 U
CHLORIDE (AS CL)	SW9056	Total	mg/l	10	NC	**46**	**97**	**180**	**18**	**11**	**100**
SULFATE (AS SO4)	SW9056	Total	mg/l	1	250 (E)	**37**	**62**	**75**	**35**	**25**	**57**

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 2	Target Area 2	Target Area 2	Target Area 3	Target Area 3	Target Area 3
					Division	C	C	C	C	C	C
					Location	MWKR0580L01	MWKR0580L02	MWKR0580L03	MWKR1525R01	MWKR1525R02	MWKR1525R02
					Screen Zone	BR	BR	BR	BR	UC	UC
					Date	10/15/2010	10/13/2010	10/13/2010	10/16/2010	10/16/2010	10/16/2010
					Sample	WGC10151310DJJ1	WGC10131435BAW1	WGC10131220BAW1	WGC10161000DJJ1	WGC10161100DJJ1	WGC10161100DJJ2
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
Field Parameters											
DISSOLVED OXYGEN	FIELD	Not applicable	percent		NA	4.1	-	-	3.2	3.1	3.1
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l		NA	-	-	-	-	-	-
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts		NC	-41.3	-	-	-108.5	-67.9	-67.9
pH	FIELD	Not applicable	su		(E)	7.23	-	-	6.95	6.96	6.96
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm		NC	0.659	-	-	0.986	1.095	1.095
TEMPERATURE	FIELD	Not applicable	deg c		NC	11.93	-	-	11.98	13.61	13.61
TURBIDITY	FIELD	Not applicable	ntu		NC	3.84	-	-	2.18	3.81	3.81
Inorganics (Metals)											
BARIUM	SW6020A	Dissolved	mg/l	0.1	2 (A) (B)	< 0.10 U	< 0.10 U	< 0.10 U	**0.28**	**0.18**	**0.17**
CALCIUM	SW6020A	Dissolved	mg/l	1	NC	**91**	**81**	**67**	**120**	**130**	**120**
IRON	SW6020A	Dissolved	mg/l	0.2	0.3 (E) (B)	< 0.20 U	***0.43***	***5.8***	***1.8 J***	***1.6 J***	***0.66 J***
MAGNESIUM	SW6020A	Dissolved	mg/l	1	400 (B)	**26**	**22**	**21**	**30**	**28**	**28**
NICKEL	SW6020A	Dissolved	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 UJ	< 0.020 UJ	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Dissolved	mg/l	1	NC	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Dissolved	mg/l	1	120	**11**	**19**	**31**	**16**	**20**	**19**
VANADIUM	SW6020A	Dissolved	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	**0.023**	< 0.0040 U	< 0.0040 U	< 0.0040 U
BARIUM	SW6020A	Total	mg/l	0.1	2 (A) (B)	< 0.10 U	< 0.10 U	< 0.10 U	**0.51**	**0.28**	**0.27**
CALCIUM	SW6020A	Total	mg/l	1	NC	**93**	**77**	**68**	**130**	**130**	**130**
IRON	SW6020A	Total	mg/l	0.2	0.3 (E) (B)	**0.30**	***2.7***	***15***	***26***	***23***	***21***
MAGNESIUM	SW6020A	Total	mg/l	1	400 (B)	**26**	**21**	**21**	**30**	**28**	**28**
NICKEL	SW6020A	Total	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Total	mg/l	1	0	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	1	120	**12**	**17**	**32**	**16**	**19**	**19**
VANADIUM	SW6020A	Total	mg/l	0.004	0.0045	< 0.0040 U	**0.011**	**0.047**	< 0.0040 U	< 0.0040 U	< 0.0040 U
Polynuclear Aromatic Hydrocarbons (PNAs)											
2-METHYLNAPHTHALENE	SW8270	Not applicable	ug/l	5	260	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHENE	SW8270	Not applicable	ug/l	5	1300	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHYLENE	SW8270	Not applicable	ug/l	5	52	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ANTHRACENE	SW8270	Not applicable	ug/l	5	43 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
BENZO(A)ANTHRACENE	SW8270	Not applicable	ug/l	1	2.1 (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(A)PYRENE	SW8270	Not applicable	ug/l	1	5 (A) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(B)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1.5 (S, AA) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(G,H,I)PERYLENE	SW8270	Not applicable	ug/l	1	1 (M); 0.26 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(K)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1 (M); 0.8 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHRYSENE	SW8270	Not applicable	ug/l	1	1.6 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
DIBENZ(A,H)ANTHRACENE	SW8270	Not applicable	ug/l	2	2 (M); 0.21 (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 2	Target Area 2	Target Area 2	Target Area 3	Target Area 3	Target Area 3
					Division	C	C	C	C	C	C
					Location	MWKR0580L01	MWKR0580L02	MWKR0580L03	MWKR1525R01	MWKR1525R02	MWKR1525R02
					Screen Zone	BR	BR	BR	BR	UC	UC
					Date	10/15/2010	10/13/2010	10/13/2010	10/16/2010	10/16/2010	10/16/2010
					Sample	WGC10151310DJJ1	WGC10131435BAW1	WGC10131220BAW1	WGC10161000DJJ1	WGC10161100DJJ1	WGC10161100DJJ2
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
FLUORANTHENE	SW8270	Not applicable	ug/l	1	210 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
FLUORENE	SW8270	Not applicable	ug/l	5	880	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
INDENO(1,2,3-C,D)PYRENE	SW8270	Not applicable	ug/l	2	2 (M); 0.022 (S) (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
NAPHTHALENE	SW8260	Not applicable	ug/l	5	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
NAPHTHALENE	SW8270	Not applicable	ug/l	1	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
PHENANTHRENE	SW8270	Not applicable	ug/l	2	52	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
PYRENE	SW8270	Not applicable	ug/l	5	140 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Volatile Organic Compounds (VOCs)											
1,2,3-TRIMETHYL BENZENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
1,2,4-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	63 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,3,5-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	72 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZENE	SW8260	Not applicable	ug/l	1	5 (A) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CYCLOHEXANE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
CYMENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
DIMETHYL BENZENE	SW8260	Not applicable	ug/l	3	280 (E) (I)	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
ETHYLBENZENE	SW8260	Not applicable	ug/l	1	74 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
ISOPROPYLBENZENE	SW8260	Not applicable	ug/l	5	800	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
N-PROPYLBENZENE	SW8260	Not applicable	ug/l	1	80 (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
SEC-BUTYLBENZENE	SW8260	Not applicable	ug/l	1	80	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
TOLUENE	SW8260	Not applicable	ug/l	1	790 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHEMISTRY											
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	**290 J-**	**260**	**240**	**480**	**490**	**490**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	R	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
CHLORIDE (AS CL)	SW9056	Total	mg/l	10	NC	**33**	**36**	**32**	**33**	**41**	**39**
SULFATE (AS SO4)	SW9056	Total	mg/l	1	250 (E)	**33**	**29**	**55**	< 1.0 U	**4.1**	**3.9**

TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 3	Target Area 4	Target Area 4	Target Area 4	Target Area 5	Target Area 5
					Division	C	D	D	D	D	D
					Location	MWKR1525R03	MWKR2260R01	MWKR2260R02	MWKR2275R01	MWKR2680R01	MWKR2700R01
					Screen Zone	UC	BR	UC	UC	UC	BR
					Date	10/16/2010	10/17/2010	10/17/2010	10/16/2010	10/16/2010	10/16/2010
					Sample	WGC10160955BRH1	WGD10171520TAS1	WGD10171540RWS1	WGD10161730BRH1	WGD10161345DJJ1	WGD10161405BRH1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
Field Parameters											
DISSOLVED OXYGEN	FIELD	Not applicable	percent		NA	-	-	-	-	3.3	-
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l		NA	1.01	0.21	0.98	0.62	-	0.18
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts		NC	-98.3	-282.7	-3.2	-435.9	-73.8	-145.2
pH	FIELD	Not applicable	su		(E)	6.83	7.43	7.09	7.46	7.15	7.25
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm		NC	0.958	505	0.576	0.674	0.657	0.633
TEMPERATURE	FIELD	Not applicable	deg c		NC	14.4	11.49	11.82	15.06	14.96	13.79
TURBIDITY	FIELD	Not applicable	ntu		NC	4.44	61.74	1.52	623.6	4.81	1.8
Inorganics (Metals)											
BARIUM	SW6020A	Dissolved	mg/l	0.1	2 (A) (B)	**0.11**	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	**0.17**
CALCIUM	SW6020A	Dissolved	mg/l	1	NC	**100**	**64**	**72**	**69**	**100**	**73**
IRON	SW6020A	Dissolved	mg/l	0.2	0.3 (E) (B)	***0.44 J***	***0.42 J***	< 0.20 UJ	< 0.20 UJ	< 0.20 UJ	< 0.20 UJ
MAGNESIUM	SW6020A	Dissolved	mg/l	1	400 (B)	**19**	**19**	**20**	**16**	**13**	**21**
NICKEL	SW6020A	Dissolved	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Dissolved	mg/l	1	NC	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Dissolved	mg/l	1	120	**42**	**5.4**	**13**	**35**	**8.7**	**10**
VANADIUM	SW6020A	Dissolved	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
BARIUM	SW6020A	Total	mg/l	0.1	2 (A) (B)	**0.16**	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	**0.18**
CALCIUM	SW6020A	Total	mg/l	1	NC	**110**	**64**	**71**	**74**	**110**	**77**
IRON	SW6020A	Total	mg/l	0.2	0.3 (E) (B)	***15***	***1.2***	< 0.20 U	***32***	***4.4***	***1.2***
MAGNESIUM	SW6020A	Total	mg/l	1	400 (B)	**20**	**19**	**20**	**20**	**14**	**21**
NICKEL	SW6020A	Total	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	**0.025**	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Total	mg/l	1	0	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	1	120	**44**	**5.3**	**12**	**34**	**9.2**	**11**
VANADIUM	SW6020A	Total	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	**0.11**	< 0.0040 U	< 0.0040 U
Polynuclear Aromatic Hydrocarbons (PNAs)											
2-METHYLNAPHTHALENE	SW8270	Not applicable	ug/l	5	260	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHENE	SW8270	Not applicable	ug/l	5	1300	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHYLENE	SW8270	Not applicable	ug/l	5	52	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ANTHRACENE	SW8270	Not applicable	ug/l	5	43 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
BENZO(A)ANTHRACENE	SW8270	Not applicable	ug/l	1	2.1 (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(A)PYRENE	SW8270	Not applicable	ug/l	1	5 (A) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(B)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1.5 (S, AA) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(G,H,I)PERYLENE	SW8270	Not applicable	ug/l	1	1 (M); 0.26 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(K)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1 (M); 0.8 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHRYSENE	SW8270	Not applicable	ug/l	1	1.6 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
DIBENZ(A,H)ANTHRACENE	SW8270	Not applicable	ug/l	2	2 (M); 0.21 (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 3	Target Area 4	Target Area 4	Target Area 4	Target Area 5	Target Area 5
					Division	C	D	D	D	D	D
					Location	MWKR1525R03	MWKR2260R01	MWKR2260R02	MWKR2275R01	MWKR2680R01	MWKR2700R01
					Screen Zone	UC	BR	UC	UC	UC	BR
					Date	10/16/2010	10/17/2010	10/17/2010	10/16/2010	10/16/2010	10/16/2010
					Sample	WGC10160955BRH1	WGD10171520TAS1	WGD10171540RWS1	WGD10161730BRH1	WGD10161345DJJ1	WGD10161405BRH1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
FLUORANTHENE	SW8270	Not applicable	ug/l	1	210 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
FLUORENE	SW8270	Not applicable	ug/l	5	880	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
INDENO(1,2,3-C,D)PYRENE	SW8270	Not applicable	ug/l	2	2 (M); 0.022 (S) (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
NAPHTHALENE	SW8260	Not applicable	ug/l	5	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
NAPHTHALENE	SW8270	Not applicable	ug/l	1	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
PHENANTHRENE	SW8270	Not applicable	ug/l	2	52	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
PYRENE	SW8270	Not applicable	ug/l	5	140 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Volatile Organic Compounds (VOCs)											
1,2,3-TRIMETHYL BENZENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
1,2,4-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	63 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,3,5-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	72 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZENE	SW8260	Not applicable	ug/l	1	5 (A) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CYCLOHEXANE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
CYMENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
DIMETHYL BENZENE	SW8260	Not applicable	ug/l	3	280 (E) (I)	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
ETHYLBENZENE	SW8260	Not applicable	ug/l	1	74 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
ISOPROPYLBENZENE	SW8260	Not applicable	ug/l	5	800	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
N-PROPYLBENZENE	SW8260	Not applicable	ug/l	1	80 (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
SEC-BUTYLBENZENE	SW8260	Not applicable	ug/l	1	80	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
TOLUENE	SW8260	Not applicable	ug/l	1	790 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHEMISTRY											
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	**360**	**230 J-**	**230 J-**	**230**	**320**	**260**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
CHLORIDE (AS CL)	SW9056	Total	mg/l	10	NC	**82**	**12**	**23**	**55**	**19**	**23**
SULFATE (AS SO4)	SW9056	Total	mg/l	1	250 (E)	**3.7**	**31**	**31**	**48**	**13**	**36**

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 5	Target Area 6	Target Area 6	Target Area 6	Target Area 6	Target Area 6
					Division	D	E	E	E	E	E
					Location	MWKR2700R02	MWKR3450L01	MWKR3450L02	MWKR3450L03	MWKR3450L04	MWKR3460L01
					Screen Zone	UC	UC	UC	UC	UC	UC
					Date	10/16/2010	10/17/2010	10/15/2010	10/17/2010	10/17/2010	10/15/2010
					Sample	WGD10161505BRH1	WGE10171245RWS1	WGE10151405BAW1	WGE10171100RWS1	WGE10171240TAS1	WGE10151530BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
Field Parameters											
DISSOLVED OXYGEN	FIELD	Not applicable	percent		NA	-	-	-	-	-	-
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l		NA	0.23	0.13	0.26	0.18	-	0.14
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts		NC	-106.5	-57.4	-85.7	-47.4	-	-52.6
pH	FIELD	Not applicable	su		(E)	7.32	7.64	7.12	7.25	7.06	7.25
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm		NC	0.508	0.589	0.815	0.644	-	0.683
TEMPERATURE	FIELD	Not applicable	deg c		NC	16.79	11.32	13.94	11.74	-	14
TURBIDITY	FIELD	Not applicable	ntu		NC	2	2.94	2.7	458.1	-	3.2
Inorganics (Metals)											
BARIUM	SW6020A	Dissolved	mg/l	0.1	2 (A) (B)	< 0.10 U	**0.20**	**0.18**	**0.20**	**0.14**	**0.16**
CALCIUM	SW6020A	Dissolved	mg/l	1	NC	**62**	**63**	**120**	**66**	**98**	**90**
IRON	SW6020A	Dissolved	mg/l	0.2	0.3 (E) (B)	***0.66 J***	***0.37 J***	***3.8***	***0.72 J***	***1.8 J***	***0.75***
MAGNESIUM	SW6020A	Dissolved	mg/l	1	400 (B)	**12**	**22**	**20**	**22**	**18**	**23**
NICKEL	SW6020A	Dissolved	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Dissolved	mg/l	1	NC	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Dissolved	mg/l	1	120	**11**	**24**	**23**	**28**	**17**	**12**
VANADIUM	SW6020A	Dissolved	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
BARIUM	SW6020A	Total	mg/l	0.1	2 (A) (B)	< 0.10 U	**0.21**	**0.19**	**0.22**	**0.15**	**0.17**
CALCIUM	SW6020A	Total	mg/l	1	NC	**65**	**65**	**120**	**71**	**100**	**91**
IRON	SW6020A	Total	mg/l	0.2	0.3 (E) (B)	***1.1***	***0.90***	***5.0***	***3.0***	***2.1***	***0.96***
MAGNESIUM	SW6020A	Total	mg/l	1	400 (B)	**13**	**22**	**20**	**24**	**19**	**23**
NICKEL	SW6020A	Total	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Total	mg/l	1	0	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	1	120	**12**	**24**	**23**	**28**	**18**	**12**
VANADIUM	SW6020A	Total	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
Polynuclear Aromatic Hydrocarbons (PNAs)											
2-METHYLNAPHTHALENE	SW8270	Not applicable	ug/l	5	260	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHENE	SW8270	Not applicable	ug/l	5	1300	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHYLENE	SW8270	Not applicable	ug/l	5	52	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ANTHRACENE	SW8270	Not applicable	ug/l	5	43 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
BENZO(A)ANTHRACENE	SW8270	Not applicable	ug/l	1	2.1 (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(A)PYRENE	SW8270	Not applicable	ug/l	1	5 (A) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(B)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1.5 (S, AA) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(G,H,I)PERYLENE	SW8270	Not applicable	ug/l	1	1 (M); 0.26 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(K)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1 (M); 0.8 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHRYSENE	SW8270	Not applicable	ug/l	1	1.6 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
DIBENZ(A,H)ANTHRACENE	SW8270	Not applicable	ug/l	2	2 (M); 0.21 (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 5	Target Area 6	Target Area 6	Target Area 6	Target Area 6	Target Area 6
					Division	D	E	E	E	E	E
					Location	MWKR2700R02	MWKR3450L01	MWKR3450L02	MWKR3450L03	MWKR3450L04	MWKR3460L01
					Screen Zone	UC	UC	UC	UC	UC	UC
					Date	10/16/2010	10/17/2010	10/15/2010	10/17/2010	10/17/2010	10/15/2010
					Sample	WGD10161505BRH1	WGE10171245RWS1	WGE10151405BAW1	WGE10171100RWS1	WGE10171240TAS1	WGE10151530BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
FLUORANTHENE	SW8270	Not applicable	ug/l	1	210 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
FLUORENE	SW8270	Not applicable	ug/l	5	880	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
INDENO(1,2,3-C,D)PYRENE	SW8270	Not applicable	ug/l	2	2 (M); 0.022 (S) (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
NAPHTHALENE	SW8260	Not applicable	ug/l	5	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
NAPHTHALENE	SW8270	Not applicable	ug/l	1	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
PHENANTHRENE	SW8270	Not applicable	ug/l	2	52	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
PYRENE	SW8270	Not applicable	ug/l	5	140 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Volatile Organic Compounds (VOCs)											
1,2,3-TRIMETHYL BENZENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
1,2,4-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	63 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,3,5-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	72 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZENE	SW8260	Not applicable	ug/l	1	5 (A) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CYCLOHEXANE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
CYMENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
DIMETHYL BENZENE	SW8260	Not applicable	ug/l	3	280 (E) (I)	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
ETHYLBENZENE	SW8260	Not applicable	ug/l	1	74 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
ISOPROPYLBENZENE	SW8260	Not applicable	ug/l	5	800	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
N-PROPYLBENZENE	SW8260	Not applicable	ug/l	1	80 (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
SEC-BUTYLBENZENE	SW8260	Not applicable	ug/l	1	80	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
TOLUENE	SW8260	Not applicable	ug/l	1	790 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHEMISTRY											
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	**210**	**280 J-**	**350 J-**	**280 J-**	**330 J-**	**300 J-**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	< 10 U	< 10 U	R	< 10 U	< 10 U	R
CHLORIDE (AS CL)	SW9056	Total	mg/l	10	NC	**22**	**32**	**26**	**38**	**23**	**22**
SULFATE (AS SO4)	SW9056	Total	mg/l	1	250 (E)	**8.0**	**3.9**	**20**	**12**	**30**	**20**

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 6	Target Area 6	Target Area 7	Target Area 7	Target Area 7	Target Area 7
					Division	E	E	E	E	E	E
					Location	MWKR3460L02	MWKR3460L02	MWKR3620L01	MWKR3620L02	MWKR3620L02	MWKR3620L03
					Screen Zone	UC	UC	UC	UC	UC	UC
					Date	10/17/2010	10/17/2010	10/14/2010	10/15/2010	10/15/2010	10/15/2010
					Sample	WGE10171041TAS1	WGE10171041TAS2	WGE10141445BAW1	WGE10151050BAW1	WGE10151050BAW2	WGE10150935BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
Field Parameters											
DISSOLVED OXYGEN	FIELD	Not applicable	percent		NA	-	-	-	-	-	-
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l		NA	0.24	0.24	0.15	5.26	5.26	3.27
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts		NC	-56.2	-56.2	-85.3	28.2	28.2	38.7
pH	FIELD	Not applicable	su		(E)	-	7.06	7.29	7.8	7.8	7.4
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm		NC	730	730	1.011	0.648	0.648	0.938
TEMPERATURE	FIELD	Not applicable	deg c		NC	13.92	13.92	12.05	12.63	12.63	13.41
TURBIDITY	FIELD	Not applicable	ntu		NC	7.81	7.81	11.4	0.2	0.2	1.6
Inorganics (Metals)											
BARIUM	SW6020A	Dissolved	mg/l	0.1	2 (A) (B)	**0.13**	**0.13**	**0.13**	< 0.10 U	< 0.10 U	< 0.10 U
CALCIUM	SW6020A	Dissolved	mg/l	1	NC	**89**	**89**	**110**	**75**	**75**	**75**
IRON	SW6020A	Dissolved	mg/l	0.2	0.3 (E) (B)	***1.6 J***	***0.80 J***	***0.36***	< 0.20 U	< 0.20 U	< 0.20 U
MAGNESIUM	SW6020A	Dissolved	mg/l	1	400 (B)	**21**	**21**	**27**	**17**	**17**	**14**
NICKEL	SW6020A	Dissolved	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Dissolved	mg/l	1	NC	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Dissolved	mg/l	1	120	**19**	**19**	**45**	**24**	**23**	**110**
VANADIUM	SW6020A	Dissolved	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
BARIUM	SW6020A	Total	mg/l	0.1	2 (A) (B)	**0.13**	**0.13**	**0.15**	< 0.10 U	< 0.10 U	< 0.10 U
CALCIUM	SW6020A	Total	mg/l	1	NC	**85**	**88**	**130**	**77**	**75**	**76**
IRON	SW6020A	Total	mg/l	0.2	0.3 (E) (B)	***2.1***	***2.2***	***2.1***	< 0.20 U	< 0.20 U	< 0.20 U
MAGNESIUM	SW6020A	Total	mg/l	1	400 (B)	**20**	**20**	**30**	**18**	**17**	**14**
NICKEL	SW6020A	Total	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Total	mg/l	1	0	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	1	120	**18**	**18**	**49**	**24**	**24**	**110**
VANADIUM	SW6020A	Total	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
Polynuclear Aromatic Hydrocarbons (PNAs)											
2-METHYLNAPHTHALENE	SW8270	Not applicable	ug/l	5	260	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHENE	SW8270	Not applicable	ug/l	5	1300	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHYLENE	SW8270	Not applicable	ug/l	5	52	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ANTHRACENE	SW8270	Not applicable	ug/l	5	43 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
BENZO(A)ANTHRACENE	SW8270	Not applicable	ug/l	1	2.1 (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(A)PYRENE	SW8270	Not applicable	ug/l	1	5 (A) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(B)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1.5 (S, AA) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(G,H,I)PERYLENE	SW8270	Not applicable	ug/l	1	1 (M); 0.26 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(K)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1 (M); 0.8 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHRYSENE	SW8270	Not applicable	ug/l	1	1.6 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
DIBENZ(A,H)ANTHRACENE	SW8270	Not applicable	ug/l	2	2 (M); 0.21 (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 6	Target Area 6	Target Area 7	Target Area 7	Target Area 7	Target Area 7
					Division	E	E	E	E	E	E
					Location	MWKR3460L02	MWKR3460L02	MWKR3620L01	MWKR3620L02	MWKR3620L02	MWKR3620L03
					Screen Zone	UC	UC	UC	UC	UC	UC
					Date	10/17/2010	10/17/2010	10/14/2010	10/15/2010	10/15/2010	10/15/2010
					Sample	WGE10171041TAS1	WGE10171041TAS2	WGE10141445BAW1	WGE10151050BAW1	WGE10151050BAW2	WGE10150935BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria						
FLUORANTHENE	SW8270	Not applicable	ug/l	1	210 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
FLUORENE	SW8270	Not applicable	ug/l	5	880	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
INDENO(1,2,3-C,D)PYRENE	SW8270	Not applicable	ug/l	2	2 (M); 0.022 (S) (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
NAPHTHALENE	SW8260	Not applicable	ug/l	5	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
NAPHTHALENE	SW8270	Not applicable	ug/l	1	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
PHENANTHRENE	SW8270	Not applicable	ug/l	2	52	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
PYRENE	SW8270	Not applicable	ug/l	5	140 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Volatile Organic Compounds (VOCs)											
1,2,3-TRIMETHYL BENZENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
1,2,4-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	63 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,3,5-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	72 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZENE	SW8260	Not applicable	ug/l	1	5 (A) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CYCLOHEXANE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
CYMENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
DIMETHYL BENZENE	SW8260	Not applicable	ug/l	3	280 (E) (I)	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
ETHYLBENZENE	SW8260	Not applicable	ug/l	1	74 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
ISOPROPYLBENZENE	SW8260	Not applicable	ug/l	5	800	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
N-PROPYLBENZENE	SW8260	Not applicable	ug/l	1	80 (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
SEC-BUTYLBENZENE	SW8260	Not applicable	ug/l	1	80	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
TOLUENE	SW8260	Not applicable	ug/l	1	790 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHEMISTRY											
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	**320 J-**	**330 J-**	**260**	**180 J-**	**190 J-**	**310 J-**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	< 10 U	< 10 U	< 10 U	R	R	R
CHLORIDE (AS CL)	SW9056	Total	mg/l	10	NC	**28**	**28**	**140**	**70**	**69**	**100**
SULFATE (AS SO4)	SW9056	Total	mg/l	1	250 (E)	**22**	**22**	**58**	**22**	**20**	**24**

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TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 8	Target Area 8	Target Area 8	Target Area 8
					Division	E	E	E	E
					Location	MWKR3680L01	MWKR3680L02	MWKR3680L02	MWKR3680L03
					Screen Zone	UC	UC	UC	UC
					Date	10/14/2010	10/14/2010	10/14/2010	10/14/2010
					Sample	WGE10141020BRH1	WGE10141200BRH1	WGE10141200BRH2	WGE10141015BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria				
Field Parameters									
DISSOLVED OXYGEN	FIELD	Not applicable	percent		NA	-	-	-	-
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l		NA	0.41	0.43	0.43	0.57
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts		NC	-328.9	-344.1	-344.1	17.3
pH	FIELD	Not applicable	su		(E)	7.6	7.47	7.47	7.57
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm		NC	0.581	0.354	0.354	0.461
TEMPERATURE	FIELD	Not applicable	deg c		NC	13.23	15.8	15.8	15.56
TURBIDITY	FIELD	Not applicable	ntu		NC	10.5	3.23	3.23	0.7
Inorganics (Metals)									
BARIUM	SW6020A	Dissolved	mg/l	0.1	2 (A) (B)	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
CALCIUM	SW6020A	Dissolved	mg/l	1	NC	**61**	**46**	**46**	**69**
IRON	SW6020A	Dissolved	mg/l	0.2	0.3 (E) (B)	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U
MAGNESIUM	SW6020A	Dissolved	mg/l	1	400 (B)	**14**	**11**	**11**	**14**
NICKEL	SW6020A	Dissolved	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Dissolved	mg/l	1	NC	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Dissolved	mg/l	1	120	**29**	**6.5**	**6.5**	**1.7**
VANADIUM	SW6020A	Dissolved	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
BARIUM	SW6020A	Total	mg/l	0.1	2 (A) (B)	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
CALCIUM	SW6020A	Total	mg/l	1	NC	**64**	**50**	**46**	**74**
IRON	SW6020A	Total	mg/l	0.2	0.3 (E) (B)	**0.30**	< 0.20 U	< 0.20 U	< 0.20 U
MAGNESIUM	SW6020A	Total	mg/l	1	400 (B)	**14**	**11**	**11**	**15**
NICKEL	SW6020A	Total	mg/l	0.02	0.1 (A) (B)	< 0.020 U	< 0.020 U	< 0.020 U	< 0.020 U
POTASSIUM	SW6020A	Total	mg/l	1	0	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	1	120	**29**	**6.6**	**6.2**	**2.4**
VANADIUM	SW6020A	Total	mg/l	0.004	0.0045	< 0.0040 U	< 0.0040 U	< 0.0040 U	< 0.0040 U
Polynuclear Aromatic Hydrocarbons (PNAs)									
2-METHYLNAPHTHALENE	SW8270	Not applicable	ug/l	5	260	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHENE	SW8270	Not applicable	ug/l	5	1300	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ACENAPHTHYLENE	SW8270	Not applicable	ug/l	5	52	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
ANTHRACENE	SW8270	Not applicable	ug/l	5	43 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
BENZO(A)ANTHRACENE	SW8270	Not applicable	ug/l	1	2.1 (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(A)PYRENE	SW8270	Not applicable	ug/l	1	5 (A) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(B)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1.5 (S, AA) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(G,H,I)PERYLENE	SW8270	Not applicable	ug/l	1	1 (M); 0.26 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZO(K)FLUORANTHENE	SW8270	Not applicable	ug/l	1	1 (M); 0.8 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHRYSENE	SW8270	Not applicable	ug/l	1	1.6 (S) (Q)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
DIBENZ(A,H)ANTHRACENE	SW8270	Not applicable	ug/l	2	2 (M); 0.21 (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U

TABLE 3
GROUNDWATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

					Section	Target Area 8	Target Area 8	Target Area 8	Target Area 8
					Division	E	E	E	E
					Location	MWKR3680L01	MWKR3680L02	MWKR3680L02	MWKR3680L03
					Screen Zone	UC	UC	UC	UC
					Date	10/14/2010	10/14/2010	10/14/2010	10/14/2010
					Sample	WGE10141020BRH1	WGE10141200BRH1	WGE10141200BRH2	WGE10141015BAW1
Analyte	Method	Fraction	Units	WATER TDL	Part 201 Residential & Commercial I Drinking Water Criteria				
FLUORANTHENE	SW8270	Not applicable	ug/l	1	210 (S)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
FLUORENE	SW8270	Not applicable	ug/l	5	880	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
INDENO(1,2,3-C,D)PYRENE	SW8270	Not applicable	ug/l	2	2 (M); 0.022 (S) (Q)	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
NAPHTHALENE	SW8260	Not applicable	ug/l	5	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 UJ
NAPHTHALENE	SW8270	Not applicable	ug/l	1	520	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
PHENANTHRENE	SW8270	Not applicable	ug/l	2	52	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
PYRENE	SW8270	Not applicable	ug/l	5	140 (S)	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
Volatile Organic Compounds (VOCs)									
1,2,3-TRIMETHYL BENZENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
1,2,4-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	63 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
1,3,5-TRIMETHYLBENZENE	SW8260	Not applicable	ug/l	1	72 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
BENZENE	SW8260	Not applicable	ug/l	1	5 (A) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CYCLOHEXANE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
CYMENE	SW8260	Not applicable	ug/l	5	NC	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
DIMETHYL BENZENE	SW8260	Not applicable	ug/l	3	280 (E) (I)	< 3.0 U	< 3.0 U	< 3.0 U	< 3.0 U
ETHYLBENZENE	SW8260	Not applicable	ug/l	1	74 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
ISOPROPYLBENZENE	SW8260	Not applicable	ug/l	5	800	< 5.0 U	< 5.0 U	< 5.0 U	< 5.0 U
N-PROPYLBENZENE	SW8260	Not applicable	ug/l	1	80 (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
SEC-BUTYLBENZENE	SW8260	Not applicable	ug/l	1	80	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
TOLUENE	SW8260	Not applicable	ug/l	1	790 (E) (I)	< 1.0 U	< 1.0 U	< 1.0 U	< 1.0 U
CHEMISTRY									
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	**190**	**160**	**160**	**240**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	10	NC	< 10 U	< 10 U	< 10 U	< 10 U
CHLORIDE (AS CL)	SW9056	Total	mg/l	10	NC	**48**	**14**	**13**	< 10 U
SULFATE (AS SO4)	SW9056	Total	mg/l	1	250 (E)	**9.4**	**3.5**	**3.2**	**5.8**

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TABLE 4
SURFACE WATER ANALYTICAL SUMMARY
TARGET AREA 1 THROUGH 8
ENBRIDGE LINE 6B MP 608
MARSHALL, MICHIGAN

			Section	Target Area 1	Target Area 2	Target Area 3	Target Area 4	Target Area 5	Target Area 6	Target Area 7	Target Area 8
			Division	C	C	C	D	D	E	E	E
			Location	SWKR0250L01	SWKR0570R01	SWKR1525R01	SWKR2260R01	SWKR2700R01	SWKR3460L01	SWKR3630L01	SWKR3690L01
			Date	10/15/2010	10/15/2010	10/15/2010	10/16/2010	10/16/2010	10/17/2010	10/15/2010	10/14/2010
			Sample	WSC10151555DJJ1	WSC10151448DJJ1	WSC10151712DJJ1	WSD10161640DJJ1	WSD10161450DJJ1	WSE10171136BRH1	WSE10151200BAW1	WSE10141155BAW1
Analyte	Method	Fraction	Units								
CHEMISTRY											
ALKALINITY, BICARBONATE (AS CACO3)	A2320B	Total	mg/l	**290 J-**	**260 J-**	**260 J-**	**260**	**260**	**260 J-**	**240 J-**	**270**
ALKALINITY, CARBONATE (AS CACO3)	A2320B	Total	mg/l	R	R	R	< 10 U	< 10 U	< 10 U	R	< 10 U
CHLORIDE (AS CL)	SW9056	Total	mg/l	**37**	**36**	**37**	**46**	**50**	**48**	**44**	**45**
SULFATE (AS SO4)	SW9056	Total	mg/l	**37**	**37**	**35**	**35**	**38**	**36**	**35**	**34**
FIELD PARAMETERS											
DISSOLVED OXYGEN	FIELD	Not applicable	mg/l	**-**	**-**	**-**	**-**	**-**	**10.47**	**8.95**	**9.07**
DISSOLVED OXYGEN	FIELD	Not applicable	percent	109.7	95.7	102.2	73.9	101.2	-	-	-
OXIDATION-REDUCTION POTENTIAL	FIELD	Not applicable	millivolts	94.2	69	69.2	29	-5.4	135	34.5	44.4
pH	FIELD	Not applicable	su	8.38	8.23	8.28	7.82	8.28	8.01	8.25	8.01
SPECIFIC CONDUCTANCE	FIELD	Not applicable	mS/cm	0.643	0.647	0.639	0.666	0.687	0.716	0.687	0.705
TEMPERATURE	FIELD	Not applicable	deg c	14.08	16.43	15.5	14.03	14.17	12.13	12.51	12.97
TURBIDITY	FIELD	Not applicable	ntu	3.4	3.02	25.4	1.31	2.18	0.97	1.3	1.4
INORGANICS (METALS)											
CALCIUM	SW6020A	Total	mg/l	**81**	**88**	**85**	**74**	**78**	**79**	**83**	**86**
IRON	SW6020A	Total	mg/l	**0.23**	**0.28**	**0.84**	**< 0.20 U**	**0.23**	**0.24**	**0.22**	**0.23**
MAGNESIUM	SW6020A	Total	mg/l	**24**	**26**	**24**	**21**	**23**	**23**	**24**	**25**
POTASSIUM	SW6020A	Total	mg/l	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SODIUM	SW6020A	Total	mg/l	**16**	**17**	**17**	**22**	**22**	**23**	**23**	**23**

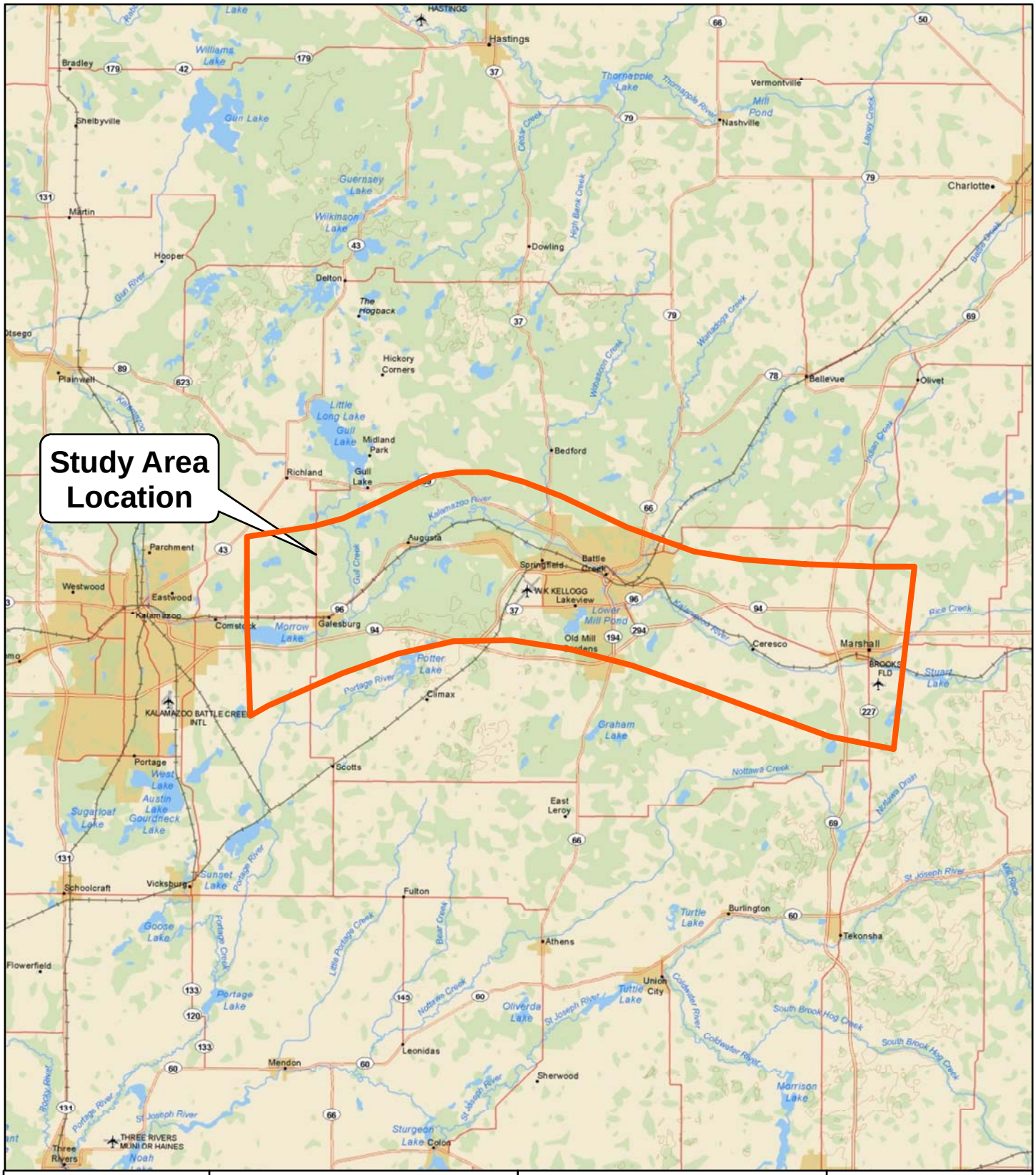
Notes
NA = Not applicable
Bold = detected above method detection limits
- = not recorded
U = The analyte was analyzed, but was not detected above the reported sample quantitation limit.
R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control critiera. The presence or absence cannot be verified.
J- = The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.

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Figures

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Map Location



0 2 4 8
Miles

N

KALAMAZOO RIVER HYDROGEOLOGICAL INVESTIGATION STUDY AREA LOCATION MAP

ENBRIDGE LINE 6B M608 PIPELINE RELEASE MARSHALL, MI

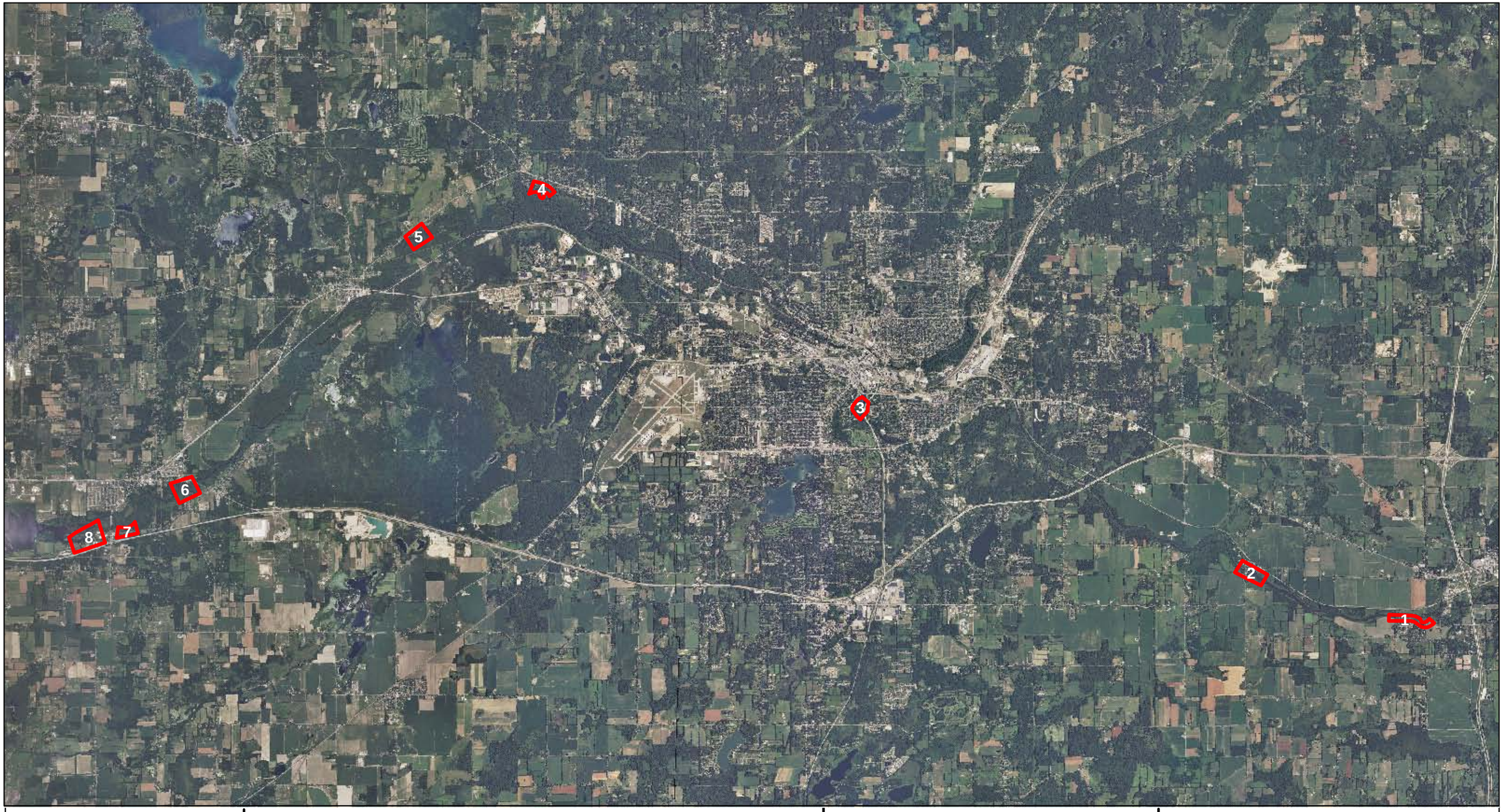
ENBRIDGE

AECOM

Map Name: HydroGeoStudy_SiteMap.mxd

October 2010 | Figure 1

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ENBRIDGE

AECOM

October, 2010

N

0 1 2 4

Miles

Legend

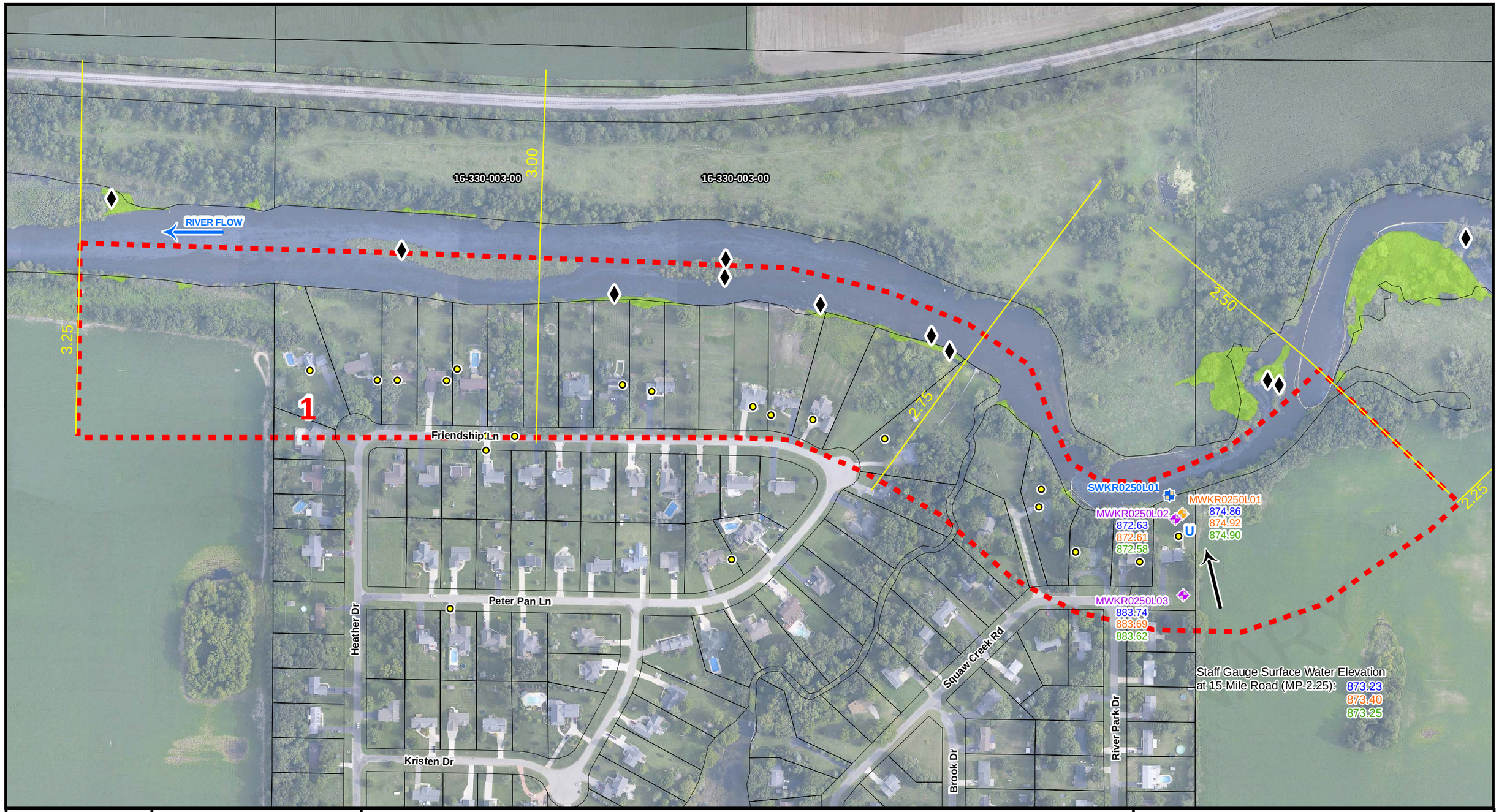
Target Area Boundary

Figure: 2

KALAMAZOO RIVER HYDROGEOLOGICAL STUDY TARGET AREA OVERVIEW MAP

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

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N

0 250 500

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

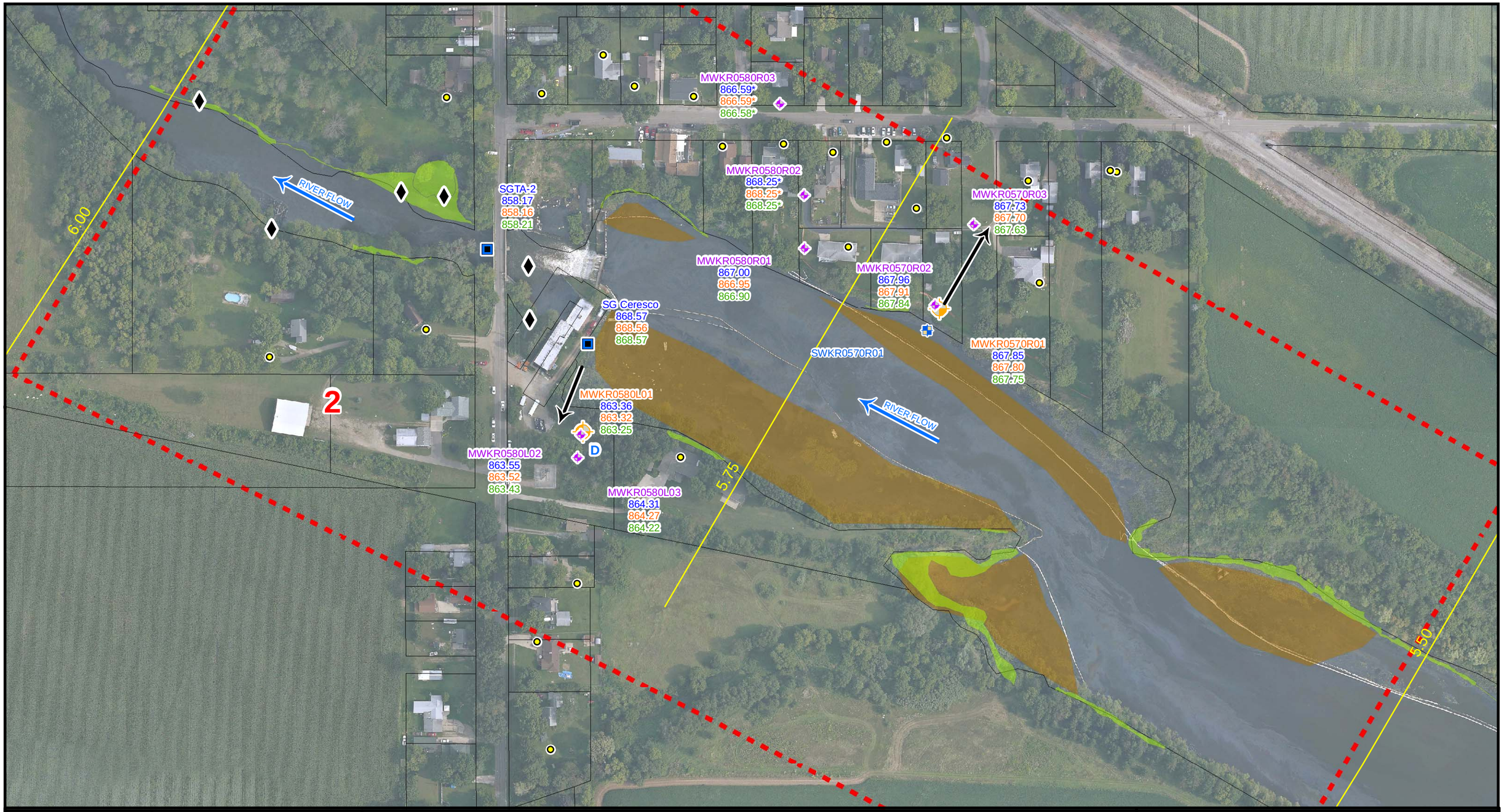
- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Gauge
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- Target Area Boundary
- SCAT Area
- Groundwater Flow Direction

Figure: 3

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 1

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

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October 2010

0 165 330

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)
18-Oct Event - 874.86
20-Oct Event - 874.92
22-Oct Event - 875.12

Note: * Does not represent a true groundwater elevation

Vertical Gradient
Upward U
Downward D
No Gradient N

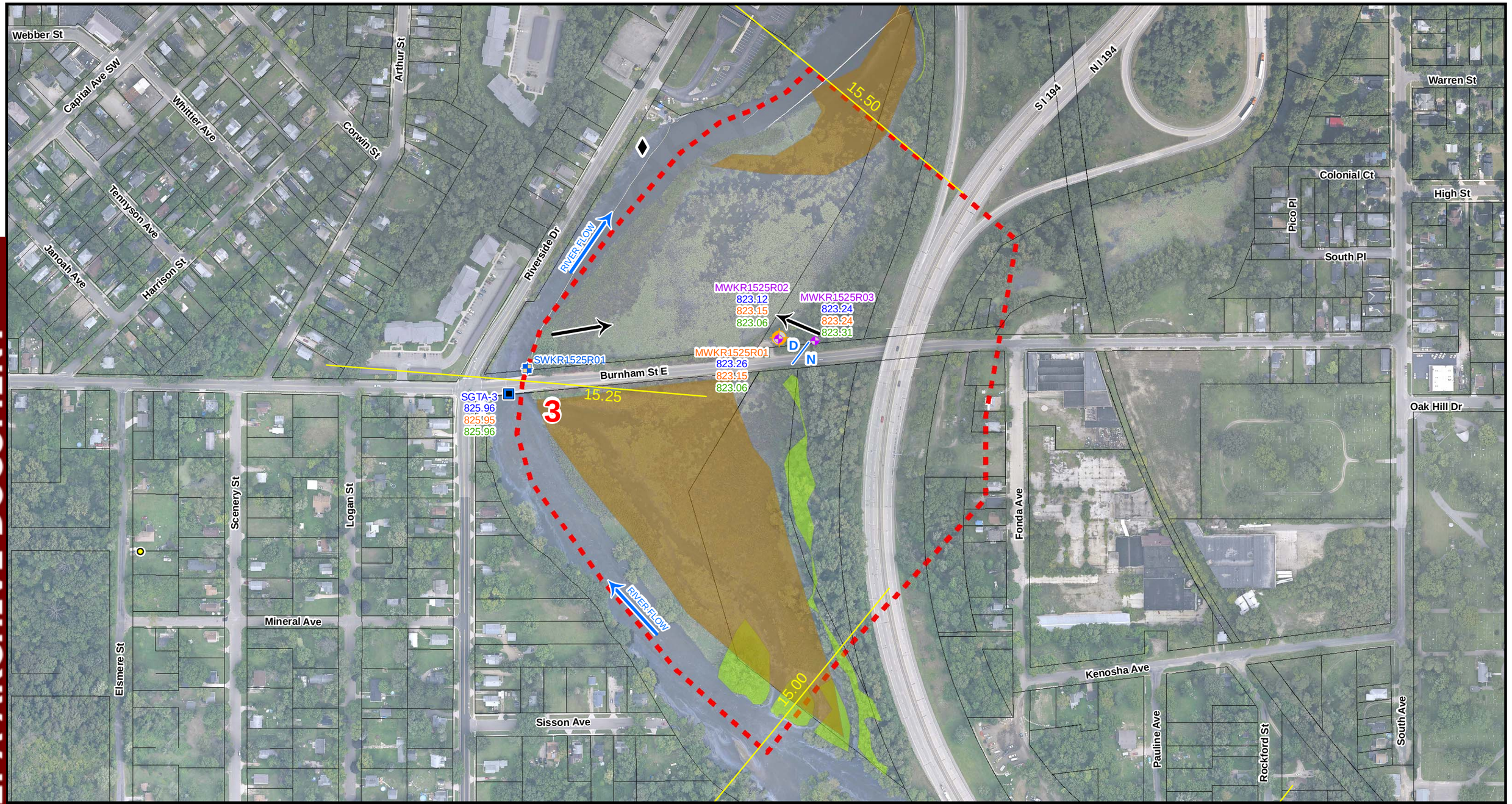
- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Gauge
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- SCAT Area
- Historic Submerged Oil
- Target Area Boundary
- Groundwater Flow Direction

Figure: 4

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 2

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

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October 2010

0 250 500

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

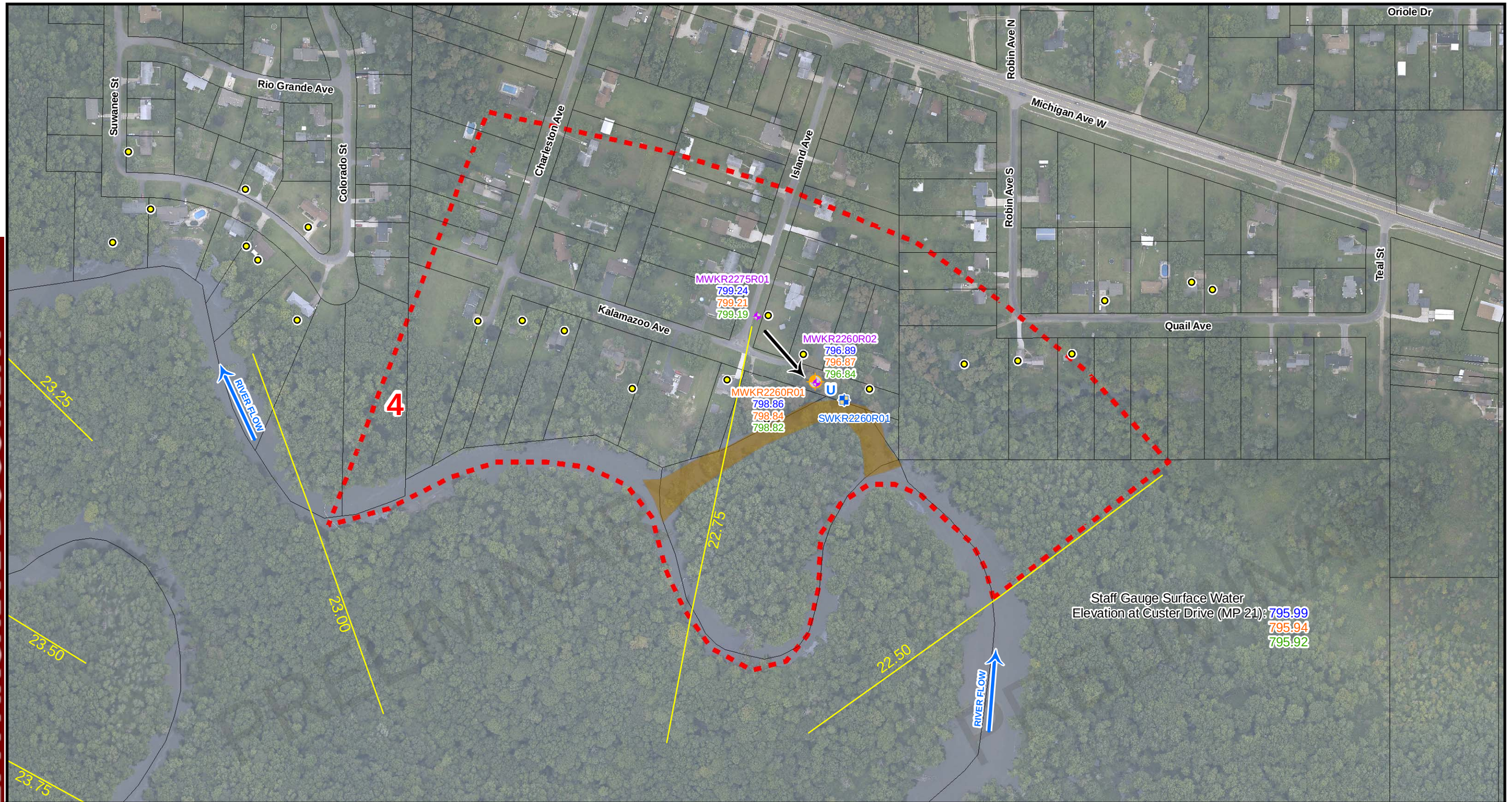
- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Guage; Staff Gauge
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- Historic Submerged Oil
- SCAT Area
- Target Area Boundary
- Groundwater Flow Direction

Figure: 5

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 3

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 250 500

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Guage; Staff Gauge
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- Historic Submerged Oil
- SCAT Area
- Target Area Boundary
- Groundwater Flow Direction

Figure: 6

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 4

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

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N 44th St

N Augusta Dr

5

26.25

26.50

26.75

27.00

27.25

RIVER FLOW

MWKR2680R01
787.39
787.34
787.33

MWKR2700R01
787.32
787.32

SWKR2700R01 787.25

SWKR2700R01

U

MWKR2700R02
787.31
787.24
787.20

Staff Gauge Surface Water Elevation at M-96 (MP 28.75): 785.75 785.66 785.62

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October 2010

0 250 500

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Guage
- Surface Water Sample
- O&M SCAT Point
- .25mile Grid Segments
- Historic Submerged Oil
- SCAT Area
- Target Area Boundary
- Groundwater Flow Direction

Figure: 7

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 5

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

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October 2010

0 250 500

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

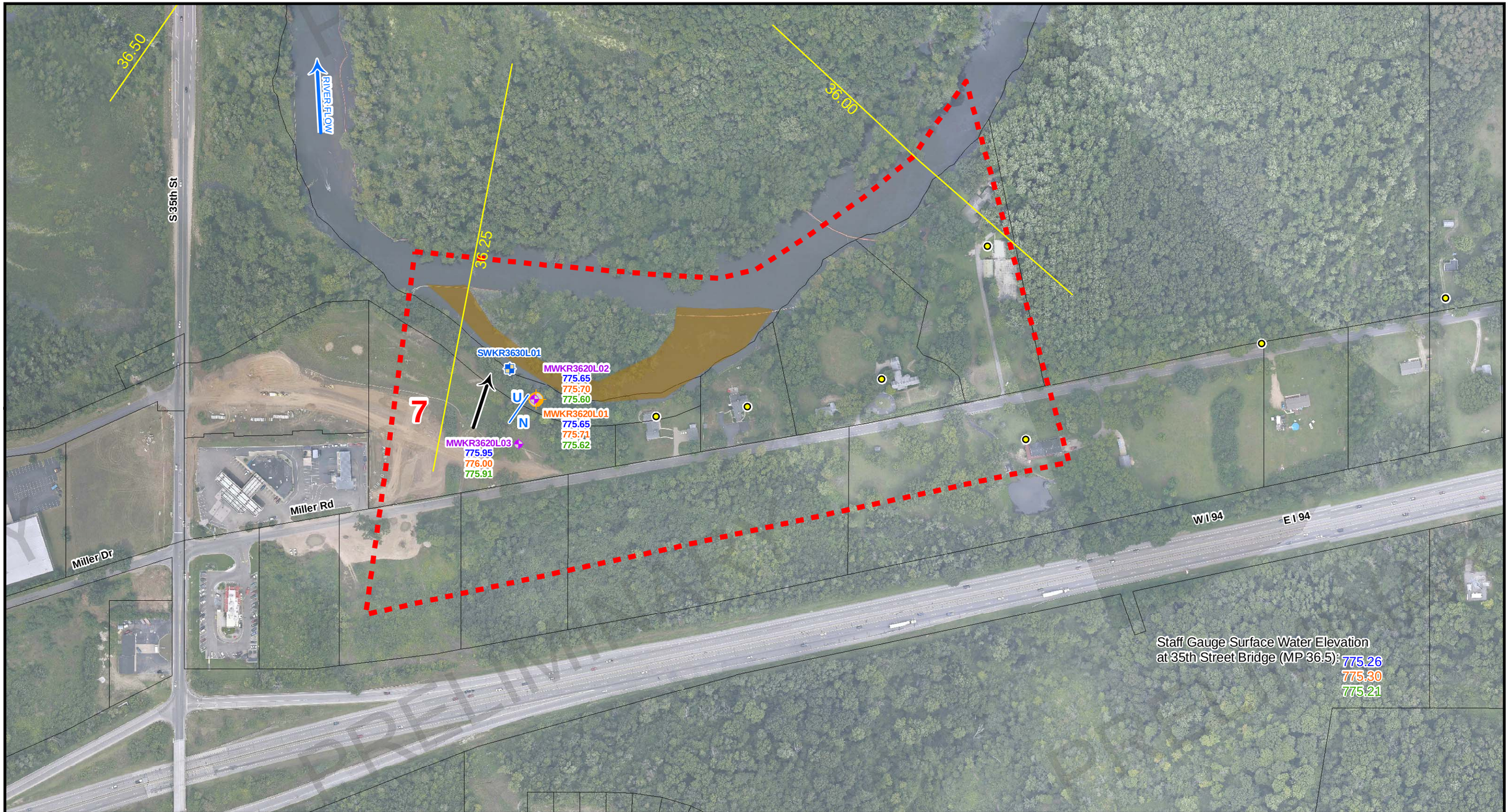
- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Gauge
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- Target Area Boundary
- Historic Submerged Oil
- SCAT Area
- Groundwater Flow Direction

Figure: 8

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 6

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 200 400

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

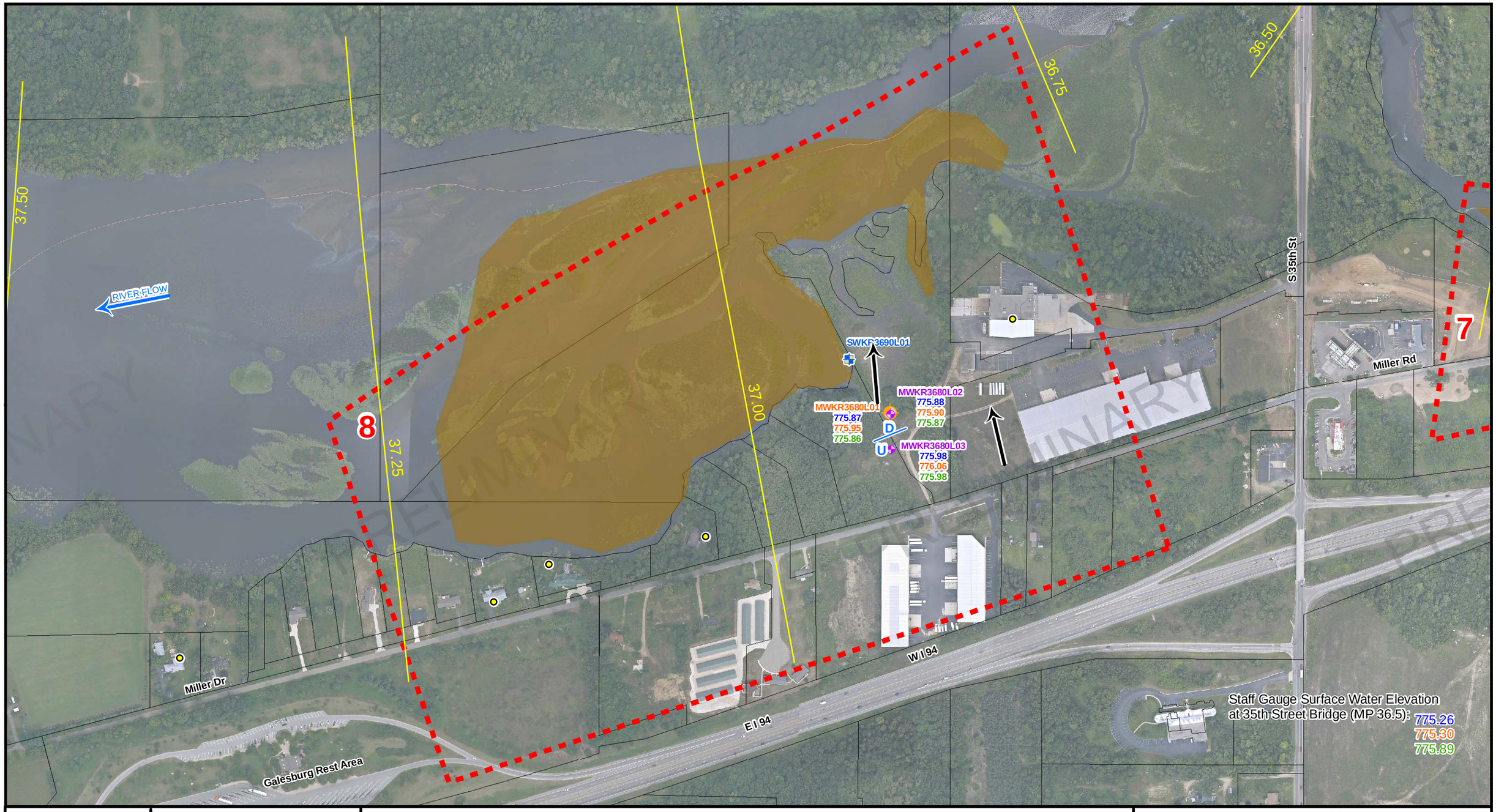
- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Gauge
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- Target Area Boundary
- Historic Submerged Oil
- SCAT Area
- Groundwater Flow Direction

Figure: 9

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 7

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 265 530

Scale in Feet

LEGEND:

Location ID - MWKR0250L01

Water Elevation (Ft. above mean Sea Level)		Vertical Gradient	
18-Oct Event -	874.86	Upward	U
20-Oct Event -	874.92	Downward	D
22-Oct Event -	875.12	No Gradient	N

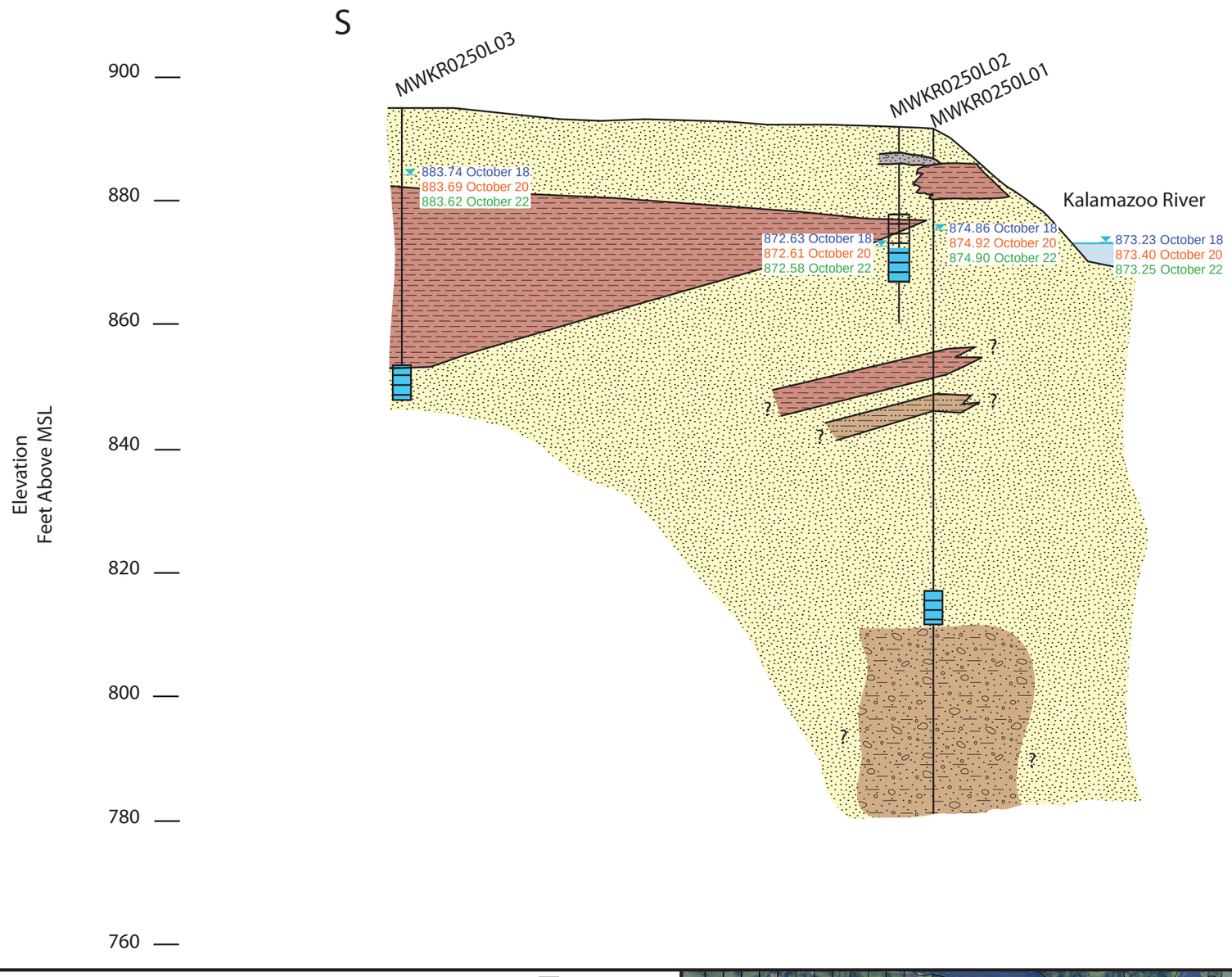
- Deep Monitoring Well
- Shallow Monitoring Well
- Staff Guage
- Surface Water Sample
- O&M SCAT Point
- Potable Well
- .25mile Grid Segments
- TargetAreas
- Historic Submerged Oil
- SCAT Area
- Groundwater Flow Direction

Figure: 10

GROUNDWATER ELEVATION, FLOW DIRECTION AND VERTICAL GRADIENT. TARGET AREA 8

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 25 50
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 2.5X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

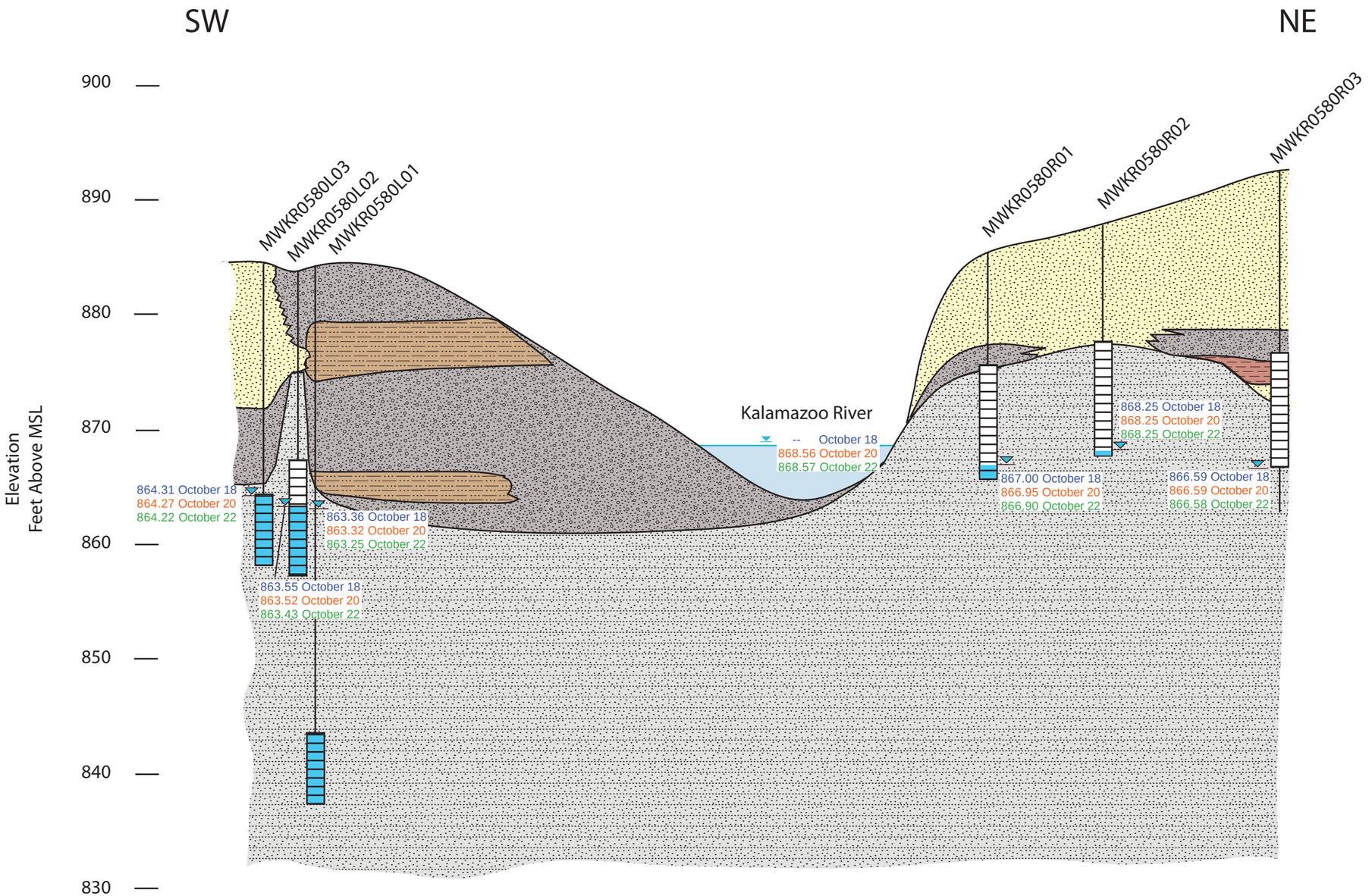


Figure: 11

TARGET AREA 1
CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 50 100
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 10X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

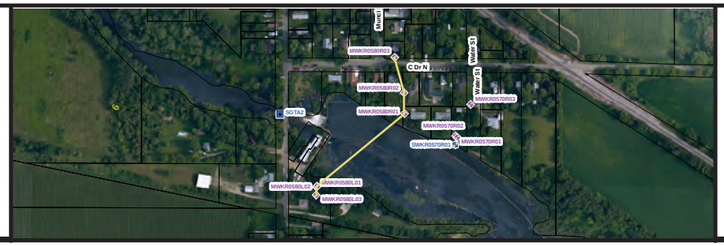
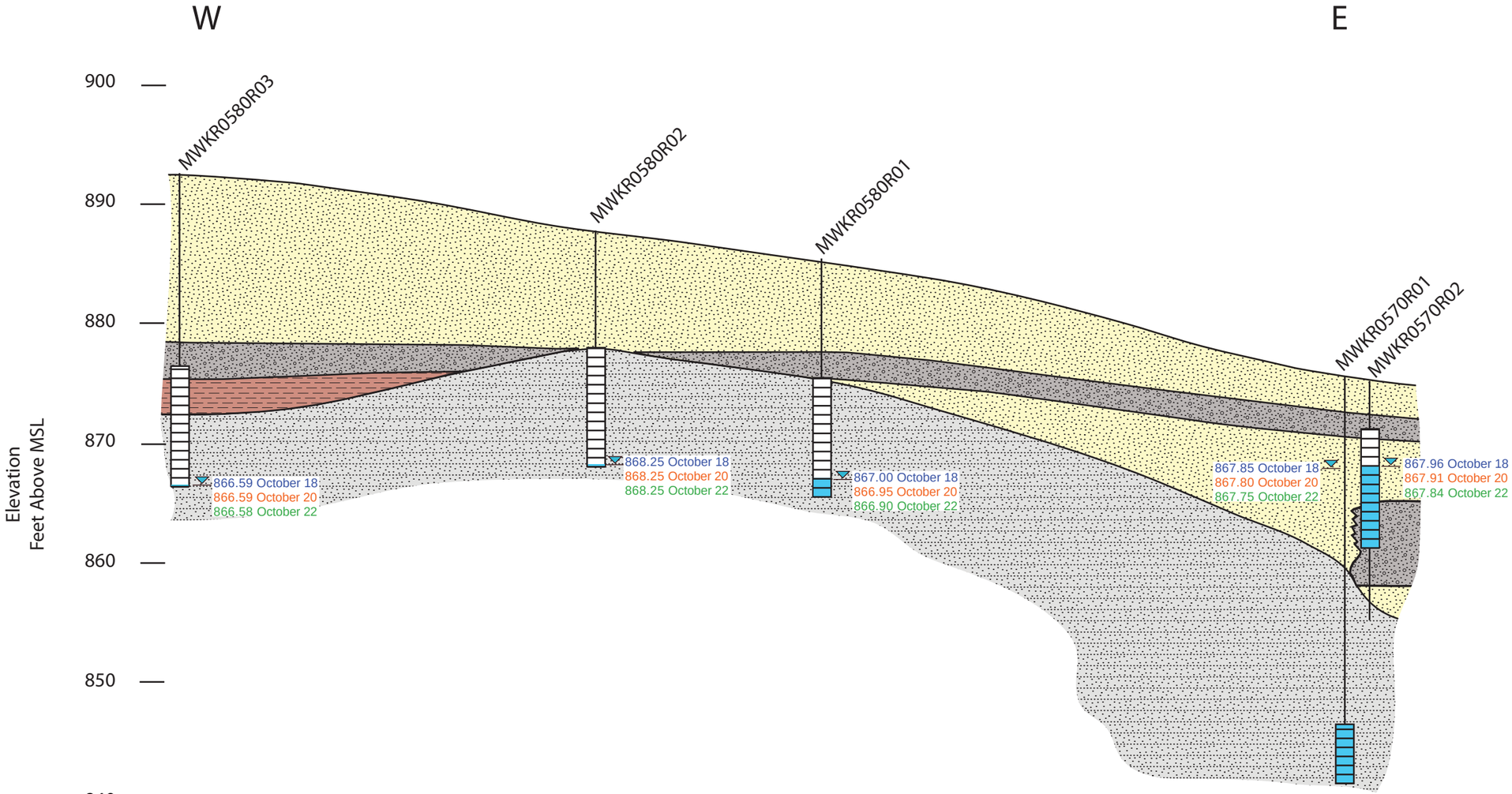


Figure: 12

TARGET AREA 2
CROSS SECTION-A

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 50 100
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 10X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

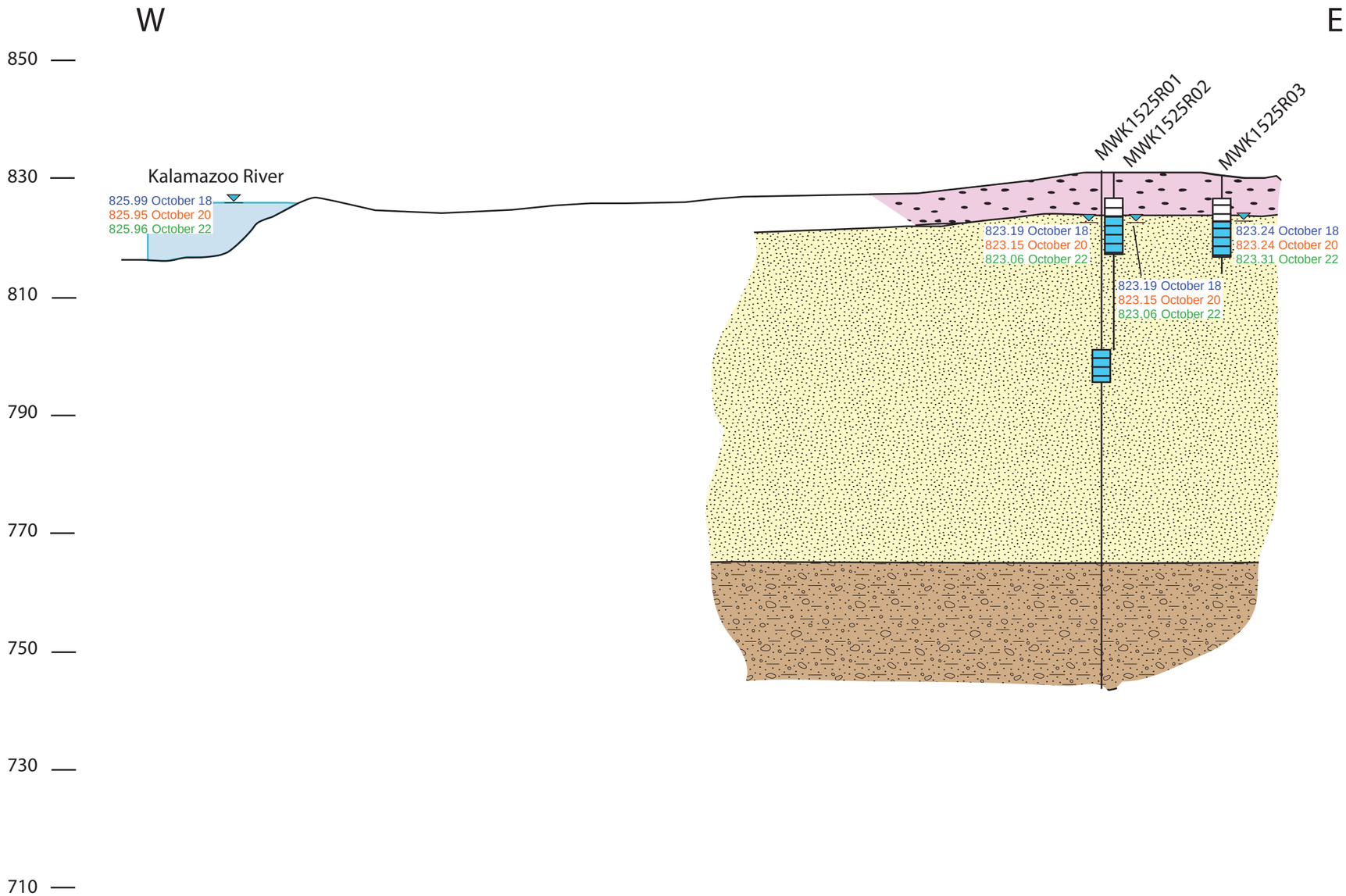


Figure: 13

TARGET AREA 2
CROSS SECTION-B

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 50 100
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

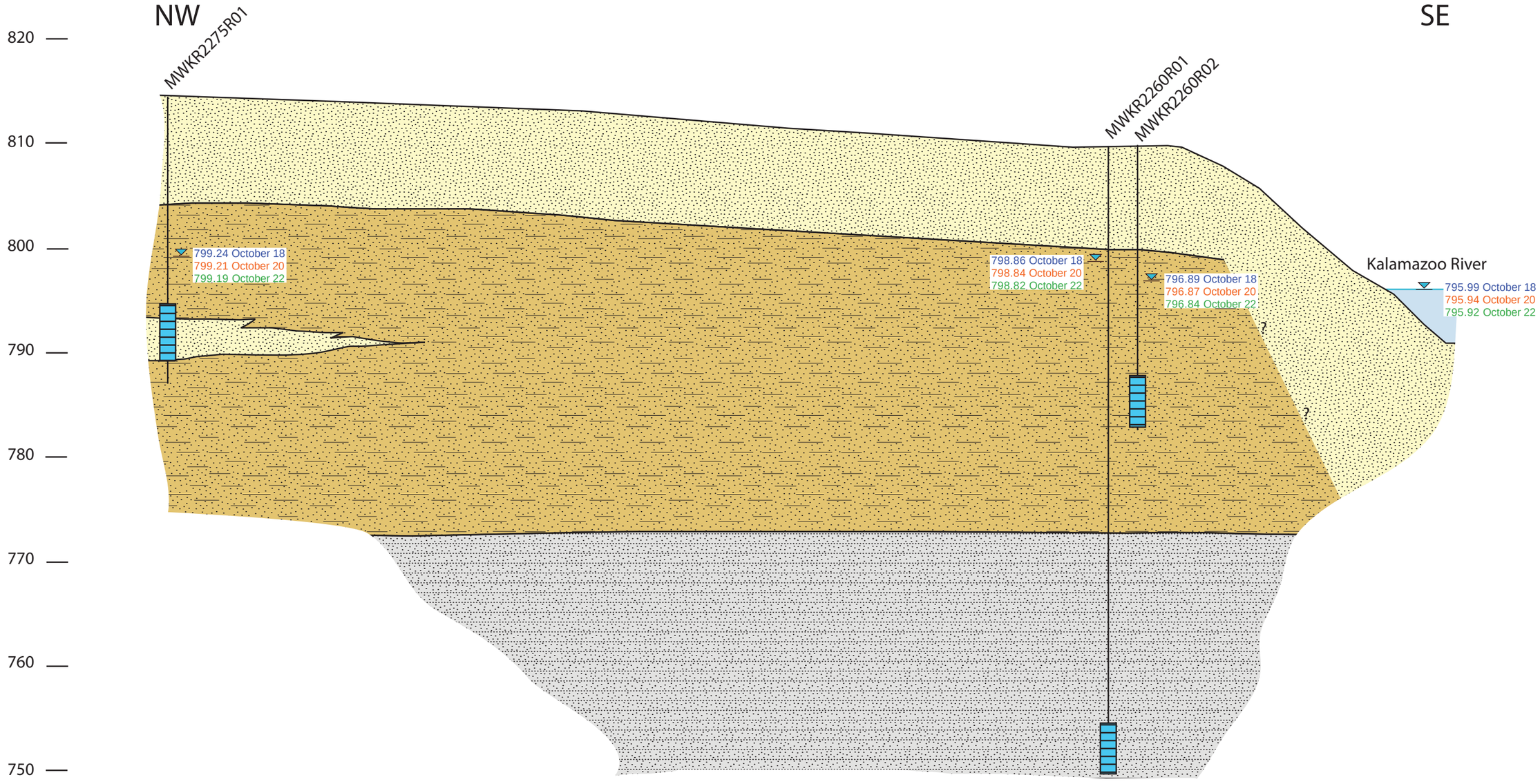


Figure: 14

TARGET AREA 3
CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 12.5 25
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

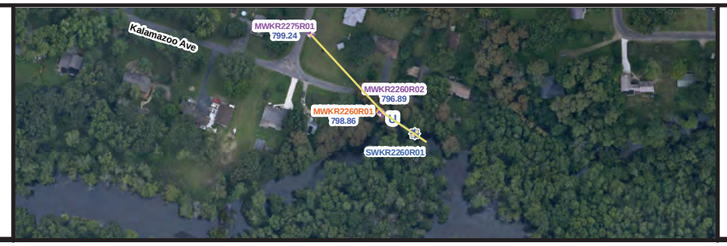
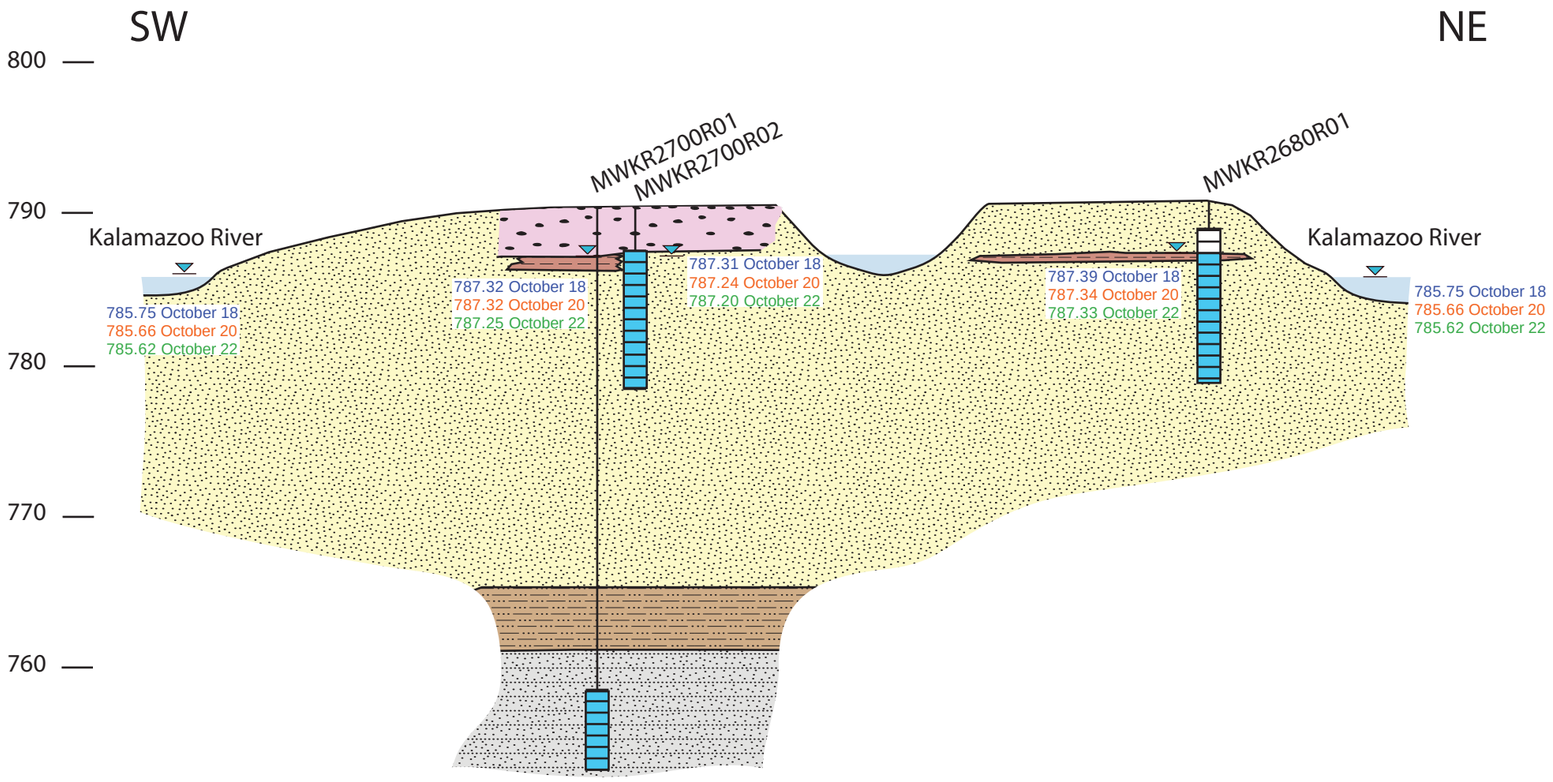


Figure: 15

TARGET AREA 4
CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 25 50
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

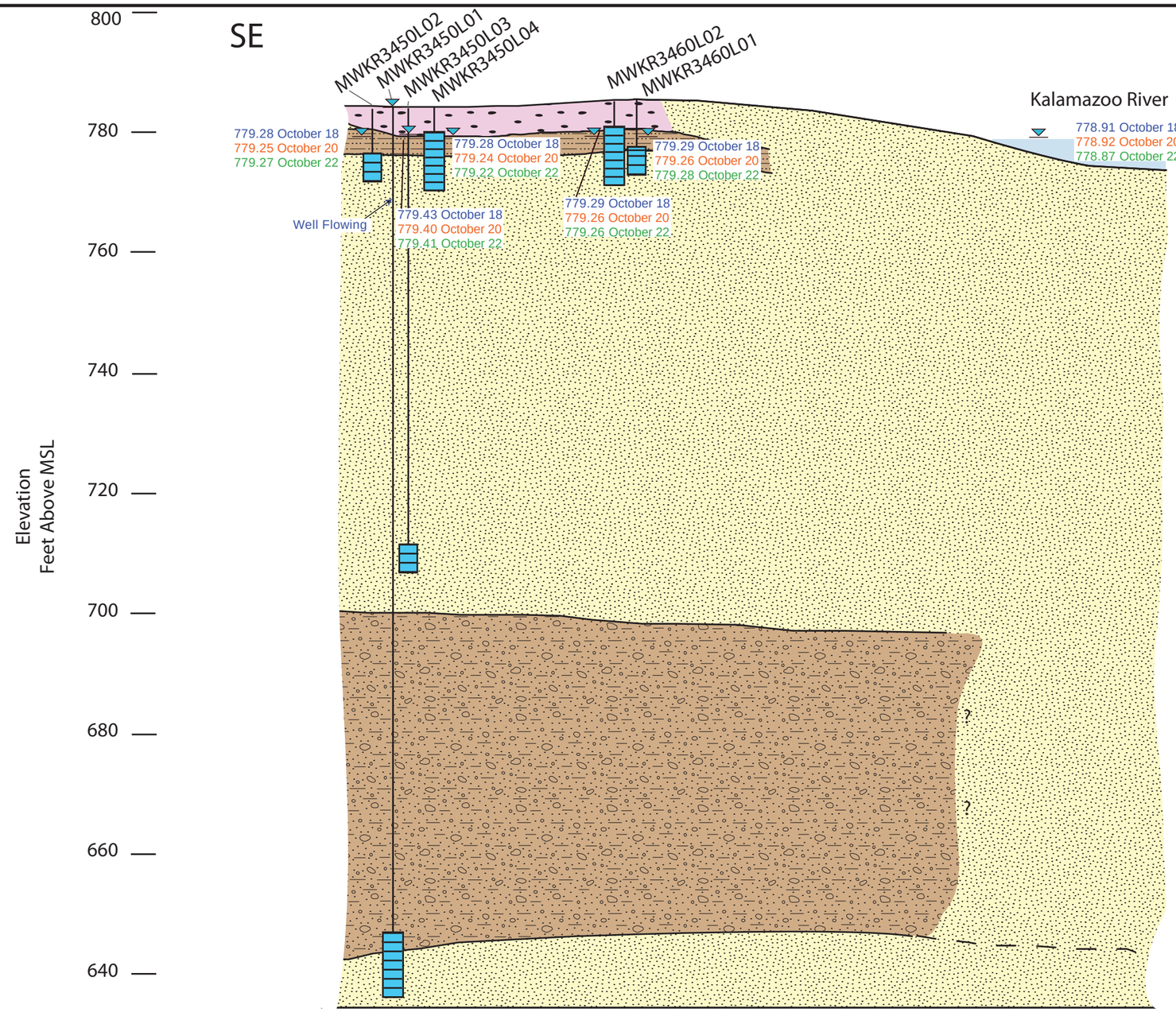


Figure: 16

TARGET AREA 5
CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 25 50
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 2.5X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

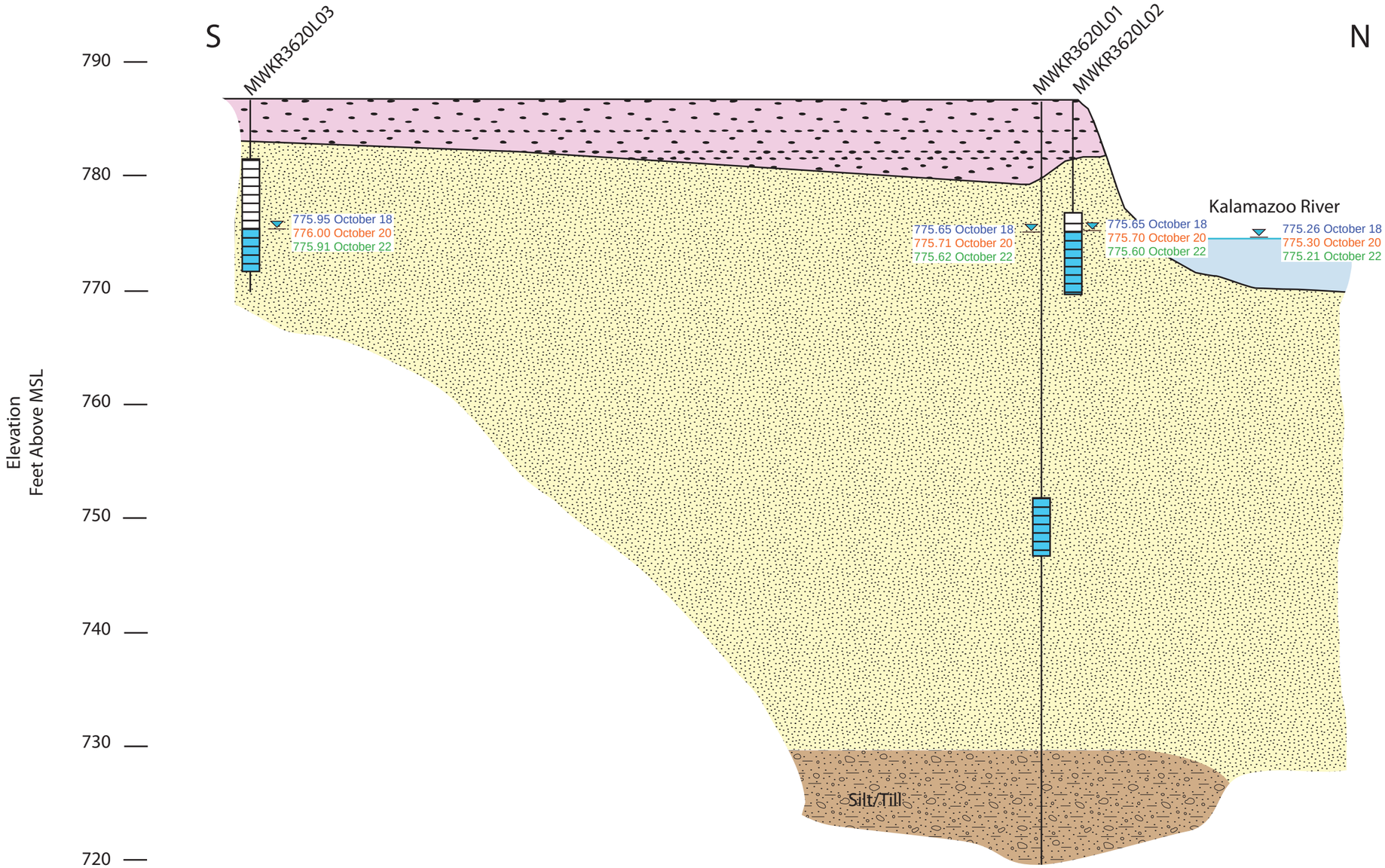


Figure: 17

TARGET AREA 6 CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 12.5 25
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 5X

Gravel
Sand
Silt
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

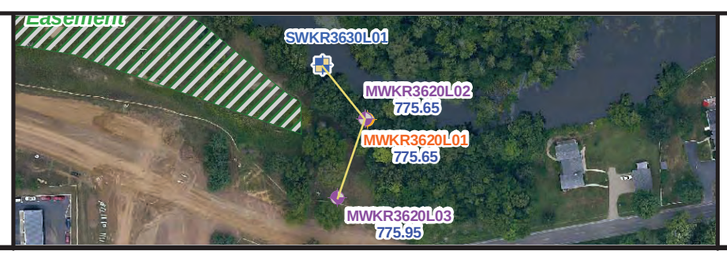
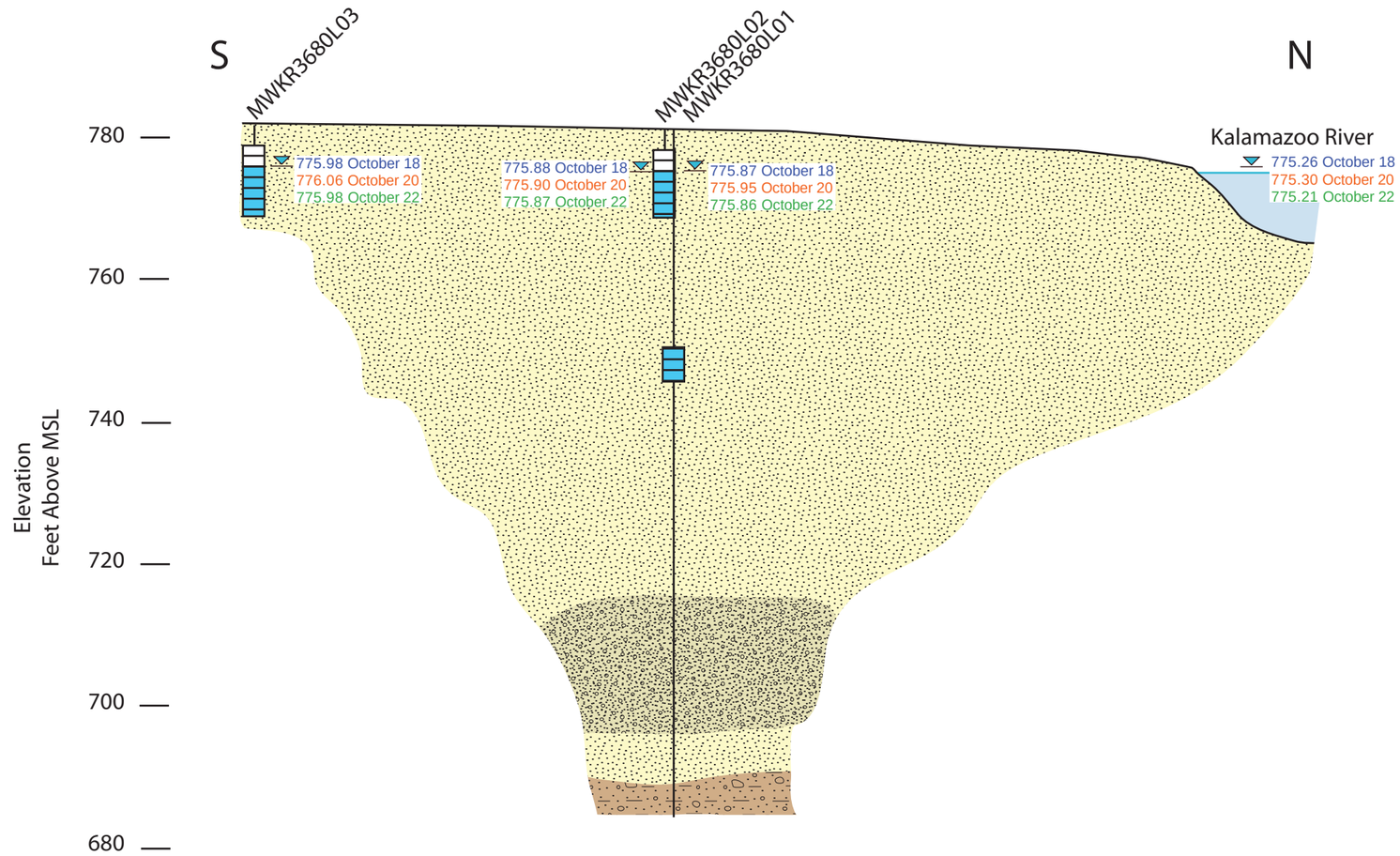


Figure: 18

TARGET AREA 7
CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



ENBRIDGE

AECOM

October 2010

0 25 50
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION = 2.5X

Gravel
Sand
Sand and Gravel
Clay
Sandstone
Silt (TILL)
Well Screen
Fill
Water Level

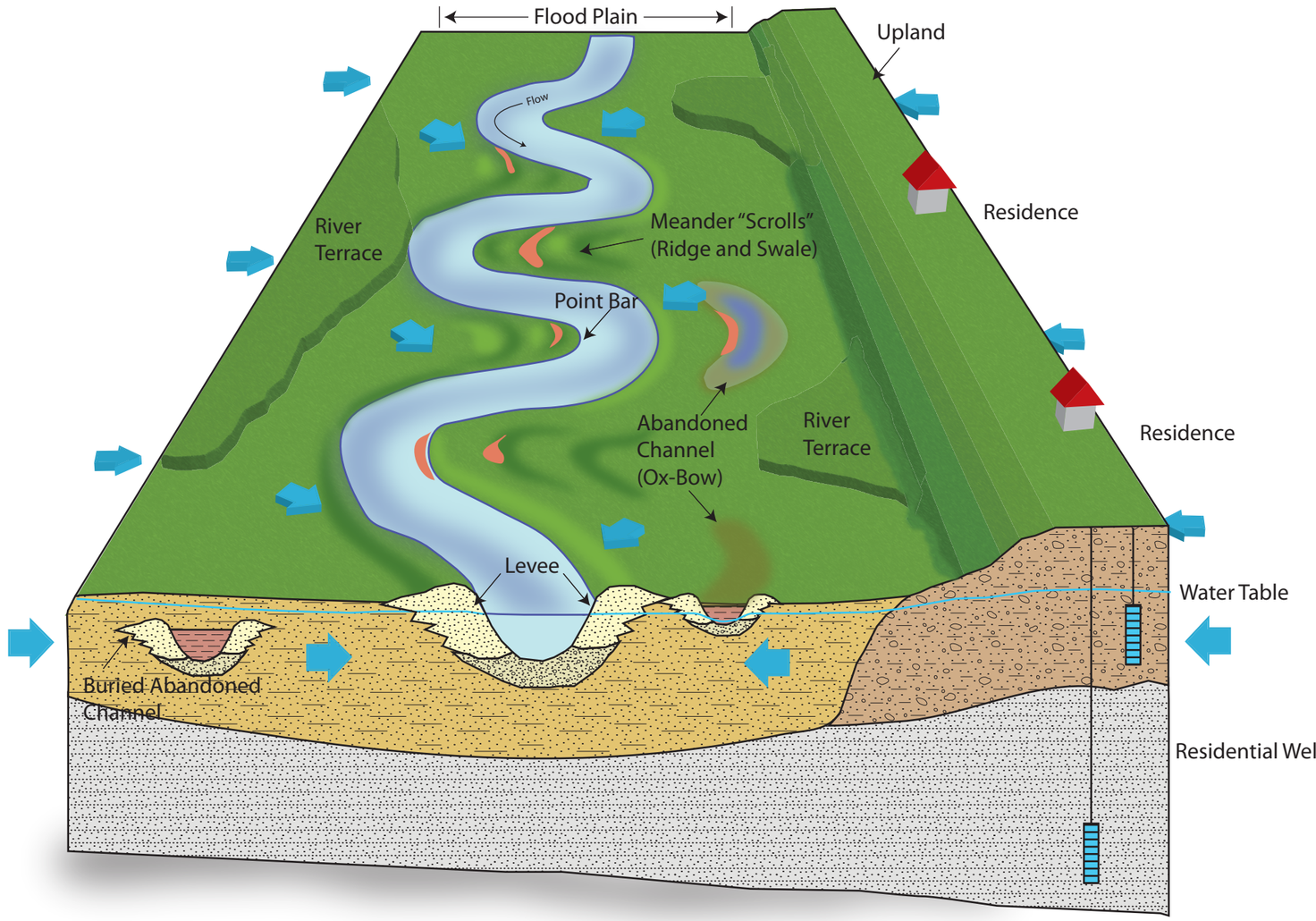


Figure: 19

TARGET AREA 8 CROSS SECTION

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE
MARSHALL, MI

US EPA ARCHIVE DOCUMENT



Based on: Fitzpatrick, F.A., Knox, J.C., and Whitman, H.E., 1999, The Effects of historical land-cover changes on flooding and sedimentation, North Fish Creek, Wisconsin: U.S. Geological Survey Water Resources Investigations Report 99-4083, 12 p.

ENBRIDGE

AECOM

October 2010

Gravel
Silty Sand
Well Screen
SCAT Area, Historic Submerged Oil and Overbank Areas
Sand
Clay
Silty Till
Sand and Gravel
Sandstone
Groundwater Flow

Figure: 20

Conceptual Site Model

ENBRIDGE LINE 6B M 608 PIPELINE RELEASE MARSHALL, MI

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Appendix A

Part 201 Sites of Environmental Contamination (FOIA)

Table 12.–Contamination sites of the Kalamazoo River watershed, by valley segment, 2002. Data from Michigan Department of Environmental Quality, Environmental Response Division. Acronyms: BTEX=benzene, toluene, ethylbenzene, and xylene; DCA=dichloroethane; DCE=dichloroethylene; DDE=dichlorodiphenyldichloroethylene; MTBE=methyl tertiary butyl ether; DDT=Dichlorodiphenyltrichloroethane; PCB=polychlorinated biphenyl; PCE or PERC=perchloroethylene; PNAs=polynuclear aromatic hydrocarbons; TCA=trichloroethane; TCE=trichloroethylene; TPH=total petroleum hydrocarbons; LF=landfill. (Web: <http://www.deq.state.mi.us/erd1/sites/index.jsp> [Accessed 2002: July 21]).

Segment and site	Location	Pollutant
Headwaters		
SE Michigan Gas	Albion	BTEX, pnas, Metals
Petco Albion	Calhoun County	Crude oil, btex, chloride
Barnett, Cecil 1	Hillsdale County	Brine, chloride
Industrial Wells	Mosherville	Chlorides
Mosherville Oil Pit Dump	Mosherville	Pnas
Scio Gas Plant	Mosherville	Chromium, phenols, nickel, benzene
Upper		
Airco Rare and Specialty Glass	Albion	Chromium, zinc
Albion-Sheridan Twp Landfill	Albion	Chromium, lead, nickel, cyanide
Brooks Foundry Building	Albion	Methylene, Chloride, pcbs, pnas, Pesticides, Lead, Zinc
Brooks Foundry Lagoon	Albion	Pnas, pcbs, Lead, Zinc, Cadmium
Brown Weld Service	Albion	Toluene
Calhoun Co Rd Comm Albion	Albion	Brine, chloride
Former Albion City Waste Yard	Albion	Tce, lead, phenanthrene
McGraw Edison Corporation	Albion	Tce
Mid Mich Metal Production	Albion	Cadmium, copper, lead, zinc, tce, dce, pce
Union Street Products Plant #1	Albion	Lead, cyanide
Woods, M.B. #1	Calhoun County	Btex, crude oil, brine, chloride
Woods, M.B. #2	Calhoun County	Btex, crude oil, brine, chloride
Keith Fransted Construction	Concord	Gasoline
Quality Production Corporation	Concord	Paint waste
Horton Area GW Contamination	Horton	Btex, isopentane, dce
Bostik Company	Marshall	Perchloroethylene
Calhoun Co Rd Comm Marshall	Marshall	Btex, methylene, chloride, tce, tca, dichloropropane
Clark Oil Apex Oil	Marshall	Lead, benzene, ethylbenzene
Consumers Energy	Marshall	Lead, Cyanide, pnas
Eaton Corporation	Marshall	Tce, pce, vinyl chloride
Marshall City LF	Marshall	Domestic waste
Marshall Iron and Metal	Marshall	Lead, cadmium, copper
Residential Well 23 Mile Road	Marshall	Benzene, toluene, xylene, oil, phenols
Ronan & Kunzl Airport	Marshall	Tce
Ronan & Kunzl Main Building	Marshall	Tce
V and L Industries	Marshall	Aluminum oxide, Curene
Springport Waste Water Treatment Plant	Springport	Chlorides, ammonia
Middle		
Ft. Custer Military Reserve	Augusta	Lead, arsenic
American Fibrit	Battle Creek	Heavy manufacturing
Battle Creek Adventist Hospital	Battle Creek	Pnas
Battle Creek Aquatic Center	Battle Creek	Metals, Arsenic, BTEX, pnas

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Table 12.–Continued.

Segment and site	Location	Pollutant
Middle – continued		
Calhoun Co Rd Comm BC	Battle Creek	Benzene, toluene, chloride
Cereal City Landfill	Battle Creek	Benzene, ammonia, vinyl chloride, arsenic
Cliff Street Wells	Battle Creek	Chloroform, dca, chlorodibromometha, dichlorobromoetha
East Columbia	Battle Creek	Btex, dca, dce
Farm Bureau Services	Battle Creek	Mercury, benzene, copper, nickel
Fouth Street Area	Battle Creek	Tce, tca, dca, dce, vinyldene, chloride
Global Paint and Ink	Battle Creek	Tca, xylene, tce
Grand Trunk Western Rail Road	Battle Creek	Tca, tce, dca, dce, diesel
Kelloggs Kelpaco	Battle Creek	Benzene, ethylbenzene, toluene, xylene
Kendall Street	Battle Creek	PCE, TCA, DCA, Metals, pnas
Main Street Dump	Battle Creek	Domestic waste
McLeieer Oil	Battle Creek	BTEX, pnas, Metals
Michigan Paperboard Corporation	Battle Creek	Ethylbenzene, xylene, toluene, napthalene
Morgan Road Ground Water	Battle Creek	Pce, dca, tca
Pink Poodle Cleaners	Battle Creek	Perchloroethylene
Quad L Corp	Battle Creek	Xylene, toluene, ethylbenzene
Raymond Road Landfill	Battle Creek	Dce, toluene, xylene, nickel, zinc
Residential Well 240 Wilson	Battle Creek	Tce, dce
Residential Well Beadle Lake Road	Battle Creek	Vinyl chloride, dce, lead, copper, magnesium, zinc
S&A Industries	Battle Creek	Cutting oil, paint
Shay Motor Company	Battle Creek	Methylene, chloride, tce, chromium, benzene, toluene
United Steel Michner Plating	Battle Creek	Metals, cyanide, halogenated hydrocar, tca, pce
Verona Well Field	Battle Creek	Tce, xylene, pce, dce
West Urbandale Area Wells	Battle Creek	Tce
AE Hoover	Charlotte	Pcb, mercury, lead
Johnson Iron Industries	Charlotte	Pcbs, Lead, Nickel, BTEX
Res Wells Oriole Drive	Charlotte	Chlorides, sodium
5177 Comstock Avenue	Comstock	Lead, chromium, zinc
Hydreco	Comstock	Tce, vinyl chloride, dce
Modern Septic Tank	Comstock	Tce, pce, tca, chloroform, dca
River Street Area	Comstock	Btex, tce, methylene, chloride
D Ave Cooper Twp	Cooper	Pcbs
MSU Kellogg Biological Station	Hickory Corners	Phenanthrene, BTEX
1606 S. Burdick Street	Kalamazoo	Lead, phenanthrene, tce
629 Hoek Court	Kalamazoo	Arsenic
Acme Printing Ink	Kalamazoo	Pce, toluene, lead, chrome
Allen Test Products	Kalamazoo	Arsenic, TCE
Allied Chemical Corporation	Kalamazoo	Pesticides
American Cyanamid	Kalamazoo	Tce, toluene, dce,
APEC Ampersee St Lots	Kalamazoo	Btex
Arcadia Creek	Kalamazoo	Pnas, Metals, Organic Hand Cleaner
Auto Ion Chemicals	Kalamazoo	Cyanide, chromium
Bank Street	Kalamazoo	Pna, tce, dce
Borroughs Corporation	Kalamazoo	Pnas, PCE, TCE, BTEX
Checker Motors Corporation	Kalamazoo	Tce, dce

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Table 12.–Continued.

Segment and site	Location	Pollutant
Middle – continued		
Clausing Industrial N. Pitcher	Kalamazoo	Tce, dce
Comstock Land Ltd	Kalamazoo	Benzene, toluene, lead, arsenic, chromium
Conrail Mill Street	Kalamazoo	Diesel fuel
Consumers Energy	Kalamazoo	Arsenic, PCB, Benzo(a)pyrene
D Ave Alamo Twp	Kalamazoo	Dca, napthalene, btex, mtbe
DeMeyers Country Kitchen	Kalamazoo	Lead, chromium
Drake Road & W Michigan	Kalamazoo	Zinc, tca, arsenic
East Willard	Kalamazoo	Arsenic, Acenaphthene, Benzo(b)fluoranthen
Fairfield Ave Area/Kal-Aero	Kalamazoo	Pce, chloroform, tca, dca
Farm Bureau Services	Kalamazoo	Chordane, nitrogen nitrite, nitrogen ammonia
Former Fisher-Graff Prop	Kalamazoo	Lead, pentachlorophenol, tce
GM BOC	Kalamazoo	Lead, Arsenic, pnas
Griffin Pest Control	Kalamazoo	Chordane, diazinon, chlorpyrifus
Kalamazoo Comm Ed Center	Kalamazoo	Benzo(a)pyrene, Benzene
Kalamazoo Wells Central No 1	Kalamazoo	Pce, tca
Kalamazoo Wells No 11	Kalamazoo	Dca, vinyl chloride
Kalamazoo Wells No 14	Kalamazoo	Tce
KL Ave LF	Kalamazoo	Zinc, BTEX, Acetone, DCE, DCA, 4-methyl 2-pentanone
Lakeside Refining Company	Kalamazoo	Benzene, lead, chromium
Lyons Machine Builders	Kalamazoo	BTEX, pnas, Metals
McLeieer Oil	Kalamazoo	Petroleum
Michigan Disposal Cork Street	Kalamazoo	Arsenic, benzene
N. Pitcher St – BIC	Kalamazoo	Arsenic, phenanthrene, tce
Nazareth College	Kalamazoo	BTEX, pnas
Newport Rd and East Milham	Kalamazoo	Pce, tce
Panelyte	Kalamazoo	Pcbs
Pitcher and Patterson Streets	Kalamazoo	Arsenic, chromium, dce, lead, toluene
Pitcher and Prouty	Kalamazoo	Pce, tce
Plastic Engineering Vanderbilt	Kalamazoo	Tca, pce, tce
Portage and Bishop Street	Kalamazoo	Methylene, Chloride, t-Butanol, DCE, THF, Acetone
Portage and Second Street Area	Kalamazoo	Tce, dca, pce
Portage Creek & Kalamazoo River	Kalamazoo	Pcb, mercury
Production Printing	Kalamazoo	Toluene, zylene, tce
Residential Well Lakeridge Road	Kalamazoo	Benzene, toluene, diatom filter cake
Residential Well Wayne Street	Kalamazoo	Tce
Roto-Finish Co., Incorporated	Kalamazoo	Tce, tca, dce
Savage Rowe Plating Company	Kalamazoo	Chromium, TCE
Schippers Crossing	Kalamazoo	Lead, mercury, chromium
SER	Kalamazoo	Heavy manufacturing
Sinclair Bulk Stor Amer Aggregate	Kalamazoo	Btex
Speare Flex	Kalamazoo	Tce, dce, pcb
Spring Street	Kalamazoo	Petroleum and Coal Products
Strebor	Kalamazoo	Pentachlorophenol
Travis St. Cooper Twp	Kalamazoo	Tca
W. Michigan and 6th Street	Kalamazoo	TCE, TCA, DCA, vinylidene, Chloride
Waste Oil Storage	Kalamazoo	Chloroform, DCA, TCE, TCA
Waste Oil Storage Hazard St	Kalamazoo	Methylene, chloride, tca, tce, dca
Jefferson Street	Otsego	Tce

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Table 12.–Continued.

Segment and site	Location	Pollutant
Middle – continued		
Parker Hannifin Corporation	Otsego	Dca, tca, dce, tce
Calhoun Co Rd Comm Pennfield	Pennfield	Salt
585 10th Street	Plainwell	Lead, chromium, cadmium
A1 Disposal Landfill	Plainwell	Lead, arsenic, nickel, tca, tce, methylenechlorid
A1 Disposal Plainwell	Plainwell	Lead, arsenic, mercury, tca, pce
Acorn Street Industrial Park	Plainwell	Cyanide
Bloomfield Res Well	Plainwell	Dca, pce, dcb, tca
Church and Allegan	Plainwell	Benzene
Conrail-Plainwell	Plainwell	Phenanthrene, naphthalene, ethylbenzene
Gun Plain Twp Landfill	Plainwell	Zinc, Lead, vocs
Hughes Engraving	Plainwell	Tca, tce, nitrites
Jersey Street	Plainwell	Tce, dce
Kewaunee Sci Equip Company	Plainwell	Tce, chromium, arsenic, nickel, zinc
Neo-Tech	Plainwell	Nickel, chromium
Sec. 25 Gun Plain Twp	Plainwell	Benzene, TCE
3900 Milham	Portage	Sodium, manganese
D&A Auto Body	Portage	Pce
Lovers Lane	Portage	Dca
Portage and Zylman Res Well	Portage	Tce
Portage Steel Fabricating	Portage	Toluene, methylene chloride, ethylbenzene
Romence and Westnedge	Portage	Tca, dca,
Rosedale Subdivision	Portage	Pce, dce, tce, tca
Upjohn Co Milham Road	Portage	Tph
Kavco Landfill	Prairieville Twp	Chromium, dce, nickel, benzene, organics
North 34th Street Area	Richland	Benzene, tce, pce, tca, chrome, copper, nickel
Production Plated Plastics	Richland	Chromium, copper
Clark Equipment	Springfield	Pce, tca, dce, dca
Dickman Auto Parts	Springfield	Tce, dce, dca, tca, metals
Dickman Landfill	Springfield	Tce, dce, dca, tca, metals, benzene, toluene
Eaton Corp	Springfield	Dce, tca, dca
Martin-Vogt Plating	Springfield	Chromium, nickel, lead, cyanide
Springfield Salt Storage	Springfield	Salt
Springfield Wells Lafayette Area	Springfield	Benzene, metals
Q Ave - Crooked Lake	Texas Corners	Benzene, xylene, toluene
Chief Noonday - Archwood	Wayland	Dichloroethane, toluene, benzene, xylene
Lower		
300 Water Street	Allegan	Phenanthrene, Benzo(a)pyrene, Acenaphthene
Allegan Metal Finishing	Allegan	Cyanide, chromium, zinc
Cappon Oil Transport Loss	Allegan	Benzene, toluene, xylene
City of Allegan	Allegan	Lead, arsenic, phenanthrene
Huitt and Sons	Allegan	Domestic and Industrial Waste
Res Wells Lincoln Road	Allegan	Pce, tce
Rockwell International Corp	Allegan	Lead, pcb, chromium
Water Street	Allegan	BTEX, pnas
Mesick Maude 1	Allegan County	Crude oil, bext, chloride

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Table 12.–Continued.

Segment and site	Location	Pollutant
Mouth		
Busk, Augie 3	Allegan County	Btex, crude oil, chloride
Ebert Farm	Allegan County	Pesticides
Sindlinger #1	Allegan County	Btex, brine, chloride, crude oil
Sutter, Frederick Well 1	Allegan County	Crude oil, brine, chloride
Village of Douglas Contamination Site	Douglas	Chromium, nickel, tce, tca, dce
LaGrange Lab Processors, Inc.	Fennville	Chloroform, DCA
MDOT Fennville	Fennville	Chlorides
Michigan Fruit Canners	Fennville	DDT, Manganese
Res Well 68th Street	Fennville	TCE
Pilgrim Farms Pickle Plant	Hamilton	Chlorides
Exit 41 Landfill	Saugatuck	DCA, DCE
Gleason Property	Saugatuck	Diesel Fuel
136th and 12th	Wayland	Lead
Goodale Facility	Wayland	TCE, Chlorides, Ethylbenzene
Sunrise Landfill	Wayland	TCE, DCE, Vinyl Chloride, Toluene Xylene

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Table 13.–Sites within the Kalamazoo River watershed listed under the Comprehensive Environmental Response, Compensation and Liability Act or CERCLA (Superfund). Acronyms: pre-remedial (DS=discovery, SI=site inspection, NF=final national priority list); removals (RS=removal investigation, RV=removal action); remedial (AR=administrative record, RA=remedial action, RD=remedial design); event lead is the agency directing the site actions (EPA=Environmental Protection Agency; RP=responsible party, State = State of Michigan). (Web: <http://www.deq.state.mi.us/erd1/sfnpl/index> [Accessed 2002: July 21]).

Site name	City	Last action	Date	Event lead
Upper				
Albion Ether Site	Albion	DS	10/24/1991	State
Albion-Sheridan Twp Landfill	Albion	RD	09/30/1999	RP
Brooks Foundry Lagoons	Albion	SI	02/10/1993	State
McGraw Edison Corporation	Albion	RA	10/29/1999	State
Union Steel Products Plant 1	Albion	RA	02/05/1997	EPA
Middle				
Orbit Enterprises	Battle Creek	AR	08/18/2000	EPA
Thomas Solvent Company	Battle Creek	AR	02/19/1991	EPA
Verona Well Field	Battle Creek	RA	04/07/1999	RP
Johnson Iron Industries	Charlotte	RA	03/15/1999	EPA
Allied Paper, Incorporated	Kalamazoo	RV	10/22/1999	RP
Auto Ion Chemicals Incorporated	Kalamazoo	RA	09/04/1998	RP
K&L Ave Landfill	Kalamazoo	NF	11/17/1992	EPA
Michigan Disposal Service	Kalamazoo	RD	12/01/1999	RP
Panelyte	Kalamazoo	RA	10/25/1995	EPA
Roto-Finish Company	Kalamazoo	RA	07/31/1998	EPA
SER-Plating Company	Kalamazoo	RV	06/12/1992	EPA
Spearflex Corporation	Kalamazoo	SI	02/06/1997	State
Production Plated Plastics	Richland	SP	09/28/1994	State
Portage Creek/Kalamazoo River	Several	RA	06/01/2001	EPA
Lower				
Rockwell International	Allegan	RS	04/22/1998	RP
Portage Creek/Kalamazoo River	Several	RA	06/01/2001	EPA
Mouth				
Chase Mfg Company	Douglas	SI	10/31/1991	State

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Table 16.–State and federal statutes administered by Michigan Department of Environmental Quality, Geological and Land Management and Water divisions that protect the aquatic resource in Michigan. N.R.E.P. Act = Natural Resources and Environmental Protection Act.

State and Federal Acts	Description of Acts
State of Michigan	
Public Health Code (1978 PA 386, as amended)	Aquatic Nuisance Control
Part 13 N.R.E.P. Act (1994 PA 451)	Floodplain Regulatory Authority
Part 31 N.R.E.P. Act (1994 PA 451)	Water Resource Protection
Part 91 N.R.E.P. Act (1994 PA 451)	Soil Erosion and Sedimentation Control
Part 301 N.R.E.P. Act (1994 PA 451)	Inland Lakes and Streams
Part 303 N.R.E.P. Act (1994 PA 451)	Wetland Protection
Part 305 N.R.E.P. Act (1994 PA 451)	Natural Rivers
Part 307 N.R.E.P. Act (1994 PA 451)	Inland Lake Level
Part 309 N.R.E.P. Act (1994 PA 451)	Inland Improvement
Part 315 N.R.E.P. Act (1994 PA 451)	Dam Safety
Part 323 N.R.E.P. Act (1994 PA 451)	Shoreland Protection and Management
Part 325 N.R.E.P. Act (1994 PA 451)	Great Lakes Submerged Lands
Part 341 N.R.E.P. Act (1994 PA 451)	Irrigation
US Federal	
Federal Water Pollution Control Act, Section 314 (PL 92-55)	
Coastal Zone Management Act (PL 92-583, 1972)	
Clean Water Act, Section 404 (PL 95-2117)	
River and Harbor Act, Section 10 (1899)	
Coastal Energy Impact Program (PL 92-538)	

US EPA ARCHIVE DOCUMENT

Summary of Environment Sites along the Kalamazoo River

Hydrogeological Investigation

Enbridge Line 6B Release

Marshall, Michigan

Number	Site Name	Status	Proximity to Enbridge Investigative Area	Contaminants of Concern	Impacted Media	NAPL Present	Groundwater Flow Direction and Conditions	Comments
1	Kellogg Foundation 55 Hamblin Street Battle Creek, MI	Closed Part 213 Site	1500 ft N of Area 3	Petroleum compounds	None	No	NW toward Battle Creek River/Kalamazoo River, 15-16 feet bgs	GW samples collected, no impact, site closed. Hydrogeological report available.
2	K-Mart 200 Capital Avenue SW Battle Creek, MI	Closed Part 213 Site	1200 ft NW of Area 3	Lead, BTEX, PNAs	S, S/GW interface	No	GW not encountered during investigation, (>25 feet bgs), soil very moist at 16' bgs	Site Investigation Work Plan, Site Assessment
3	Lakeview Shell 866 Capital Avenue SW Battle Creek, MI	Closed Part 213 Site	0.8 Miles SW of Area 3	BTEX, MTBE	S, GW	No	NE toward Lower Mill Pond, 0.006 ft/ft, 482 ft/yr, 43-46 ft bgs	Phase II Hydrogeological Interim Status Report, FAR, Closure Report, Initial Abatement Report
4	Lassen Pontiac/Cadillac 331 Michigan Avenue W Battle Creek, MI	Closed Part 213 Site	1 Mile N of Area 3	PNAs, BTEX	S, not significant	No	33 ft bgs	Closure Report
5	Leatherman Oil 455 Upton Avenue Battle Creek, MI	Part 213 Site	2 Miles NW of Area 3	BTEX, Pb, fluorene, naphthalene	S, GW	No	N-NE toward Kalamazoo River, 11-12 ft bgs	BEA, FAR
6	Lily Mobile Home Court 15011 W Michigan Avenue Marshall, MI	Closed Part 213 Site	0.75 Mile N of Area 1	Pb	S	No	Approximately 20 ft bgs	Initial site characterization
7	Machine Cartage Ways 12101 17 Mile Road Marshall, MI	Closed Part 213 Site	1.5 Miles SE of Area 1 (upstream)	BTEX, PNAs	S	No	Approximately 14 ft bgs	Closure Report
8	McLeier Oil Bulk Storage 252 Elm Street Battle Creek, MI	Part 213 Site	1 Mile NE of Area 3	BTEX, PNAs	S, GW	Yes (MWS-5)	E, SW, SE away from ASTs, approximately 13 ft bgs	Emergency Spill Response, Site Characterization
9	MDOT-Marshall Maintenance Garage 1242 S Kalamazoo Avenue Marshall, MI	Closed Part 213 Site	9600 ft E of Area 1 (upstream)	BTEX, TCE, TMBs	S, GW	Yes	N-NE, E, shallow 0.04-0.01 ft/day, deep 0.07-0.18 ft/day, 31-33 ft bgs	FAR, GW monitoring reports
10	Medler Electric 212 E Michigan Avenue Battle Creek, MI	Closed Part 213 Site	3000 ft NE of Area 3	BTEX, TMBs, PNAs	S	No	Approximately 20 ft bgs	Closure Report
11	Miller Brothers 864 Capital Avenue SW Battle Creek, MI	Part 213 Site	7000 ft SW of Area 3	BTEX, MTBE, TMBs, naphthalene, 2-methylnaphthalene, Pb	S, GW	No	NE, 0.006 ft/ft, 207 ft/yr, 42-45 ft bgs	FAR, Status/GW reports, BEAs
12	Neighborhoods, Inc. 482 W Van Buren Battle Creek, MI	Closed Part 213 Site	1000 ft NE of Kalamazoo River, 7200 ft N-NW of Area 3	Pb	S	No	SW, 37 ft bgs	Closure Report, IAR
13	P.S. Food Mart 1344 E Columbia Avenue Battle Creek, MI	Part 213 Site	500 ft N of Kalamazoo River, 8000 ft SE of Area 2	BTEX	S, GW	No	NE, 0.01 ft/ft, 37-39 ft bgs	Various site investigations, FAR
14	Scott VanderPloeg 430 N 20th Street Springfield, MI	Part 213 Site	3500 ft SW of Kalamazoo River, 4 Miles SE of Area 4, 2 Miles NW of Area 3	BTEX, heavy metals, PNAs	S	No	NW based on topography - no GW investigation	Phase II ESA
15	Former Sears Roebuck 170 Capital Avenue Battle Creek, MI	Closed Part 213 Site	1000 ft SW of Kalamazoo River, 2000 ft NW of Area 3	BTEX, PNAs	S	No	18 ft bgs	BEA, Site Characterization, Site Investigation
16	Sunny Honda Mazda 1385 W Dickman Road Battle Creek, MI	Closed Part 213 Site	1.5 Miles NW of Area 3, 4000 ft S of Kalamazoo River	Petroleum compounds	S	No	Unknown	Clean Closure Report
17	Terry's Service 334 N 20th Street Springfield, MI	Closed Part 213 Site	4800 ft SW of Kalamazoo River, 1.7 Miles NW of Area 3	BTEX	S, GW	No	N-NE, 0.02 ft/ft, 0.04 ft/day, 10 ft bgs	Hydrogeological work, quarterly reports, Closure Report, NPDES submittals, Site Investigation, Pump Test

Summary of Environment Sites along the Kalamazoo River

Hydrogeological Investigation

Enbridge Line 6B Release

Marshall, Michigan

Number	Site Name	Status	Proximity to Enbridge Investigative Area	Contaminants of Concern	Impacted Media	NAPL Present	Groundwater Flow Direction and Conditions	Comments
18	Neighborhoods, Inc. 482 W Van Buren Battle Creek, MI	Part 213 Site	3000 ft. E of Lower Mill Pond/Area 3	MTBE, BTEX, Pb, TMBs	S, GW	Yes	Generally S but inconsistent, 0.0037 ft/ft, 13 ft/yr, 25-28 ft bgs	IAR, FAR, free product reports, status reports, GW reports
19	Trumbull Service Station 94 North Avenue Battle Creek, MI	Part 213 Site	Approximately 1000 ft NW of Kalamazoo River, 4000 ft N-NE of Area 3	BTEX, PNAs	S, GW	No	S-SW, 28 ft bgs	Site Investigation Reports, UST Removal
20	Battle Creek Enquirer 155 W Van Buren Street Battle Creek, MI	Closed Part 213 Site	400 ft N of Battle Creek River, 3800 ft N of Area 3	TCE, BTEX	S, GW	No	South toward Battle Creek River, 12-27 ft bgs	Closure Reports, Hydrogeological Report, Investigation Reports, UST Removal
21	Union Electric 109 Elm Street Battle Creek, MI	Closed Part 213 Site	Not reviewed - file too small	-	-	-	-	-
22	Battle Creek Federal Center 7225 Tower Road Battle Creek, MI	Part 213 Site	Not reviewed - file too small	-	-	-	-	-
23	Wagner-Flook Builders Inc. 235 Hamblin Avenue Battle Creek, MI	Closed Part 213 Site	Immediately W of Kalamazoo River, 4000 N-NW of Area 3	PNAs	S	No	No information	Closure Report
24	Waldorf Corporation 177 Angel Street Battle Creek, MI	Closed Part 213 Site	Not reviewed - file too small	-	-	-	-	-
25	W.K. Kellogg Institute 2 Hamblin Avenue Battle Creek, MI	Closed Part 213 Site	Approximately 1000 ft NE of Kalamazoo River, 0.5 Miles NE of Area 3	BTEX, MTBE, Pb	S, GW	No	No information	Closure Report, 45-day Report, Soil Investigation
26	United Steel & Wire Company 105 S. Washington Street Battle Creek, MI	Part 201 Site	1 Mile N of Area 3	Cr, Cu, Ni, Pb, Zn, As, Hg, Si, Cd, VOCs, phenanthrene	S, GW, SW	No	Possibly perched GW, W toward Battle Creek River, 0.0008 ft/ft, 2.2 ft/yr	Remedial Investigation Reports
27	Bowers Manufacturing 5177 Comstock Avenue Comstock, MI	Part 201 Site	Downstream of Morrow Lake, >2 Miles NW of Area 8	As	S	No	2-10 ft bgs	Phase II ESA, BEA
28	Comstock Land Ltd Partnership 6900 E Michigan Avenue Comstock, MI	Part 201 Site	Approximately 2 Miles W of Area 8, western edge of Morrow Lake	As, Benzene, Pb, Toluene	GW	Yes	W, 0.004 ft/ft, 2 ft/day	Interim Activities, Hydrogeological Investigation, Geophysical Investigation, BEA, 2005 GW Report
29	Hydreco-General Signal-Benteler 9000 E. Michigan Avenue Galesburg, MI	Part 201 Site	3150 ft N of Morrow Lake, 0.5 Mile N of Area 8	VOCs	S, GW	No	South toward Morrow Lake, 1016 ft/day, GW elevation 783-786 ft amsl	RAP, GW Status Reports, Former Treatment System (Purge Wells)
30	Johnson Controls/American Fibrit 76 Armstrong Battle Creek, MI	Part 201 Site	1.5 Miles South of Area 4, 2 Miles SE of Area 5	Therminol 59 release, PNAs	S, SW	Yes	N-NW toward Kalamazoo River	Tech Memos, Site Assessment
31	Calhoun County Road Commission-Battle Creek Facility 1040 Raymond Road Battle Creek, MI	Active Part 201 Site	2 Miles E-SE of Area 3, 5 Miles NW of Area 2	CL, BTEX	GW	No	N and W toward Kalamazoo River, 0.004 ft/ft	Hydrogeological Study, GW Reports, ongoing monitoring
32	Cliff Street Wells aka General Foods 275 Cliff Street Battle Creek, MI	Active Part 201 Site	1.25 Miles E of Area 3	VOCs	GW	Yes	W toward Lower Mill Pond	Free Product Recovery, quarterly GW sampling

Summary of Environment Sites along the Kalamazoo River

Hydrogeological Investigation

Enbridge Line 6B Release

Marshall, Michigan

Number	Site Name	Status	Proximity to Enbridge Investigative Area	Contaminants of Concern	Impacted Media	NAPL Present	Groundwater Flow Direction and Conditions	Comments
33	E. Columbia Groundwater Contamination Battle Creek, MI	Closed Part 201 Site	Boundary within 1 Mile E of Area 3	VOCs	GW	Yes	Generally NE toward Kalamazoo River	GW sampling, Remedial Investigation Reports, Well Abandonment Report
34	Global Paint & Ink Company 74 Leonard Wood Drive Battle Creek, MI	Part 201 Site	1.5 Miles SE of Area 4	BTEX, TMBs, 1,1,1-TCA	GW	No	Perched water, S-SE	Remedial Investigation Report, Phase I & II ESA
35	Grand Trunk Western Railroad 105 E. Jameson Battle Creek, MI	Active Part 201 Site	1-3 Miles E-NE of Area 3	TCE, PCE, DCE, VC	S, GW	Yes	Shallow aquifer W-SW toward Battle Creek River, deep aquifer SW toward Lower Mill Pond	Active AS/SVE systems and groundwater carbon treatment systems, active NPDES permit, quarterly GW reports
36	Augusta Total 301 E. Michigan Avenue Augusta, MI	Closed Part 213 Site	1.25 Miles SW of Area 5	Petroleum compounds	S, GW	No	E-SE toward Kalamazoo River, 0.001 ft/ft, 32 ft/yr	BEAs, FAR, status reports, Well Decommissioning Report
37	Battle Creek Adventist Hospital 165 N. Washington Avenue Battle Creek, MI	Closed Part 213 Site	2400 ft N of confluence of Battle Creek and Kalamazoo Rivers, 7000 ft N of Area 3	BTEX, PNAs	S, GW	No	W-NW, 50-60 ft bgs, 0.05 ft/ft	Hydrogeological Report
38	Eaton Corp-Springfield 463 N. 20th Street Springfield, MI	Part 201 Site	2.25 Miles NW of Area 3	Cr, Hg, TCE, 1,1,1-TCA	GW	No	NE toward Kalamazoo River, 8-15 ft bgs, 0.0072 ft/ft, 3.2 ft/day	Hydrogeological Reports, purge well groundwater system, biostimulation
39	City of Battle Creek-Kendall Intersection of Kendall and Hamblin Battle Creek, MI	Part 201 Site	500 ft South of Kalamazoo River, 4800 ft NW of Area 3	VOCs	S, GW	No	N-NW toward Kalamazoo River, 11-14 ft bgs	Site Investigation Report, Phase I and II ESAs, BEA
40	West Urbandale Area Wells 2384 W. Michigan Avenue Battle Creek, MI	Closed Part 201 Site	2 Miles E-SE of Area 4	VOCs	GW	No	No information	Well Decommissioning Report, analytical data
41	A.K. Zinn/K&M Salvage 160 S. Kendall Street Battle Creek, MI	Part 201 Site	1 Mile NW of Area 3	VOCs, Cr, Pb, Hg	S, GW	No	N-NE toward Kalamazoo River, 14-17 ft bgs, 0.0033 ft/ft, 0.94 ft/day	Exposure Pahtway Evaluation, Remedial Investigation Report
42	W. Dickman/Kellogg Property Intersection of Brady and W. Dickman Battle Creek, MI	Part 201 Site	3.25 Miles NW of Area 3, 4 Miles SE of Area 4	Metals, PNAs	S, GW	No	Assumed N toward Kalamazoo River, 22-34 ft bgs	Phase I ESA, Geophysical Survey, Remedial Investigation, Feasibility Study
43	Former Springfield Elementary School 383 N 20th Street Springfield, MI	Part 201 Site	2 Miles NW of Area 3	As, Hg, Se, Pb	S	No	No water encountered, assumed to be within 60 ft bgs	Remedial Investigation
44	Clark Equipment Company Plant Springfield, MI	Part 201 Site (Act 307 Site)	0.75 Mile South of Kalamazoo River, 46 ft/day	Chlorinated VOCs	GW	No	NE toward Kalamazoo River, 0.71 ft/day, 10 ft bgs	Hydrogeological Investigation, Groundwater Extraction and Treatment System, Water Quality and Geological Reports
45	Ronan & Kunzl Main Site 500 S. Kalamazoo Marshall, MI	Part 201 Site	500 ft N of Kalamazoo River, upstream of Area 1	TCE, DCE, Ba	GW	No	South toward Kalamazoo River, approximately 10 ft bgs	Tech Memos (groundwater investigations)
46	Former Marshall Manufactured Gas Plant 200 E Spruce Street Marshall, MI	Active Part 201 Site	600 ft N of Rice Creek, 2 Miles E-NE of Area 1 (upstream)	BTEX, PNAs	GW	No	SW toward Rice Creek, 0.010-0.040 ft/ft, 885-895 ft amsl	Groundwater containment and treatment system
47	Former Marshall City Landfill Intersection of Hughes and Marshall Marshall, MI	Part 201 Site	100 ft South of Kalamazoo River, 2 Miles E of Area 1 (upstream)	Unknown	None	No	No information	Screening Site Inspection Report, Environmental Investigation Report

Summary of Environment Sites along the Kalamazoo River

Hydrogeological Investigation

Enbridge Line 6B Release

Marshall, Michigan

Number	Site Name	Status	Proximity to Enbridge Investigative Area	Contaminants of Concern	Impacted Media	NAPL Present	Groundwater Flow Direction and Conditions	Comments
48	Calhoun County Road Commission-Marshall Facility 13300 15 Mile Road Marshall, MI	Active Part 201 Site	0.5 Mile NE of Area 1, upstream	Chlorinated VOCs, Na, Cl	GW	No	SW and SE toward Kalamazoo River, 8-14.5 ft bgs	Groundwater monitoring ongoing, hydrogeological study
49	Equilon Enterprises LLC (Clark), Marshall Terminal 12451 Old US 27 South Marshall, MI	Part 201 Site	4800 ft South of Kalamazoo River, 2 Miles SE of Area 1 (upstream)	BTEX, MTBE, Pb	GW	Yes	Generally N and NW, approximately 15 ft bgs	Groundwater monitoring reports, remediation system installed
50	Bostik 205 West Oliver Drive Marshall, MI	Part 201 Site	6500 ft South of Kalamazoo River, 2 Miles SE of Area 1 (upstream)	PCE	S, GW	No	NW, 0.22 ft/day, 12-14 ft bgs	Hydrogeological investigations, UST removal
51	June Aldrich LUST Site 516-520 Capital Ave Battle Creek, MI	Part 213		BTEX, chlorinated solvents	GW, S	No	NW, 25 ft bgs, 31.34 ft/year, gradient 0.106 ft/ft	Hydrogeological study (copied), 1994 Phase II Hydrogeo study, Initial assessment report.
52	AT&T 216 Spring Street Battle Creek, MI	Part 213	3000 feet south of Kalamazoo River	phenanthrene, fluoranthrene	s	No	No groundwater encountered in soil borings down to 20 feet	file too small and no significant hydrogeo information to copy
53	Baker Oil 1583 West Dickman Road Battle Creek	Part 213	<0.5 mile south of Kalamazoo River	2-methylnaphthalene, BTEX, TMBs, naphthalene	S, GW	Yes	NE, 0-6 feet bgs, 2.85 ft/day, one gw unit indentified	1995 BEA, 1995FAR (portions copied), 2006 well decomissioning report, 2006 Verification of Remediation
54	City of Battle Creek, Equipment Division 350 West Michigan Ave Battle Creek MI	Part 213	500 feet north of Kalamazoo River	BTEX, TMBs	S, GW	Yes	SW, 25-32 ft bgs, gradient 0.006 ft/ft, 15.5 ft/year	2002 FAR (portions copied), 1989 tank reports, Initial Assessment Report, Free Product Status reports (portions copied)
55	City of Battle Creek Police Division 20 North Division Battle Creek, MI	Part 213	1100 north of Kalamazoo River, 400 feet south of Battle Creek River	BTEX	GW, S		N-NW towards Battle Creek River, 9-16 ft bgs, 816-821ft	1989 Hydrogeolocial Report (portions copied), 2000 FAR (Portions copied)
56	169 East State Street Battle Creek, MI	Part 213	1000 feet east of Kalamazoo River, 400 feet south of Battle creek River	Vinyl Chloride, dichlorofluormenthane	GW, surface water samples were ND	No	NW (towards Battle Creek River) 816-817 feet amsl	1995 Hydrogeolical Study (portions copied) 1991 45-day Report (portions copied)
57	Battle Creek Gas Com 165 S Monroe Steet Battle Creek, MI	Part 213	<500 feet east of Kalamazoo River	BTEX	GW, S	No	N-NW, 10-12 ft bgs, 38 ft/year, 0.01 ft/ft	1996 FAR, Aquifer performance test (copied), Phase III Site investigation (portions copied) Phase I &II site investigation
58	Clark Service Station 328 Capital Ave	Part 213	1500 feet NE of Kalamazoo River	BTEX, Naphthalene, TMBs	GW, S	No	NE, 16 ft bgs, one hydrogeo unit	1999 FAR (portions copied), IAR, BEA, Supplemental reports (monitoring reports)
59	Columbia Cleaners 859 Capital Ave Battle Creek MI	Part 213		BTEX	S, GW		NE, 42-46 ft bgs	BEAs
60	Classic Crysler 1484 South Michigan Ave Battle Creek, MI	Part 213, closed						
61	General Foods 275 Cliff Street 12/31 Building	Part 213	3500 feet North of Kalamazoo river and south of Battle Creek river	BTEX	GW	Y	two aquifers upper flow direction is North at 852-858 amsl, and lower flow is N-NW at 816.5-817.5 amsl	Groundwater sampling reports, 2009 groundwater sampking and groundwater system decomissioning report 1998 RBCA Evaluation (poritons copied), Free product reports, 1990 preliminary Investigation report (copied)
62	General Foods 275 Cliff Street 10/19 Building	Part 213	3500 feet North of Kalamazoo river and south of Battle Creek river	acetaldeyde	s, gw	No	two aquifers upper flow direction is North at 852-858 amsl, and lower flow is N-NW at 816.5-817.5 amsl	1992 RAP (portions copied - aquifer hydraulic drawdown tests), 1994-2009 Groundwater monitoring reports, 1990 IAR, 1990 Site investigation Work Plan

Summary of Environment Sites along the Kalamazoo River

Hydrogeological Investigation

Enbridge Line 6B Release

Marshall, Michigan

Number	Site Name	Status	Proximity to Enbridge Investigative Area	Contaminants of Concern	Impacted Media	NAPL Present	Groundwater Flow Direction and Conditions	Comments
63	EMRO #6318 390 East Michigan Ave Battle Creek, MI	Part 213	3000 feet north of Kalamazoo river, 2000 feet south of BC River	BTEX, MTBE	S, GW	Y	N, 20 ft bgs	1991, Site Assessment Report, 1993 Expanded Hydrogeolocial Report, Free Product Recovery Rports (1993-1994) 1996 & 2007 FAR, 1990-2010 Groundwater and Free Product Monitoring Reports
64	FISCA Oil Company 321 Capital Ave Battle Creek, Michigan	Part 213	4000 ft south of Kalamazoo river	Lead, BTEX,	S, GW	No	N, 28-31 ft bgs	1995 Initial Site Assessment,1998 LUST Closure report, 1994 & 2007Site Activities Reports, 2008 FAR (portions copied), Several status/monitoring reports (2008-2009)
65	Former Gas Station 170 Capital Ave Battle Creek, Mi	Part 213	200 ft SW of Kalamazoo river, Mill Pond is 1500 SE	PNAs	S		18' bgs, direction unknown	BEA
66	Kellogg Inst/BC Transit 2 Hamblin AVE/75 Beacon Street Battle Creek, MI	part 213	500 feet east of Kalamazoo river	BTEX, TMBs, PNAs	S, GW	No	W-SW, 812-815 amsl	1995 NPDES Permit, 1995 Administrative Agreement, 1994 Site Investigation and Corrective Action Plan (portions copied), O&M Plans for treatment, Performance Monitoring Reports (1996-2010)
67	Wright Brothers 420 East Michigan Battle Creek, MI	Part 213	3400 feet N of Kalamazoo river	BTEX, Lead	S. GW		East, 13.5 ft bgs, 0.008 ft/ft	1994 Hydrogeo Report (portions copied), 1992 Stie Investigation and Free Product Investigation and Hydrogeo Work Plan
68	Canteen Services 110 McCullen Kalamazoo, Mi	Part 201, closed	1500 ft North of Kalamazoo Rier		GW	No	South, 3-9'bgs	2003 Closure report
69	Bell Auto Sales 169 East Michigan Ave Galesburg, MI	closed 201/213	1500 ft North of Kalmazoo river	BTEX,TMBs	GW		South, 8' bgs	2003 Closure report, not much infor in file
70	Roelof Dairy 95 East Michigan Ave Kalamazoo, MI	Part 201	1000 ft north of Kalamazoo River				South, 9' bgs	2008 BEA, 1994 Phase I Hydrogeological Report, 1993 IAR, 1997 FAR (portions copied)
71	Titus Construction Co. 12105 East Michigan Ave Galesburg, MI	Part 201	300 ft South of Kalamazoo River	BTEX	GW, S		N-NW, 23' bgs	2001 Lust Closure Report (copied portions), 1998 FAR, 1994 Phase I Hydrogeological Report, 1995 Phase II Hydrogeological Report
72	Fort Custer Miliary Center Reservation	part 201	0-1 mile S of Kalamazoo River	BTEX, Lead, 111-TCA, Pce, Arsenic	S, GW, SW?		N&west of Kalamazoo River, 9-55' bgs, 4.2 ft/d	1993 Prelimiary Assessment, 1996 SAP, 1995 Work Plan, 1995 Work Plan, 1995 Scope of Work/Site Investigation, 1997 Site Investigation Report (portions copied), 2007 final groundwater, surface water, and pore water Sampling Plan, 2007-2009 Groundwater Sampling Reports
73	Fort Custer Small Arms Firing Range	Part 201	0-1 mile S of Kalamazoo River	metals, SVOCs	S		N&west of Kalamazoo River, 9-55' bgs, 4.2 ft/d	1999 Scope of work, 1999 Environmental Site Assessment Work Plan, 2000 Site Investigation Report
74	Michigan Paperboard 79 Fountain Street Battle Creek, MI	Part 201/213	< 500 feet west of Kalamazoo River	BTEX, Isopropanol	S	No	No information	1989 Subsurface Investigation UST Removal Site, 1992 Progress Report and Site Investigation Work Plan
75	Western Michigan Refrigeration Warehouse 1400 South 35th Street Galesburg, Mi	Part 201/213	0.25 south of Kalamazoo River	BTEX, Naphthalene	GW	no	NW	1996 Closure Report, 1996 Environmental Reports - Phase II Subsurface Investigation (portions copied), 1998 Revision to the 1996 Closure Report
76	Texaco 1540 S 35th Street Kalamazoo, Mi	Part 201/213	0.25 mile South of Kalamazoo River	BTEX, Naphthalene, TMBs, PNAs	S, GW	yes	N, 10' bgs	1996 Remediation Pilot Test Results, 1999 Groundwater Sampling Report, 1996 IAR, 1997 FAR, 2005 BEA
77	Mikes Tire Service 144 West Michigan Ave Kalamazoo, MI	Part 201	0.25 Mile North of Kalamazoo River	BTEX, PCE, Carbon Tet.	S, GW		W-SW, 0.00148 ft/day	1994 IAR, 1995 IAR/Phase I Hydrogeological Report (portions copied), 2006 BEA

Summary of Environment Sites along the Kalamazoo River

Hydrogeological Investigation

Enbridge Line 6B Release

Marshall, Michigan

Number	Site Name	Status	Proximity to Enbridge Investigative Area	Contaminants of Concern	Impacted Media	NAPL Present	Groundwater Flow Direction and Conditions	Comments
78	Galesburg-Augusta School 600 West Michigan Ave Kalamazoo, Mi	Part 201	900 feet west of Kalamazoo River an	BTEX, Naphthalene	S, SW	yes	N, 5.5-9.5 bgs	2004-2005 Status Reports, 1996 FAR, 1996 Investigation Summary Report, 1995 Investigation Summary Report (portions copied), 1994 Corrective Action Plan, 1993 Summary of Groundwater Investigation,
79	Davis Oil C-Store 6 East Michigan Ave Kalamazoo, MI	Part 201	1000 ft north of Kalamazoo River	BTEX	S, GW		S, 9 ft bgs	1987-89 Hydrogeolocigal Reports (Groundwater Monitoring), 1991 Site Investigation Report, 1992 Interin Response Report, 1992 NPDES Permit, 1993 Site Investigation Report, 1994 Soils Investigation Report, 2000-2006 Status and Monitoring Reports
80	Davis Oil #2 45 West Michigan Ave	Part 201	1000 ft north of Kalamazoo River	BTEX	S, GW	yes	S-SE towrds Kalamazoo River	1991 Site Investigation Report, 2002-2009 Free Product Status Reports, 1994 Hydrogeological Report, 1996 FAR
81	Fort Custer Heating Oil Spill	NFRA, Part 201						1996 No Further Remedial Action Letter, 1996 Release Closure Report. No Hydrogeological information in file.
82	Fort Custer State Lead							Mostly correspondence in file, no hydrogeological information
83	60 North 12th Street Springfield Michigan	Part 201	1000 ft South of Kalamazoo River	Arsenic, Lead, Benzo(a)pyrene	S		22' bgs	2003 BEA & Due Care Plan
84	1450 & 1588 West Dickman Road Springfield, MI	Part 201	1 mile South of Kalamazoo River					2005 BEA and Due Care Plan
85	C&F Service Station 3 Spring Street Battle Creek, Mi	Closed Part 213 Site						File not significant to Review
86	Calhoun County Medical Care Facility 1150 East Michigan Battle Creek, Mi	Closed Part 213 Site						File not significant to Review

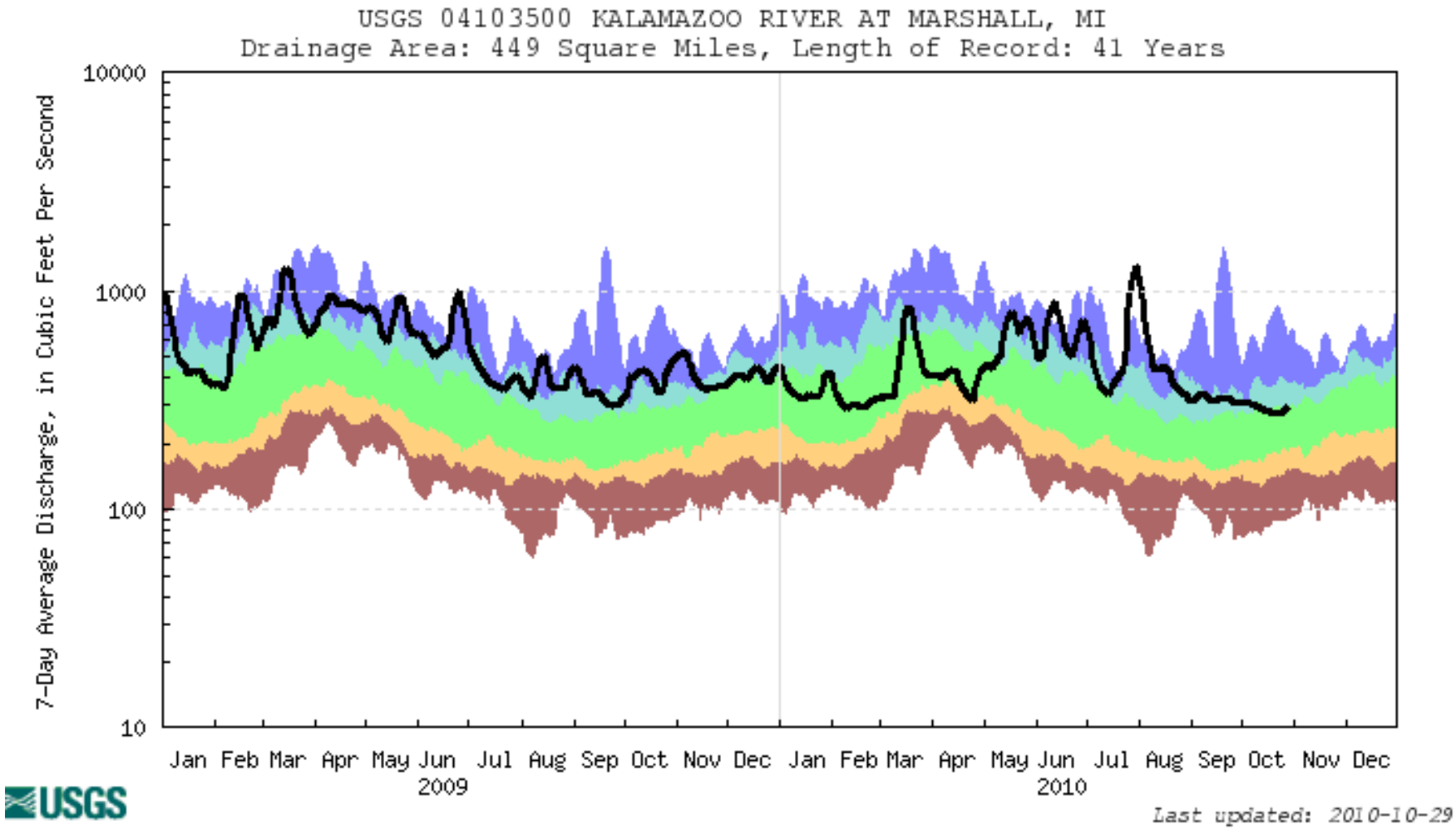
S	Soil
GW	Groundwater
SW	Surface Water
GWFV	Groundwater Flow Velocity
bgs	Below Ground Surface
ft	foot or feet
N	North
NE	Northeast
NW	Northwest
SE	Southeast
SW	Southwest
amsl	Above Mean Sea Level

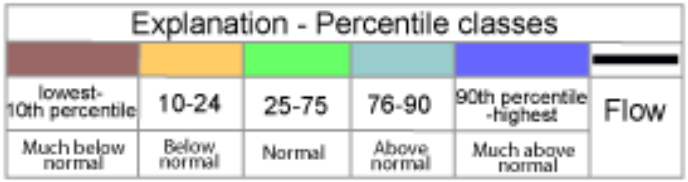
US EPA ARCHIVE DOCUMENT

Appendix B

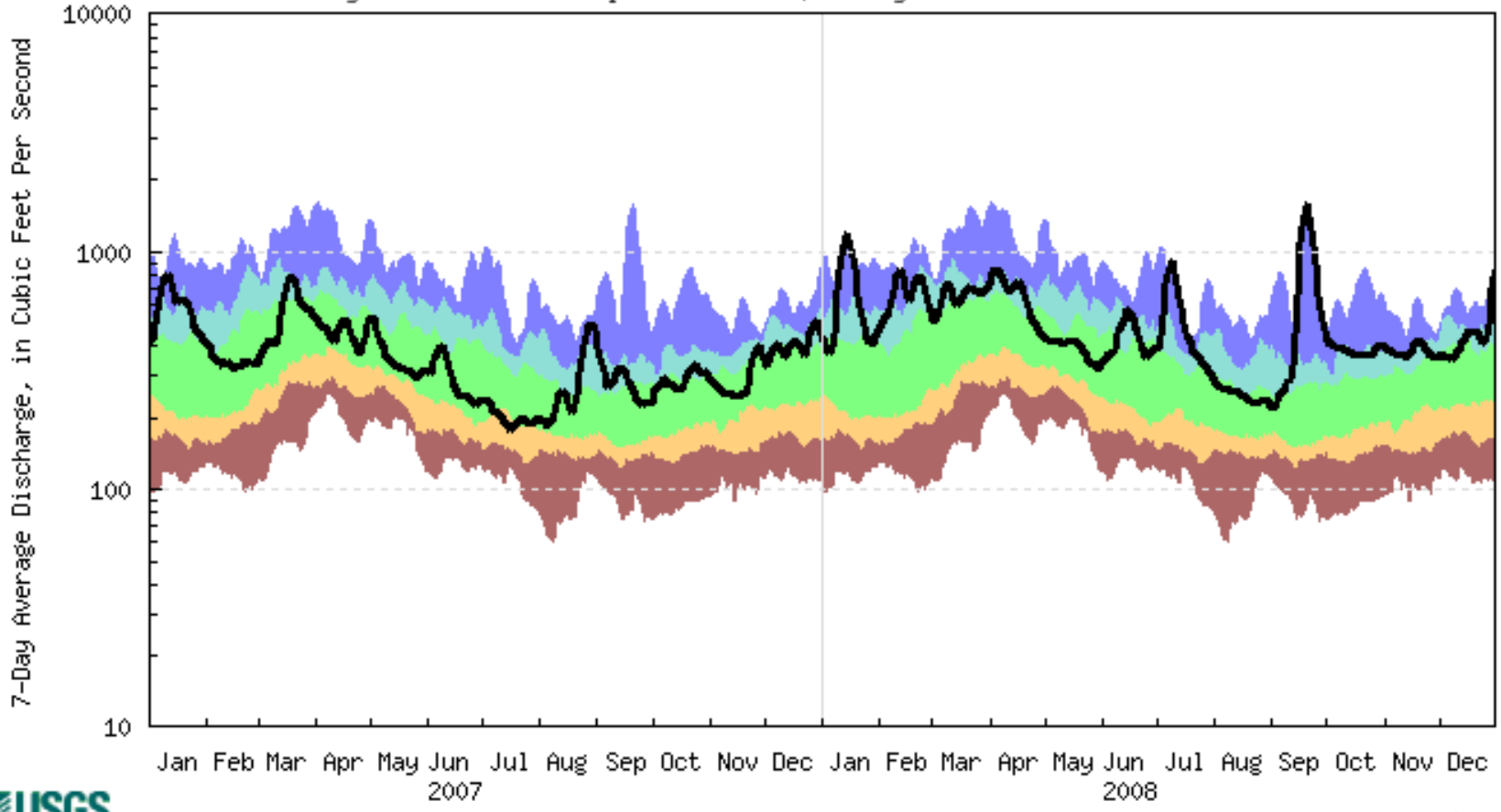
USGS Hydrographs

US EPA ARCHIVE DOCUMENT





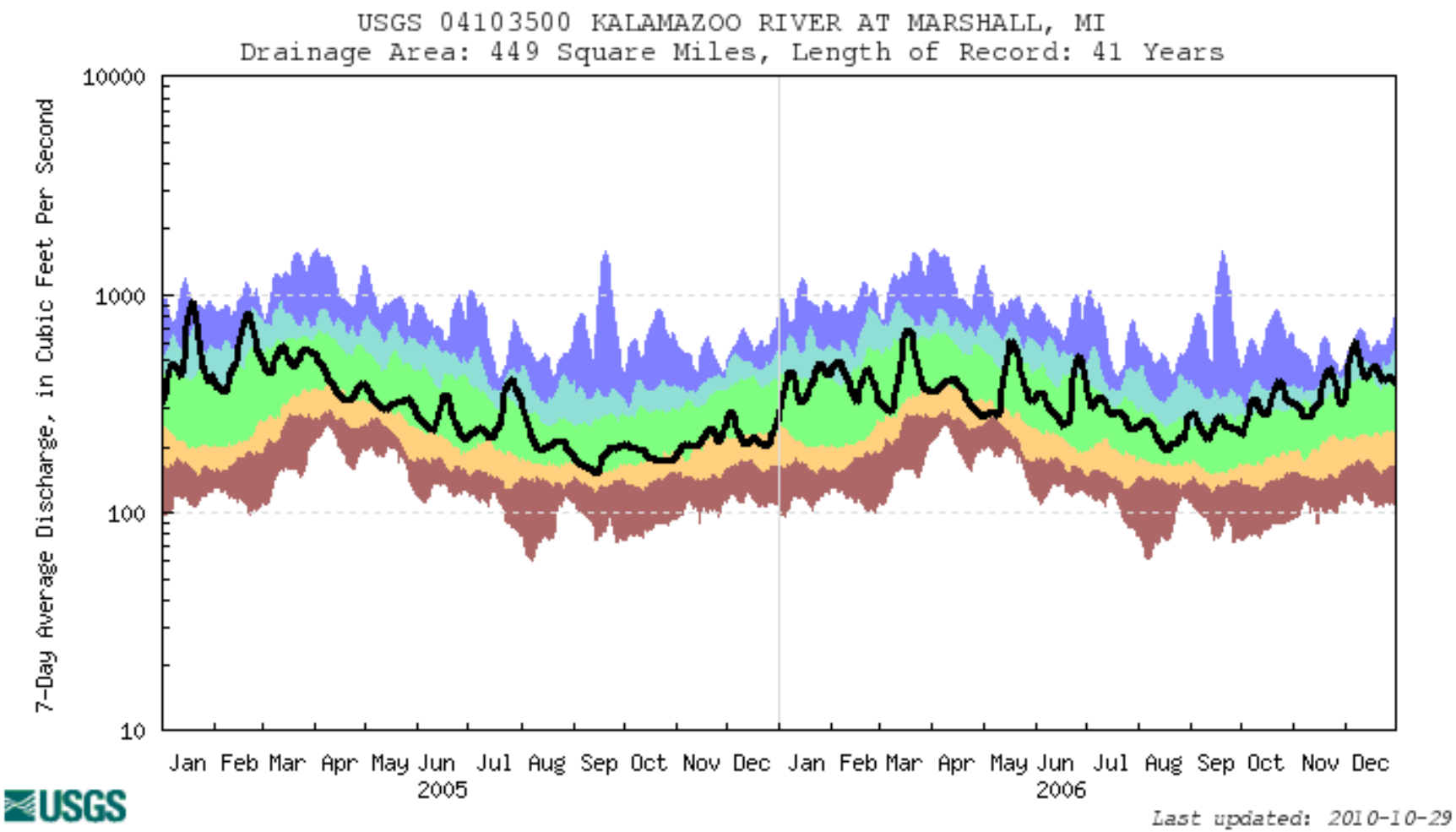
USGS 04103500 KALAMAZOO RIVER AT MARSHALL, MI
Drainage Area: 449 Square Miles, Length of Record: 41 Years

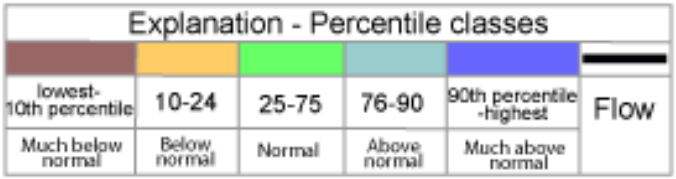


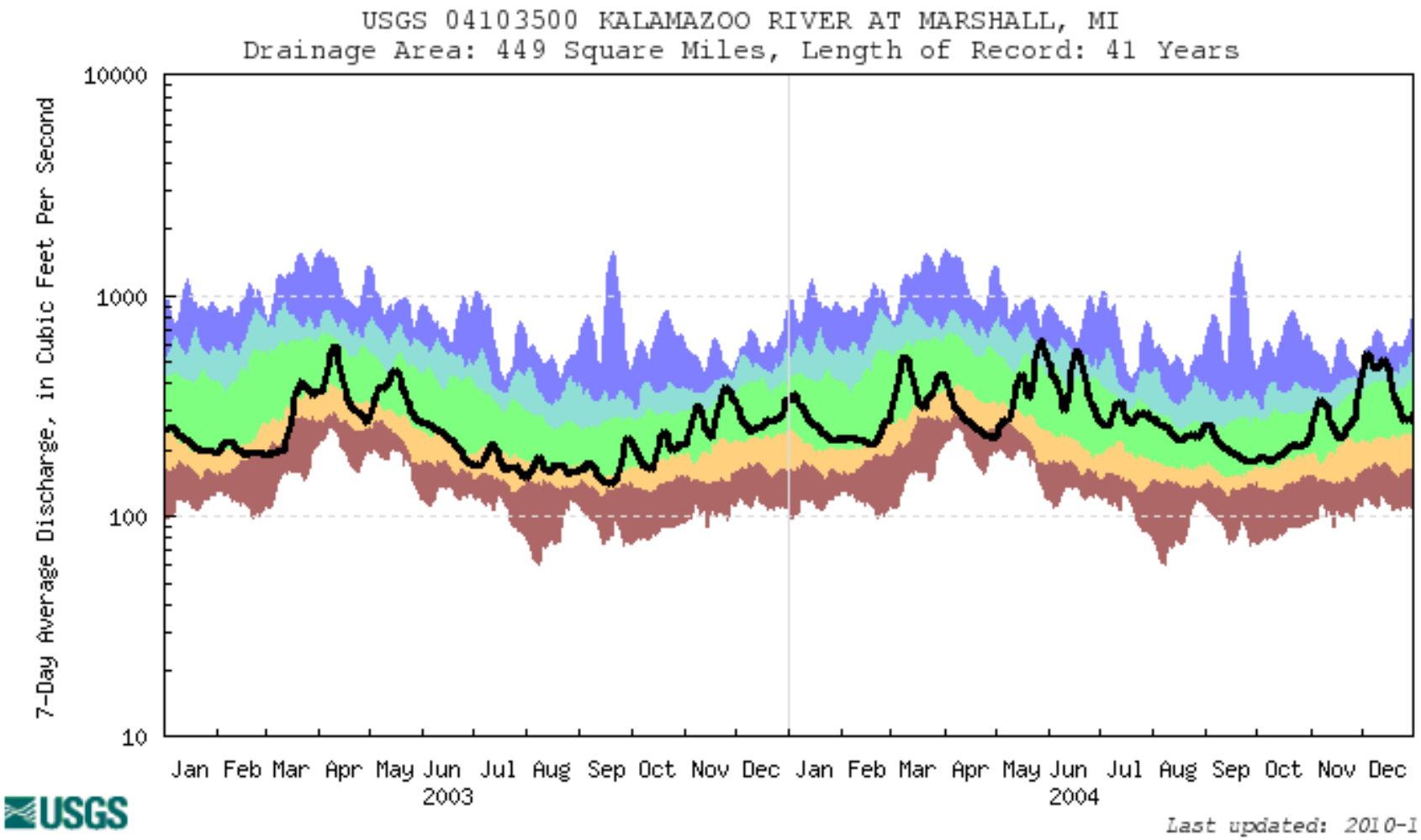
USGS

Last updated: 2010-10-29

Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile -highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

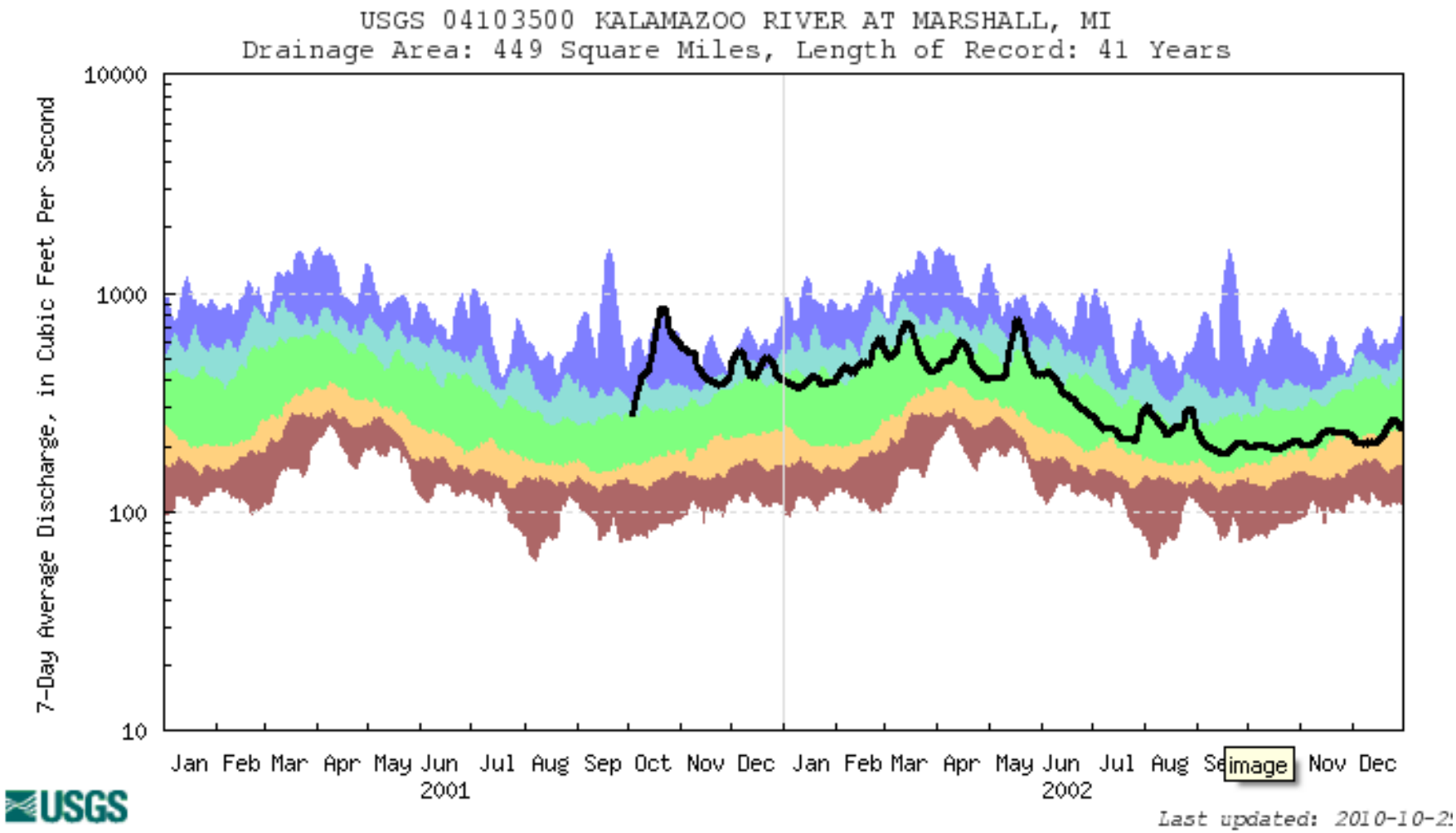

USGS 04103500 KALAMAZOO RIVER AT MARSHALL, MI
Drainage Area: 449 Square Miles, Length of Record: 41 Years
7-Day Average Discharge, in Cubic Feet Per Second
10000
1000
100
10
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2005
2006
USGS
Last updated: 2010-10-29

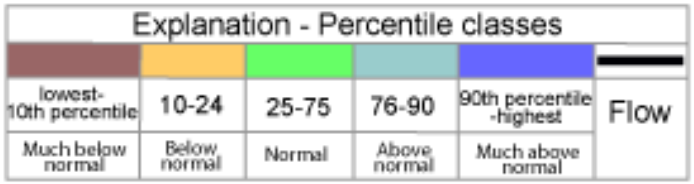

Explanation - Percentile classes
lowest-10th percentile
10-24
25-75
76-90
90th percentile -highest
Flow
Much below normal
Below normal
Normal
Above normal
Much above normal



Explanation - Percentile classes					
lowest-10th percentile	10-24	25-75	76-90	90th percentile -highest	Flow
Much below normal	Below normal	Normal	Above normal	Much above normal	

US EPA ARCHIVE DOCUMENT



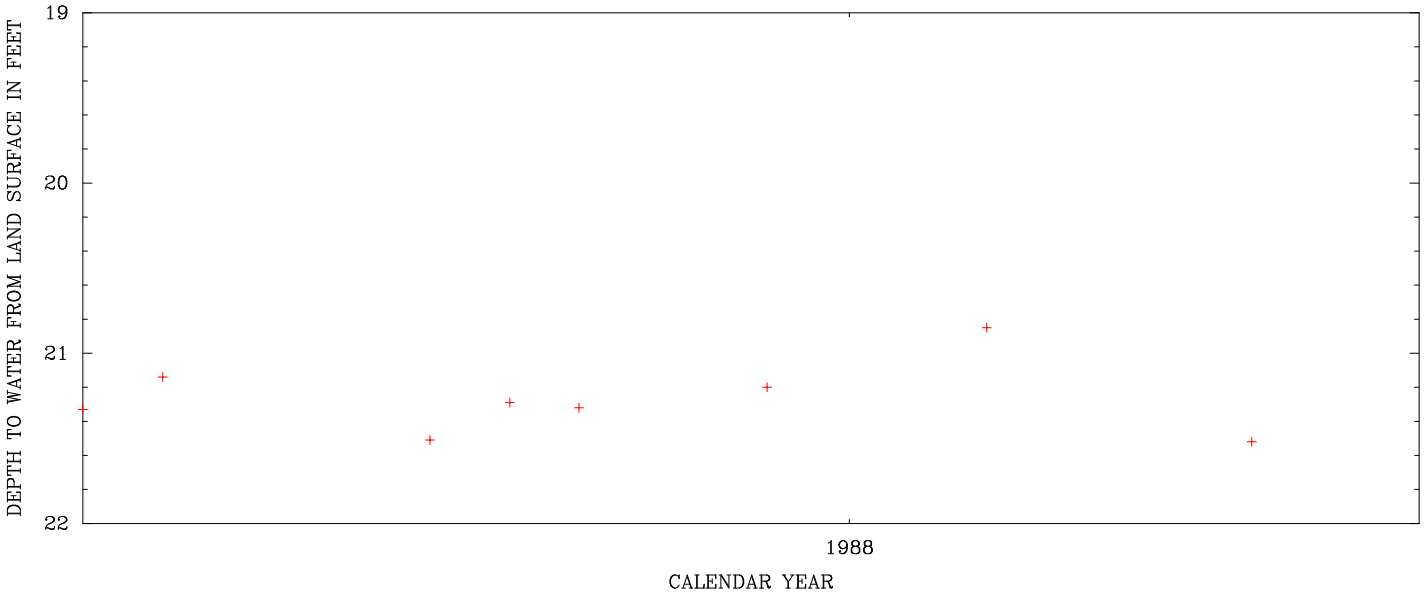


US EPA ARCHIVE DOCUMENT

USGS OBSERVATION LOGS

USGS Station ID	Location	Lat	Long	Depth	Depth to Water Range (feet below LS)	Dates
#421614085270801	Miller Drive at Morrow Lake	42.27059785	-85.45222335	27	6 to 13.5	1987 - 2005
#421616085262801	Galesburgh Rest Area	42.2711534	-85.4411118	47.7	20.8 to 21.6	1987 - 1988
#421713085264601	E. Michigan Avenue, North of Morrow Lake	42.28781959	-85.44527929	29	13.2 to 16	1987 - 2005
#422056085211701	N. 42cnd St. North of Augusta	42.34892908	-85.35472255	34.8	9.8 to 12	1987 - 2005
#422207085175501	Michigan Ave, north of Kalamazoo River, near Area 4.	42.36753978	-85.29861	62.5	1.2 to 3.65	1987 - 2002

02S 10W 26ABD01 KALAMAZOO CO (K-31)



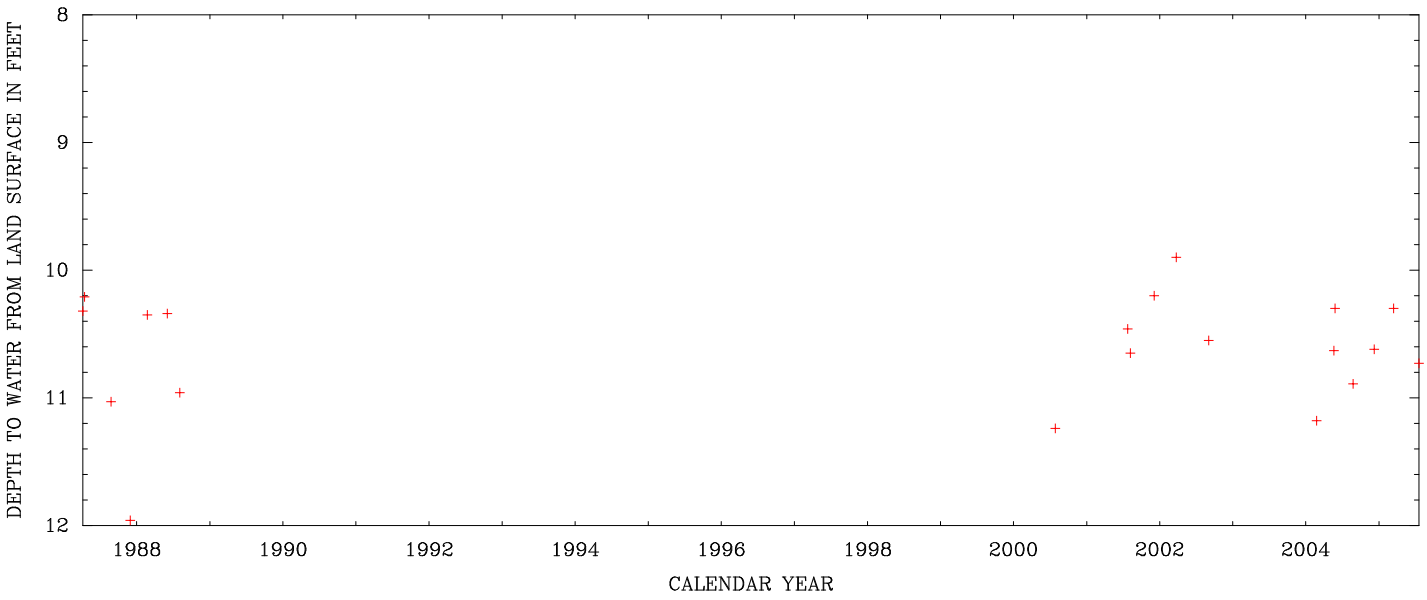
EXPLANATION

GWSI TAPE-DOWN MEASUREMENTS

NO WATER YEAR SUMMARY FOR TAPE-DOWN ONLY STATIONS

USGS STATION 421616085262801
PERIOD OF RECORD, WATER YEARS 1987 - 1988, PLOT GENERATED 8/4/2005
DEPTH OF WELL IS 47.7 FT, PRIMARY AQUIFER DESIGNATION:
FOR MORE INFORMATION REGARDING THESE DATA, PLEASE CONTACT
USGS MICHIGAN WATER SCIENCE CENTER, http://mi.water.usgs.gov
517-887-8903(TELEPHONE); 517-887-8937(FAX); hwreeves@usgs.gov (EMAIL)

01S 09W 27CCC 01 KALAMAZOO CO (K-5)



EXPLANATION

+ GWSI TAPE-DOWN MEASUREMENTS

NO WATER YEAR SUMMARY FOR TAPE-DOWN ONLY STATIONS

USGS STATION 422056085211701
PERIOD OF RECORD, WATER YEARS 1987 - 2005, PLOT GENERATED 8/4/2005
DEPTH OF WELL IS 34.8 FT, PRIMARY AQUIFER DESIGNATION:
FOR MORE INFORMATION REGARDING THESE DATA, PLEASE CONTACT
USGS MICHIGAN WATER SCIENCE CENTER, http://mi.water.usgs.gov
517-887-8903(TELEPHONE); 517-887-8937(FAX); hwreeves@usgs.gov (EMAIL)

US EPA ARCHIVE DOCUMENT

Appendix C

Potable Wells

US EPA ARCHIVE DOCUMENT

Summary of Iron and Nickel Detection Ranges in Townships Along the Kalamazoo River

Townships	Iron Minimum Detected Concentration (mg/L)	Iron Maximum Detected Concentration (mg/L)	Nickel Minimum Detected Concentration (mg/L)*	Nickel Maximum Detected Concentration (mg/L)
Marshall	0.1	6.5	0.003	0.01
Emmett	0.1	5.9	0.002	0.01
Battle creek	0.1	5.08	0.001	0.007
Bedford	0.09	6	0.002	0.01
Ross	0.01	7.2	0.003	0.01
Charleston	0.1	10.3	0.003	0.01
Comstock	0.02	16	0.002	0.008

Enbridge PW Data Set	0.02	6.71	0.005	0.043

* a number of the results were reported as 0.000, these are suspect and not included in the summary for nickel

Residential Well Sampling and Letter Status
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Well Number	Property Number	Tax ID	House No	Street	Address	City	State	County	Permission	Permission Date	BTEX, GRO, ORO, DRO Detects	Other Crude Oil Constituent Detects	Period 0 (7/27 - 8/18)	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Sampling Events Count	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Letters Sent Count
C0002C6A	C0002C6	[redacted]	[redacted]	[redacted]	[redacted]	Ceresco	MI	Calhoun	Unattended Permission, Anytime	25-Sep-10		Iron (1)				9/25/2010		10/25/2010	2			10/6/2010			1
C0004F3A	C0004F3	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Permit but Call/Schedule Required	12-Sep-10		Iron (2)		8/31/2010	9/12/2010	9/20/2010		10/17/2010	4	10/1/2010	10/1/2010				2
C001311A	C001311	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	06-Sep-10		Iron (1)			9/8/2010			10/27/2010	2		10/4/2010				1
C001899A	C001899	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	31-Aug-10				8/31/2010			10/11/2010, 10/12/2010	10/22/2010	4	10/14/2010	10/15/2010				2
C002068A	C002068	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Permit but Call/Schedule Required	31-Aug-10				8/31/2010	9/12/2010			10/22/2010	3	10/21/2010	10/15/2010				2
C0021FEA	C0021FE	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Permit but Call/Schedule Required	19-Sep-10					9/4/2010	9/19/2010	10/11/2010	10/24/2010	4	10/14/2010	10/4/2010				2
C0023D2WP1	C0023D2	[redacted]	[redacted]	[redacted]	[redacted]	Ceresco	MI	Calhoun	Permit but Call/Schedule Required	13-Oct-10															
C002471A	C002471	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	01-Sep-10		Iron (2)		9/1/2010	9/4/2010	9/17/2010	10/13/2010		4	10/5/2010	10/4/2010, 10/13/2010				3
C0027CBA	C0027CB	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission - Anytime	31-Aug-10		Iron (3)		8/31/2010	9/12/2010	9/17/2010	10/11/2010	10/21/2010	5	10/14/2010	10/13/2010				2
C0029CCWP1	C0029CC	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	08-Sep-10															
C0040EE	C0040EE	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI		Permit but Call/Schedule Required	25-Oct-10								10/25/2010	1						
C0042C2WP1	C0042C2	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK			Unattended Permission, Anytime	23-Oct-10															
C00474DA	C00474D	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI		Unattended Permission, Anytime	24-Oct-10								10/24/2010	1						
C0048DCA	C0048DC	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	CALHOUN	Unattended Permission, Anytime	23-Sep-10		Iron (2)				9/23/2010	10/7/2010	10/17/2010	3			10/6/2010	10/26/2010		2
C005139A	C005139	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10		Iron (5)		8/28/2010	9/13/2010	9/21/2010	10/7/2010	10/17/2010	5	10/2/2010	10/4/2010	10/8/2010	10/25/2010		4
C005315A	C005315	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI		Unattended Permission, Restricted Times	25-Oct-10								10/25/2010	1						
C00589DA	C00589D	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10		Iron (5)		8/28/2010	9/13/2010	9/21/2010	10/7/2010	10/17/2010	5	10/2/2010	10/4/2010	10/7/2010	10/26/2010		4
C00856DA	C00856D	[redacted]	[redacted]	[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	07-Sep-10		Iron (3)			9/7/2010	9/17/2010	10/8/2010	10/18/2010	4		10/5/2010		10/25/2010		2
C00928FA	C00928F	[redacted]	[redacted]	[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission - Anytime	27-Oct-10				8/31/2010				10/27/2010	2	10/5/2010					1
C0094BAPW1	C0094BA	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Permit but Call/Schedule Required	01-Sep-10		Iron (2)			9/11/2010	9/25/2010			2		10/4/2010	10/6/2010			2
C009696A	C009696	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI		Unattended Permission, Anytime	25-Oct-10								10/25/2010	1						
C0108EFWP1	C0108EF	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	24-Oct-10															
C011485A	C011485	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	19-Sep-10		Iron (2)				9/19/2010	10/6/2010	10/16/2010	3				10/19/2010		1
C0118AEA	C0118AE	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Permit but Call/Schedule Required	28-Aug-10		Iron (3)		8/28/2010	9/11/2010	9/20/2010	10/12/2010	10/22/2010	5	10/14/2010	10/14/2010				2
C0127FCA	C0127FC	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	16-Sep-10				8/31/2010				10/23/2010	2	10/5/2010					1

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Residential Well Sampling and Letter Status
Wells Within 200-Foot High Water Mark Buffer
as of October 25, 2010

Well Number	Property Number	Tax ID	House No	Street	Address	City	State	County	Permission	Permission Date	BTEX, GRO, ORO, DRO Detects	Other Crude Oil Constituent Detects	Period 0 (7/27 - 8/18)	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Sampling Events Count	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Letters Sent Count
C0129FBA	C0129FB	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	04-Sep-10		Iron (3)			9/4/2010, 9/9/2010	9/24/2010	10/11/2010	10/21/2010	5		10/4/2010, 10/4/2010	10/6/2010			3
C013407A	C013407	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	19-Sep-10		Iron (1)			9/5/2010	9/20/2010	10/6/2010	10/15/2010	4		10/1/2010		10/19/2010		2
C0137BDA	C0137BD	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	01-Sep-10		Iron (5)		9/1/2010	9/11/2010	9/20/2010	10/2/2010	10/16/2010	5	10/5/2010	10/4/2010				2
C0139BAA	C0139BA	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	01-Sep-10		Iron (4)		9/1/2010	9/12/2010	9/19/2010	10/3/2010	10/16/2010	5	10/5/2010	10/4/2010		10/19/2010		3
C0144C0A	C0144C0	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	12-Sep-10		Iron (3)		8/31/2010	9/12/2010	9/19/2010	10/1/2010	10/14/2010	5	10/5/2010	10/4/2010				2
C01477APW1	C01477A	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek		Calhoun	Refused Permission	29-Sep-10		Iron (2)													
C01497DA	C01497D	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	21-Sep-10		Iron (2)		8/31/2010		9/21/2010	10/10/2010	10/21/2010	4	10/14/2010		10/8/2010			2
C015098PW1	C015098	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10		Iron (4)		8/28/2010	9/13/2010	9/19/2010	10/10/2010	10/20/2010	5	10/2/2010	10/4/2010, 10/13/2010				3
C015322A	C015322	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	07-Sep-10		Iron (3)			9/13/2010	9/16/2010	9/30/2010	10/14/2010	4		10/6/2010, 10/4/2010	10/6/2010	10/19/2010		4
C015481A	C015481	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	04-Sep-10		Iron (2)			9/4/2010	9/16/2010	9/30/2010	10/14/2010	4		10/4/2010	10/6/2010	10/19/2010		3
C0156ADA	C0156AD	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	01-Sep-10		Iron (4), Nickel (3)		9/1/2010	9/13/2010	9/21/2010	9/30/2010	10/14/2010	5	10/14/2010					1
C01573BA	C01573B	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	01-Sep-10		Iron (4)		9/1/2010	9/13/2010	9/16/2010	9/30/2010	10/14/2010	5		10/4/2010	10/14/2010			2
C016277A	C016277	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	06-Sep-10		Iron (2)			9/8/2010			10/23/2010	2		10/5/2010				1
C0165D4PW1	C0165D4	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	14-Sep-10		Iron (2)		8/28/2010, 8/31/2010	9/14/2010	9/20/2010	10/9/2010	10/19/2010	6	10/4/2010, 10/5/2010	10/5/2010				3
C017595PW1	C017595	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	Mi	Calhoun	Unattended Permission, Anytime	24-Oct-10								10/24/2010	1						
C0177B9A	C0177B9	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	Calhoun	Unattended Permission, Anytime	28-Sep-10		Iron (2)				9/28/2010		10/24/2010	2			10/20/2010			1
C0179BEPW1	C0179BE	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	15-Sep-10							10/13/2010	10/23/2010	2						
C0180D5A	C0180D5	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	31-Aug-10		Iron (4)		8/31/2010	9/14/2010	9/20/2010	10/7/2010	10/17/2010	5	10/5/2010	10/5/2010				2
C01836FA	C01836F	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	30-Aug-10		Iron (5)		8/30/2010	9/13/2010	9/20/2010	10/7/2010	10/17/2010	5	10/5/2010	10/4/2010, 10/13/2010				3
C01855AA	C01855A	[redacted]	[redacted]	[redacted]	[redacted]	GALESBURG	MI	KALAMAZOO	Unattended Permission, Anytime	23-Sep-10						9/23/2010	10/5/2010	10/16/2010	3			10/6/2010	10/19/2010	10/28/2010	3
C018776A	C018776	[redacted]	[redacted]	[redacted]	[redacted]	GALESBURG	MI	KALAMAZOO	Unattended Permission, Anytime	23-Sep-10						9/23/2010	10/5/2010	10/16/2010	3			10/6/2010	10/19/2010		2
C0188E7A	C0188E7	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI																		
C01932EA	C01932E	[redacted]	[redacted]	[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	01-Sep-10		Iron (1)		9/1/2010	9/12/2010		10/3/2010	10/16/2010	4	9/2/2010	10/4/2010, 10/18/2010				3
C01948DPW1	C01948D	[redacted]	[redacted]	[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	06-Sep-10					9/8/2010	9/17/2010	10/8/2010	10/18/2010	4		10/16/2010	10/8/2010	10/25/2010		3
C019930PW1	C019930	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	23-Oct-10								10/23/2010	1						
C0208B6A	C0208B6	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	CALHOUN	Unattended Permission, Anytime	24-Sep-10		Iron (2), Naphthalene (1)				9/24/2010	10/6/2010	10/16/2010	3			10/6/2010			1

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Residential Well Sampling and Letter Status
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C0218F7PW1	C0218F7	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	01-Sep-10		Iron (2)			9/15/2010	9/22/2010			2		10/4/2010	10/13/2010			2
C0227A5A	C0227A5	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10				8/28/2010	9/13/2010	9/21/2010	10/10/2010	10/21/2010	5	10/4/2010	10/14/2010	10/14/2010			3
C0229A2A	C0229A2	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	CALHOUN	Unattended Permission, Anytime	28-Sep-10		Iron (1)				9/28/2010	10/12/2010	10/27/2010	3			10/19/2010, 10/20/2010			2
C023047A	C023047	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	31-Aug-10		Iron (4)		8/31/2010	9/13/2010	9/16/2010	9/30/2010	10/14/2010	5	10/5/2010	10/4/2010	10/7/2010	10/19/2010		4
C0231D1A	C0231D1	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	CALHOUN	Unattended Permission, Anytime	23-Sep-10		Iron (3)				9/25/2010	9/30/2010	10/14/2010	3			10/6/2010			1
C02433AWP1	C02433A	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	04-Sep-10		Iron (2)			9/4/2010	9/17/2010	10/6/2010	10/15/2010	4		10/13/2010	10/13/2010	10/16/2010		3
C0246B5WP1	C0246B5	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	12-Oct-10															
C024723PW1	C024723	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	26-Aug-10					9/4/2010	9/17/2010	10/6/2010	10/19/2010	4						
C0248B2PW1	C0248B2	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Permit but Call/Schedule Required	06-Sep-10		Iron (3)			9/8/2010	9/17/2010	10/6/2010	10/16/2010	4		10/13/2010	10/7/2010	10/19/2010		3
C0250C1WP1	C0250C1	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo																	
C0250C1WP2	C0250C1	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo										10/23/2010	1						
C0252EDA	C0252ED	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Permit but Call/Schedule Required	06-Sep-10					9/8/2010	9/17/2010	10/6/2010	10/16/2010	4		10/13/2010	10/7/2010	10/19/2010		3
C0254D8	C0254D8	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	05-Sep-10		Iron (1)			9/5/2010			10/24/2010	2		10/6/2010				1
C025965WP1	C025965	[redacted]		[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	09-Oct-10								10/16/2010	1						
C0269A6PW1	C0269A6	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	08-Oct-10				8/29/2010	9/11/2010	9/17/2010	10/8/2010	10/18/2010	5	10/13/2010		10/13/2010	10/25/2010		3
C0271D5PW1	C0271D5	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	25-Oct-10						9/19/2010		10/25/2010	2			10/14/2010			1
C0273F9WP1	C0273F9	[redacted]		[redacted]	[redacted]	Ceresco	MI	Calhoun	Unattended Permission, Anytime	03-Oct-10	Toluene (1)	Iron (1)					10/3/2010	10/24/2010	2						
C0286B9PW1	C0286B9	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Refused Permission	24-Sep-10															
C0292E1A	C0292E1	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission - Anytime	31-Aug-10		Iron (2)		8/31/2010		9/22/2010	10/1/2010	10/14/2010	4	10/13/2010		10/13/2010			2
C0298FFWP1	C0298FF	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call/Schedule Required	06-Oct-10		Iron (1)					10/7/2010	10/17/2010	2						
C0298FFWP2	C0298FF	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call/Schedule Required	06-Oct-10															
C0300B3WP1	C0300B3	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	07-Sep-10		Iron (1)			9/9/2010			10/23/2010	2		10/16/2010				1
C030309WP1	C030309	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	08-Sep-10					9/10/2010, 9/11/2010	9/20/2010	10/6/2010	10/15/2010	5		10/13/2010, 10/13/2010	10/13/2010	10/19/2010		4
C0304AAPW1	C0304AA	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	29-Sep-10		Iron (1)			9/4/2010	9/29/2010	10/12/2010	10/23/2010	4		10/13/2010	10/20/2010			2
C030917WP1	C030917	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	07-Sep-10								10/23/2010	1						
C0310F2PW1	C0310F2	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	24-Oct-10		Iron (1)			9/8/2010			10/24/2010	2		10/16/2010				1

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Residential Well Sampling and Letter Status
Wells Within 200-Foot High Water Mark Buffer
as of October 25, 2010

Well Number	Property Number	Tax ID	House No	Street	Address	City	State	County	Permission	Permission Date	BTEX, GRO, ORO, DRO Detects	Other Crude Oil Constituent Detects	Period 0 (7/27 - 8/18)	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Sampling Events Count	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Letters Sent Count
C0314EBWP1	C0314EB	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Restricted Times	12-Oct-10								10/15/2010	1						
C031751PW1	C031751	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10		Iron (2)		8/28/2010	9/11/2010			10/24/2010	3	10/26/2010					1
C032604WP1	C032604	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO	MI	Calhoun	Unknown																
C033469WP1	C033469	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	05-Sep-10		Iron (6)			9/8/2010	9/18/2010	10/8/2010	10/19/2010	4						
C0335FFWP1	C0335FF	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Permit but Call/Schedule Required	29-Aug-10		Iron (1)					10/3/2010	10/27/2010	2						
C033645WP1	C033645	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	12-Sep-10		Iron (2)			9/12/2010			10/27/2010	2						
C033645WP1	C033645	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	12-Sep-10		Iron (2)			9/12/2010			10/27/2010	2						
C0337D3WP1	C0337D3	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	04-Sep-10		Iron (2)			9/4/2010	9/18/2010	10/8/2010	10/18/2010	4		10/13/2010	10/13/2010	10/25/2010		3
C03429BWP1	C03429B	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	18-Oct-10		Iron (3)			9/7/2010	9/18/2010	10/9/2010	10/20/2010	4		10/13/2010	10/13/2010	10/26/2010		3
C035755WP1	C035755	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	05-Sep-10		Iron (3)			9/8/2010	9/18/2010	10/8/2010	10/18/2010	4		10/13/2010	10/8/2010, 10/13/2010	10/25/2010		4
C035755WP2	C035755	[redacted]		[redacted]	[redacted]	AUGUSTA	MI	Kalamazoo	Unattended Permission, Anytime	05-Sep-10					9/8/2010	9/18/2010	10/8/2010	10/18/2010	4		10/13/2010	10/8/2010, 10/13/2010	10/25/2010		4
C0375FBWP1	C0375FB	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	04-Sep-10								10/21/2010	1						
C0377D7A	C0377D7	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	25-Sep-10		Iron (2)		8/28/2010		9/25/2010	10/6/2010	10/20/2010	4	10/1/2010		10/6/2010	10/19/2010		3
C038297	C038297	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	05-Sep-10					9/5/2010			10/24/2010	2		10/6/2010				1
C0384A2WP1	C0384A2	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	05-Sep-10		Iron (3)			9/5/2010	9/21/2010	10/6/2010	10/15/2010	4		10/13/2010	10/13/2010	10/25/2010		3
C03868EWP1	C03868E	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Unattended Permission, Anytime	04-Sep-10					9/4/2010	9/21/2010	10/6/2010	10/15/2010	4		10/13/2010	10/13/2010	10/19/2010		3
C038718WP1	C038718	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	21-Sep-10					9/11/2010	9/21/2010	10/2/2010	10/15/2010	4		10/13/2010	10/13/2010			2
C039759WP1	C039759	[redacted]		[redacted]	[redacted]	CERESCO	MI	Calhoun	Permit but Call/Schedule Required	03-Oct-10							10/12/2010	10/23/2010	2						
C043756WP1	C043756	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Permit but Call/Schedule Required	07-Sep-10		Iron (2)			9/9/2010	9/21/2010	10/12/2010	10/22/2010	4		10/13/2010	10/13/2010			2
C044607PW1	C044607	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Permit but Call/Schedule Required	08-Sep-10		Iron (2)			9/9/2010	9/21/2010	10/12/2010	10/22/2010	4		10/13/2010	10/13/2010			2
C046713WP1	C046713	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10															
C046882A	C046882	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call and Schedule First	26-Aug-10				8/28/2010	9/13/2010	9/21/2010	10/10/2010	10/20/2010	5		10/13/2010				1
C0470F1PW1	C0470F1	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	26-Aug-10		Iron (2)			9/4/2010	9/21/2010	10/10/2010	10/21/2010	4		10/13/2010	10/13/2010			2
C04757EWP1	C04757E	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	07-Sep-10					9/7/2010	9/21/2010	10/10/2010	10/21/2010	4		10/13/2010	10/13/2010			2
C04879DWP1	C04879D	[redacted]		[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	28-Sep-10		Iron (1)				9/28/2010	10/12/2010	10/23/2010	3			10/20/2010	10/28/2010		2

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Residential Well Sampling and Letter Status
Wells Within 200-Foot High Water Mark Buffer
as of October 25, 2010

Well Number	Property Number	Tax ID	House No	Street	Address	City	State	County	Permission	Permission Date	BTEX, GRO, ORO, DRO Detects	Other Crude Oil Constituent Detects	Period 0 (7/27 - 8/18)	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Sampling Events Count	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Letters Sent Count
C0491E9PW1	C0491E9	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Aug-10		Iron (4)		8/28/2010	9/13/2010	9/19/2010	10/10/2010	10/20/2010	5	10/13/2010	10/13/2010	10/13/2010	10/28/2010		4
C052339PW1	C052339	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission - Anytime	26-Sep-10		Iron (4)		8/28/2010	9/13/2010	9/19/2010	10/9/2010	10/19/2010	5	10/13/2010	10/13/2010	10/13/2010			3
C053154PW1	C053154	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call/Schedule Required	04-Sep-10		Iron (1)					10/9/2010	10/20/2010	2						
C05354DA	C05354D	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	15-Sep-10		Iron (5)		8/28/2010	9/15/2010	9/22/2010	10/9/2010	10/19/2010	5	10/2/2010, 10/15/2010	10/15/2010, 10/4/2010	10/14/2010	10/26/2010		6
C053761WP1	C053761	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call/Schedule Required	09-Sep-10		Iron (1)				9/20/2010	10/12/2010	10/25/2010	3			10/13/2010			1
C0555CBA	C0555CB	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	06-Sep-10		Iron (4)			9/8/2010	9/19/2010	10/1/2010	10/14/2010	4		10/5/2010				1
C0568B5PW1	C0568B5	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	06-Sep-10		Iron (3)			9/8/2010	9/19/2010	10/1/2010	10/15/2010	4		10/13/2010	10/13/2010			2
C0572EAWP1	C0572EA	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call/Schedule Required	04-Sep-10		Iron (2)			9/7/2010	9/20/2010	10/11/2010	10/23/2010	4		10/13/2010	10/13/2010			2
C0574DFWP1	C0574DF	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	14-Sep-10		Iron (1)				9/28/2010	10/12/2010	10/23/2010	3			10/19/2010			1
C0587AAWP1	C0587AA	[redacted]		[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	0																
C059451PW1	C059451	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Refused Permission	20-Sep-10					9/4/2010				1		10/13/2010				1
C0601CEWP1	C0601CE	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	11-Oct-10								10/20/2010	1						
C0601CEWP2	C0601CE	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	11-Oct-10								10/20/2010	1						
C0603E2WP1	C0603E2	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Unattended Permission, Anytime	14-Sep-10		Iron (2)		8/30/2010	9/14/2010				2	10/15/2010	10/15/2010				2
C060441WP1	C060441	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	On DO NOT CONTACT List	25-Sep-10		Iron (1)			9/4/2010	9/19/2010			2		10/13/2010	10/13/2010			2
C06162CPW1	C06162C	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK	MI	Calhoun	Permit but Call/Schedule Required	20-Sep-10		Iron (2)			9/7/2010	9/20/2010	10/11/2010	10/25/2010	4		10/13/2010	10/13/2010			2
C062360A	C062360	[redacted]	[redacted]	[redacted]	[redacted]	CERESCO																			
C0668ECA	C0668EC	[redacted]	[redacted]	[redacted]	[redacted]	MARSHALL	MI											10/24/2010	1						
C0678ADA	C0678AD	[redacted]	[redacted]	[redacted]	[redacted]	AUGUSTA	MI	KALAMAZOO	Unattended Permission, Anytime	23-Sep-10						9/23/2010	10/8/2010	10/18/2010	3			10/6/2010	10/26/2010		2
C06827CA	C06827C	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK																			
C0693ABPW1	C0693AB	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	Calhoun	Permit but Call/Schedule Required	27-Oct-10								10/27/2010	1						
C07198APW1	C07198A	[redacted]	[redacted]	[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Permit but Call/Schedule Required	04-Oct-10		Iron (1)					10/4/2010		1				10/19/2010		1
C0730ACPW1	C0730AC	[redacted]	[redacted]	[redacted]	[redacted]	GALESBURG	MI	Kalamazoo	Unattended Permission, Anytime	14-Sep-10		Iron (2)		9/1/2010	9/14/2010	9/22/2010	10/9/2010	10/25/2010	5	10/13/2010	10/13/2010		10/25/2010		3
C0755A5PW1	C0755A5	[redacted]	[redacted]	[redacted]	[redacted]R	Augusta		Kalamazoo	Permit but Call/Schedule Required	03-Oct-10											10/16/2010				1
C07824BPW1	C07824B	[redacted]	[redacted]	[redacted]	[redacted]	Augusta		Kalamazoo	Unattended Permission, Anytime	29-Aug-10								10/27/2010	1						
C08523BPW1	C08523B	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	Calhoun	Unattended Permission, Anytime	27-Oct-10								10/27/2010	1						
C086970PW1	C086970	[redacted]		AUGUSTA WELL #1	AUGUSTA WELL #1	Augusta	MI	Kalamazoo	Permit but Call/Schedule Required	27-Oct-10								10/27/2010	1						
C086970PW2	C086970	[redacted]		AUGUSTA WELL #1	AUGUSTA WELL #1	Augusta	MI	Kalamazoo	Permit but Call/Schedule Required	27-Oct-10								10/27/2010	1						

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Residential Well Sampling and Letter Status
Wells Within 200-Foot High Water Mark Buffer
as of October 25, 2010

Well Number	Property Number	Tax ID	House No	Street	Address	City	State	County	Permission	Permission Date	BTEX, GRO, ORO, DRO Detects	Other Crude Oil Constituent Detects	Period 0 (7/27 - 8/18)	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Sampling Events Count	Period 1 (8/19 - 9/1)	Period 2 (9/2 - 9/15)	Period 3 (9/16 - 9/29)	Period 4 (9/30 - 10/13)	Period 5 (10/14 - 10/27)	Letters Sent Count
C0872B9PW1	C0872B9	[redacted]		[redacted]	[redacted]	Augusta	MI	Kalamazoo	Unattended Permission, Anytime	29-Aug-10		Iron (3)		8/30/2010		9/18/2010	10/8/2010		3		10/17/2010		10/25/2010		2
C0872B9PW2	C0872B9	[redacted]		[redacted]	[redacted]	Augusta	MI	Kalamazoo	Unattended Permission, Anytime	29-Aug-10					9/4/2010	9/18/2010	10/8/2010		3		10/17/2010		10/25/2010		2
C0876A0WP1	C0876A0	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	Calhoun	Permit but Call/Schedule Required	04-Oct-10		Iron (1)					10/5/2010	10/25/2010	2				10/19/2010		1
C087736WP1	C087736	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	27-Sep-10		Nickel (1)				9/27/2010	10/9/2010	10/19/2010	3				10/25/2010		1
C0878A7WP1	C0878A7	[redacted]	[redacted]	[redacted]	[redacted]	Springfield	MI	Calhoun																	
C0881CCWP1	C0881CC	[redacted]	[redacted]	[redacted]	[redacted]	Ceresco	MI	Calhoun	Unattended Permission, Anytime	02-Oct-10		Iron (1)					10/4/2010	10/16/2010	2				10/20/2010		1
C088276WP1	C088276	[redacted]	[redacted]	[redacted]	[redacted]	Ceresco	MI	Calhoun	Unattended Permission, Anytime	12-Oct-10							10/13/2010	10/22/2010	2						
C0883E0WP1	C0883E0	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Permit but Call/Schedule Required	07-Oct-10															
C08901BWP1	C08901B	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	11-Oct-10							10/12/2010	10/23/2010	2						
C090249WP1	C090249	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	26-Sep-10							10/4/2010, 10/13/2010	10/23/2010	3						
C091208WP2	C091208	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	29-Sep-10												10/20/2010	10/26/2010		2
C091816WP1	C091816	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	Calhoun	Unattended Permission, Anytime	29-Sep-10															
C0928D5WP1	C0928D5	[redacted]		[redacted]	[redacted]	Marshall	MI	Calhoun	Unattended Permission, Anytime	05-Oct-10															
C092943WP1	C092943	[redacted]		[redacted]	[redacted]	Marshall	MI	Calhoun	Unattended Permission, Anytime	02-Oct-10		Iron (2)					10/5/2010		1						
C0947C2WP1	C0947C2	[redacted]		[redacted]	[redacted]	Marshall	MI	Calhoun	Permit but Call/Schedule Required	05-Oct-10															
C0949C5WP1	C0949C5	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI	Calhoun	Unattended Permission, Anytime	25-Sep-10		Iron (1)				9/25/2010	10/12/2010	10/23/2010	3			10/13/2010			1
C098474WP1	C098474	[redacted]	[redacted]	[redacted]	[redacted]	Galesbug	MI	Kalamazoo																	
C10619FWP1	C10619F	[redacted]		[redacted]	[redacted]	CERESCO		Calhoun	Unattended Permission, Anytime	09-Oct-10							10/12/2010	10/22/2010	2						
C107264WP1	C107264	[redacted]		[redacted]	[redacted]	CERESCO		Calhoun																	
C1346E7WP1	C1346E7	[redacted]	[redacted]	[redacted]	[redacted]	Galesburg	MI	Kalamazoo	Unattended Permission, Anytime	16-Oct-10								10/16/2010	1						
C135093WP1	C135093	[redacted]		[redacted]	[redacted]	MARSHALL	MI	Calhoun	Unattended Permission, Anytime	11-Oct-10							10/11/2010	10/21/2010	2						
C14123EWP1	C14123E	[redacted]	[redacted]	[redacted]	[redacted]	BATTLE CREEK			Unattended Permission, Anytime	20-Oct-10								10/24/2010	1						
C1426E4WP1	C1426E4	[redacted]	[redacted]	[redacted]	[redacted]	Battle Creek	MI		Unattended Permission, Anytime	27-Oct-10								10/27/2010	1						

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Well ID - C044607PW1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

Well ID - C0218F7PW1
Sampled - 2
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 8

Well ID - C092943WP1
Sampled - 3
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 15

Well ID - C0027CBA
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 19

Well ID - C0094BAPW1
Sampled - 2
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 10

Well ID - C0292E1A
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 22

Well ID - C002068A
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 9

Well ID - C043756WP1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

Well ID - C002471A
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C0139BAA
Sampled - 6
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 28

Well ID - C135093WP1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 2

Well ID - C001311A
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C0668ECA
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 3

Well ID - C0021FEA
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 6

Well ID - C009696A
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 4

Well ID - C009891A
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C001899A
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 15

Well ID - C0286B9PW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

2.75
2.25
2
0.75
0.5
0.25
0

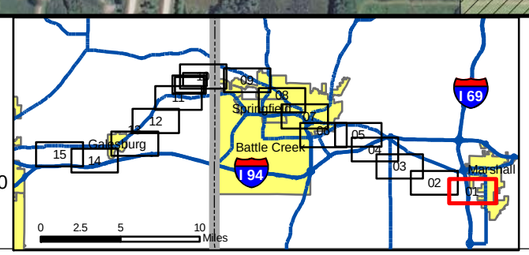
ENBRIDGE

AECOM

October 2010

Map: 01

0 1,125 2,250
Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C0118AEA
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 19

Well ID - C0002C6A
ed - 2
- 1
carbon - 0
t
Detect - 5

Well ID - C038297
Sampled - 1
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 2

Well ID - C013407A
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 15

Well ID - C0144C0A
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 26

Well ID - C0127FCA
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 8

Well ID - C038718WP1
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 10

Well ID - C0310F2PW1
Sampled - 1
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C0137BDA
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 33

Well ID - C0129FBA
Sampled - 6
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 28

Well ID - C044607PW1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

Well ID - C016277A
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 9

Well ID - C043756WP1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

Well ID - C0555CBA
Sampled - 5
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 29

Well ID - C0139BAA
Sampled - 6
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 28

Well ID - C0568B5PW1
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 21

Well ID - C001311A
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C0179BEPW1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0668ECA
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 3

4.75
4.5
4.25
4
3.75
3.5
2.25
2

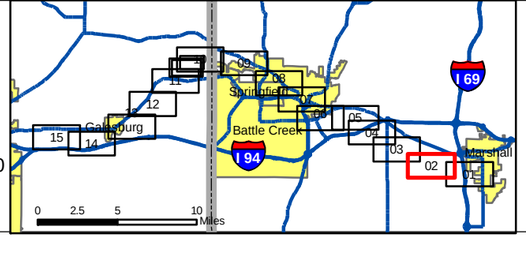
ENBRIDGE

AECOM

October 2010 **Map: 02**

N

0 1,125 2,250
Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C10619FWP1
Sampled - 3
Letter - 0
Hydrocarbon - 1
Detect
Other Detect - 14

Well ID - C0004F3A
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 11

Well ID - C0208B6A
Sampled - 5
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 14

Well ID - C0254D8
Sampled - 1
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 4

Well ID - C0029ccpw1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 8

Well ID - C062360A
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 8

Well ID - C0273F9WP1
Sampled - 1
Letter - 0
Hydrocarbon - 1
Detect
Other Detect - 7

Well ID - C005315A
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0188E7A
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 3

Well ID - C030309WP1
Sampled - 5
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C006475A
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0314EBWP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C032604WP1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0377D7A
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 19

Well ID - C031751PW1
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C0384A2WP1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 21

Well ID - C039759WP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 4

Well ID - C0118AEA
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 19

Well ID - C013407A
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 15

Well ID - C02433AWP1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C088276WP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0881CCWP1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 11

Well ID - C011485A
Sampled - 4
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C03868EWP1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 9

Well ID - C0002C6A
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C038297
Sampled - 1
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 2

8
7.75
7.5
7.25
7
4.75

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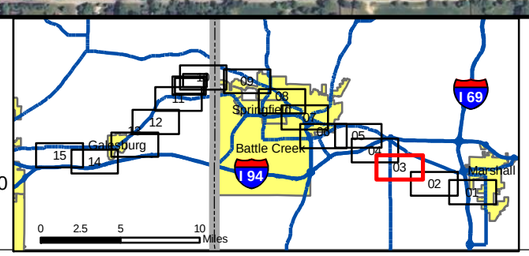
AECOM

October 2010 **Map: 03**

N

0 1,125 2,250

Scale in Feet



Legend

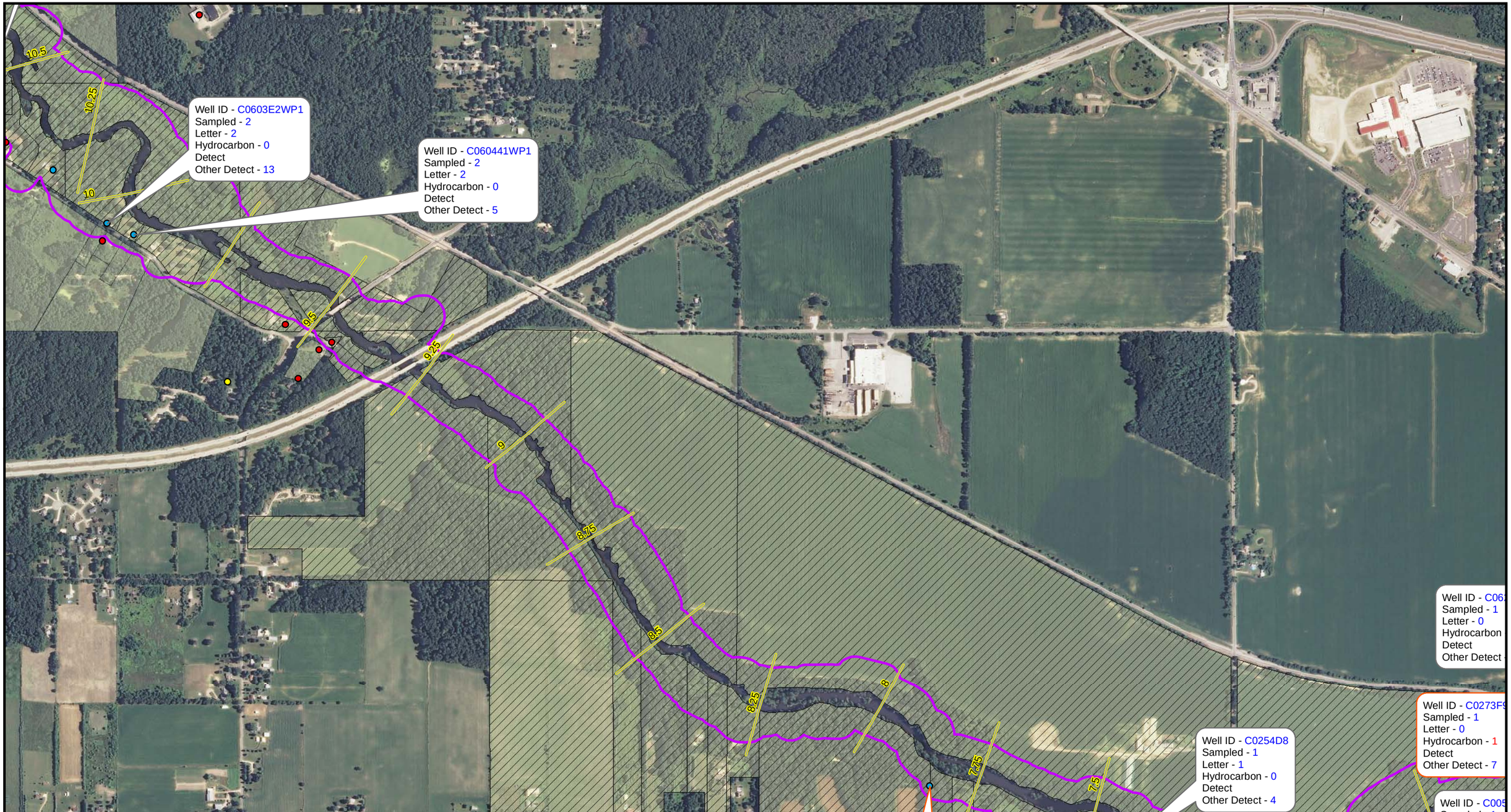
New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT



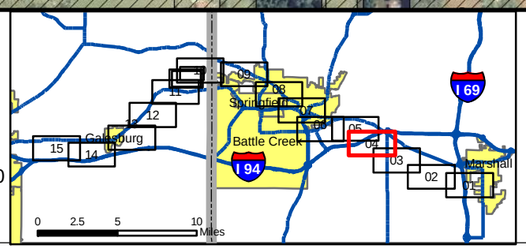
ENBRIDGE

AECOM

October 2010 **Map: 04**

0 1,125 2,250

Scale in Feet



Legend

- New High Water Mark Buffer
- TargetAreas
- Previously identified 200 foot parcels
- 200-ft Buffer of Parcels

Well Eligibility Status

- Ineligible
- Unclassified
- Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C0375FB
Sampled -
Letter -
Hydrocarbon -
Detect
Other Detect -

Well ID - C06827CA
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 4

Well ID - C0693ABPW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C059451PW1
Sampled - 1
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0603E2WP1
Sampled - 2
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C060441WP1
Sampled - 2
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 5

12
11.75
11.5
12.25
11.25
11
12.5
10.5
10.25
10
9.5
9.25

ENBRIDGE

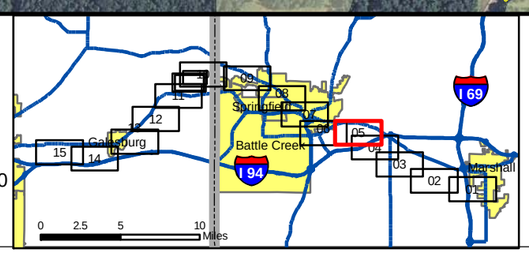
AECOM

October 2010 **Map: 05**

N

0 1,125 2,250

Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C015098PW1
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 19

Well ID - C06162CPW1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

Well ID - C015098PW1
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 19

Well ID - C0491E9PW1
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 25

Well ID - C0572EAWP1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 17

Well ID - C017595PW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0375FB
Sampled -
Letter -
Hydrocarbon -
Detect
Other Detect -

Well ID - C0229A2A
Sampled - 3
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C0177B9A
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 11

Well ID - C04879DWP1
Sampled - 2
Letter - 1
Hydrocarbon - 1
Detect
Other Detect - 11

Well ID - C0180D5A
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 31

Well ID - C06827CA
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 4

Well ID - C052339PW1
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 25

Well ID - C01836FA
Sampled - 6
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 31

Well ID - C053154PW1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 6

Well ID - C00474DA
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C05354DA
Sampled - 6
Letter - 6
Hydrocarbon - 0
Detect
Other Detect - 30

Well ID - C0165D4PW1
Sampled - 6
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 22

Well ID - C0574DFWP1
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 11

Well ID - C0949C5WP1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 10

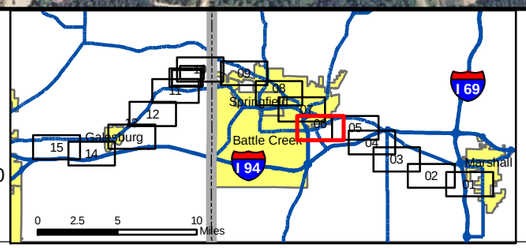
Well ID - C0304AAPW1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 11

ENBRIDGE

AECOM

October 2010 **Map: 06**

0 1,125 2,250
Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C0298FFPW2
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 6

Well ID - C0298FFWP1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 5

17.5
17.25
17
16.75
16.5
16.25
16
15.75
15.5
15.25
15

Well ID - C015098PW1
Sampled - 5

Well ID - C06162CPW1
Sampled - 3

Well ID - C015098PW1

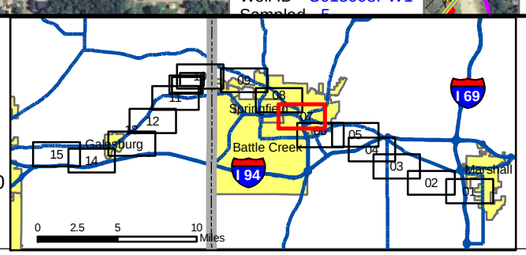
ENBRIDGE

AECOM

October 2010 **Map: 07**

N

0 1,125 2,250
Scale in Feet



Legend

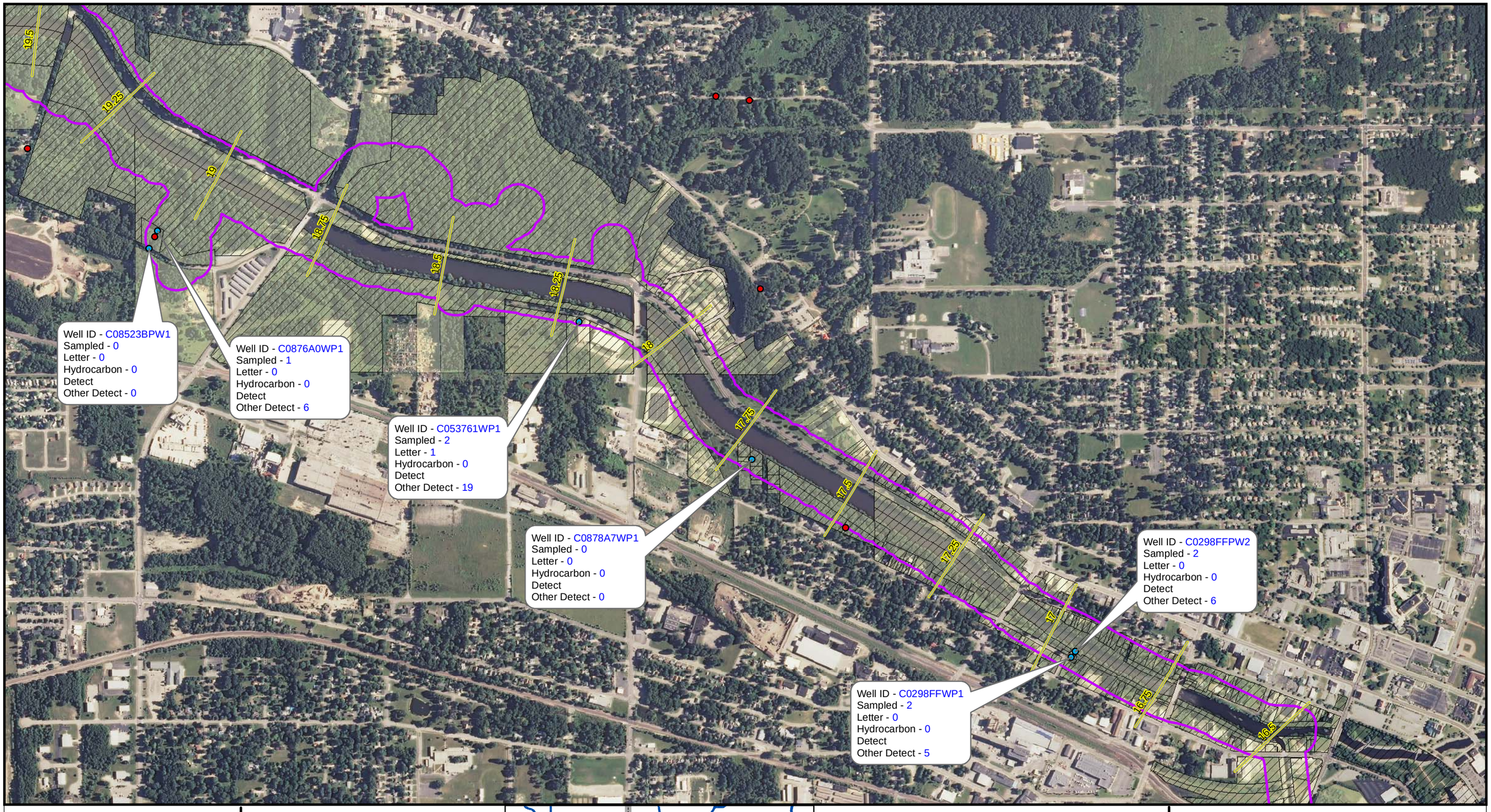
New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT



ENBRIDGE

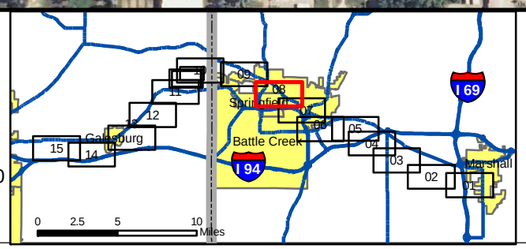
AECOM

October 2010 **Map: 08**

N

0 1,125 2,250

Scale in Feet



Legend

- New High Water Mark Buffer
- TargetAreas
- Previously identified 200 foot parcels
- 200-ft Buffer of Parcels

Well Eligibility Status

- Ineligible
- Unclassified
- Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C0048DCA
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C01477APW1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 13

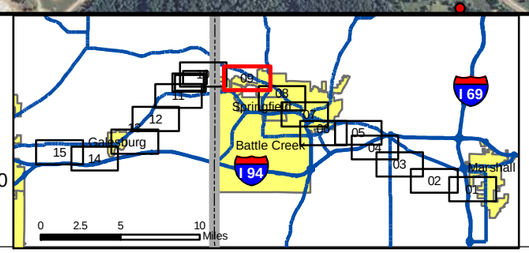
21.75
21.5
21.25
21
20.75
20.5
20.25
20
19.75
19.5
19.25
19

ENBRIDGE

AECOM

October 2010 **Map: 09**

0 1,125 2,250
Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C0872B9PW2
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 7

Well ID - C00856DA
Sampled - 5
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 18

Well ID - C0337D3WP1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C0335FFWP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C03429BWP1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 14

Well ID - C00928FA
Sampled - 2
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 4

Well ID - C07824BPW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0872B9PW1
Sampled - 3
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 18

Well ID - C033645WP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C01573BA
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 24

Well ID - C0156ADA
Sampled - 6
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 36

Well ID - C015481A
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 14

Well ID - C015322A
Sampled - 5
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 24

Well ID - C023047A
Sampled - 6
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 36

Well ID - C035755WP1
Sampled - 4
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C0231D1A
Sampled - 4
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 21

Well ID - C04757EWP1
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 9

Well ID - C01497DA
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C035755WP2
Sampled - 4
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 9

Well ID - C046882A
Sampled - 6
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 14

Well ID - C0470F1PW1
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 8

Well ID - C0227A5A
Sampled - 6
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 20

Well ID - C00589DA
Sampled - 6
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 24

Well ID - C0048DCA
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C046713PW1
Sampled -
Letter -
Hydrocarbon -
Detect
Other Detect -

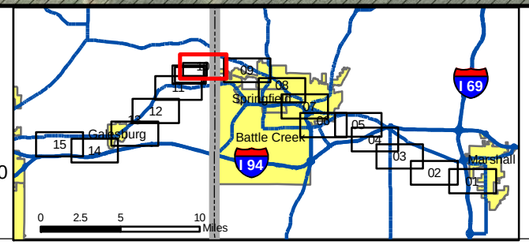
Well ID - C005139A
Sampled - 6
Letter - 4
Hydrocarbon - 0
Detect
Other Detect - 25

ENBRIDGE

AECOM

October 2010 **Map: 10**

0 1,125 2,250
Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status
Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C086970PW2
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C086970PW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0678ADA
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C07824BPW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C033645WP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 12

Well ID - C033469WP1
Sampled - 8
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 28

27.75
28
28.25
28.5
28.75
29
29.25
29.5
29.75
30
30.25
30.5

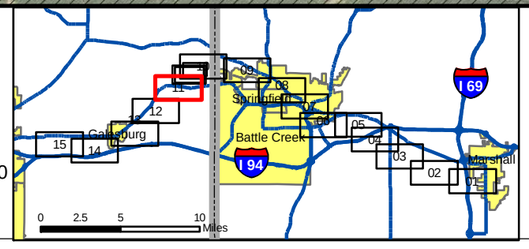
ENBRIDGE

AECOM

October 2010 **Map: 11**

N

0 1,125 2,250
Scale in Feet



Legend

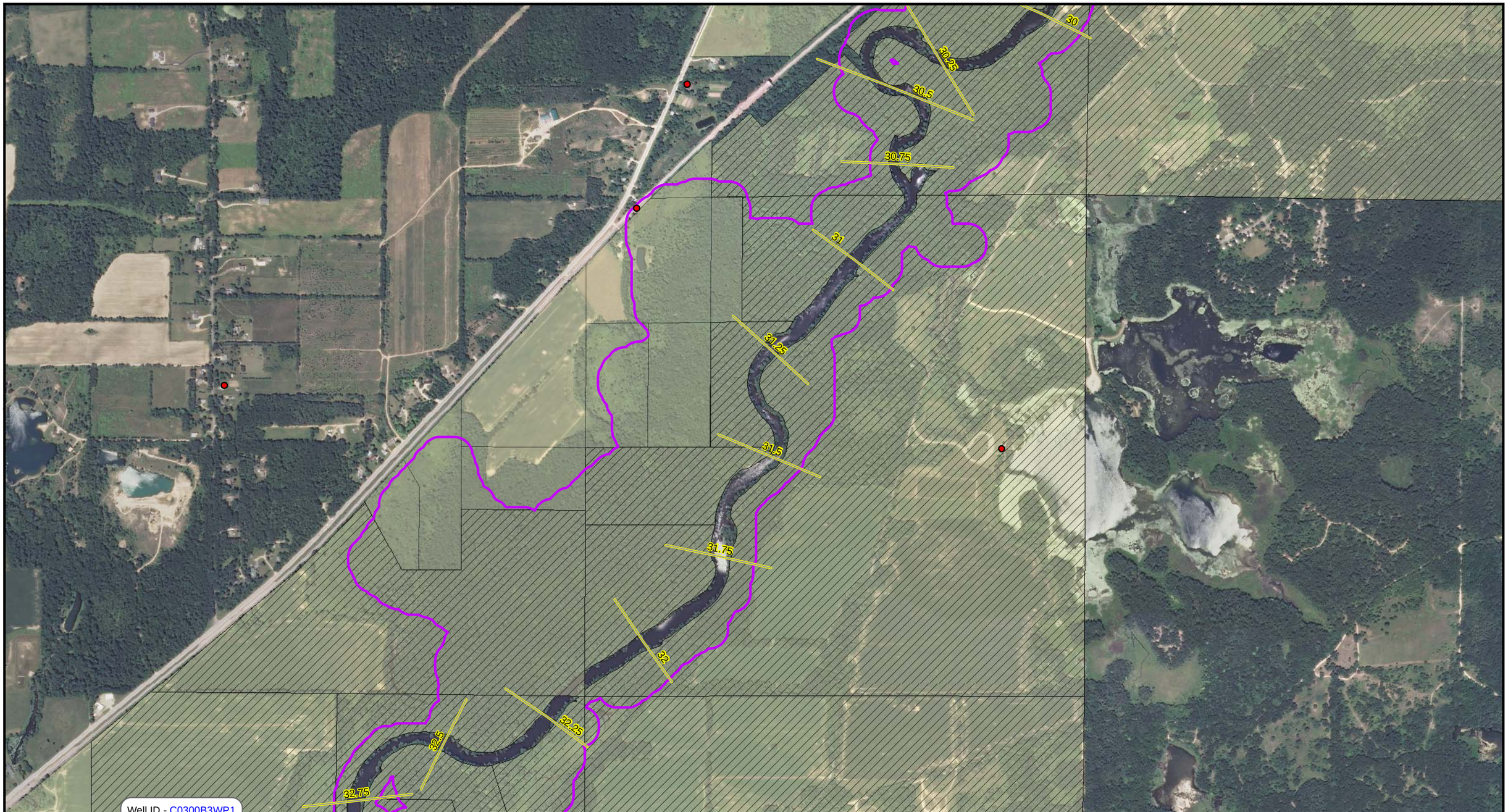
New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT



ENBRIDGE

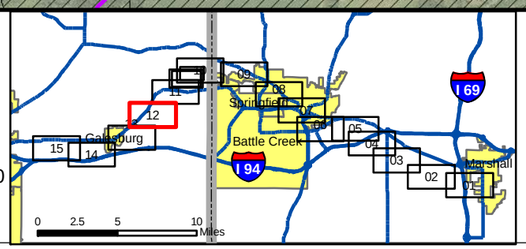
AECOM

October 2010 **Map: 12**

N

0 1,125 2,250

Scale in Feet



Legend

- New High Water Mark Buffer
- TargetAreas
- Previously identified 200 foot parcels
- 200-ft Buffer of Parcels

Well Eligibility Status

- Ineligible
- Unclassified
- Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

Well ID - C01932EA
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 14

Well ID - C0271D5PW1
Sampled - 1
Letter - 1
Hydrocarbon - 0
Detect
Other Detect - 3

Well ID - C0300B3WP1
Sampled - 1
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 6

Well ID - C030917WP1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C025965WP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 5

Well ID - C01948DPW1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 10

Well ID - C0755A5PW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C07198APW1
Sampled - 1
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 6

Well ID - C019930PW1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0269A6PW1
Sampled - 5
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 14

Well ID - C087736WP1
Sampled - 3
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 8

Well ID - C0730ACPW1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 16

32.25
32.5
32.75
33.25
33.5
33.75
34
34.25
35.5
35.25
35.75

ENBRIDGE

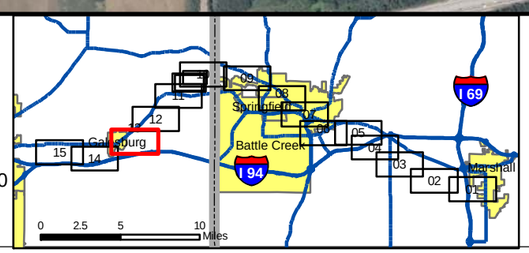
AECOM

October 2010 **Map: 13**

N

0 1,125 2,250

Scale in Feet



Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status

Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT

Well ID - C1346E7WP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 3

Well ID - C098474WP1
Sampled - 0
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C0250C1PW1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 0

Well ID - C08901BWP1
Sampled - 1
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 3

Well ID - C01855AA
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

Well ID - C024723PW1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 9

Well ID - C0248B2PW1
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 20

Well ID - C0252EDA
Sampled - 4
Letter - 3
Hydrocarbon - 0
Detect
Other Detect - 13

Well ID - C090249WP1
Sampled - 2
Letter - 0
Hydrocarbon - 0
Detect
Other Detect - 4

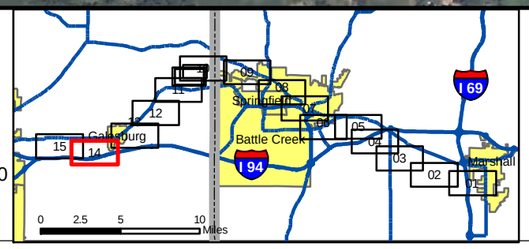
Well ID - C018776A
Sampled - 4
Letter - 2
Hydrocarbon - 0
Detect
Other Detect - 16

ENBRIDGE

AECOM

October 2010 **Map: 14**

0 1,125 2,250
Scale in Feet



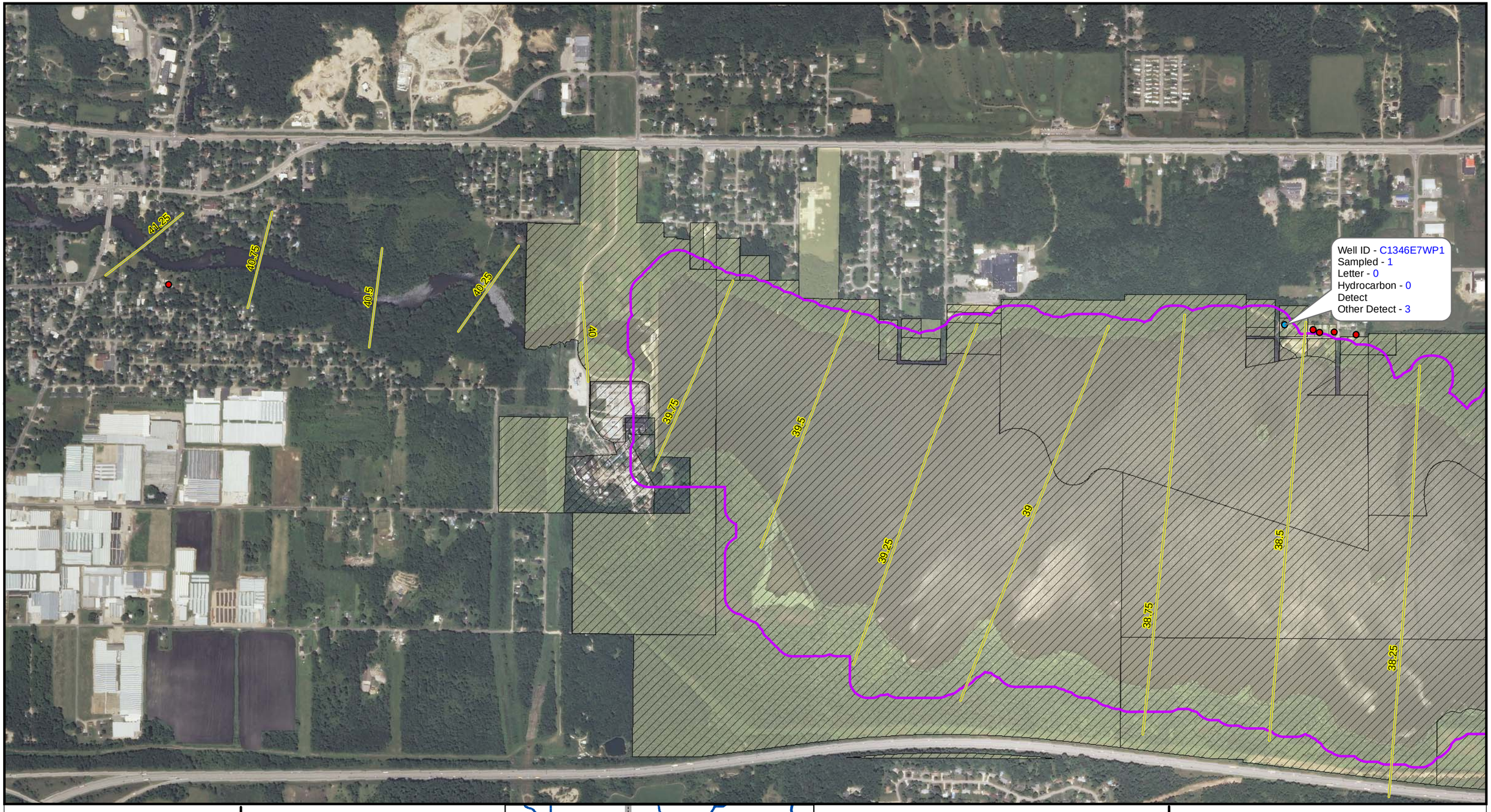
Legend

New High Water Mark Buffer
TargetAreas
Previously identified 200 foot parcels
200-ft Buffer of Parcels

Well Eligibility Status
Ineligible
Unclassified
Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

US EPA ARCHIVE DOCUMENT



ENBRIDGE

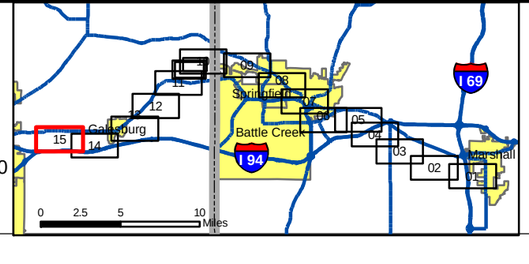
AECOM

October 2010 **Map: 15**

N

0 1,125 2,250

Scale in Feet



Legend

- New High Water Mark Buffer
- TargetAreas
- Previously identified 200 foot parcels
- 200-ft Buffer of Parcels

Well Eligibility Status

- Ineligible
- Unclassified
- Eligible

PARCELS AND WELLS WITHIN 200 FEET OF RIVER INNUNDATION AS OF OCTOBER 27, 2010

Appendix D

Laboratory and Validation Results

US EPA ARCHIVE DOCUMENT

AECOM
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Data Validation Report

To	Kris Nolan/AECOM	Page 1
Project	Enbridge Line 6B MP 608 Pipeline Release Hydrogeologic Investigation	
Laboratory	ALS Environmental, Holland, MI	
Laboratory SDG	1010307	
Analyses/Method	VOCs, PAHs, Metals by SW846 Methods Hardness by Standard Methods TOC by EPA Method	
Validation Level	Level II (QC summary report review)	
AECOM Project Number	60162778.01	
Prepared by	Paula DiMattei/AECOM	Completed: October 24, 2010
Reviewed by	Robert Kennedy/AECOM	
CC	Mike Wolf/AECOM	

SUMMARY

The sample listed below was collected by AECOM Environment in Marshall, Michigan on October 12, 2010 and submitted to ALS Environmental in Holland, MI for analysis.

Client Sample ID	Matrix	Parameters
WGA10120950BAW1	Groundwater	VOCs, PAHs, Metals (total), Hardness, TOC
WGA10120950BAW3	Groundwater	VOCs, PAHs, Metals (total), Hardness, TOC
WGA10121400TVF5	Trip blank	VOCs

The following methods were applicable to the samples in this data set:

Analyte	Primary Method Reference
Volatile Organic Compounds (VOCs) (project-specific list)	SW846 8260
Polynuclear Aromatic Hydrocarbons (PAHs)	SW846 8270
Total Metals (project-specific list)	SW846 6020
Hardness by calculation	SM 2340B
Total Organic Carbon (TOC)	EPA Method 415.3

US EPA ARCHIVE DOCUMENT

Data validation activities were conducted with reference to the above method along with USEPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), USEPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- Data Completeness
- * Chain-of-custody (COC)/sample integrity
- * Holding times and sample preservation
- * Laboratory method blanks
- * Trip Blanks/equipment blanks
- * Surrogate recoveries (%Rs)
- NA Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- * Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- NA Field duplicate results
- * General reporting issues

The symbol (*) indicates that all quality control (QC) criteria were met for this parameter. The NA indicates that the parameter was not included as part of this data set, and therefore not reviewed.

The data appear valid as reported and may be used for decision making purposes. Qualification of the data was not required.

Data Completeness

Sample WGA10120950BAW3 was logged in by the laboratory as a separate sample and not as the MS/MSD aliquot for sample WGA10120950BAW1 since it was not designated on the COC as the MS/MSD sample. No data validation actions were taken on this basis.

ATTACHMENTS

Attachment A: Data Review Summary Worksheets/Fraction

Attachment B: Validation Qualifier Codes and Explanation

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US EPA ARCHIVE DOCUMENT

Attachment A

Data Review Summary Worksheets/Fraction

US EPA ARCHIVE DOCUMENT

Attachment B

Qualifier Codes and Explanation

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is an estimated quantity with an unknown bias.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential high bias.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

US EPA ARCHIVE DOCUMENT

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010307
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 2 GW, 1 Trip blank
Analysis (Include Method #): Select VOCs (SW846 8260)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4°C
Holding Time	Yes	No	Collected 10/12/10 Analyzed 10/13/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Batch QC only	No	MS/MSD analyses were performed on batch QC; Results were not evaluated since the non-project sample used to perform the MS/MSD analyses are not an applicable representative matrix to the samples in this SDG.
Matrix Spike Duplicate[2]	Batch QC only	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	Yes	No	
Laboratory Control Standards	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked into LCS/LCSD; No DV actions taken on this basis.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010307
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 2 GW
Analysis (Include Method #): PAHs (SW846 8270)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4°C
Holding Time	Yes	No	Collected 10/12/10 Extracted 10/13/2010 Analyzed 10/14/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 1.0 was not met for napthalene. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	NA	No	
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Batch QC only	No	MS/MSD analyses were performed on batch QC; Results were not evaluated since the non-project sample used to perform the MS/MSD analyses are not an applicable representative matrix to the samples in this SDG.
Matrix Spike Duplicate[2]	Batch QC only	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	No	No	2-fluorobiphenyl recovered below QC limits (50-110) in both samples: WGA10120950BAW1 (41.6) and WGA10120950BAW3 (41.9). No action on this basis since only 1 of 3 surrogates not met.
Laboratory Control Standards	Yes	No	All targets were spiked into LCS/LCSD.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010307
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 2 GW
Analysis (Include Method #): Select metals (beryllium, molybdenum, vanadium, and iron) (SW846 6020)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/12/10 Analyzed 10/13/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 4 ug/L was not met for vanadium. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Mo present in MB at 0.0001589 mg/L; All associated samples were ND.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on sample WGA10120950BAW1. Lab limits reported as 80-120; All analytes met QAPP criteria of 75-125%.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	All targets spiked.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010307
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 2 GW
Analysis (Include Method #): Hardness by calculation (SM 2340B)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Method Blanks	Yes	No	All ND

Note: This parameter is determined by calculation; The laboratory reports method blank results as a QC parameter for the hardness results; thus, hardness results were reviewed for data completeness and method blank contamination only.

No Qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010307
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 2 GW
Analysis (Include Method #): TOC (EPA 415.3)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/12/10 Analyzed 10/13/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	NA		
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Batch QC only	No	MS/MSD analyses were performed on batch QC; Results were not evaluated since the non-project sample used to perform the MS/MSD analyses are not an applicable representative matrix to the samples in this SDG.
Matrix Spike Duplicate[2]	Batch QC only	No	
Laboratory Duplicate[2]	NA		
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

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Data Validation Report

To	Kris Nolan/AECOM	Page 1
Project	Enbridge Line 6B MP 608 Pipeline Release Hydrogeologic Investigation	
Laboratory	ALS Environmental, Holland, MI	
Laboratory SDG	1010353	
Analyses/Method	VOCs, PAHs, Metals, Chloride, and Sulfate by SW846 Methods Alkalinity by Standard Methods	
Validation Level	Level II (QC summary report review)	
AECOM Project Number	60162778.01	
Prepared by	Paula DiMattei/AECOM	Completed: October 24, 2010
Reviewed by	Robert Kennedy/AECOM	
CC	Mike Wolf/AECOM	

SUMMARY

The samples listed below were collected by AECOM Environment in Marshall, Michigan on October 13, 2010 and submitted to ALS Environmental in Holland, MI for analysis.

Client Sample ID	Matrix	Parameters
WGC10131220BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10130900BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10131435BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10131600BAW4	Equipment blank	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10131545BAW5	Trip blank	VOCs
WGC10131605BAW5	Trip blank	VOCs

The following methods were applicable to the samples in this data set:

Analyte	Primary Method Reference
Volatile Organic Compounds (VOCs) (project-specific list)	SW846 8260
Polynuclear Aromatic Hydrocarbons (PAHs)	SW846 8270
Total/dissolved Metals (project-specific list)	SW846 6020
Alkalinity (Bicarbonate & carbonate [as CaCO3])	SM 2320
Chloride and Sulfate	SW846 9056

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Data validation activities were conducted with reference to the above method along with USEPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), USEPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- * Data Completeness
- * Chain-of-custody (COC)/sample integrity
- * Holding times and sample preservation
- * Laboratory method blanks
- * Trip Blanks/equipment blanks
- * Surrogate recoveries (%Rs)
- Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- * Laboratory duplicate
- * Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- NA Field duplicate results
- General reporting issues

The symbol (*) indicates that all quality control (QC) criteria were met for this parameter. The NA indicates that the parameter was not included as part of this data set, and therefore not reviewed.

The data appear valid as reported and may be used for decision making purposes. Selected data points were qualified as estimated due to non-conformances of certain QC criteria (see discussion below). Minor deviations from method SOPs or quality requirements are also addressed below.

MS/MSD

<u>Dissolved Metals</u>

The MS/MSD analyses were performed on sample WGC10131220BAW1. The relative percent difference (RPD) for nickel exceeded the laboratory's QC limit of <20 (refer to Attachment A). Consequently, the nondetect nickel results in all dissolved groundwater samples were qualified as estimated (UJ). Qualified sample results are shown in Table 1.

General Reporting Issues

It should be noted that the "Reporting Limit" for each analysis is equivalent to the target detection limit (TDL). In cases were dilution analyses were required, the TDL reflects the dilution factor used

US EPA ARCHIVE DOCUMENT

in the analysis when the TDL is equivalent to the laboratory's practical quantitation limit (PQL). In cases where the TDL is greater than the laboratory's PQL, the dilution factor is not reflected in the reporting limit.

ATTACHMENTS

Attachment A: Data Review Summary Worksheets/Fraction

Attachment B: Validation Qualifier Codes and Explanation

Attachment C: Reason Codes and Explanations

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Table 1 - Data Validation Summary of Qualified Data

Sample ID	Matrix	Compound	Result	QL	Units	Validation Qualifiers	Validation Reason
WGC10130900BAW1	WG	NICKEL		0.020	mg/l	UJ	ld
WGC10131220BAW1	WG	NICKEL		0.020	mg/l	UJ	ld
WGC10131435BAW1	WG	NICKEL		0.020	mg/l	UJ	ld
WGC10131600BAW4	WQ	NICKEL		0.020	mg/l	UJ	ld

Notes:

- Refer to Attachment A for data review summary worksheets.
- Refer to Attachment B for validation qualifier definitions.
- Refer to Attachment C for validation reason code definitions.
- There will be no value under the Result column if the result is nondetect.

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US EPA ARCHIVE DOCUMENT

Attachment A

Data Review Summary Worksheets/Fraction

US EPA ARCHIVE DOCUMENT

Attachment B

Qualifier Codes and Explanation

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is an estimated quantity with an unknown bias.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential high bias.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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Attachment C

Reason Codes and Explanations

Reason Code	Explanation
be	Equipment blank contamination
bl	Laboratory blank contamination
bt	Trip blank contamination
fd	Field duplicate RPDs
h	Holding times
l	LCS recoveries
ld	Laboratory duplicate RPDs (matrix duplicate, MSD, LCSD)
m	Matrix spike recovery
p	Chemical preservation issue
s	Surrogate recovery
t	Temperature preservation issue

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010353
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 3 GW, 1 Equipment blank, 2 Trip blanks
Analysis (Include Method #): Select VOCs (SW846 8260)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.0°C
Holding Time	Yes	No	Collected 10/13/10 Analyzed 10/14/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked for MS/MSD; No DV actions were taken on this basis. MS/MSD performed on WGC10131220BAW1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	Yes	No	
Laboratory Control Standards	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked into LCS/LCSD; No DV actions taken on this basis. All criteria met.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010353
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 3 GW, 1 Equipment blank
Analysis (Include Method #): PAHs (SW846 8270)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.0°C
Holding Time	Yes	No	Collected 10/13/10 Extracted 10/14/2010 Analyzed 10/14-15/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 1.0 was not met for napthalene. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGC10131220BAW1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	**No**	**No**	terphenyl-d_{14} recovered below QC limits (50-125%) in samples WGC10131220BAW1 (49.3), WGC10131600BAW4 (45.0). No action on this basis since only 1 of 3 surrogates not met.
Laboratory Control Standards	Yes	No	All targets were spiked into LCS/LCSD.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Client/Site Name: Enbridge/Hydrogeo Investigation
Laboratory SDG/Job No: 1010353
Project Number: 60162778.1
Validation Level: Level II (QC summary report review) (using Level II data package)
Date: 10/23/10
Validator: Paula DiMattei
Number of Samples/Matrix: 3 GW, 1 Equipment blank
Analysis (Include Method #): Select total/dissolved metals (Ba, Ni, V, Fe, Na, K, Ca, Mg) (SW846 6020)

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.0°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/13/10 Analyzed 10/14-15/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 4 ug/L was not met for vanadium. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	(total) All ND. (dissolved) Mg present in MB at 0.004457 mg/L & Na present in MB at 0.006481 mg/L. All samples >RL and >5x blank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	**No**	**Yes**	MS/MSD performed on samples WGC10131220BAW1 (total/dissolved). Lab limits reported as 80-120%; All analytes met QAPP criteria of 75-125% for total and dissolved. **RPD=24 (QC limit <20) for Ni (dissolved) MS/MSD. Estimate (UJ) all dissolved samples.**
Matrix Spike Duplicate[2]	**No**	**Yes**	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	All targets spiked.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Client/Site Name: Enbridge/Hydrogeo Investigation
Laboratory SDG/Job No: 1010353
Project Number: 60162778.1
Validation Level: Level II (QC summary report review) (using Level II data package)
Date: 10/23/10
Validator: Paula DiMattei
Number of Samples/Matrix: 3 GW, 1 Equipment blank
Analysis (Include Method #): Bicarbonate and carbonate Alkalinity (Standard Methods 2320)

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.0°C
Holding Time	Yes	No	Collected 10/13/10 Analyzed 10/13/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) & Alkalinity, Carbonate (as CaCO3) each present in MB at 2 mg/L. All samples ND or >RL and >5xblank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	NA		
Matrix Spike Duplicate[2]	NA		
Laboratory Duplicate[2]	Yes	No	Lab duplicate performed on WGC10131220BAW1; All criteria met.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.
[4]The MSD result was not calculable (NC) since the native concentration was > the MSD concentration detected.

No Qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010353
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 3 GW, 1 Equipment blank
Analysis (Include Method #): Chloride and Sulfate (SW846 9056)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.0°C
Holding Time	Yes	No	Collected 10/13/10 Analyzed 10/14/10
Quantitation Limits	Yes	No	All samples except WGC10131600BAW4 were analyzed on dilution 4x-10x as a result of high concentrations of chloride or sulfate.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND.
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGC10131220BAW1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

AECOM
2 Technology Park Drive
Westford, MA 01886-3140

978.589.3000 tel
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Data Validation Report

To	Kris Nolan/AECOM	Page 1
Project	Enbridge Line 6B MP 608 Pipeline Release Hydrogeologic Investigation	
Laboratory	ALS Environmental, Holland, MI	
Laboratory SDG	1010389	
Analyses/Method	VOCs, PAHs, Metals, Chloride, and Sulfate by SW846 Methods Alkalinity by Standard Methods	
Validation Level	Level II (QC summary report review)	
AECOM Project Number	60162778.01	
Prepared by	Paula DiMattei/AECOM	Completed: October 24, 2010
Reviewed by	Robert Kennedy/AECOM	
CC	Mike Wolf/AECOM	

SUMMARY

The samples listed below were collected by AECOM Environment in Marshall, Michigan on October 14, 2010 and submitted to ALS Environmental in Holland, MI for analysis.

Client Sample ID	Matrix	Parameters
WGE10141015BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WSE10141155BAW1	Surface water	Metals (total), Alkalinity, Chloride, Sulfate
WGE10141445BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10141745TV4	Field blank	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10141800TVF4	Equipment blank	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10141730TVF5	Trip blank	VOCs
WGC10141735TV5	Trip blank	VOCs
WGE10141020BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10141200BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10141200BRH2[1]	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10141505BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10141640BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10141810BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10141810BRH5	Trip blank	VOCs

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Client Sample ID	Matrix	Parameters
[1]Field duplicate of WGE10141200BRH1		

The following methods were applicable to the samples in this data set:

Analyte	Primary Method Reference
Volatile Organic Compounds (VOCs) (project-specific list)	SW846 8260
Polynuclear Aromatic Hydrocarbons (PAHs)	SW846 8270
Total/dissolved Metals (project-specific list)	SW846 6020
Alkalinity (Bicarbonate & carbonate [as CaCO3])	SM 2320
Chloride and Sulfate	SW846 9056

Data validation activities were conducted with reference to the above method along with USEPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), USEPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- * Data Completeness
- Chain-of-custody (COC)/sample integrity
- * Holding times and sample preservation
- * Laboratory method blanks
- * Trip Blanks/equipment blanks
- * Surrogate recoveries (%Rs)
- Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- * Laboratory duplicate
- * Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- * Field duplicate results
- General reporting issues

The symbol (*) indicates that all quality control (QC) criteria were met for this parameter. The NA indicates that the parameter was not included as part of this data set, and therefore not reviewed.

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The data appear valid as reported and may be used for decision making purposes. Selected data points were qualified as estimated due to non-conformances of certain QC criteria (see discussion below).

Chain-of-Custody (COC)/Sample Integrity

The trip blank identified on the COC as WGC101**4**1730TV5 was incorrectly identified in the data package as WGC101**5**1730TV5.

MS/MSD

VOCs

The MS/MSD analyses were performed on sample WGE10141015BAW1. The relative percent difference (RPD) for naphthalene exceeded the laboratory's QC limit of <30 (refer to Attachment A). Consequently, the nondetect naphthalene result sample WGE10141015BAW1 was qualified as estimated (UJ). Qualified sample results are shown in Table 1.

General Reporting Issues

It should be noted that the "Reporting Limit" for each analysis is equivalent to the target detection limit (TDL). In cases were dilution analyses were required, the TDL reflects the dilution factor used in the analysis when the TDL is equivalent to the laboratory's practical quantitation limit (PQL). In cases where the TDL is greater than the laboratory's PQL, the dilution factor is not reflected in the reporting limit.

ATTACHMENTS

Attachment A: Data Review Summary Worksheets/Fraction

Attachment B: Validation Qualifier Codes and Explanation

Attachment C: Reason Codes and Explanations

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Table 1 - Data Validation Summary of Qualified Data

Sample ID	Matrix	Compound	Result	QL	Units	Validation Qualifiers	Validation Reason
WGE10141015BAW1	WG	NAPHTHALENE		5.0	ug/l	UJ	ld

Notes:

- Refer to Attachment A for data review summary worksheets.
- Refer to Attachment B for validation qualifier definitions.
- Refer to Attachment C for validation reason code definitions.
- There will be no value under the Result column if the result is nondetect.

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Attachment A

Data Review Summary Worksheets/Fraction

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Attachment B

Qualifier Codes and Explanation

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is an estimated quantity with an unknown bias.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential high bias.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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Attachment C

Reason Codes and Explanations

Reason Code	Explanation
be	Equipment blank contamination
bl	Laboratory blank contamination
bt	Trip blank contamination
fd	Field duplicate RPDs
h	Holding times
l	LCS recoveries
ld	Laboratory duplicate RPDs (matrix duplicate, MSD, LCSD)
m	Matrix spike recovery
p	Chemical preservation issue
s	Surrogate recovery
t	Temperature preservation issue

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010389
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Field Blank, 1 Equipment Blank, 3 Trip Blanks
Analysis (Include Method #): Select VOCs (SW846 8260)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	Trip blank sample WGC10141730TVF5 was incorrectly identified by the laboratory as WGC101**5**1730TVF5.
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/14/10 Analyzed 10/15/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	**No**	**Yes**	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked for MS/MSD; No DV actions were taken on this basis. **MS/MSD performed on WGE10141015BAW1: Naphthalene 162/ok; RPD=35 (QC limits: 55-140%; <30) and isopropylbenzene ok/126%; (QC limits: 75-125%). All results ND. Estimate Naphthalene (UJ) in native. No other actions required.**
Matrix Spike Duplicate[2]	**No**	**Yes**	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	Yes	No	
Laboratory Control Standards	**No**	**No**	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked into LCS/LCSD; No DV actions taken on this basis. All criteria met except Isopropylbenzene ok/127% (75-125%)[LCS/LCSD Batch R82566]; Isopropylbenzene 129%/ok (75-125%)[LCS/LCSD Batch R82513]. All samples ND; No DV actions on this basis.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010389
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Field Blank, 1 Equipment Blank
Analysis (Include Method #): PAHs (SW846 8270)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/14/10 Extracted 10/15/2010 Analyzed 10/15/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 1.0 was not met for napthalene. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGE10141015BAW1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	**No**	**No**	terphenyl-d_{14} recovered below QC limits (50-125%) in samples WGE10141445BAW1 (44.9), WGE10141800TV4 (37.0), WGE10141200BRH2 (42.3). No action on this basis since only 1 of 3 surrogates not met. Acid surrogate nonconformances are not applicable to the PAH analyses; thus, no DV actions taken on this basis.
Laboratory Control Standards	Yes	No	All targets were spiked into LCS/LCSD.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010389
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 SW, 1 Field Blank, 1 Equipment Blank
Analysis (Include Method #): Select total/dissolved metals (Ba, Ni, V, Fe, Na, K, Ca, Mg) (SW846 6020) and Select metals (SW metals): Fe, Na, K, Ca, Mg (SW846 6020)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/14/10 Analyzed 10/15/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 4 ug/L was not met for vanadium. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on samples WGE10141015BAW1 (total/dissolved). Lab limits reported as 80-120%; All analytes met QAPP criteria of 75-125%.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	All targets spiked.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010389
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 SW, 1 Field Blank, 1 Equipment Blank
Analysis (Include Method #): Bicarbonate and carbonate Alkalinity (Standard Methods 2320)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/14/10 Analyzed 10/15/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) & Alkalinity, Carbonate (as CaCO3) each present in MB at 1 mg/L. All samples ND or >RL and >5xblank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	NA		
Matrix Spike Duplicate[2]	NA		
Laboratory Duplicate[2]	Yes	No	Lab duplicate performed on WGE10141015BAW1, WGE10141015BAW1(RE), WGC10141640BRH1; All criteria met.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.
[4]The MSD result was not calculable (NC) since the native concentration was > the MSD concentration detected.

No Qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010389
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 SW, 1 Field Blank, 1 Equipment Blank
Analysis (Include Method #): Chloride and Sulfate (SW846 9056)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/14/10 Analyzed 10/15/10
Quantitation Limits	Yes	No	Several samples were analyzed on dilution 5x-20x as a result of high concentrations of chloride or sulfate.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Chloride present in MB at 0.3154 mg/L & sulfate present in MB at 0.2956 mg/L. All samples are ND or >RL and >5x blank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGE10141015BAW1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

US EPA ARCHIVE DOCUMENT

Analyte	RL	5xRL	WGE10141200BRH1 (mg/L)	WGE10141200BRH2 (mg/L)	RPD	Actions
Calcium (total)	10	50	50	46.0	8.3	none
Magnesium (total)	1.0	5.0	11	11	0.0	none
Sodium (total)	1.0	5.0	6.6	6.2	6.2	none
Calcium (dissolved)	10	50	46	46	0.0	none
Magnesium (dissolved)	1.0	5.0	11	11	0.0	none
Sodium (dissolved)	1.0	5.0	6.5	6.5	0.0	none
Alkalinity, Bicarbonate (as CaCO3)	10	50	160	160	0.0	none
Chloride	10	50	14	13	7.4	none
Sulfate	1.0	5.0	3.5	3.2	9.0	none

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Data Validation Report

To	Kris Nolan/AECOM	Page 1
Project	Enbridge Line 6B MP 608 Pipeline Release Hydrogeologic Investigation	
Laboratory	ALS Environmental, Holland, MI	
Laboratory SDG	1010436	
Analyses/Method	VOCs, PAHs, Metals, Chloride, and Sulfate by SW846 Methods Alkalinity by Standard Methods	
Validation Level	Level II (QC summary report review)	
AECOM Project Number	60162778.01	
Prepared by	Paula DiMattei/AECOM	Completed: October 24, 2010
Reviewed by	Robert Kennedy/AECOM	
CC	Mike Wolf/AECOM	

SUMMARY

The samples listed below were collected by AECOM Environment in Marshall, Michigan on October 15, 2010 and submitted to ALS Environmental in Holland, MI for analysis.

Client Sample ID	Matrix	Parameters
WGE10150935BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10151050BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10151050BAW2[1]	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WSE10151200BAW1	Surface water	Metals (total), Alkalinity, Chloride, Sulfate
WGE10151405BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10151530BAW1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10151600BAW5	Trip blank	VOCs
WGE10151605BAW5	Trip blank	VOCs
WGC10150950DJJ1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10151120DJJ1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10151310DJJ1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WSC10151712DJJ1	Surface water	Metals (total), Alkalinity, Chloride, Sulfate
WSC10151555DJJ1	Surface water	Metals (total), Alkalinity, Chloride, Sulfate
WSC10151448DJJ1	Surface water	Metals (total), Alkalinity, Chloride, Sulfate

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Client Sample ID	Matrix	Parameters
WGE10150935DJJ4	Equipment blank	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10151830DJJ5	Trip blank	VOCs
WGC10151835DJJ5	Trip blank	VOCs
[1]Field duplicate of WGE10151050BAW1		

The following methods were applicable to the samples in this data set:

Analyte	Primary Method Reference
Volatile Organic Compounds (VOCs) (project-specific list)	SW846 8260
Polynuclear Aromatic Hydrocarbons (PAHs)	SW846 8270
Total and/or dissolved Metals (project-specific list)	SW846 6020
Alkalinity (Bicarbonate & carbonate [as CaCO3])	SM 2320
Chloride and Sulfate	SW846 9056

Data validation activities were conducted with reference to the above method along with USEPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), USEPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- * Data Completeness
- * Chain-of-custody (COC)/sample integrity
- * Holding times and sample preservation
- * Laboratory method blanks
- * Trip Blanks/equipment blanks
- * Surrogate recoveries (%Rs)
- Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- * Laboratory duplicate
- * Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- * Field duplicate results
- General reporting issues

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The symbol (*) indicates that all quality control (QC) criteria were met for this parameter. The NA indicates that the parameter was not included as part of this data set, and therefore not reviewed.

The data appear valid as reported and may be used for decision making purposes with the following exception. The nondetect results for Alkalinity, carbonate (as CaCO3) in all samples were qualified as rejected (R) due to very low (<10%) matrix spike and matrix spike duplicate recoveries. These results are not usable for project decisions. Selected other data points were qualified as estimated due to non-conformances of certain QC criteria (see discussion below).

MS/MSD

VOCs

The MS/MSD analyses were performed on sample WGC10151120DJJ1. The percent recovery for isopropyltoluene (cymene) was below the laboratory's lower QC limit of 75%, but greater than the NFG guidance criterion of 20% (refer to Attachment A). Consequently, the nondetect isopropyltoluene result in sample WGC10151120DJJ1 was qualified as estimated (UJ). Qualified sample results are shown in Table 1.

Alkalinity

The MS/MSD analyses were performed on sample WGC10150950DJJ1. The percent recovery for Alkalinity, bicarbonate (as CaCO3) was below the laboratory's lower QC limit of 40%, and less than the NFG guidance criterion of 30% (refer to Attachment A). Consequently, the positive results for Alkalinity, bicarbonate (as CaCO3) in all samples were qualified as estimated (J-). The percent recovery for Alkalinity, carbonate (as CaCO3) was below the laboratory's lower QC limit of 40%, and less than the NFG guidance criterion of 30% (refer to Attachment A). Consequently, the nondetect results for Alkalinity, carbonate (as CaCO3) in all samples were qualified as rejected (R). The results are not usable for project decisions. Qualified sample results are shown in Table 1.

General Reporting Issues

It should be noted that the "Reporting Limit" for each analysis is equivalent to the target detection limit (TDL). In cases where dilution analyses were required, the TDL reflects the dilution factor used in the analysis when the TDL is equivalent to the laboratory's practical quantitation limit (PQL). In cases where the TDL is greater than the laboratory's PQL, the dilution factor is not reflected in the reporting limit.

ATTACHMENTS

Attachment A: Data Review Summary Worksheets/Fraction

Attachment B: Validation Qualifier Codes and Explanation

Attachment C: Reason Codes and Explanations

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Table 1 - Data Validation Summary of Qualified Data

Sample ID	Matrix	Compound	Result	QL	Units	Validation Qualifiers	Validation Reason
WGC10150950DJJ1	WG	ALKALINITY, BICARBONATE (AS CACO3)	300	10	mg/l	J-	m
WGC10150950DJJ1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGC10151120DJJ1	WG	ALKALINITY, BICARBONATE (AS CACO3)	260	10	mg/l	J-	m
WGC10151120DJJ1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGC10151310DJJ1	WG	ALKALINITY, BICARBONATE (AS CACO3)	290	10	mg/l	J-	m
WGC10151310DJJ1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGE10150935BAW1	WG	ALKALINITY, BICARBONATE (AS CACO3)	310	10	mg/l	J-	m
WGE10150935BAW1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGE10150935DJJ4	WQ	ALKALINITY, BICARBONATE (AS CACO3)	10	10	mg/l	J-	m
WGE10150935DJJ4	WQ	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGE10151050BAW1	WG	ALKALINITY, BICARBONATE (AS CACO3)	180	10	mg/l	J-	m
WGE10151050BAW1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGE10151050BAW2	WG	ALKALINITY, BICARBONATE (AS CACO3)	190	10	mg/l	J-	m
WGE10151050BAW2	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGE10151405BAW1	WG	ALKALINITY, BICARBONATE (AS CACO3)	350	10	mg/l	J-	m
WGE10151405BAW1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGE10151530BAW1	WG	ALKALINITY, BICARBONATE (AS CACO3)	300	10	mg/l	J-	m
WGE10151530BAW1	WG	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WSC10151448DJJ1	WS	ALKALINITY, BICARBONATE (AS CACO3)	260	10	mg/l	J-	m
WSC10151448DJJ1	WS	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WSC10151555DJJ1	WS	ALKALINITY, BICARBONATE (AS CACO3)	290	10	mg/l	J-	m
WSC10151555DJJ1	WS	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WSC10151712DJJ1	WS	ALKALINITY, BICARBONATE (AS CACO3)	260	10	mg/l	J-	m
WSC10151712DJJ1	WS	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WSE10151200BAW1	WS	ALKALINITY, BICARBONATE (AS CACO3)	240	10	mg/l	J-	m
WSE10151200BAW1	WS	ALKALINITY, CARBONATE (AS CACO3)			mg/l	R	m
WGC10151120DJJ1	WG	CYMENE		5.0	ug/l	UJ	m

Notes:

- Refer to Attachment A for data review summary worksheets.
- Refer to Attachment B for validation qualifier definitions.
- Refer to Attachment C for validation reason code definitions.
- There will be no value under the Result column if the result is nondetect.

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Attachment A

Data Review Summary Worksheets/Fraction

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Attachment B

Qualifier Codes and Explanation

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is an estimated quantity with an unknown bias.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential high bias.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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Attachment C

Reason Codes and Explanations

Reason Code	Explanation
be	Equipment blank contamination
bl	Laboratory blank contamination
bt	Trip blank contamination
fd	Field duplicate RPDs
h	Holding times
l	LCS recoveries
ld	Laboratory duplicate RPDs (matrix duplicate, MSD, LCSD)
m	Matrix spike recovery
p	Chemical preservation issue
s	Surrogate recovery
t	Temperature preservation issue

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010436
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Equipment blank, 4 Trip blanks
Analysis (Include Method #): Select VOCs (SW846 8260)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	3.6°C
Holding Time	Yes	No	Collected 10/15/10 Analyzed 10/16/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	**No**	**Yes**	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked for MS/MSD; No DV actions were taken on this basis. **WGC10151120DJJ1 p-isopropyltoluene (72.8/69.8: QC limits 75-130%) Estimate (UJ) in native sample** WGC10150950DJJI MS/MSD: all criteria met; It should be noted that the initial analysis of this MS/MSD recovered high for most target compounds;thus, the MS/MSD was reanalyzed. No DV actions were taken on the basis of the original analysis of the MS/MSD.
Matrix Spike Duplicate[2]	**No**	**Yes**	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	Yes	No	
Laboratory Control Standards	**No**	**No**	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked into LCS/LCSD; No DV actions taken on this basis. All met except Isopropylbenzene 129/ok (75-125%) [LCS/LCSD batch R82565: WGC10151120DJJ1, WGC10151310DJJ1, WGE10150935DJJ4] All ND; no DV actions on this basis.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010436
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Equipment blank
Analysis (Include Method #): PAHs (SW846 8270)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	3.6°C
Holding Time	Yes	No	Collected 10/15/10 Extracted 10/15/2010 Analyzed 10/16/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 1.0 was not met for napthalene. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	WGC10150950DJJ1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	**No**	**No**	2-fluorobiphenyl recovered below QC limits (50-110%) in sample WGE10150935BAW1 (47.1). No action on this basis since only 1 of 3 surrogates not met. Acid surrogate nonconformances are not applicable to the PAH analyses; thus, no DV actions taken on this basis.
Laboratory Control Standards	Yes	No	All targets were spiked into LCS/LCSD.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010436
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 4 SW, 1 Equipment blank
Analysis (Include Method #): Select total/dissolved metals (Ba, Ni, V, Fe, Na, K, Ca, Mg) (SW846 6020) and Select metals (SW metals): Fe, Na, K, Ca, Mg (SW846 6020)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	3.6°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/15/10 Analyzed 10/15-16/10
Quantitation Limits	Yes	No	WGE10150935BAW1 (dissolved & total) 10x for Na due to high concentration. The SAP target detection limit of 4 ug/L was not met for vanadium. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	**No**	**No**	MS/MSD performed on samples WGC10150950DJJ1 (total/dissolved) and WGE10141015BAW1 (in SDG 1010389) (dissolved). Lab limits reported as 80-120%; All analytes met QAPP criteria of 75-125% except Ca in both MS/MSD pairs. However, Ca >4x spike in both native samples; thus, no DV actions on this basis.
Matrix Spike Duplicate[2]	**No**	**No**	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	All targets spiked.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

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Laboratory: ALS Environmental
Client/Site Name: Enbridge/Hydrogeo Investigation
Laboratory SDG/Job No: 1010436
Project Number: 60162778.1
Validation Level: Level II (QC summary report review) (using Level II data package)
Date: 10/23/10
Validator: Paula DiMattei
Number of Samples/Matrix: 8 GW, 4 SW, 1 Equipment blank
Analysis (Include Method #): Bicarbonate and carbonate Alkalinity (Standard Methods 2320)

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	3.6°C
Holding Time	Yes	No	Collected 10/15/10 Analyzed 10/16/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) present in MB at 4 mg/L. All samples >RL and >5xblank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) present in EB at 10 mg/L. All samples >RL and >5xblank concentration;thus, no DV actions on this basis.
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	**No**	**Yes**	**MS/MSD performed on sample WGC10150950DJJ1. Alkalinity, bicarbonate (as CaCO3) 0.975/0.0585 (40-160%); Estimate all samples (J-). Alkalinity, carbonate (as CaCO3) 0/NC[4] (40-160%); Reject (R) ND results in all samples.**
Matrix Spike Duplicate[2]	**No**	**Yes**	
Laboratory Duplicate[2]	Yes	No	Lab duplicate performed on WGE10150935BAW1; All criteria met.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.
[4]The MSD result was not calculable (NC) since the native concentration was > the MSD concentration detected.

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010436
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 4 SW, 1 Equipment blank
Analysis (Include Method #): Chloride and Sulfate (SW846 9056)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/23/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	3.6°C
Holding Time	Yes	No	Collected 10/15/10 Analyzed 10/16/10
Quantitation Limits	Yes	No	All samples except the EB (WGE10150935DJJ4) were analyzed on dilution 2x-10x as a result of high concentrations of chloride or sulfate.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Chloride present in MB at 0.2134 mg/L & sulfate present in MB at 0.1194 mg/L. All samples >RL and >5xblank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes		All ND.
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGC10150950DJJ1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

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Analyte	RL	5xRL	WGE10151050BAW1 (mg/L)	WGE10151050BAW2 (mg/L)	RPD	Actions
Calcium (total)	10	50	77	75.0	2.6	none
Magnesium (total)	1.0	5.0	18	17	5.7	none
Sodium (total)	1.0	5.0	24	24	0.0	none
Calcium (dissolved)	10	50	75	75	0.0	none
Magnesium (dissolved)	1.0	5.0	17	17	0.0	none
Sodium (dissolved)	1.0	5.0	24	23	4.3	none
Alkalinity, Bicarbonate (as CaCO3)	10	50	180	190	5.4	none
Chloride	10	50	70	69	1.4	none
Sulfate	5.0	25	22	20	9.5	none

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Data Validation Report

To	Kris Nolan/AECOM	Page 1
Project	Enbridge Line 6B MP 608 Pipeline Release Hydrogeologic Investigation	
Laboratory	ALS Environmental, Holland, MI	
Laboratory SDG	1010453	
Analyses/Method	VOCs, PAHs, Metals, Chloride, and Sulfate by SW846 Methods Alkalinity by Standard Methods	
Validation Level	Level II (QC summary report review)	
AECOM Project Number	60162778.01	
Prepared by	Paula DiMattei/AECOM	Completed: October 24, 2010
Reviewed by	Robert Kennedy/AECOM	
CC	Mike Wolf/AECOM	

SUMMARY

The samples listed below were collected by AECOM Environment in Marshall, Michigan on October 16, 2010 and submitted to ALS Environmental in Holland, MI for analysis.

Client Sample ID	Matrix	Parameters
WGC10160955BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10161000DJJ1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10161100DJJ1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10161100DJJ2[1]	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGD10161345DJJ1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGD10161405BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGD10161505BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WSD10161450DJJ1	Surface water	Metals (total), Alkalinity
WSD10161640DJJ1	Surface water	Metals (total), Alkalinity
WGD10161730BRH1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10161405BRH4	Equipment blank	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGC10161925BRH5	Trip blank	VOCs
WGC10161930BRH5	Trip blank	VOCs
WGC10161935BRH5	Trip blank	VOCs

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Client Sample ID	Matrix	Parameters
[1]Field duplicate of WGC10161100DJJ1		

The following methods were applicable to the samples in this data set:

Analyte	Primary Method Reference
Volatile Organic Compounds (VOCs) (project-specific list)	SW846 8260
Polynuclear Aromatic Hydrocarbons (PAHs)	SW846 8270
Total and/or dissolved Metals (project-specific list)	SW846 6020
Alkalinity (Bicarbonate & carbonate [as CaCO3])	SM 2320
Chloride and Sulfate	SW846 9056

Data validation activities were conducted with reference to the above method along with USEPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), USEPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- * Data Completeness
- * Chain-of-custody (COC)/sample integrity
- * Holding times and sample preservation
- * Laboratory method blanks
- * Trip Blanks/equipment blanks
- * Surrogate recoveries (%Rs)
- * Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- * Laboratory duplicate
- * Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- Field duplicates
- General reporting issues

The symbol (*) indicates that all quality control (QC) criteria were met for this parameter. The NA indicates that the parameter was not included as part of this data set, and therefore not reviewed.

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The data appear valid as reported and may be used for decision making purposes. Selected data points were qualified as estimated due to non-conformances of certain QC criteria (see discussion below).

Field Duplicates

Dissolved Metals

The following table summarizes the field duplicate results that exceeded the field duplicate relative percent difference (RPD) criterion of <30% (for results >5x the reporting limit) in the field duplicate samples WGC10161100DJJ1 and WGC10161100DJJ2.

Analyte	WGC10161100DJJ1 (mg/L)	WGC10161100DJJ2 (mg/L)	RPD
Iron	1.6	0.66	83

The positive and nondetect iron results in all dissolved groundwater samples were qualified as estimated (J and UJ, respectively) due to the field duplicate imprecision. Qualified sample results are shown in Table 1.

General Reporting Issues

It should be noted that the "Reporting Limit" for each analysis is equivalent to the target detection limit (TDL). In cases were dilution analyses were required, the TDL reflects the dilution factor used in the analysis when the TDL is equivalent to the laboratory's practical quantitation limit (PQL). In cases where the TDL is greater than the laboratory's PQL, the dilution factor is not reflected in the reporting limit.

ATTACHMENTS

Attachment A: Data Review Summary Worksheets/Fraction

Attachment B: Validation Qualifier Codes and Explanation

Attachment C: Reason Codes and Explanation

US EPA ARCHIVE DOCUMENT

Table 1 - Data Validation Summary of Qualified Data

Sample ID	Matrix	Compound	Result	QL	Units	Validation Qualifiers	Validation Reason
WGC10160955BRH1	WG	IRON	0.44	0.20	mg/l	J	fd
WGC10161000DJJ1	WG	IRON	1.8	0.20	mg/l	J	fd
WGC10161100DJJ1	WG	IRON	1.6	0.20	mg/l	J	fd
WGC10161100DJJ2	WG	IRON	0.66	0.20	mg/l	J	fd
WGC10161405BRH4	WQ	IRON		0.20	mg/l	UJ	fd
WGD10161345DJJ1	WG	IRON		0.20	mg/l	UJ	fd
WGD10161405BRH1	WG	IRON		0.20	mg/l	UJ	fd
WGD10161505BRH1	WG	IRON	0.66	0.20	mg/l	J	fd
WGD10161730BRH1	WG	IRON		0.20	mg/l	UJ	fd

Notes:

- Refer to Attachment A for data review summary worksheets.
- Refer to Attachment B for validation qualifier definitions.
- Refer to Attachment C for validation reason code definitions.
- There will be no value under the Result column if the result is nondetect.

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Attachment A

Data Review Summary Worksheets/Fraction

US EPA ARCHIVE DOCUMENT

Attachment B

Qualifier Codes and Explanation

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is an estimated quantity with an unknown bias.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential high bias.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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Attachment C

Reason Codes and Explanations

Reason Code	Explanation
be	Equipment blank contamination
bl	Laboratory blank contamination
bt	Trip blank contamination
fd	Field duplicate RPDs
h	Holding times
l	LCS recoveries
ld	Laboratory duplicate RPDs (matrix duplicate, MSD, LCSD)
m	Matrix spike recovery
p	Chemical preservation issue
s	Surrogate recovery
t	Temperature preservation issue

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010453
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Equipment Blank, 3 Trip Blanks
Analysis (Include Method #): Select VOCs (SW846 8260)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.8°C
Holding Time	Yes	No	Collected 10/16/10 Analyzed 10/17/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked for MS/MSD; No DV actions were taken on this basis. MS/MSD performed on WGD10161505BRH1: All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	Yes	No	
Laboratory Control Standards	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked into LCS/LCSD; No DV actions taken on this basis. All criteria met.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010453
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Equipment Blank
Analysis (Include Method #): PAHs (SW846 8270)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.8°C
Holding Time	Yes	No	Collected 10/16/10 Extracted 10/16/2010 Analyzed 10/17/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 1.0 was not met for napthalene. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGD10161505BRH1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	**No**	**No**	terphenyl-d_{14} recovered below QC limits (50-125%) in sample WGC10161000DJJ1 (49.2). No action on this basis since only 1 of 3 surrogates not met.
Laboratory Control Standards	Yes	No	All targets were spiked into LCS/LCSD.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Client/Site Name: Enbridge/Hydrogeo Investigation
Laboratory SDG/Job No: 1010453
Project Number: 60162778.1
Validation Level: Level II (QC summary report review) (using Level II data package)
Date: 10/24/10
Validator: Paula DiMattei
Number of Samples/Matrix: 8 GW, 2 SW, 1 Equipment Blank
Analysis (Include Method #): Select total/dissolved metals (Ba, Ni, V, Fe, Na, K, Ca, Mg) (SW846 6020) and Select metals (SW metals): Fe, Na, K, Ca, Mg (SW846 6020)

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.8°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/16/10 Analyzed 10/17/10
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 4 ug/L was not met for vanadium. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	(dissolved) All ND. (total) Ni present in MB at 0.001253 mg/L, K present in MB at 0.0102 mg/L, & Na present in MB at 0.01301 mg/L. All samples ND or >RL and >5x blank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on samples WGD10161505BRH1 (total/dissolved). Lab limits reported as 80-120%; All analytes met QAPP criteria of 75-125%.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	All targets spiked.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

Data qualified due to field duplicate imprecision (see field duplicate tab for details)

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010453
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 2 SW, 1 Equipment Blank
Analysis (Include Method #): Bicarbonate and carbonate Alkalinity (Standard Methods 2320)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.8°C
Holding Time	Yes	No	Collected 10/16/10 Analyzed 10/17/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) & Alkalinity, Carbonate (as CaCO3) each present in MB at 1 mg/L. All samples ND or >RL and >5xblank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	NA		
Matrix Spike Duplicate[2]	NA		
Laboratory Duplicate[2]	Yes	No	Lab duplicate performed on WGD10161505BRH1, WGD10161505BRH1(RE), WGC10161405BRH4; All criteria met.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.
[4]The MSD result was not calculable (NC) since the native concentration was > the MSD concentration detected.

No Qualifications

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Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010453
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 8 GW, 1 Equipment Blank
Analysis (Include Method #): Chloride and Sulfate (SW846 9056)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.8°C
Holding Time	Yes	No	Collected 10/16/10 Analyzed 10/17/10
Quantitation Limits	Yes	No	Several samples were analyzed on dilution 2x or 10x as a result of high concentrations of chloride or sulfate.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGD10161505BRH1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

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Analyte	RL	5xRL	WGC10161100DJJ1 (mg/L)	WGC10161100DJJ2 (mg/L)	RPD	Actions
Barium (total)	0.10	1	0.28	0.3	3.6	none
Calcium (total)	10	50	130	130.0	0.0	none
Iron (total)	0.20	1	23	21.0	9.1	none
Magnesium (total)	1.0	5.0	28	28	0.0	none
Sodium (total)	1.0	5.0	19	19	0.0	none
Barium (dissolved)	0.10	0.5	0.18	0.17	5.7	none
Calcium (dissolved)	10	50	130	120	8.0	none
Iron (dissolved)	0.20	1.0	1.6	0.66	83.2	**J/UJ all dissolved**
Magnesium (dissolved)	1.0	5.0	28	28	0.0	none
Sodium (dissolved)	1.0	5.0	20	19	5.1	none
Alkalinity, Bicarbonate (as CaCO3)	10	50	490	490	0.0	none
Chloride	10	50	41	39	5.0	none
Sulfate	1.0	5.0	4.1	3.9	5.0	none

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Data Validation Report

To	Kris Nolan/AECOM	Page 1
Project	Enbridge Line 6B MP 608 Pipeline Release Hydrogeologic Investigation	
Laboratory	ALS Environmental, Holland, MI	
Laboratory SDG	1010458	
Analyses/Method	VOCs, PAHs, Metals, Chloride, and Sulfate by SW846 Methods Alkalinity by Standard Methods	
Validation Level	Level II (QC summary report review)	
AECOM Project Number	60162778.01	
Prepared by	Paula DiMattei/AECOM	Completed: October 24, 2010
Reviewed by	Robert Kennedy/AECOM	
CC	Mike Wolf/AECOM	

SUMMARY

The samples listed below were collected by AECOM Environment in Marshall, Michigan on October 17, 2010 and submitted to ALS Environmental in Holland, MI for analysis.

Client Sample ID	Matrix	Parameters
WGE10171041TAS1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10171041TAS2[1]	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10171100RWS1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WSE10171136BRH1	Surface water	Metals (total), Alkalinity
WGE10171245RWS1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10171240TAS1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGD10171520TAS1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGD10171540RWS1	Groundwater	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGD10171620TAS4	Equipment blank	VOCs, PAHs, Metals (total/dissolved), Alkalinity, Chloride, Sulfate
WGE10171740RWS5	Trip blank	VOCs
WGE10171745RWS5	Trip blank	VOCs
WGE10171750RWS5	Trip blank	VOCs
[1]Field duplicate of WGE10171041TAS1		

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The following methods were applicable to the samples in this data set:

Analyte	Primary Method Reference
Volatile Organic Compounds (VOCs) (project-specific list)	SW846 8260
Polynuclear Aromatic Hydrocarbons (PAHs)	SW846 8270
Total and/or dissolved Metals (project-specific list)	SW846 6020
Alkalinity (Bicarbonate & carbonate [as CaCO3])	SM 2320
Chloride and Sulfate	SW846 9056

Data validation activities were conducted with reference to the above method along with USEPA National Functional Guidelines for Superfund Organic Methods Data Review (June 2008), USEPA National Functional Guidelines for Inorganic Data Review (October 2004), the Quality Assurance Project Plan, Enbridge Line 6B MP 608, Marshall, Michigan (revised August 15, 2010), the Supplement to the Sampling and Analysis Plan (revised October 7, 2010), and the laboratory specific standard operating procedures (SOPs). In the absence of QAPP-specified criteria, method or laboratory quality assurance limits were used as appropriate.

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- * Data Completeness
- * Chain-of-custody (COC)/sample integrity
- * Holding times and sample preservation
- * Laboratory method blanks
- * Trip Blanks/equipment blanks
- * Surrogate recoveries (%Rs)
- Matrix spike (MS) and/or matrix spike duplicate (MSD) results
- * Laboratory duplicate
- * Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- Field duplicate results
- General reporting issues

The symbol (*) indicates that all quality control (QC) criteria were met for this parameter. The NA indicates that the parameter was not included as part of this data set, and therefore not reviewed.

The data appear valid as reported and may be used for decision making purposes. Selected data points were qualified as estimated due to non-conformances of certain QC criteria (see discussion below).

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MS/MSD

Alkalinity

The MS/MSD analyses were performed on sample WGD10171540RWS. The percent recovery for Alkalinity, bicarbonate (as CaCO3) was below the laboratory's lower QC limit of 40%, and less than the NFG guidance criterion of 30% (refer to Attachment A). Consequently, the positive results for Alkalinity, bicarbonate (as CaCO3) in all samples were qualified as estimated (J-). Qualified sample results are shown in Table 1.

Field Duplicates

Dissolved Metals

The following table summarizes the field duplicate results that exceeded the field duplicate relative percent difference (RPD) criterion of <30% (for results >5x the reporting limit) in the field duplicate samples WGE10171041TAS1 and WGE10171041TAS2.

Analyte	WGE10171041TAS1 (mg/L)	WGE10171041TAS2 (mg/L)	RPD
Iron	1.6	0.8	67

The positive and nondetect iron results in all dissolved groundwater samples were qualified as estimated (J and UJ, respectively) due to the field duplicate imprecision. Qualified sample results are shown in Table 1.

General Reporting Issues

It should be noted that the "Reporting Limit" for each analysis is equivalent to the target detection limit (TDL). In cases were dilution analyses were required, the TDL reflects the dilution factor used in the analysis when the TDL is equivalent to the laboratory's practical quantitation limit (PQL). In cases where the TDL is greater than the laboratory's PQL, the dilution factor is not reflected in the reporting limit.

ATTACHMENTS

Attachment A: Data Review Summary Worksheets/Fraction

Attachment B: Validation Qualifier Codes and Explanation

Attachment C: Reason Codes and Explanation

US EPA ARCHIVE DOCUMENT

Table 1 - Data Validation Summary of Qualified Data

Sample ID	Matrix	Compound	Result	QL	Units	Validation Qualifiers	Validation Reason
WGD10171520TAS1	WG	ALKALINITY, BICARBONATE (AS CACO3)	230	10	mg/l	J-	m
WGD10171540RWS1	WG	ALKALINITY, BICARBONATE (AS CACO3)	230	10	mg/l	J-	m
WGD10171620TAS4	WQ	ALKALINITY, BICARBONATE (AS CACO3)	20	10	mg/l	J-	m
WGE10171041TAS1	WG	ALKALINITY, BICARBONATE (AS CACO3)	320	10	mg/l	J-	m
WGE10171041TAS2	WG	ALKALINITY, BICARBONATE (AS CACO3)	330	10	mg/l	J-	m
WGE10171100RWS1	WG	ALKALINITY, BICARBONATE (AS CACO3)	280	10	mg/l	J-	m
WGE10171240TAS1	WG	ALKALINITY, BICARBONATE (AS CACO3)	330	10	mg/l	J-	m
WGE10171245RWS1	WG	ALKALINITY, BICARBONATE (AS CACO3)	280	10	mg/l	J-	m
WSE10171136BRH1	WS	ALKALINITY, BICARBONATE (AS CACO3)	260	10	mg/l	J-	m
WGD10171520TAS1	WG	IRON	0.42	0.20	mg/l	J	fd
WGD10171540RWS1	WG	IRON		0.20	mg/l	UJ	fd
WGD10171620TAS4	WQ	IRON		0.20	mg/l	UJ	fd
WGE10171041TAS1	WG	IRON	1.6	0.20	mg/l	J	fd
WGE10171041TAS2	WG	IRON	0.80	0.20	mg/l	J	fd
WGE10171100RWS1	WG	IRON	0.72	0.20	mg/l	J	fd
WGE10171240TAS1	WG	IRON	1.8	0.20	mg/l	J	fd
WGE10171245RWS1	WG	IRON	0.37	0.20	mg/l	J	fd

Notes:

- Refer to Attachment A for data review summary worksheets.
- Refer to Attachment B for validation qualifier definitions.
- Refer to Attachment C for validation reason code definitions.
- There will be no value under the Result column if the result is nondetect.

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US EPA ARCHIVE DOCUMENT

Attachment A

Data Review Summary Worksheets/Fraction

US EPA ARCHIVE DOCUMENT

Attachment B

Qualifier Codes and Explanation

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is an estimated quantity with an unknown bias.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity with a potential high bias.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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Attachment C

Reason Codes and Explanations

Reason Code	Explanation
be	Equipment blank contamination
bl	Laboratory blank contamination
bt	Trip blank contamination
fd	Field duplicate RPDs
h	Holding times
l	LCS recoveries
ld	Laboratory duplicate RPDs (matrix duplicate, MSD, LCSD)
m	Matrix spike recovery
p	Chemical preservation issue
s	Surrogate recovery
t	Temperature preservation issue

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010458
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 7 GW, 1 Equipment blank, 3 Trip blanks
Analysis (Include Method #): Select VOCs (SW846 8260)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/17/10 Analyzed 10/18/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked for MS/MSD; No DV actions were taken on this basis. MS/MSD performed on WGD10171540RWS1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	Yes	No	
Laboratory Control Standards	Yes	No	All targets except 1,2,3-trimethylbenzene and cyclohexane were spiked into LCS/LCSD; No DV actions taken on this basis. All met criteria.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010458
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 7 GW, 1 Equipment blank
Analysis (Include Method #): PAHs (SW846 8270)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/17/10 Extracted 10/17/2010 Analyzed 10/18/1(
Quantitation Limits	Yes	No	No dilutions. The SAP target detection limit of 1.0 was not met for napthalene. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	All ND
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGD10171540RWS1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		
Surrogate Standards[2]	**No**	**No**	terphenyl-d_{14} recovered below QC limits (50-110%) in samples WGE10171041TAS1 (32.3), WGE10171041TAS2 (35.5), WGE10171100RWS1 (47.5), WGE10171245RWS1 (40.0), WGE10171240TAS1 (48.9), WGD10171520TAS1 (43.0), WGD10171540RWS1 (33.5). No action on this basis since only 1 of 3 surrogates not met.
Laboratory Control Standards	Yes	No	All targets were spiked into LCS/LCSD.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No qualifications

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010458
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 7 GW, 1 SW, 1 Equipment blank
Analysis (Include Method #): Select total/dissolved metals (Ba, Ni, V, Fe, Na, K, Ca, Mg) (SW846 6020) and Select metals (SW metals): Fe, Na, K, Ca, Mg (SW846 6020)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C; Sample receipt notes pH is acceptable.
Holding Time	Yes	No	Collected 10/17/10 Analyzed 10/18/10
Quantitation Limits	Yes	No	The SAP target detection limit of 4 ug/L was not met for vanadium. The lab reported RL=5.0 for this compound.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	(dissolved) All ND. (total) Mg present in MB at 0.002598 mg/L, & K present in MB at 0.007595 mg/L. All samples ND or >RL and >5x blank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	All ND
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on samples WGD10171540RWS1 (total/dissolved) and WGD10161505BRH1 (in SDG 1010453) (dissolved). Lab limits reported as 80-120%; All analytes met QAPP criteria of 75-125%.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	All targets spiked.
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

Data qualified due to field duplicate imprecision (see field duplicate tab for details)

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Client/Site Name: Enbridge/Hydrogeo Investigation
Laboratory SDG/Job No: 1010458
Project Number: 60162778.1
Validation Level: Level II (QC summary report review) (using Level II data package)
Date: 10/24/10
Validator: Paula DiMattei
Number of Samples/Matrix: 7 GW, 1 SW, 1 Equipment blank
Analysis (Include Method #): Bicarbonate and carbonate Alkalinity (Standard Methods 2320)

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/17/10 Analyzed 10/18/10
Quantitation Limits	Yes	No	No dilutions
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) present in MB at 1 mg/L. All samples >RL and >5x blank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes	No	Alkalinity, Bicarbonate (as CaCO3) present in EB at 20 mg/L. All samples >RL and >5xblank concentration;thus, no DV actions on this basis.
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	**No**	**Yes**	**MS/MSD performed on sample WGD10171540RWS. Alkalinity, bicarbonate (as CaCO3) 27/0k (40-160%); Estimate all samples (J-).**
Matrix Spike Duplicate[2]	**No**	**Yes**	
Laboratory Duplicate[2]	Yes	No	Lab duplicate performed on WGD10171520TAS1; All criteria met.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

US EPA ARCHIVE DOCUMENT

Laboratory: ALS Environmental
Laboratory SDG/Job No: 1010458
Validation Level: Level II (QC summary report review) (using Level II data package)
Number of Samples/Matrix: 7 GW, 1 Equipment blank
Analysis (Include Method #): Chloride and Sulfate (SW846 9056)

Client/Site Name: Enbridge/Hydrogeo Investigation
Project Number: 60162778.1
Date: 10/24/10
Validator: Paula DiMattei

Review Item	Criteria Met? (Yes/No)	Qualification? (Yes/No)	Comments
Chain of Custody	Yes	No	
Sample Preservation	Yes	No	4.2°C
Holding Time	Yes	No	Collected 10/17/10 Analyzed 10/18/10
Quantitation Limits	Yes	No	All samples except the EB (WGD10171620TAS4) were analyzed on dilution 2x or 4x as a result of high concentrations of chloride or sulfate.
Percent Solids (>30%)	NA		Aqueous sample only
Method Blanks	Yes	No	Sulfate present in MB at 0.1248 mg/L. All samples ND or >RL and >5x blank concentration;thus, no DV actions on this basis.
Other Laboratory Blanks[1,2]	NA		
Trip/Equipment Blanks	Yes		All ND.
Initial Calibration [3]	Not provided in Level II; therefore, not evaluated		
Continuing Calibration Verification [3]	Not provided in Level II; therefore, not evaluated		
Matrix Spike	Yes	No	MS/MSD performed on WGD10171540RWS1; All criteria met.
Matrix Spike Duplicate[2]	Yes	No	
Laboratory Duplicate[2]	NA		MS/MSD performed in lieu of Laboratory duplicate.
Laboratory Control Standards	Yes	No	
Internal Standards[2,3]	Not provided in Level II; therefore, not evaluated		
GC/MS Tunes[2,3]	Not provided in Level II; therefore, not evaluated		
Interferences[3]	Not provided in Level II; therefore, not evaluated		
Calculation Spot Checks[3]	Not provided in Level II; therefore, not evaluated		
Transcription Spot Checks[3]	Not provided in Level II; therefore, not evaluated		

[1]May include reagent blanks, calibration blanks, etc.
[2]May not be applicable to all analyses.
[3]Level IV validation only. See full NFG worksheets for details.

No Qualifications

US EPA ARCHIVE DOCUMENT

Analyte	RL	5xRL	WGE10171041TAS1 (mg/L)	WGE10171041TAS2 (mg/L)	RPD	Actions
Barium (total)	0.10	1	0.13	0.1	0.0	none
Calcium (total)	10	50	85	88.0	3.5	none
Iron (total)	0.20	1	2.1	2.2	4.7	none
Magnesium (total)	1.0	5.0	20	20	0.0	none
Sodium (total)	1.0	5.0	18	18	0.0	none
Barium (dissolved)	0.10	0.5	0.13	0.13	0.0	none
Calcium (dissolved)	10	50	89	89	0.0	none
Iron (dissolved)	0.20	1.0	1.6	0.8	66.7	**J/UJ all dissolved**
Magnesium (dissolved)	1.0	5.0	21	21	0.0	none
Sodium (dissolved)	1.0	5.0	19	19	0.0	none
Alkalinity, Bicarbonate (as CaCO3)	10	50	320	330	3.1	none
Chloride	10	50	28	28	0.0	none
Sulfate	2.0	10	22	22	0.0	none

13-Oct-2010

Kris Nolan
AECOM Enviroment
5555 Glenwood Parkway SE
Grand Rapids, MI 49512

Re: **Marshall Oil Spill Hydrogeo Investigation 10/12/10** Work Order: **1010303**

Dear Kris,

ALS Group USA, Corp received 1 sample on 12-Oct-2010 for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 8.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Ann Preston

Electronically approved by: Ann Preston

Ann Preston
Project Manager

Certificate No: IL100452

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 13-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Investigation 10/12/10
Work Order: **1010303**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1010303-01	WG10121900KJN1	Water		10/12/2010 19:00	10/12/2010	☐

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 13-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Investigation 10/12/10
WorkOrder: **1010303**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitation Limit
SD	Serial Dilution

Units Reported	Description
µg/L	Micrograms per Liter

ALS Group USA, Corp

Date: *13-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WG10121900KJN1
Work Order: 1010303
Collection Date: 10/12/2010 7:00:00 PM
Project: Marshall Oil Spill Hydrogeo Investigation 10/12/10
Lab ID: 1010303-01
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/13/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/13/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/13/2010
Benzene	ND	1.0	1.0		µg/L	1	10/13/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/13/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/13/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/13/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/13/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/13/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/13/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/13/2010
Toluene	ND	1.0	1.0		µg/L	1	10/13/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/13/2010
Surr: 1,2-Dichloroethane-d4	*114*	*70-120*			*%REC*	1	10/13/2010
Surr: 4-Bromofluorobenzene	*95.3*	*75-120*			*%REC*	1	10/13/2010
Surr: Dibromofluoromethane	*107*	*85-115*			*%REC*	1	10/13/2010
Surr: Toluene-d8	*102*	*85-120*			*%REC*	1	10/13/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 13-Oct-10

Client: AECOM Enviroment

QC BATCH REPORT

Work Order: 1010303

Project: Marshall Oil Spill Hydrogeo Investigation 10/12/10

Batch ID: **R82416** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW2-101012-R82416** Units: **µg/L** Analysis Date: **10/13/2010 02:43 AM**

Client ID: Run ID: **VMS7_101012B** SeqNo: **1448059** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*113.4*	0	*100*	0	*113*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*96.25*	0	*100*	0	*96.2*	*75-120*	0			
Surr: Dibromofluoromethane	*106.1*	0	*100*	0	*106*	*85-115*	0			
Surr: Toluene-d8	*104.4*	0	*100*	0	*104*	*85-120*	0			

LCS Sample ID: **VLCSW2-101012-R82416** Units: **µg/L** Analysis Date: **10/13/2010 01:21 AM**

Client ID: Run ID: **VMS7_101012B** SeqNo: **1448055** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	19.96	1.0	20	0	99.8	75-130	0			
1,3,5-Trimethylbenzene	20.56	1.0	20	0	103	75-130	0			
Benzene	20.62	1.0	20	0	103	80-120	0			
Ethylbenzene	21.32	1.0	20	0	107	75-125	0			
Isopropylbenzene	23.83	1.0	20	0	119	75-125	0			
n-Propylbenzene	21.24	1.0	20	0	106	70-130	0			
Naphthalene	21.32	5.0	20	0	107	55-140	0			
p-Isopropyltoluene	19.69	2.0	20	0	98.4	75-130	0			
sec-Butylbenzene	20.09	2.0	20	0	100	70-125	0			
Toluene	20.16	1.0	20	0	101	75-120	0			
Xylenes, Total	63.75	2.0	60	0	106	75-130	0			
Surr: 1,2-Dichloroethane-d4	*107.1*	0	*100*	0	*107*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*99.17*	0	*100*	0	*99.2*	*75-120*	0			
Surr: Dibromofluoromethane	*107.2*	0	*100*	0	*107*	*85-115*	0			
Surr: Toluene-d8	*103.6*	0	*100*	0	*104*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010303
Project: Marshall Oil Spill Hydrogeo Investigation 10/12/10

QC BATCH REPORT

Batch ID: **R82416** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW2-101012-R82416** Units: **µg/L** Analysis Date: **10/13/2010 01:48 AM**

Client ID: Run ID: **VMS7_101012B** SeqNo: **1448056** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	18.6	1.0	20	0	93	75-130	19.96	7.05	30	
1,3,5-Trimethylbenzene	19.19	1.0	20	0	96	75-130	20.56	6.89	30	
Benzene	19.8	1.0	20	0	99	80-120	20.62	4.06	30	
Ethylbenzene	19.99	1.0	20	0	100	75-125	21.32	6.44	30	
Isopropylbenzene	22.19	1.0	20	0	111	75-125	23.83	7.13	30	
n-Propylbenzene	19.38	1.0	20	0	96.9	70-130	21.24	9.16	30	
Naphthalene	20.7	5.0	20	0	104	55-140	21.32	2.95	30	
p-Isopropyltoluene	18.38	2.0	20	0	91.9	75-130	19.69	6.88	30	
sec-Butylbenzene	18.1	2.0	20	0	90.5	70-125	20.09	10.4	30	
Toluene	18.64	1.0	20	0	93.2	75-120	20.16	7.84	30	
Xylenes, Total	60.5	2.0	60	0	101	75-130	63.75	5.23	30	
Surr: 1,2-Dichloroethane-d4	*109.2*	0	*100*	0	*109*	*70-120*	107.1	*2.02*	*30*	
Surr: 4-Bromofluorobenzene	*98.2*	0	*100*	0	*98.2*	*75-120*	99.17	*0.983*	*30*	
Surr: Dibromofluoromethane	*106.8*	0	*100*	0	*107*	*85-115*	107.2	*0.392*	*30*	
Surr: Toluene-d8	*102*	0	*100*	0	*102*	*85-120*	103.6	*1.62*	*30*	

The following samples were analyzed in this batch: 1010303-01A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

☐ ALS Laboratory Group
10450 Stancliff Rd., Suite 210
Houston, Texas 77099
Tel. +1 281 530 5656
Fax. +1 281 530 5887

Chain of Custody Form

☐ ALS Laboratory Group
3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

Page 1 of 1

ALS Project Manager: | ALS Work Order #: 10 10303

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study/Inv	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WG10121900KJN1	10/12/10	1900	W	HCl	3	X				MWKR0250L01						TA-1
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Kristopher Nolan

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date: ASAP

	Date:	Time:	
Relinquished by:	10/12/10	1923	Received by:
Relinquished by:	Date:	Time:	Received by (Laboratory):
Logged by (Laboratory):	Date: 10/12/10	Time: 10:25	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	4.0C

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Laboratory Group.
2. Unless otherwise agreed in a formal contract, services provided by ALS Laboratory Group are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.

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Sample Receipt Checklist

Client Name: **AECOM - GR** Date/Time Received: **12-Oct-10 00:00**

Work Order: **1010303** Received by: **AP**

Checklist completed by Ann Preston (eSignature) 12-Oct-10 (Date) Reviewed by: Ann Preston (eSignature) 13-Oct-10 (Date)

Matrices: water
Carrier name: ALSHN

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	4.0°C		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☑	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑
pH adjusted?	Yes ☐	No ☐	N/A ☑
pH adjusted by:			

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

US EPA ARCHIVE DOCUMENT

☐ ALS Laboratory Group
10450 Stancliff Rd., Suite 210
Houston, Texas 77099
Tel. +1 281 530 5656
Fax. +1 281 530 5887

Chain of Custody Form

☐ ALS Laboratory Group
3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

Page 1 of 1

ALS Project Manager: | ALS Work Order #: 10 10303

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study/Inv	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WG10121900KJN1	10/12/10	1900	W	HCl	3	X				MWKR0250L01						TA-1
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Kristopher Nolan

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date: ASAP

	Date:	Time:	
Relinquished by:	10/12/10	1923	Received by:
Relinquished by:	Date:	Time:	Received by (Laboratory):
Logged by (Laboratory):	Date: 10/12/10	Time: 10:25	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	4.0C

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Laboratory Group.
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3. The Chain of Custody is a legal document. All information must be completed accurately.

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16-Oct-2010

Kris Nolan
AECOM Enviroment
5555 Glenwood Parkway SE
Grand Rapids, MI 49512

Re: **Marshall Oil Spill Hydrogeo Study 10/13/10** Work Order: **1010353**

Dear Kris,

ALS Group USA, Corp received 6 samples on 13-Oct-2010 04:05 PM for the analyses presented in the following report.

This is a REVISED REPORT. The Case Narrative provides information discussing the reason for issuing a revised report. The total number of pages in this revision is 34.

If you have any questions regarding these test results, please feel free to contact me.

Sincerely,

Ann Preston

Electronically approved by: Ann Preston

Ann Preston
Project Manager

Certificate No: IL100452

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Work Order: **1010353**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1010353-01	WGC10131220BAW1	Water		10/13/2010 12:20	10/13/2010 16:05	☐
1010353-02	WGC10130900BAW1	Water		10/13/2010 09:00	10/13/2010 16:05	☐
1010353-03	WGC10131435BAW1	Water		10/13/2010 14:35	10/13/2010 16:05	☐
1010353-04	WGC10131545BAW5	Water		10/13/2010	10/13/2010 16:05	☐
1010353-05	WGC10131600BAW4	Water		10/13/2010 16:00	10/13/2010 16:05	☐
1010353-06	WGC10131605BAW5	Water		10/13/2010	10/13/2010 16:05	☐

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Work Order: 1010353

Case Narrative

This revised report has corrected a laboratory error for dissolved metals. At the client's request, the laboratory filtered the samples for dissolved metals. After the filtration step, the two samples, WGC10131435BAW1 and WGC10131600BAW, were labeled incorrectly, switching one for the other. The client noticed the discrepancy between the total and dissolved metals. Both samples were re-run for both total and dissolved, and it was determined the error was during the labeling after the filtration. A Corrective Action Report has been requested for QA review.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
WorkOrder: **1010353**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitation Limit
SD	Serial Dilution

Units Reported	Description
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10131220BAW1
Work Order: 1010353
Collection Date: 10/13/2010 12:20:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-01
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/14/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/14/2010
Calcium	**68**	**10**	**10**		**mg/L**	1	10/14/2010
Iron	**15**	**0.20**	**0.20**		**mg/L**	1	10/14/2010
Magnesium	**21**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Nickel	ND	0.020	0.020		mg/L	1	10/14/2010
Potassium	ND	10	10		mg/L	1	10/14/2010
Sodium	**32**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Vanadium	**0.047**	**0.0040**	**0.0040**		**mg/L**	1	10/14/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/14/2010
Calcium	**67**	**10**	**10**		**mg/L**	1	10/14/2010
Iron	**5.8**	**0.20**	**0.20**		**mg/L**	1	10/14/2010
Magnesium	**21**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Nickel	ND	0.020	0.020		mg/L	1	10/14/2010
Potassium	ND	10	10		mg/L	1	10/14/2010
Sodium	**31**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Vanadium	**0.023**	**0.0040**	**0.0040**		**mg/L**	1	10/14/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/14/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/14/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/14/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/14/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/14/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/14/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/14/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/14/2010
Surr: 2,4,6-Tribromophenol	*85.6*	*40-125*			*%REC*	1	10/14/2010
Surr: 2-Fluorobiphenyl	*57.3*	*50-110*			*%REC*	1	10/14/2010
Surr: 2-Fluorophenol	*40.3*	*20-110*			*%REC*	1	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10131220BAW1
Work Order: 1010353 **Collection Date:** 10/13/2010 12:20:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-01 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*49.3*	*50-125*		S	*%REC*	1	10/14/2010
Surr: Nitrobenzene-d5	*60.1*	*40-110*			*%REC*	1	10/14/2010
Surr: Phenol-d6	*24.4*	*20-110*			*%REC*	1	10/14/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzene	ND	1.0	1.0		µg/L	1	10/14/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/14/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/14/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Toluene	ND	1.0	1.0		µg/L	1	10/14/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/14/2010
Surr: 1,2-Dichloroethane-d4	*119*	*70-120*			*%REC*	1	10/14/2010
Surr: 4-Bromofluorobenzene	*96.1*	*75-120*			*%REC*	1	10/14/2010
Surr: Dibromofluoromethane	*111*	*85-115*			*%REC*	1	10/14/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/14/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **KB**
Alkalinity, Bicarbonate (as CaCO3)	**240**	**10**	**10**		**mg/L**	1	10/13/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/13/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**32**	**10**	**10**		**mg/L**	4	10/14/2010
Sulfate	**55**	**4.0**	**1.0**		**mg/L**	4	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10130900BAW1
Work Order: 1010353
Collection Date: 10/13/2010 9:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-02
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/14/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/14/2010
Calcium	**77**	**10**	**10**		**mg/L**	1	10/14/2010
Iron	**10**	**0.20**	**0.20**		**mg/L**	1	10/14/2010
Magnesium	**19**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Nickel	**0.025**	**0.020**	**0.020**		**mg/L**	1	10/14/2010
Potassium	ND	10	10		mg/L	1	10/14/2010
Sodium	**72**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Vanadium	**0.034**	**0.0040**	**0.0040**		**mg/L**	1	10/14/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/14/2010
Calcium	**75**	**10**	**10**		**mg/L**	1	10/14/2010
Iron	**0.49**	**0.20**	**0.20**		**mg/L**	1	10/14/2010
Magnesium	**18**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Nickel	ND	0.020	0.020		mg/L	1	10/14/2010
Potassium	ND	10	10		mg/L	1	10/14/2010
Sodium	**75**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Vanadium	**0.0062**	**0.0040**	**0.0040**		**mg/L**	1	10/14/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*80.6*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*59.1*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*45.1*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10130900BAW1
Work Order: 1010353 **Collection Date:** 10/13/2010 9:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-02 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*112*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*60.8*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*28.4*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzene	ND	1.0	1.0		µg/L	1	10/14/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/14/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/14/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Toluene	ND	1.0	1.0		µg/L	1	10/14/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/14/2010
Surr: 1,2-Dichloroethane-d4	*118*	*70-120*			*%REC*	1	10/14/2010
Surr: 4-Bromofluorobenzene	*95.2*	*75-120*			*%REC*	1	10/14/2010
Surr: Dibromofluoromethane	*110*	*85-115*			*%REC*	1	10/14/2010
Surr: Toluene-d8	*103*	*85-120*			*%REC*	1	10/14/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **KB**
Alkalinity, Bicarbonate (as CaCO3)	**240**	**10**	**10**		**mg/L**	1	10/13/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/13/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**100**	**100**	**10**		**mg/L**	10	10/14/2010
Sulfate	**57**	**10**	**1.0**		**mg/L**	10	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10131435BAW1
Work Order: 1010353
Collection Date: 10/13/2010 2:35:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-03
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/14/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/14/2010
Calcium	**77**	**10**	**10**		**mg/L**	1	10/14/2010
Iron	**2.7**	**0.20**	**0.20**		**mg/L**	1	10/14/2010
Magnesium	**21**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Nickel	ND	0.020	0.020		mg/L	1	10/14/2010
Potassium	ND	10	10		mg/L	1	10/14/2010
Sodium	**17**	**1.0**	**1.0**		**mg/L**	1	10/14/2010
Vanadium	**0.011**	**0.0040**	**0.0040**		**mg/L**	1	10/14/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**81**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.43**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**22**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**19**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/14/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/14/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/14/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/14/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/14/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/14/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/14/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/14/2010
Surr: 2,4,6-Tribromophenol	*76.3*	*40-125*			*%REC*	1	10/14/2010
Surr: 2-Fluorobiphenyl	*52.5*	*50-110*			*%REC*	1	10/14/2010
Surr: 2-Fluorophenol	*34.4*	*20-110*			*%REC*	1	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10131435BAW1
Work Order: 1010353 **Collection Date:** 10/13/2010 2:35:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-03 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*66.9*	*50-125*			*%REC*	1	10/14/2010
Surr: Nitrobenzene-d5	*54.2*	*40-110*			*%REC*	1	10/14/2010
Surr: Phenol-d6	*20.6*	*20-110*			*%REC*	1	10/14/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzene	ND	1.0	1.0		µg/L	1	10/14/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/14/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/14/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Toluene	ND	1.0	1.0		µg/L	1	10/14/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/14/2010
Surr: 1,2-Dichloroethane-d4	*120*	*70-120*			*%REC*	1	10/14/2010
Surr: 4-Bromofluorobenzene	*94.4*	*75-120*			*%REC*	1	10/14/2010
Surr: Dibromofluoromethane	*112*	*85-115*			*%REC*	1	10/14/2010
Surr: Toluene-d8	*102*	*85-120*			*%REC*	1	10/14/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **KB**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/13/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/13/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**36**	**10**	**10**		**mg/L**	10	10/14/2010
Sulfate	**29**	**10**	**1.0**		**mg/L**	10	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10131545BAW5
Work Order: 1010353
Collection Date: 10/13/2010
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-04
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzene	ND	1.0	1.0		µg/L	1	10/14/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/14/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/14/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Toluene	ND	1.0	1.0		µg/L	1	10/14/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/14/2010
Surr: 1,2-Dichloroethane-d4	*117*	*70-120*			*%REC*	1	10/14/2010
Surr: 4-Bromofluorobenzene	*93.5*	*75-120*			*%REC*	1	10/14/2010
Surr: Dibromofluoromethane	*109*	*85-115*			*%REC*	1	10/14/2010
Surr: Toluene-d8	*102*	*85-120*			*%REC*	1	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10131600BAW4
Work Order: 1010353
Collection Date: 10/13/2010 4:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-05
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/14/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/14/2010
Calcium	ND	10	10		mg/L	1	10/14/2010
Iron	ND	0.20	0.20		mg/L	1	10/14/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/14/2010
Nickel	ND	0.020	0.020		mg/L	1	10/14/2010
Potassium	ND	10	10		mg/L	1	10/14/2010
Sodium	ND	1.0	1.0		mg/L	1	10/14/2010
Vanadium	**0.0047**	**0.0040**	**0.0040**		**mg/L**	1	10/14/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	ND	10	10		mg/L	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	ND	1.0	1.0		mg/L	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/14/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/14/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/14/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/14/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/14/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/14/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/14/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/14/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/14/2010
Surr: 2,4,6-Tribromophenol	*92.5*	*40-125*			*%REC*	1	10/14/2010
Surr: 2-Fluorobiphenyl	*59.2*	*50-110*			*%REC*	1	10/14/2010
Surr: 2-Fluorophenol	*41.9*	*20-110*			*%REC*	1	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10131600BAW4
Work Order: 1010353
Collection Date: 10/13/2010 4:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-05
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*45.0*	*50-125*		S	*%REC*	1	10/14/2010
Surr: Nitrobenzene-d5	*62.1*	*40-110*			*%REC*	1	10/14/2010
Surr: Phenol-d6	*24.1*	*20-110*			*%REC*	1	10/14/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzene	ND	1.0	1.0		µg/L	1	10/14/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/14/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/14/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Toluene	ND	1.0	1.0		µg/L	1	10/14/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/14/2010
Surr: 1,2-Dichloroethane-d4	*118*	*70-120*			*%REC*	1	10/14/2010
Surr: 4-Bromofluorobenzene	*95.8*	*75-120*			*%REC*	1	10/14/2010
Surr: Dibromofluoromethane	*111*	*85-115*			*%REC*	1	10/14/2010
Surr: Toluene-d8	*103*	*85-120*			*%REC*	1	10/14/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **KB**
Alkalinity, Bicarbonate (as CaCO3)	ND	10	10		mg/L	1	10/13/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/13/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	ND	10	10		mg/L	1	10/14/2010
Sulfate	ND	1.0	1.0		mg/L	1	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10131605BAW5
Work Order: 1010353
Collection Date: 10/13/2010
Project: Marshall Oil Spill Hydrogeo Study 10/13/10
Lab ID: 1010353-06
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Benzene	ND	1.0	1.0		µg/L	1	10/14/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/14/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/14/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/14/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/14/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/14/2010
Toluene	ND	1.0	1.0		µg/L	1	10/14/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/14/2010
Surr: 1,2-Dichloroethane-d4	*117*	*70-120*			*%REC*	1	10/14/2010
Surr: 4-Bromofluorobenzene	*95.2*	*75-120*			*%REC*	1	10/14/2010
Surr: Dibromofluoromethane	*110*	*85-115*			*%REC*	1	10/14/2010
Surr: Toluene-d8	*103*	*85-120*			*%REC*	1	10/14/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment

QC BATCH REPORT

Work Order: 1010353

Project: Marshall Oil Spill Hydrogeo Study 10/13/10

Batch ID: **29958** Instrument ID **ICPMS2** Method: **SW6020A**

MBLK Sample ID: **MBLK-29958-29958** Units: **mg/L** Analysis Date: **10/14/2010 02:36 PM**

Client ID: Run ID: **ICPMS2_101014A** SeqNo: **1450776** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	ND	0.20								
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-29958-29958** Units: **mg/L** Analysis Date: **10/14/2010 02:41 PM**

Client ID: Run ID: **ICPMS2_101014A** SeqNo: **1450777** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.09548	0.0050	0.1	0	95.5	80-120	0			
Calcium	9.661	0.50	10	0	96.6	80-120	0			
Iron	9.756	0.080	10	0	97.6	80-120	0			
Magnesium	9.733	0.20	10	0	97.3	80-120	0			
Nickel	0.09624	0.0050	0.1	0	96.2	80-120	0			
Potassium	9.755	0.20	10	0	97.6	80-120	0			
Sodium	9.634	0.20	10	0	96.3	80-120	0			
Vanadium	0.09707	0.0050	0.1	0	97.1	80-120	0			

LCSD Sample ID: **LCSD-29958-29958** Units: **mg/L** Analysis Date: **10/14/2010 02:45 PM**

Client ID: Run ID: **ICPMS2_101014A** SeqNo: **1450778** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.09629	0.0050	0.1	0	96.3	80-120	0.09548	0.845	20	
Calcium	9.686	0.50	10	0	96.9	80-120	9.661	0.258	20	
Iron	9.812	0.080	10	0	98.1	80-120	9.756	0.572	20	
Magnesium	9.717	0.20	10	0	97.2	80-120	9.733	0.165	20	
Nickel	0.09713	0.0050	0.1	0	97.1	80-120	0.09624	0.921	20	
Potassium	9.732	0.20	10	0	97.3	80-120	9.755	0.236	20	
Sodium	9.657	0.20	10	0	96.6	80-120	9.634	0.238	20	
Vanadium	0.09729	0.0050	0.1	0	97.3	80-120	0.09707	0.226	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29958** Instrument ID **ICPMS2** Method: **SW6020A**

MS Sample ID: **1010353-01CMS** Units: **mg/L** Analysis Date: **10/14/2010 05:02 PM**

Client ID: **WGC10131220BAW1** Run ID: **ICPMS2_101014A** SeqNo: **1450796** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1231	0.0050	0.1	0.02918	93.9	80-120	0			
Calcium	77.7	0.50	10	68.09	96.1	80-120	0			O
Iron	24.75	0.080	10	15.29	94.6	80-120	0			
Magnesium	30.86	0.20	10	21.33	95.3	80-120	0			
Nickel	0.1073	0.0050	0.1	0.01085	96.4	80-120	0			
Potassium	12.21	0.20	10	2.692	95.2	80-120	0			
Sodium	42.11	0.20	10	32.36	97.5	80-120	0			
Vanadium	0.1403	0.0050	0.1	0.04659	93.7	80-120	0			

MSD Sample ID: **1010353-01CMSD** Units: **mg/L** Analysis Date: **10/14/2010 05:07 PM**

Client ID: **WGC10131220BAW1** Run ID: **ICPMS2_101014A** SeqNo: **1450797** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1202	0.0050	0.1	0.02918	91	80-120	0.1231	2.38	20	
Calcium	76.42	0.50	10	68.09	83.3	80-120	77.7	1.66	20	O
Iron	24.09	0.080	10	15.29	88	80-120	24.75	2.7	20	
Magnesium	30.27	0.20	10	21.33	89.4	80-120	30.86	1.93	20	
Nickel	0.1103	0.0050	0.1	0.01085	99.4	80-120	0.1073	2.76	20	
Potassium	11.95	0.20	10	2.692	92.6	80-120	12.21	2.15	20	
Sodium	41.33	0.20	10	32.36	89.7	80-120	42.11	1.87	20	
Vanadium	0.1379	0.0050	0.1	0.04659	91.3	80-120	0.1403	1.73	20	

The following samples were analyzed in this batch:

1010353-01C	1010353-02C	1010353-03C
1010353-05C		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82520** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MBLK Sample ID: **MBLK-R82520-R82520** Units: **mg/L** Analysis Date: **10/14/2010 11:58 AM**
Client ID: Run ID: **ICPMS2_101014A** SeqNo: **1451064** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	0.004457	0.20								J
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	0.006481	0.20								J
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-R82520-R82520** Units: **mg/L** Analysis Date: **10/14/2010 11:53 AM**
Client ID: Run ID: **ICPMS2_101014A** SeqNo: **1451063** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.0971	0.0050	0.1	0	97.1	80-120	0			
Calcium	9.81	0.50	10	0	98.1	80-120	0			
Iron	9.87	0.080	10	0	98.7	80-120	0			
Magnesium	10.04	0.20	10	0	100	80-120	0			
Nickel	0.09789	0.0050	0.1	0	97.9	80-120	0			
Potassium	9.957	0.20	10	0	99.6	80-120	0			
Sodium	9.976	0.20	10	0	99.8	80-120	0			
Vanadium	0.1001	0.0050	0.1	0	100	80-120	0			

LCSD Sample ID: **LCSD-R82520-R82520** Units: **mg/L** Analysis Date: **10/14/2010 12:57 PM**
Client ID: Run ID: **ICPMS2_101014A** SeqNo: **1451065** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.0981	0.0050	0.1	0	98.1	80-120	0.0971	1.02	20	
Calcium	9.743	0.50	10	0	97.4	80-120	9.81	0.685	20	
Iron	9.778	0.080	10	0	97.8	80-120	9.87	0.936	20	
Magnesium	10.02	0.20	10	0	100	80-120	10.04	0.199	20	
Nickel	0.09655	0.0050	0.1	0	96.6	80-120	0.09789	1.38	20	
Potassium	9.798	0.20	10	0	98	80-120	9.957	1.61	20	
Sodium	10.01	0.20	10	0	100	80-120	9.976	0.34	20	
Vanadium	0.09922	0.0050	0.1	0	99.2	80-120	0.1001	0.883	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82520** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MS Sample ID: **1010353-01DMS** Units: **mg/L** Analysis Date: **10/14/2010 12:08 PM**

Client ID: **WGC10131220BAW1** Run ID: **ICPMS2_101014A** SeqNo: **1450750** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1091	0.0050	0.1	0.021	88.1	80-120	0			
Calcium	75.22	0.50	10	66.72	85	80-120	0			O
Iron	15.09	0.080	10	5.804	92.9	80-120	0			
Magnesium	29.97	0.20	10	20.9	90.7	80-120	0			
Nickel	0.09174	0.0050	0.1	0.006304	85.4	80-120	0			
Potassium	11.98	0.20	10	2.92	90.6	80-120	0			
Sodium	40.35	0.20	10	31.37	89.8	80-120	0			
Vanadium	0.114	0.0050	0.1	0.02312	90.9	80-120	0			

MSD Sample ID: **1010353-01DMSD** Units: **mg/L** Analysis Date: **10/14/2010 12:13 PM**

Client ID: **WGC10131220BAW1** Run ID: **ICPMS2_101014A** SeqNo: **1450751** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1327	0.0050	0.1	0.021	112	80-120	0.1091	19.5	20	
Calcium	77.58	0.50	10	66.72	109	80-120	75.22	3.09	20	O
Iron	17.3	0.080	10	5.804	115	80-120	15.09	13.6	20	
Magnesium	31.96	0.20	10	20.9	111	80-120	29.97	6.43	20	
Nickel	0.1168	0.0050	0.1	0.006304	110	80-120	0.09174	24	20	R
Potassium	14.43	0.20	10	2.92	115	80-120	11.98	18.6	20	
Sodium	42.38	0.20	10	31.37	110	80-120	40.35	4.91	20	
Vanadium	0.138	0.0050	0.1	0.02312	115	80-120	0.114	19	20	

The following samples were analyzed in this batch:

1010353-01D	1010353-02D	1010353-03D
1010353-05D		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MBLK Sample ID: **SBLKW1-29957-29957** Units: **µg/L** Analysis Date: **10/14/2010 02:49 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450726** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	ND	5.0								
Acenaphthene	ND	5.0								
Acenaphthylene	ND	5.0								
Anthracene	ND	5.0								
Benzo(a)anthracene	ND	5.0								
Benzo(a)pyrene	ND	5.0								
Benzo(b)fluoranthene	ND	5.0								
Benzo(g,h,i)perylene	ND	5.0								
Benzo(k)fluoranthene	ND	5.0								
Chrysene	ND	5.0								
Dibenzo(a,h)anthracene	ND	5.0								
Fluoranthene	ND	5.0								
Fluorene	ND	5.0								
Indeno(1,2,3-cd)pyrene	ND	5.0								
Naphthalene	ND	5.0								
Phenanthrene	ND	5.0								
Pyrene	ND	5.0								
Surr: 2,4,6-Tribromophenol	*49.79*	0	*50*	0	*99.6*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*32.31*	0	*50*	0	*64.6*	*50-110*	0			
Surr: 2-Fluorophenol	*23.59*	0	*50*	0	*47.2*	*20-110*	0			
Surr: 4-Terphenyl-d14	*44.72*	0	*50*	0	*89.4*	*50-125*	0			
Surr: Nitrobenzene-d5	*33.12*	0	*50*	0	*66.2*	*40-110*	0			
Surr: Phenol-d6	*13.74*	0	*50*	0	*27.5*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

LCS Sample ID: **SLCSW1-29957-29957** Units: **µg/L** Analysis Date: **10/14/2010 12:13 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450722** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	27.46	5.0	40	0	68.6	45-105	0			
Acenaphthene	27.95	5.0	40	0	69.9	45-110	0			
Acenaphthylene	28.15	5.0	40	0	70.4	50-105	0			
Anthracene	27.91	5.0	40	0	69.8	55-110	0			
Benzo(a)anthracene	35.1	5.0	40	0	87.8	55-110	0			
Benzo(a)pyrene	30.37	5.0	40	0	75.9	55-110	0			
Benzo(b)fluoranthene	30.18	5.0	40	0	75.4	45-120	0			
Benzo(g,h,i)perylene	29.12	5.0	40	0	72.8	40-125	0			
Benzo(k)fluoranthene	30.24	5.0	40	0	75.6	45-125	0			
Chrysene	32.33	5.0	40	0	80.8	55-110	0			
Dibenzo(a,h)anthracene	32.09	5.0	40	0	80.2	40-125	0			
Fluoranthene	29.47	5.0	40	0	73.7	55-115	0			
Fluorene	27.76	5.0	40	0	69.4	50-110	0			
Indeno(1,2,3-cd)pyrene	31.24	5.0	40	0	78.1	45-125	0			
Naphthalene	28.07	5.0	40	0	70.2	40-100	0			
Phenanthrene	29.87	5.0	40	0	74.7	50-115	0			
Pyrene	31.81	5.0	40	0	79.5	50-130	0			
Surr: 2,4,6-Tribromophenol	*37.04*	0	*50*	0	*74.1*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*32.12*	0	*50*	0	*64.2*	*50-110*	0			
Surr: 2-Fluorophenol	*23.87*	0	*50*	0	*47.7*	*20-110*	0			
Surr: 4-Terphenyl-d14	*36.75*	0	*50*	0	*73.5*	*50-125*	0			
Surr: Nitrobenzene-d5	*34.12*	0	*50*	0	*68.2*	*40-110*	0			
Surr: Phenol-d6	*13.45*	0	*50*	0	*26.9*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

LCSD Sample ID: **SLCSDW1-29957-29957** Units: **µg/L** Analysis Date: **10/14/2010 12:44 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450723** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	27.43	5.0	40	0	68.6	45-105	27.46	0.109	30	
Acenaphthene	27.72	5.0	40	0	69.3	45-110	27.95	0.826	30	
Acenaphthylene	27.68	5.0	40	0	69.2	50-105	28.15	1.68	30	
Anthracene	28.05	5.0	40	0	70.1	55-110	27.91	0.5	30	
Benzo(a)anthracene	35.13	5.0	40	0	87.8	55-110	35.1	0.0854	30	
Benzo(a)pyrene	31.14	5.0	40	0	77.8	55-110	30.37	2.5	30	
Benzo(b)fluoranthene	30.83	5.0	40	0	77.1	45-120	30.18	2.13	30	
Benzo(g,h,i)perylene	29.5	5.0	40	0	73.8	40-125	29.12	1.3	30	
Benzo(k)fluoranthene	30.9	5.0	40	0	77.2	45-125	30.24	2.16	30	
Chrysene	32.41	5.0	40	0	81	55-110	32.33	0.247	30	
Dibenzo(a,h)anthracene	31.72	5.0	40	0	79.3	40-125	32.09	1.16	30	
Fluoranthene	30.3	5.0	40	0	75.8	55-115	29.47	2.78	30	
Fluorene	27.39	5.0	40	0	68.5	50-110	27.76	1.34	30	
Indeno(1,2,3-cd)pyrene	31.18	5.0	40	0	78	45-125	31.24	0.192	30	
Naphthalene	28.14	5.0	40	0	70.4	40-100	28.07	0.249	30	
Phenanthrene	30.17	5.0	40	0	75.4	50-115	29.87	0.999	30	
Pyrene	32.08	5.0	40	0	80.2	50-130	31.81	0.845	30	
Surr: 2,4,6-Tribromophenol	*37.74*	0	*50*	0	*75.5*	*40-125*	37.04	*1.87*	*40*	
Surr: 2-Fluorobiphenyl	*32*	0	*50*	0	*64*	*50-110*	32.12	*0.374*	*40*	
Surr: 2-Fluorophenol	*23.03*	0	*50*	0	*46.1*	*20-110*	23.87	*3.58*	*40*	
Surr: 4-Terphenyl-d14	*33.06*	0	*50*	0	*66.1*	*50-125*	36.75	*10.6*	*40*	
Surr: Nitrobenzene-d5	*34.81*	0	*50*	0	*69.6*	*40-110*	34.12	*2*	*40*	
Surr: Phenol-d6	*13.2*	0	*50*	0	*26.4*	*20-110*	13.45	*1.88*	*40*	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MS Sample ID: **1010353-01B MS** Units: **µg/L** Analysis Date: **10/14/2010 01:15 PM**

Client ID: **WGC10131220BAW1** Run ID: **SVMS4_101014A** SeqNo: **1450724** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	263.9	50	400	0	66	45-105	0			
Acenaphthene	270.1	50	400	0	67.5	45-110	0			
Acenaphthylene	271.5	50	400	0	67.9	50-105	0			
Anthracene	259.6	50	400	0	64.9	55-110	0			
Benzo(a)anthracene	324.3	50	400	0	81.1	55-110	0			
Benzo(a)pyrene	280.3	50	400	0	70.1	55-110	0			
Benzo(b)fluoranthene	281.3	50	400	0	70.3	45-120	0			
Benzo(g,h,i)perylene	273.1	50	400	0	68.3	40-125	0			
Benzo(k)fluoranthene	275.9	50	400	0	69	45-125	0			
Chrysene	301.6	50	400	0	75.4	55-110	0			
Dibenzo(a,h)anthracene	296.8	50	400	0	74.2	40-125	0			
Fluoranthene	273.9	50	400	0	68.5	55-115	0			
Fluorene	271.7	50	400	0	67.9	50-110	0			
Indeno(1,2,3-cd)pyrene	292.1	50	400	0	73	45-125	0			
Naphthalene	269.5	50	400	0	67.4	40-100	0			
Phenanthrene	286.5	50	400	0	71.6	50-115	0			
Pyrene	302.3	50	400	0	75.6	50-130	0			
Surr: 2,4,6-Tribromophenol	*368*	0	*500*	0	*73.6*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*310.1*	0	*500*	0	*62*	*50-110*	0			
Surr: 2-Fluorophenol	*218.4*	0	*500*	0	*43.7*	*20-110*	0			
Surr: 4-Terphenyl-d14	*346.9*	0	*500*	0	*69.4*	*50-125*	0			
Surr: Nitrobenzene-d5	*324.1*	0	*500*	0	*64.8*	*40-110*	0			
Surr: Phenol-d6	*128.2*	0	*500*	0	*25.6*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MS Sample ID: **1010389-01B MS** Units: **µg/L** Analysis Date: **10/15/2010 03:13 PM**

Client ID: Run ID: **SVMS4_101015A** SeqNo: **1452084** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	314.8	50	400	0	78.7	45-105	0			
Acenaphthene	313.6	50	400	0	78.4	45-110	0			
Acenaphthylene	315.5	50	400	0	78.9	50-105	0			
Anthracene	316.3	50	400	0	79.1	55-110	0			
Benzo(a)anthracene	394	50	400	0	98.5	55-110	0			
Benzo(a)pyrene	344.7	50	400	0	86.2	55-110	0			
Benzo(b)fluoranthene	338.1	50	400	0	84.5	45-120	0			
Benzo(g,h,i)perylene	293.1	50	400	0	73.3	40-125	0			
Benzo(k)fluoranthene	389.8	50	400	0	97.4	45-125	0			
Chrysene	365.7	50	400	0	91.4	55-110	0			
Dibenzo(a,h)anthracene	297.6	50	400	0	74.4	40-125	0			
Fluoranthene	329.2	50	400	0	82.3	55-115	0			
Fluorene	320.7	50	400	0	80.2	50-110	0			
Indeno(1,2,3-cd)pyrene	294.6	50	400	0	73.6	45-125	0			
Naphthalene	320.3	50	400	0	80.1	40-100	0			
Phenanthrene	336.8	50	400	0	84.2	50-115	0			
Pyrene	374	50	400	0	93.5	50-130	0			
Surr: 2,4,6-Tribromophenol	*413.3*	0	*500*	0	*82.7*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*382.3*	0	*500*	0	*76.5*	*50-110*	0			
Surr: 2-Fluorophenol	*222.2*	0	*500*	0	*44.4*	*20-110*	0			
Surr: 4-Terphenyl-d14	*416.5*	0	*500*	0	*83.3*	*50-125*	0			
Surr: Nitrobenzene-d5	*417.2*	0	*500*	0	*83.4*	*40-110*	0			
Surr: Phenol-d6	*144.5*	0	*500*	0	*28.9*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MSD Sample ID: **1010353-01B MSD** Units: **µg/L** Analysis Date: **10/14/2010 01:46 PM**

Client ID: **WGC10131220BAW1** Run ID: **SVMS4_101014A** SeqNo: **1450725** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	245.6	50	400	0	61.4	45-105	263.9	7.18	30	
Acenaphthene	248.5	50	400	0	62.1	45-110	270.1	8.33	30	
Acenaphthylene	252.3	50	400	0	63.1	50-105	271.5	7.33	30	
Anthracene	232.7	50	400	0	58.2	55-110	259.6	10.9	30	
Benzo(a)anthracene	282.6	50	400	0	70.6	55-110	324.3	13.7	30	
Benzo(a)pyrene	249.4	50	400	0	62.4	55-110	280.3	11.7	30	
Benzo(b)fluoranthene	242.3	50	400	0	60.6	45-120	281.3	14.9	30	
Benzo(g,h,i)perylene	244.3	50	400	0	61.1	40-125	273.1	11.1	30	
Benzo(k)fluoranthene	248.4	50	400	0	62.1	45-125	275.9	10.5	30	
Chrysene	262.4	50	400	0	65.6	55-110	301.6	13.9	30	
Dibenzo(a,h)anthracene	260.4	50	400	0	65.1	40-125	296.8	13.1	30	
Fluoranthene	243.7	50	400	0	60.9	55-115	273.9	11.7	30	
Fluorene	243.8	50	400	0	61	50-110	271.7	10.8	30	
Indeno(1,2,3-cd)pyrene	257.9	50	400	0	64.5	45-125	292.1	12.4	30	
Naphthalene	257.3	50	400	0	64.3	40-100	269.5	4.63	30	
Phenanthrene	257.4	50	400	0	64.4	50-115	286.5	10.7	30	
Pyrene	266	50	400	0	66.5	50-130	302.3	12.8	30	
Surr: 2,4,6-Tribromophenol	*358.1*	0	*500*	0	*71.6*	*40-125*	368	*2.73*	*40*	
Surr: 2-Fluorobiphenyl	*283*	0	*500*	0	*56.6*	*50-110*	310.1	*9.14*	*40*	
Surr: 2-Fluorophenol	*209.7*	0	*500*	0	*41.9*	*20-110*	218.4	*4.06*	*40*	
Surr: 4-Terphenyl-d14	*260.5*	0	*500*	0	*52.1*	*50-125*	346.9	*28.4*	*40*	
Surr: Nitrobenzene-d5	*311.9*	0	*500*	0	*62.4*	*40-110*	324.1	*3.84*	*40*	
Surr: Phenol-d6	*129.2*	0	*500*	0	*25.8*	*20-110*	128.2	*0.777*	*40*	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MSD Sample ID: **1010389-01B MSD** Units: **µg/L** Analysis Date: **10/15/2010 03:44 PM**

Client ID: Run ID: **SVMS4_101015A** SeqNo: **1452085** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	307.3	50	400	0	76.8	45-105	314.8	2.41	30	
Acenaphthene	308.6	50	400	0	77.2	45-110	313.6	1.61	30	
Acenaphthylene	309.3	50	400	0	77.3	50-105	315.5	1.98	30	
Anthracene	316.5	50	400	0	79.1	55-110	316.3	0.0632	30	
Benzo(a)anthracene	398.9	50	400	0	99.7	55-110	394	1.24	30	
Benzo(a)pyrene	346.5	50	400	0	86.6	55-110	344.7	0.521	30	
Benzo(b)fluoranthene	334	50	400	0	83.5	45-120	338.1	1.22	30	
Benzo(g,h,i)perylene	291.3	50	400	0	72.8	40-125	293.1	0.616	30	
Benzo(k)fluoranthene	393.7	50	400	0	98.4	45-125	389.8	0.996	30	
Chrysene	375.8	50	400	0	94	55-110	365.7	2.72	30	
Dibenzo(a,h)anthracene	298.3	50	400	0	74.6	40-125	297.6	0.235	30	
Fluoranthene	337.3	50	400	0	84.3	55-115	329.2	2.43	30	
Fluorene	314.4	50	400	0	78.6	50-110	320.7	1.98	30	
Indeno(1,2,3-cd)pyrene	295.9	50	400	0	74	45-125	294.6	0.44	30	
Naphthalene	311.6	50	400	0	77.9	40-100	320.3	2.75	30	
Phenanthrene	342.5	50	400	0	85.6	50-115	336.8	1.68	30	
Pyrene	378.9	50	400	0	94.7	50-130	374	1.3	30	
Surr: 2,4,6-Tribromophenol	*420.4*	0	*500*	0	*84.1*	*40-125*	413.3	*1.7*	*40*	
Surr: 2-Fluorobiphenyl	*371.4*	0	*500*	0	*74.3*	*50-110*	382.3	*2.89*	*40*	
Surr: 2-Fluorophenol	*239.1*	0	*500*	0	*47.8*	*20-110*	222.2	*7.33*	*40*	
Surr: 4-Terphenyl-d14	*419.8*	0	*500*	0	*84*	*50-125*	416.5	*0.789*	*40*	
Surr: Nitrobenzene-d5	*417.8*	0	*500*	0	*83.6*	*40-110*	417.2	*0.144*	*40*	
Surr: Phenol-d6	*152.9*	0	*500*	0	*30.6*	*20-110*	144.5	*5.65*	*40*	

The following samples were analyzed in this batch: 1010353-01B 1010353-02B 1010353-03B 1010353-05B

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82464** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW2-101013-R82464** Units: **µg/L** Analysis Date: **10/14/2010 03:27 AM**

Client ID: Run ID: **VMS7_101013B** SeqNo: **1449531** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*115.9*	0	*100*	0	*116*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*93.69*	0	*100*	0	*93.7*	*75-120*	0			
Surr: Dibromofluoromethane	*107.9*	0	*100*	0	*108*	*85-115*	0			
Surr: Toluene-d8	*101.6*	0	*100*	0	*102*	*85-120*	0			

LCS Sample ID: **VLCSW2-101013-R82464** Units: **µg/L** Analysis Date: **10/14/2010 02:05 AM**

Client ID: Run ID: **VMS7_101013B** SeqNo: **1449249** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	19.3	1.0	20	0	96.5	75-130	0			
1,3,5-Trimethylbenzene	20.21	1.0	20	0	101	75-130	0			
Benzene	21.03	1.0	20	0	105	80-120	0			
Ethylbenzene	21.65	1.0	20	0	108	75-125	0			
Isopropylbenzene	23.86	1.0	20	0	119	75-125	0			
n-Propylbenzene	20.82	1.0	20	0	104	70-130	0			
Naphthalene	21.45	5.0	20	0	107	55-140	0			
p-Isopropyltoluene	20	2.0	20	0	100	75-130	0			
sec-Butylbenzene	19.55	2.0	20	0	97.8	70-125	0			
Toluene	20.61	1.0	20	0	103	75-120	0			
Xylenes, Total	64.38	2.0	60	0	107	75-130	0			
Surr: 1,2-Dichloroethane-d4	*110.5*	0	*100*	0	*111*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*97.04*	0	*100*	0	*97*	*75-120*	0			
Surr: Dibromofluoromethane	*109.2*	0	*100*	0	*109*	*85-115*	0			
Surr: Toluene-d8	*105.7*	0	*100*	0	*106*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82464** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW2-101013-R82464** Units: **µg/L** Analysis Date: **10/14/2010 02:32 AM**

Client ID: Run ID: **VMS7_101013B** SeqNo: **1449250** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	18.82	1.0	20	0	94.1	75-130	19.3	2.52	30	
1,3,5-Trimethylbenzene	19.68	1.0	20	0	98.4	75-130	20.21	2.66	30	
Benzene	20.41	1.0	20	0	102	80-120	21.03	2.99	30	
Ethylbenzene	20.88	1.0	20	0	104	75-125	21.65	3.62	30	
Isopropylbenzene	22.91	1.0	20	0	115	75-125	23.86	4.06	30	
n-Propylbenzene	20.07	1.0	20	0	100	70-130	20.82	3.67	30	
Naphthalene	20.02	5.0	20	0	100	55-140	21.45	6.9	30	
p-Isopropyltoluene	18.72	2.0	20	0	93.6	75-130	20	6.61	30	
sec-Butylbenzene	18.54	2.0	20	0	92.7	70-125	19.55	5.3	30	
Toluene	19.89	1.0	20	0	99.4	75-120	20.61	3.56	30	
Xylenes, Total	62.42	2.0	60	0	104	75-130	64.38	3.09	30	
Surr: 1,2-Dichloroethane-d4	*110.8*	0	*100*	0	*111*	*70-120*	110.5	*0.262*	*30*	
Surr: 4-Bromofluorobenzene	*97.55*	0	*100*	0	*97.6*	*75-120*	97.04	*0.524*	*30*	
Surr: Dibromofluoromethane	*110.4*	0	*100*	0	*110*	*85-115*	109.2	*1.08*	*30*	
Surr: Toluene-d8	*106.3*	0	*100*	0	*106*	*85-120*	105.7	*0.519*	*30*	

MS Sample ID: **1010222-05A MS** Units: **µg/Kg** Analysis Date: **10/14/2010 11:38 AM**

Client ID: Run ID: **VMS7_101013B** SeqNo: **1449926** Prep Date: DF: **100**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	2120	100	2000	0	106	65-135	0			
1,3,5-Trimethylbenzene	2201	100	2000	0	110	65-135	0			
Benzene	2302	100	2000	30	114	75-125	0			
Ethylbenzene	2249	200	2000	0	112	75-125	0			
Isopropylbenzene	2525	100	2000	0	126	75-130	0			
n-Propylbenzene	2248	200	2000	0	112	65-135	0			
Naphthalene	1855	200	2000	0	92.8	40-140	0			
p-Isopropyltoluene	1997	950	2000	0	99.8	75-135	0			
sec-Butylbenzene	2087	100	2000	0	104	65-130	0			
Toluene	2123	150	2000	0	106	70-125	0			
Xylenes, Total	6774	300	6000	0	113	75-125	0			
Surr: 1,2-Dichloroethane-d4	*11490*	0	*10000*	0	*115*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*10380*	0	*10000*	0	*104*	*75-120*	0			
Surr: Dibromofluoromethane	*11090*	0	*10000*	0	*111*	*85-115*	0			
Surr: Toluene-d8	*10460*	0	*10000*	0	*105*	*85-115*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82464** Instrument ID **VMS7** Method: **SW8260**

MS Sample ID: **1010353-01A MS** Units: **µg/L** Analysis Date: **10/14/2010 12:32 PM**

Client ID: **WGC10131220BAW1** Run ID: **VMS7_101013B** SeqNo: **1449929** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.54	1.0	20	0	103	75-130	0			
1,3,5-Trimethylbenzene	20.98	1.0	20	0	105	75-130	0			
Benzene	22.33	1.0	20	0	112	80-120	0			
Ethylbenzene	22.03	1.0	20	0	110	75-125	0			
Isopropylbenzene	24.34	1.0	20	0	122	75-125	0			
n-Propylbenzene	21.65	1.0	20	0	108	70-130	0			
Naphthalene	20.66	5.0	20	0	103	55-140	0			
p-Isopropyltoluene	19.37	2.0	20	0	96.8	75-130	0			
sec-Butylbenzene	20.41	2.0	20	0	102	70-125	0			
Toluene	21.62	1.0	20	0	108	75-120	0			
Xylenes, Total	66.57	2.0	60	0	111	75-130	0			
Surr: 1,2-Dichloroethane-d4	*112.6*	0	*100*	0	*113*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*101.7*	0	*100*	0	*102*	*75-120*	0			
Surr: Dibromofluoromethane	*110.9*	0	*100*	0	*111*	*85-115*	0			
Surr: Toluene-d8	*107.7*	0	*100*	0	*108*	*85-120*	0			

MSD Sample ID: **1010222-05A MSD** Units: **µg/Kg** Analysis Date: **10/14/2010 12:05 PM**

Client ID: Run ID: **VMS7_101013B** SeqNo: **1449927** Prep Date: DF: **100**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	2007	100	2000	0	100	65-135	2120	5.48	30	
1,3,5-Trimethylbenzene	2111	100	2000	0	106	65-135	2201	4.17	30	
Benzene	2237	100	2000	30	110	75-125	2302	2.86	30	
Ethylbenzene	2175	200	2000	0	109	75-125	2249	3.35	30	
Isopropylbenzene	2424	100	2000	0	121	75-130	2525	4.08	30	
n-Propylbenzene	2148	200	2000	0	107	65-135	2248	4.55	30	
Naphthalene	1948	200	2000	0	97.4	40-140	1855	4.89	30	
p-Isopropyltoluene	1974	950	2000	0	98.7	75-135	1997	1.16	30	
sec-Butylbenzene	2004	100	2000	0	100	65-130	2087	4.06	30	
Toluene	2042	150	2000	0	102	70-125	2123	3.89	30	
Xylenes, Total	6481	300	6000	0	108	75-125	6774	4.42	30	
Surr: 1,2-Dichloroethane-d4	*11290*	0	*10000*	0	*113*	*70-120*	11490	*1.77*	*30*	
Surr: 4-Bromofluorobenzene	*9990*	0	*10000*	0	*99.9*	*75-120*	10380	*3.88*	*30*	
Surr: Dibromofluoromethane	*11110*	0	*10000*	0	*111*	*85-115*	11090	*0.198*	*30*	
Surr: Toluene-d8	*10330*	0	*10000*	0	*103*	*85-115*	10460	*1.25*	*30*	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82464** Instrument ID **VMS7** Method: **SW8260**

MSD Sample ID: **1010353-01A MSD** Units: **µg/L** Analysis Date: **10/14/2010 12:59 PM**

Client ID: **WGC10131220BAW1** Run ID: **VMS7_101013B** SeqNo: **1449930** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.6	1.0	20	0	103	75-130	20.54	0.292	30	
1,3,5-Trimethylbenzene	21.05	1.0	20	0	105	75-130	20.98	0.333	30	
Benzene	21.86	1.0	20	0	109	80-120	22.33	2.13	30	
Ethylbenzene	22.11	1.0	20	0	111	75-125	22.03	0.362	30	
Isopropylbenzene	23.97	1.0	20	0	120	75-125	24.34	1.53	30	
n-Propylbenzene	21.42	1.0	20	0	107	70-130	21.65	1.07	30	
Naphthalene	20.3	5.0	20	0	102	55-140	20.66	1.76	30	
p-Isopropyltoluene	19.01	2.0	20	0	95	75-130	19.37	1.88	30	
sec-Butylbenzene	20.31	2.0	20	0	102	70-125	20.41	0.491	30	
Toluene	21.27	1.0	20	0	106	75-120	21.62	1.63	30	
Xylenes, Total	65.61	2.0	60	0	109	75-130	66.57	1.45	30	
Surr: 1,2-Dichloroethane-d4	*112.6*	0	*100*	0	*113*	*70-120*	112.6	*0*	*30*	
Surr: 4-Bromofluorobenzene	*102.4*	0	*100*	0	*102*	*75-120*	101.7	*0.598*	*30*	
Surr: Dibromofluoromethane	*111.8*	0	*100*	0	*112*	*85-115*	110.9	*0.754*	*30*	
Surr: Toluene-d8	*107.5*	0	*100*	0	*108*	*85-120*	107.7	*0.167*	*30*	

The following samples were analyzed in this batch:

1010353-01A	1010353-02A	1010353-03A
1010353-04A	1010353-05A	1010353-06A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82517** Instrument ID **WETCHEM** Method: **A2320 B**

MBLK Sample ID: **WBLKW1-101013-R82517** Units: **mg/L** Analysis Date: **10/13/2010 05:00 PM**
Client ID: Run ID: **WETCHEM_101013I** SeqNo: **1450706** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	2	10								J
Alkalinity, Carbonate (as CaCO3)	2	10								J

LCS Sample ID: **WLCSW1-101013-R82517** Units: **mg/L** Analysis Date: **10/13/2010 05:00 PM**
Client ID: Run ID: **WETCHEM_101013I** SeqNo: **1450707** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	860	10	1000	0	86	80-120	0			
Alkalinity, Carbonate (as CaCO3)	860	10	1000	0	86	80-120	0			

LCSD Sample ID: **WLCSDW1-101013-R82517** Units: **mg/L** Analysis Date: **10/13/2010 05:00 PM**
Client ID: Run ID: **WETCHEM_101013I** SeqNo: **1450713** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	860	10	1000	0	86	80-120	860	0	20	
Alkalinity, Carbonate (as CaCO3)	860	10	1000	0	86	80-120	860	0	20	

DUP Sample ID: **1010353-01D DUP** Units: **mg/L** Analysis Date: **10/13/2010 05:00 PM**
Client ID: **WGC10131220BAW1** Run ID: **WETCHEM_101013I** SeqNo: **1450709** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	237.8	10	0	0	0		239.8	0.838	20	
Alkalinity, Carbonate (as CaCO3)	1.2	10	0	0	0		1.2	0	20	J

The following samples were analyzed in this batch: 1010353-01D 1010353-02D 1010353-03D 1010353-05D

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82522** Instrument ID **IC3** Method: **SW9056**

MBLK Sample ID: **CCB/MBLK-R82522** Units: **mg/L** Analysis Date: **10/14/2010 05:24 AM**
Client ID: Run ID: **IC3_101014A** SeqNo: **1450917** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	ND	1.0								
Sulfate	ND	1.0								

LCS Sample ID: **CCV/LCS-R82522** Units: **mg/L** Analysis Date: **10/14/2010 04:44 AM**
Client ID: Run ID: **IC3_101014A** SeqNo: **1450915** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.91	1.0	10	0	99.1	80-120	0			
Sulfate	9.868	1.0	10	0	98.7	80-120	0			

LCSD Sample ID: **CCV/LCSD-R82522** Units: **mg/L** Analysis Date: **10/14/2010 05:04 AM**
Client ID: Run ID: **IC3_101014A** SeqNo: **1450916** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	10.14	1.0	10	0	101	80-120	9.91	2.3	20	
Sulfate	10.18	1.0	10	0	102	80-120	9.868	3.12	20	

MS Sample ID: **1010305-13A MS** Units: **mg/L** Analysis Date: **10/14/2010 10:22 AM**
Client ID: Run ID: **IC3_101014A** SeqNo: **1450932** Prep Date: DF: **2**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	14.76	2.0	10	5.238	95.2	75-125	0			
Sulfate	31.77	2.0	10	21.97	97.9	75-125	0			

MS Sample ID: **1010353-01D MS** Units: **mg/L** Analysis Date: **10/14/2010 12:00 PM**
Client ID: **WGC10131220BAW1** Run ID: **IC3_101014A** SeqNo: **1450937** Prep Date: DF: **4**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	40.3	4.0	10	31.13	91.7	75-125	0			
Sulfate	61.01	4.0	10	51.83	91.8	75-125	0			O

MSD Sample ID: **1010305-13A MSD** Units: **mg/L** Analysis Date: **10/14/2010 10:42 AM**
Client ID: Run ID: **IC3_101014A** SeqNo: **1450933** Prep Date: DF: **2**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	14.72	2.0	10	5.238	94.8	75-125	14.76	0.271	20	
Sulfate	30.7	2.0	10	21.97	87.2	75-125	31.77	3.43	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010353
Project: Marshall Oil Spill Hydrogeo Study 10/13/10

QC BATCH REPORT

Batch ID: **R82522** Instrument ID **IC3** Method: **SW9056**

MSD Sample ID: **1010353-01D MSD** Units: **mg/L** Analysis Date: **10/14/2010 12:20 PM**

Client ID: **WGC10131220BAW1** Run ID: **IC3_101014A** SeqNo: **1450938** Prep Date: DF: **4**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	40.82	4.0	10	31.13	96.9	75-125	40.3	1.28	20	
Sulfate	62.32	4.0	10	51.83	105	75-125	61.01	2.12	20	O

The following samples were analyzed in this batch: 1010353-01D 1010353-02D 1010353-03D 1010353-05D

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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Chain of Custody Form

Page 1 of 1

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ALS Project Manager: | ALS Work Order #: 1010353

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filter)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGC10131220BAW1 -1	10/13/10	1220	W	-	7	X	X	X	X	X	X	MWKR0580L03				
2	WGC10131220BAW3 (MS/MSD)	10/13/10	1220	W	-	7	X	X	X	X	X	X	MWKR0580L03				
3	WGC10130900BAW1 -2	10/13/10	0900	W	-	7	X	X	X	X	X	X	MWKR0570R03				
4	WGC10131435BAW1 -3	10/13/10	1435	W	-	7	X	X	X	X	X	X	MWKR0580L02				
5	WGC10131545BAW5 -4	10/13/10				1	X										
6	WGC10131600BAW4 -5	10/13/10	1600	W	-	7	X	X	X	X	X	X					
7	WGC10131605BAW5 -6	10/13/10				1	X										
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Bridget Walsh Bridget Walsh | Shipment Method | Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour | Results Due Date:

Relinquished by: Bridget Walsh	Date: 10/13/10	Time: 1605	Received by:	Notes:
Relinquished by:	Date: 10/13/10	Time:	Received by (Laboratory):	
Logged by (Laboratory):	Date: 10/14/10	Time: 0749	Checked by (Laboratory):	

Cooler ID	Cooler Temp

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Laboratory Group.
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Sample Receipt Checklist

Client Name: **AECOM - GR** Date/Time Received: **13-Oct-10 16:05**

Work Order: **1010353** Received by: **MA**

Checklist completed by Bill Carey (eSignature) 14-Oct-10 (Date) Reviewed by: Ann Preston (eSignature) 14-Oct-10 (Date)

Matrices: Water
Carrier name: ALSHN

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	4.0 C		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☑	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☑	No ☐	N/A ☐
pH adjusted?	Yes ☐	No ☑	N/A ☐
pH adjusted by:			

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

US EPA ARCHIVE DOCUMENT

☐ ALS Laboratory Group
10450 Stancliff Rd., Suite 210
Houston, Texas 77099
Tel. +1 281 530 5656
Fax. +1 281 530 5887

Chain of Custody Form

Page 1 of 1

☐ ALS Laboratory Group
3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | ALS Work Order #: 1010353

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filter)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGC10131220BAW1 -1	10/13/10	1220	W	-	7	X	X	X	X	X	X	MWKR0580L03				
2	WGC10131220BAW3 (MS/MSD)	10/13/10	1220	W	-	7	X	X	X	X	X	X	MWKR0580L03				
3	WGC10130900BAW1 -2	10/13/10	0900	W	-	7	X	X	X	X	X	X	MWKR0570R03				
4	WGC10131435BAW1 -3	10/13/10	1435	W	-	7	X	X	X	X	X	X	MWKR0580L02				
5	WGC10131545BAW5 -4	10/13/10				1	X										
6	WGC10131600BAW4 -5	10/13/10	1600	W	-	7	X	X	X	X	X	X					
7	WGC10131605BAW5 -6	10/13/10				1	X										
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Bridget Walsh Bridget Walsh | Shipment Method | Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour | Results Due Date:

Relinquished by: Bridget Walsh	Date: 10/13/10	Time: 1605	Received by:	Notes:
Relinquished by:	Date: 10/13/10	Time:	Received by (Laboratory):	
Logged by (Laboratory):	Date: 10/14/10	Time: 0749	Checked by (Laboratory):	

Cooler ID	Cooler Temp

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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16-Oct-2010

Jim Tolbert
AECOM Enviroment
5555 Glenwood Parkway SE
Grand Rapids, MI 49512

Re: **Marshall Oil Spill Hydrogeo Study 10/14/10** Work Order: **1010389**

Dear Jim,

ALS Group USA, Corp received 14 samples on 14-Oct-2010 08:05 PM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 50.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Ann Preston

Electronically approved by: Ann Preston

Ann Preston
Project Manager

Certificate No: IL100452

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Work Order: **1010389**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1010389-01	WGE10141015BAW1	Water		10/14/2010 10:15	10/14/2010 20:05	☐
1010389-02	WSE10141155BAW1	Water		10/14/2010 11:55	10/14/2010 20:05	☐
1010389-03	WGE10141445BAW1	Water		10/14/2010 14:45	10/14/2010 20:05	☐
1010389-04	WGE10141745TVF4	Water		10/14/2010 17:45	10/14/2010 20:05	☐
1010389-05	WGE10141800TVF4	Water		10/14/2010 18:00	10/14/2010 20:05	☐
1010389-06	WGC10151730TVF5	Water		10/14/2010	10/14/2010 20:05	☐
1010389-07	WGC10141735TVF5	Water		10/14/2010	10/14/2010 20:05	☐
1010389-08	WGE10141020BRH1	Water		10/14/2010 10:20	10/14/2010 20:05	☐
1010389-09	WGE10141200BRH1	Water		10/14/2010 12:00	10/14/2010 20:05	☐
1010389-10	WGE10141200BRH2	Water		10/14/2010 12:00	10/14/2010 20:05	☐
1010389-11	WGC10141505BRH1	Water		10/14/2010 15:05	10/14/2010 20:05	☐
1010389-12	WGC10141640BRH1	Water		10/14/2010 16:40	10/14/2010 20:05	☐
1010389-13	WGC10141810BRH1	Water		10/14/2010 18:10	10/14/2010 20:05	☐
1010389-14	WGC10141810BRH5	Water		10/14/2010 18:10	10/14/2010 20:05	☐

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Work Order: 1010389

Case Narrative

Batch R8251 LCS recovery for Isopropylbenzene was above control limits, but all samples in this quality control batch were ND for this compound. Sample WGE10141015BAW1 MS recovery for Naphthalene was above control limits. The MSD recovery for Isopropylbenzene was above control limits, but the parent sample was ND for both compounds.

Batch R82566 LCSD recovery for Isopropylbenzene was above control limits, but all samples in this quality control batch were ND for this compound.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
WorkOrder: **1010389**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitation Limit
SD	Serial Dilution

Units Reported	Description
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141015BAW1
Work Order: 1010389
Collection Date: 10/14/2010 10:15:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-01
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**74**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**15**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**2.4**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**69**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**14**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**1.7**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*82.8*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*67.2*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*40.1*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141015BAW1
Work Order: 1010389 **Collection Date:** 10/14/2010 10:15:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-01 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*71.3*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*70.9*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*25.7*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*118*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.1*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*110*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**240**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	ND	10	10		mg/L	1	10/15/2010
Sulfate	**5.8**	**1.0**	**1.0**		**mg/L**	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

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ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-02

Client Sample ID: WSE10141155BAW1
Collection Date: 10/14/2010 11:55:00 AM
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Calcium	**86**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.23**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**25**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**23**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**270**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**45**	**10**	**10**		**mg/L**	5	10/15/2010
Sulfate	**34**	**5.0**	**1.0**		**mg/L**	5	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141445BAW1
Work Order: 1010389
Collection Date: 10/14/2010 2:45:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-03
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	**0.15**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**130**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**2.1**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**30**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**49**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	**0.13**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**110**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.36**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**27**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**45**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*81.7*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*71.9*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*40.2*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141445BAW1
Work Order: 1010389 **Collection Date:** 10/14/2010 2:45:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-03 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*44.9*	*50-125*		S	*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*72.6*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*26.1*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*119*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.1*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*112*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*102*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**140**	**10**	**10**		**mg/L**	10	10/15/2010
Sulfate	**58**	**10**	**1.0**		**mg/L**	10	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141745TVF4
Work Order: 1010389
Collection Date: 10/14/2010 5:45:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-04
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	ND	10	10		mg/L	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	ND	1.0	1.0		mg/L	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	ND	10	10		mg/L	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	ND	1.0	1.0		mg/L	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*82.6*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*73.1*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*46.5*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141745TVF4
Work Order: 1010389 **Collection Date:** 10/14/2010 5:45:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-04 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*52.0*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*73.5*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*28.7*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*120*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*98.0*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*113*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*99.1*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	ND	10	10		mg/L	1	10/15/2010
Sulfate	ND	1.0	1.0		mg/L	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141800TVF4
Work Order: 1010389
Collection Date: 10/14/2010 6:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-05
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	ND	10	10		mg/L	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	ND	1.0	1.0		mg/L	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	ND	10	10		mg/L	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	ND	1.0	1.0		mg/L	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*74.6*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*62.3*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*37.6*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141800TVF4
Work Order: 1010389 **Collection Date:** 10/14/2010 6:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-05 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*37.0*	*50-125*		S	*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*63.6*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*23.1*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*120*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*97.8*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*113*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*99.8*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	ND	10	10		mg/L	1	10/15/2010
Sulfate	ND	1.0	1.0		mg/L	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

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ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10151730TVF5
Work Order: 1010389
Collection Date: 10/14/2010
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-06
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*117*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.0*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*109*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*99.6*	*85-120*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141735TVF5
Work Order: 1010389
Collection Date: 10/14/2010
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-07
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*119*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.4*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*111*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141020BRH1
Work Order: 1010389
Collection Date: 10/14/2010 10:20:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-08
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**64**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.30**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**14**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**29**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**61**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**14**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**29**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*52.7*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*47.9*	*50-110*		S	*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*29.0*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141020BRH1
Work Order: 1010389 **Collection Date:** 10/14/2010 10:20:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-08 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*53.6*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*47.8*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*19.6*	*20-110*		S	*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*119*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*92.4*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*111*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*99.3*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**190**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**48**	**10**	**10**		**mg/L**	5	10/15/2010
Sulfate	**9.4**	**5.0**	**1.0**		**mg/L**	5	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141200BRH1
Work Order: 1010389
Collection Date: 10/14/2010 12:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-09
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**50**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**11**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**6.6**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**46**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**11**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**6.5**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*56.9*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*54.3*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*30.6*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141200BRH1
Work Order: 1010389 **Collection Date:** 10/14/2010 12:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-09 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*65.0*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*54.0*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*19.4*	*20-110*		S	*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*120*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.8*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*113*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**160**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**14**	**10**	**10**		**mg/L**	1	10/15/2010
Sulfate	**3.5**	**1.0**	**1.0**		**mg/L**	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10141200BRH2
Work Order: 1010389
Collection Date: 10/14/2010 12:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-10
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**46**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**11**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**6.2**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**46**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**11**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**6.5**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*49.1*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*50.3*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*26.8*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10141200BRH2
Work Order: 1010389 **Collection Date:** 10/14/2010 12:00:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-10 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*42.3*	*50-125*		S	*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*50.0*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*17.4*	*20-110*		S	*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*120*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*95.4*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*113*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*100*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**160**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**13**	**10**	**10**		**mg/L**	1	10/15/2010
Sulfate	**3.2**	**1.0**	**1.0**		**mg/L**	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141505BRH1
Work Order: 1010389
Collection Date: 10/14/2010 3:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-11
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	**0.11**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**110**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.41**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**28**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**62**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**110**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**27**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**59**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*76.9*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*66.3*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*36.9*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141505BRH1
Work Order: 1010389
Collection Date: 10/14/2010 3:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-11
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*51.8*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*61.7*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*23.7*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*103*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*97.6*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*100*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*99.9*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**340**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**97**	**10**	**10**		**mg/L**	10	10/15/2010
Sulfate	**62**	**10**	**1.0**		**mg/L**	10	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141640BRH1
Work Order: 1010389
Collection Date: 10/14/2010 4:40:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-12
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	**0.20**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**78**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**1.9**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**22**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**30**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	**0.18**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**74**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**22**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**30**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*63.9*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*56.9*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*31.7*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10141640BRH1
Work Order: 1010389 **Collection Date:** 10/14/2010 4:40:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-12 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*54.5*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*55.3*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*20.7*	*20-110*			*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*119*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.7*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*112*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*102*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**250**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**46**	**10**	**10**		**mg/L**	5	10/15/2010
Sulfate	**37**	**5.0**	**1.0**		**mg/L**	5	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141810BRH1
Work Order: 1010389
Collection Date: 10/14/2010 6:10:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-13
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	**0.12**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**140**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.37**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**32**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**120**	**2.0**	**1.0**		**mg/L**	10	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	**0.11**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**130**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**32**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**110**	**2.0**	**1.0**		**mg/L**	10	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/14/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/15/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/15/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/15/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/15/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/15/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/15/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/15/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/15/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/15/2010
Surr: 2,4,6-Tribromophenol	*66.9*	*40-125*			*%REC*	1	10/15/2010
Surr: 2-Fluorobiphenyl	*57.0*	*50-110*			*%REC*	1	10/15/2010
Surr: 2-Fluorophenol	*31.8*	*20-110*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141810BRH1
Work Order: 1010389
Collection Date: 10/14/2010 6:10:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-13
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*58.9*	*50-125*			*%REC*	1	10/15/2010
Surr: Nitrobenzene-d5	*56.0*	*40-110*			*%REC*	1	10/15/2010
Surr: Phenol-d6	*19.8*	*20-110*		S	*%REC*	1	10/15/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*105*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*97.7*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*102*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/15/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**380**	**10**	**10**		**mg/L**	1	10/15/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/15/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**180**	**20**	**10**		**mg/L**	20	10/15/2010
Sulfate	**75**	**20**	**1.0**		**mg/L**	20	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *16-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10141810BRH5
Work Order: 1010389
Collection Date: 10/14/2010 6:10:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/14/10
Lab ID: 1010389-14
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Benzene	ND	1.0	1.0		µg/L	1	10/15/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/15/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/15/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/15/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/15/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/15/2010
Toluene	ND	1.0	1.0		µg/L	1	10/15/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/15/2010
Surr: 1,2-Dichloroethane-d4	*118*	*70-120*			*%REC*	1	10/15/2010
Surr: 4-Bromofluorobenzene	*94.8*	*75-120*			*%REC*	1	10/15/2010
Surr: Dibromofluoromethane	*110*	*85-115*			*%REC*	1	10/15/2010
Surr: Toluene-d8	*102*	*85-120*			*%REC*	1	10/15/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

ALS Group USA, Corp

Date: 16-Oct-10

Client: AECOM Enviroment

QC BATCH REPORT

Work Order: 1010389

Project: Marshall Oil Spill Hydrogeo Study 10/14/10

Batch ID: **29984** Instrument ID **ICPMS2** Method: **SW6020A**

MBLK Sample ID: **MBLK-29984-29984** Units: **mg/L** Analysis Date: **10/15/2010 02:27 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451626** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	ND	0.20								
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-29984-29984** Units: **mg/L** Analysis Date: **10/15/2010 02:31 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451627** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1005	0.0050	0.1	0	100	80-120	0			
Calcium	10.24	0.50	10	0	102	80-120	0			
Iron	10.49	0.080	10	0	105	80-120	0			
Magnesium	10.34	0.20	10	0	103	80-120	0			
Nickel	0.09442	0.0050	0.1	0	94.4	80-120	0			
Potassium	10.4	0.20	10	0	104	80-120	0			
Sodium	10.19	0.20	10	0	102	80-120	0			
Vanadium	0.1024	0.0050	0.1	0	102	80-120	0			

LCSD Sample ID: **LCSD-29984-29984** Units: **mg/L** Analysis Date: **10/15/2010 02:36 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451628** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1019	0.0050	0.1	0	102	80-120	0.1005	1.38	20	
Calcium	10.4	0.50	10	0	104	80-120	10.24	1.55	20	
Iron	10.64	0.080	10	0	106	80-120	10.49	1.42	20	
Magnesium	10.61	0.20	10	0	106	80-120	10.34	2.58	20	
Nickel	0.0952	0.0050	0.1	0	95.2	80-120	0.09442	0.823	20	
Potassium	10.56	0.20	10	0	106	80-120	10.4	1.53	20	
Sodium	10.31	0.20	10	0	103	80-120	10.19	1.17	20	
Vanadium	0.1031	0.0050	0.1	0	103	80-120	0.1024	0.681	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29984** Instrument ID **ICPMS2** Method: **SW6020A**

MS Sample ID: **1010389-01CMS** Units: **mg/L** Analysis Date: **10/15/2010 03:00 PM**

Client ID: **WGE10141015BAW1** Run ID: **ICPMS2_101015A** SeqNo: **1451718** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1268	0.0050	0.1	0.02535	101	80-120	0			
Calcium	82.2	0.50	10	73.67	85.3	80-120	0			O
Iron	10.39	0.080	10	0.03879	104	80-120	0			
Magnesium	24.81	0.20	10	15.04	97.7	80-120	0			
Nickel	0.09202	0.0050	0.1	0.001613	90.4	80-120	0			
Potassium	11.02	0.20	10	0.7019	103	80-120	0			
Sodium	11.81	0.20	10	2.419	93.9	80-120	0			
Vanadium	0.1016	0.0050	0.1	0.0001752	101	80-120	0			

MSD Sample ID: **1010389-01CMSD** Units: **mg/L** Analysis Date: **10/15/2010 03:05 PM**

Client ID: **WGE10141015BAW1** Run ID: **ICPMS2_101015A** SeqNo: **1451719** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.12	0.0050	0.1	0.02535	94.6	80-120	0.1268	5.51	20	
Calcium	82.97	0.50	10	73.67	93	80-120	82.2	0.932	20	O
Iron	10.07	0.080	10	0.03879	100	80-120	10.39	3.13	20	
Magnesium	24.6	0.20	10	15.04	95.6	80-120	24.81	0.85	20	
Nickel	0.08965	0.0050	0.1	0.001613	88	80-120	0.09202	2.61	20	
Potassium	10.8	0.20	10	0.7019	101	80-120	11.02	2.02	20	
Sodium	11.5	0.20	10	2.419	90.8	80-120	11.81	2.66	20	
Vanadium	0.09989	0.0050	0.1	0.0001752	99.7	80-120	0.1016	1.7	20	

The following samples were analyzed in this batch:

1010389-01C	1010389-02B	1010389-03C
1010389-04C	1010389-05C	1010389-08C
1010389-09C	1010389-10C	1010389-11C
1010389-12C	1010389-13C	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82544** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MBLK Sample ID: **MBLK-R82544-R82544** Units: **mg/L** Analysis Date: **10/15/2010 01:18 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451992** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	ND	0.20								
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-R82544-R82544** Units: **mg/L** Analysis Date: **10/15/2010 01:13 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451991** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1062	0.0050	0.1	0	106	80-120	0			
Calcium	10.46	0.50	10	0	105	80-120	0			
Iron	10.75	0.080	10	0	108	80-120	0			
Magnesium	10.72	0.20	10	0	107	80-120	0			
Nickel	0.101	0.0050	0.1	0	101	80-120	0			
Potassium	10.68	0.20	10	0	107	80-120	0			
Sodium	10.58	0.20	10	0	106	80-120	0			
Vanadium	0.1062	0.0050	0.1	0	106	80-120	0			

LCSD Sample ID: **LCSD-R82544-R82544** Units: **mg/L** Analysis Date: **10/15/2010 02:17 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451993** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1038	0.0050	0.1	0	104	80-120	0			
Calcium	10.29	0.50	10	0	103	80-120	0			
Iron	10.44	0.080	10	0	104	80-120	0			
Magnesium	10.32	0.20	10	0	103	80-120	0			
Nickel	0.09575	0.0050	0.1	0	95.8	80-120	0			
Potassium	10.37	0.20	10	0	104	80-120	0			
Sodium	10.2	0.20	10	0	102	80-120	0			
Vanadium	0.1025	0.0050	0.1	0	102	80-120	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82544** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MS Sample ID: **1010389-01DMS** Units: **mg/L** Analysis Date: **10/15/2010 01:28 PM**

Client ID: **WGE10141015BAW1** Run ID: **ICPMS2_101015A** SeqNo: **1451615** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1173	0.0050	0.1	0.02219	95.1	80-120	0			
Calcium	77.81	0.50	10	69.33	84.8	80-120	0			O
Iron	9.787	0.080	10	0.02091	97.7	80-120	0			
Magnesium	23.7	0.20	10	14.5	92	80-120	0			
Nickel	0.08795	0.0050	0.1	0.002004	85.9	80-120	0			
Potassium	10.75	0.20	10	1.007	97.4	80-120	0			
Sodium	11.28	0.20	10	1.741	95.4	80-120	0			
Vanadium	0.09632	0.0050	0.1	0.0003998	95.9	80-120	0			

MSD Sample ID: **1010389-01DMSD** Units: **mg/L** Analysis Date: **10/15/2010 01:33 PM**

Client ID: **WGE10141015BAW1** Run ID: **ICPMS2_101015A** SeqNo: **1451616** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1167	0.0050	0.1	0.02219	94.5	80-120	0.1173	0.513	20	
Calcium	77.99	0.50	10	69.33	86.6	80-120	77.81	0.231	20	O
Iron	9.775	0.080	10	0.02091	97.5	80-120	9.787	0.123	20	
Magnesium	23.55	0.20	10	14.5	90.5	80-120	23.7	0.635	20	
Nickel	0.08816	0.0050	0.1	0.002004	86.2	80-120	0.08795	0.238	20	
Potassium	10.68	0.20	10	1.007	96.7	80-120	10.75	0.653	20	
Sodium	11.28	0.20	10	1.741	95.4	80-120	11.28	0	20	
Vanadium	0.09592	0.0050	0.1	0.0003998	95.5	80-120	0.09632	0.416	20	

The following samples were analyzed in this batch:

1010389-01D	1010389-03D	1010389-04D
1010389-05D	1010389-08D	1010389-09D
1010389-10D	1010389-11D	1010389-12D
1010389-13D		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MBLK Sample ID: **SBLKW1-29957-29957** Units: **µg/L** Analysis Date: **10/14/2010 02:49 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450726** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	ND	5.0								
Acenaphthene	ND	5.0								
Acenaphthylene	ND	5.0								
Anthracene	ND	5.0								
Benzo(a)anthracene	ND	5.0								
Benzo(a)pyrene	ND	5.0								
Benzo(b)fluoranthene	ND	5.0								
Benzo(g,h,i)perylene	ND	5.0								
Benzo(k)fluoranthene	ND	5.0								
Chrysene	ND	5.0								
Dibenzo(a,h)anthracene	ND	5.0								
Fluoranthene	ND	5.0								
Fluorene	ND	5.0								
Indeno(1,2,3-cd)pyrene	ND	5.0								
Naphthalene	ND	5.0								
Phenanthrene	ND	5.0								
Pyrene	ND	5.0								
Surr: 2,4,6-Tribromophenol	*49.79*	0	*50*	0	*99.6*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*32.31*	0	*50*	0	*64.6*	*50-110*	0			
Surr: 2-Fluorophenol	*23.59*	0	*50*	0	*47.2*	*20-110*	0			
Surr: 4-Terphenyl-d14	*44.72*	0	*50*	0	*89.4*	*50-125*	0			
Surr: Nitrobenzene-d5	*33.12*	0	*50*	0	*66.2*	*40-110*	0			
Surr: Phenol-d6	*13.74*	0	*50*	0	*27.5*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

LCS Sample ID: **SLCSW1-29957-29957** Units: **µg/L** Analysis Date: **10/14/2010 12:13 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450722** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	27.46	5.0	40	0	68.6	45-105	0			
Acenaphthene	27.95	5.0	40	0	69.9	45-110	0			
Acenaphthylene	28.15	5.0	40	0	70.4	50-105	0			
Anthracene	27.91	5.0	40	0	69.8	55-110	0			
Benzo(a)anthracene	35.1	5.0	40	0	87.8	55-110	0			
Benzo(a)pyrene	30.37	5.0	40	0	75.9	55-110	0			
Benzo(b)fluoranthene	30.18	5.0	40	0	75.4	45-120	0			
Benzo(g,h,i)perylene	29.12	5.0	40	0	72.8	40-125	0			
Benzo(k)fluoranthene	30.24	5.0	40	0	75.6	45-125	0			
Chrysene	32.33	5.0	40	0	80.8	55-110	0			
Dibenzo(a,h)anthracene	32.09	5.0	40	0	80.2	40-125	0			
Fluoranthene	29.47	5.0	40	0	73.7	55-115	0			
Fluorene	27.76	5.0	40	0	69.4	50-110	0			
Indeno(1,2,3-cd)pyrene	31.24	5.0	40	0	78.1	45-125	0			
Naphthalene	28.07	5.0	40	0	70.2	40-100	0			
Phenanthrene	29.87	5.0	40	0	74.7	50-115	0			
Pyrene	31.81	5.0	40	0	79.5	50-130	0			
Surr: 2,4,6-Tribromophenol	*37.04*	0	*50*	0	*74.1*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*32.12*	0	*50*	0	*64.2*	*50-110*	0			
Surr: 2-Fluorophenol	*23.87*	0	*50*	0	*47.7*	*20-110*	0			
Surr: 4-Terphenyl-d14	*36.75*	0	*50*	0	*73.5*	*50-125*	0			
Surr: Nitrobenzene-d5	*34.12*	0	*50*	0	*68.2*	*40-110*	0			
Surr: Phenol-d6	*13.45*	0	*50*	0	*26.9*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

LCSD Sample ID: **SLCSDW1-29957-29957** Units: **µg/L** Analysis Date: **10/14/2010 12:44 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450723** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	27.43	5.0	40	0	68.6	45-105	27.46	0.109	30	
Acenaphthene	27.72	5.0	40	0	69.3	45-110	27.95	0.826	30	
Acenaphthylene	27.68	5.0	40	0	69.2	50-105	28.15	1.68	30	
Anthracene	28.05	5.0	40	0	70.1	55-110	27.91	0.5	30	
Benzo(a)anthracene	35.13	5.0	40	0	87.8	55-110	35.1	0.0854	30	
Benzo(a)pyrene	31.14	5.0	40	0	77.8	55-110	30.37	2.5	30	
Benzo(b)fluoranthene	30.83	5.0	40	0	77.1	45-120	30.18	2.13	30	
Benzo(g,h,i)perylene	29.5	5.0	40	0	73.8	40-125	29.12	1.3	30	
Benzo(k)fluoranthene	30.9	5.0	40	0	77.2	45-125	30.24	2.16	30	
Chrysene	32.41	5.0	40	0	81	55-110	32.33	0.247	30	
Dibenzo(a,h)anthracene	31.72	5.0	40	0	79.3	40-125	32.09	1.16	30	
Fluoranthene	30.3	5.0	40	0	75.8	55-115	29.47	2.78	30	
Fluorene	27.39	5.0	40	0	68.5	50-110	27.76	1.34	30	
Indeno(1,2,3-cd)pyrene	31.18	5.0	40	0	78	45-125	31.24	0.192	30	
Naphthalene	28.14	5.0	40	0	70.4	40-100	28.07	0.249	30	
Phenanthrene	30.17	5.0	40	0	75.4	50-115	29.87	0.999	30	
Pyrene	32.08	5.0	40	0	80.2	50-130	31.81	0.845	30	
Surr: 2,4,6-Tribromophenol	*37.74*	0	*50*	0	*75.5*	*40-125*	37.04	*1.87*	*40*	
Surr: 2-Fluorobiphenyl	*32*	0	*50*	0	*64*	*50-110*	32.12	*0.374*	*40*	
Surr: 2-Fluorophenol	*23.03*	0	*50*	0	*46.1*	*20-110*	23.87	*3.58*	*40*	
Surr: 4-Terphenyl-d14	*33.06*	0	*50*	0	*66.1*	*50-125*	36.75	*10.6*	*40*	
Surr: Nitrobenzene-d5	*34.81*	0	*50*	0	*69.6*	*40-110*	34.12	*2*	*40*	
Surr: Phenol-d6	*13.2*	0	*50*	0	*26.4*	*20-110*	13.45	*1.88*	*40*	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MS Sample ID: **1010353-01B MS** Units: **µg/L** Analysis Date: **10/14/2010 01:15 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450724** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	263.9	50	400	0	66	45-105	0			
Acenaphthene	270.1	50	400	0	67.5	45-110	0			
Acenaphthylene	271.5	50	400	0	67.9	50-105	0			
Anthracene	259.6	50	400	0	64.9	55-110	0			
Benzo(a)anthracene	324.3	50	400	0	81.1	55-110	0			
Benzo(a)pyrene	280.3	50	400	0	70.1	55-110	0			
Benzo(b)fluoranthene	281.3	50	400	0	70.3	45-120	0			
Benzo(g,h,i)perylene	273.1	50	400	0	68.3	40-125	0			
Benzo(k)fluoranthene	275.9	50	400	0	69	45-125	0			
Chrysene	301.6	50	400	0	75.4	55-110	0			
Dibenzo(a,h)anthracene	296.8	50	400	0	74.2	40-125	0			
Fluoranthene	273.9	50	400	0	68.5	55-115	0			
Fluorene	271.7	50	400	0	67.9	50-110	0			
Indeno(1,2,3-cd)pyrene	292.1	50	400	0	73	45-125	0			
Naphthalene	269.5	50	400	0	67.4	40-100	0			
Phenanthrene	286.5	50	400	0	71.6	50-115	0			
Pyrene	302.3	50	400	0	75.6	50-130	0			
Surr: 2,4,6-Tribromophenol	*368*	0	*500*	0	*73.6*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*310.1*	0	*500*	0	*62*	*50-110*	0			
Surr: 2-Fluorophenol	*218.4*	0	*500*	0	*43.7*	*20-110*	0			
Surr: 4-Terphenyl-d14	*346.9*	0	*500*	0	*69.4*	*50-125*	0			
Surr: Nitrobenzene-d5	*324.1*	0	*500*	0	*64.8*	*40-110*	0			
Surr: Phenol-d6	*128.2*	0	*500*	0	*25.6*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MS Sample ID: **1010389-01B MS** Units: **µg/L** Analysis Date: **10/15/2010 03:13 PM**

Client ID: **WGE10141015BAW1** Run ID: **SVMS4_101015A** SeqNo: **1452084** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	314.8	50	400	0	78.7	45-105	0			
Acenaphthene	313.6	50	400	0	78.4	45-110	0			
Acenaphthylene	315.5	50	400	0	78.9	50-105	0			
Anthracene	316.3	50	400	0	79.1	55-110	0			
Benzo(a)anthracene	394	50	400	0	98.5	55-110	0			
Benzo(a)pyrene	344.7	50	400	0	86.2	55-110	0			
Benzo(b)fluoranthene	338.1	50	400	0	84.5	45-120	0			
Benzo(g,h,i)perylene	293.1	50	400	0	73.3	40-125	0			
Benzo(k)fluoranthene	389.8	50	400	0	97.4	45-125	0			
Chrysene	365.7	50	400	0	91.4	55-110	0			
Dibenzo(a,h)anthracene	297.6	50	400	0	74.4	40-125	0			
Fluoranthene	329.2	50	400	0	82.3	55-115	0			
Fluorene	320.7	50	400	0	80.2	50-110	0			
Indeno(1,2,3-cd)pyrene	294.6	50	400	0	73.6	45-125	0			
Naphthalene	320.3	50	400	0	80.1	40-100	0			
Phenanthrene	336.8	50	400	0	84.2	50-115	0			
Pyrene	374	50	400	0	93.5	50-130	0			
Surr: 2,4,6-Tribromophenol	*413.3*	0	*500*	0	*82.7*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*382.3*	0	*500*	0	*76.5*	*50-110*	0			
Surr: 2-Fluorophenol	*222.2*	0	*500*	0	*44.4*	*20-110*	0			
Surr: 4-Terphenyl-d14	*416.5*	0	*500*	0	*83.3*	*50-125*	0			
Surr: Nitrobenzene-d5	*417.2*	0	*500*	0	*83.4*	*40-110*	0			
Surr: Phenol-d6	*144.5*	0	*500*	0	*28.9*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MSD Sample ID: **1010353-01B MSD** Units: **µg/L** Analysis Date: **10/14/2010 01:46 PM**

Client ID: Run ID: **SVMS4_101014A** SeqNo: **1450725** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	245.6	50	400	0	61.4	45-105	263.9	7.18	30	
Acenaphthene	248.5	50	400	0	62.1	45-110	270.1	8.33	30	
Acenaphthylene	252.3	50	400	0	63.1	50-105	271.5	7.33	30	
Anthracene	232.7	50	400	0	58.2	55-110	259.6	10.9	30	
Benzo(a)anthracene	282.6	50	400	0	70.6	55-110	324.3	13.7	30	
Benzo(a)pyrene	249.4	50	400	0	62.4	55-110	280.3	11.7	30	
Benzo(b)fluoranthene	242.3	50	400	0	60.6	45-120	281.3	14.9	30	
Benzo(g,h,i)perylene	244.3	50	400	0	61.1	40-125	273.1	11.1	30	
Benzo(k)fluoranthene	248.4	50	400	0	62.1	45-125	275.9	10.5	30	
Chrysene	262.4	50	400	0	65.6	55-110	301.6	13.9	30	
Dibenzo(a,h)anthracene	260.4	50	400	0	65.1	40-125	296.8	13.1	30	
Fluoranthene	243.7	50	400	0	60.9	55-115	273.9	11.7	30	
Fluorene	243.8	50	400	0	61	50-110	271.7	10.8	30	
Indeno(1,2,3-cd)pyrene	257.9	50	400	0	64.5	45-125	292.1	12.4	30	
Naphthalene	257.3	50	400	0	64.3	40-100	269.5	4.63	30	
Phenanthrene	257.4	50	400	0	64.4	50-115	286.5	10.7	30	
Pyrene	266	50	400	0	66.5	50-130	302.3	12.8	30	
Surr: 2,4,6-Tribromophenol	*358.1*	0	*500*	0	*71.6*	*40-125*	368	*2.73*	*40*	
Surr: 2-Fluorobiphenyl	*283*	0	*500*	0	*56.6*	*50-110*	310.1	*9.14*	*40*	
Surr: 2-Fluorophenol	*209.7*	0	*500*	0	*41.9*	*20-110*	218.4	*4.06*	*40*	
Surr: 4-Terphenyl-d14	*260.5*	0	*500*	0	*52.1*	*50-125*	346.9	*28.4*	*40*	
Surr: Nitrobenzene-d5	*311.9*	0	*500*	0	*62.4*	*40-110*	324.1	*3.84*	*40*	
Surr: Phenol-d6	*129.2*	0	*500*	0	*25.8*	*20-110*	128.2	*0.777*	*40*	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **29957** Instrument ID **SVMS4** Method: **SW8270**

MSD Sample ID: **1010389-01B MSD** Units: **µg/L** Analysis Date: **10/15/2010 03:44 PM**

Client ID: **WGE10141015BAW1** Run ID: **SVMS4_101015A** SeqNo: **1452085** Prep Date: **10/14/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	307.3	50	400	0	76.8	45-105	314.8	2.41	30	
Acenaphthene	308.6	50	400	0	77.2	45-110	313.6	1.61	30	
Acenaphthylene	309.3	50	400	0	77.3	50-105	315.5	1.98	30	
Anthracene	316.5	50	400	0	79.1	55-110	316.3	0.0632	30	
Benzo(a)anthracene	398.9	50	400	0	99.7	55-110	394	1.24	30	
Benzo(a)pyrene	346.5	50	400	0	86.6	55-110	344.7	0.521	30	
Benzo(b)fluoranthene	334	50	400	0	83.5	45-120	338.1	1.22	30	
Benzo(g,h,i)perylene	291.3	50	400	0	72.8	40-125	293.1	0.616	30	
Benzo(k)fluoranthene	393.7	50	400	0	98.4	45-125	389.8	0.996	30	
Chrysene	375.8	50	400	0	94	55-110	365.7	2.72	30	
Dibenzo(a,h)anthracene	298.3	50	400	0	74.6	40-125	297.6	0.235	30	
Fluoranthene	337.3	50	400	0	84.3	55-115	329.2	2.43	30	
Fluorene	314.4	50	400	0	78.6	50-110	320.7	1.98	30	
Indeno(1,2,3-cd)pyrene	295.9	50	400	0	74	45-125	294.6	0.44	30	
Naphthalene	311.6	50	400	0	77.9	40-100	320.3	2.75	30	
Phenanthrene	342.5	50	400	0	85.6	50-115	336.8	1.68	30	
Pyrene	378.9	50	400	0	94.7	50-130	374	1.3	30	
Surr: 2,4,6-Tribromophenol	*420.4*	0	*500*	0	*84.1*	*40-125*	413.3	*1.7*	*40*	
Surr: 2-Fluorobiphenyl	*371.4*	0	*500*	0	*74.3*	*50-110*	382.3	*2.89*	*40*	
Surr: 2-Fluorophenol	*239.1*	0	*500*	0	*47.8*	*20-110*	222.2	*7.33*	*40*	
Surr: 4-Terphenyl-d14	*419.8*	0	*500*	0	*84*	*50-125*	416.5	*0.789*	*40*	
Surr: Nitrobenzene-d5	*417.8*	0	*500*	0	*83.6*	*40-110*	417.2	*0.144*	*40*	
Surr: Phenol-d6	*152.9*	0	*500*	0	*30.6*	*20-110*	144.5	*5.65*	*40*	

The following samples were analyzed in this batch:

1010389-01B	1010389-03B	1010389-04B
1010389-05B	1010389-08B	1010389-09B
1010389-10B	1010389-11B	1010389-12B
1010389-13B		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82513** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW2-101014-R82513** Units: **µg/L** Analysis Date: **10/15/2010 03:39 AM**

Client ID: Run ID: **VMS7_101014B** SeqNo: **1450904** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*115.5*	0	*100*	0	*115*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*95.41*	0	*100*	0	*95.4*	*75-120*	0			
Surr: Dibromofluoromethane	*106.2*	0	*100*	0	*106*	*85-115*	0			
Surr: Toluene-d8	*100.7*	0	*100*	0	*101*	*85-120*	0			

LCS Sample ID: **VLCSW2-101014-R82513** Units: **µg/L** Analysis Date: **10/15/2010 02:17 AM**

Client ID: Run ID: **VMS7_101014B** SeqNo: **1450600** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	21.63	1.0	20	0	108	75-130	0			
1,3,5-Trimethylbenzene	22.45	1.0	20	0	112	75-130	0			
Benzene	22.79	1.0	20	0	114	80-120	0			
Ethylbenzene	23.17	1.0	20	0	116	75-125	0			
Isopropylbenzene	25.74	1.0	20	0	129	75-125	0			S
n-Propylbenzene	22.88	1.0	20	0	114	70-130	0			
Naphthalene	22.12	5.0	20	0	111	55-140	0			
p-Isopropyltoluene	21.56	2.0	20	0	108	75-130	0			
sec-Butylbenzene	21.84	2.0	20	0	109	70-125	0			
Toluene	22.21	1.0	20	0	111	75-120	0			
Xylenes, Total	69.46	2.0	60	0	116	75-130	0			
Surr: 1,2-Dichloroethane-d4	*109.5*	0	*100*	0	*110*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*100.2*	0	*100*	0	*100*	*75-120*	0			
Surr: Dibromofluoromethane	*108.4*	0	*100*	0	*108*	*85-115*	0			
Surr: Toluene-d8	*106*	0	*100*	0	*106*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82513** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW2-101014-R82513** Units: **µg/L** Analysis Date: **10/15/2010 02:44 AM**

Client ID: Run ID: **VMS7_101014B** SeqNo: **1450601** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.35	1.0	20	0	102	75-130	21.63	6.1	30	
1,3,5-Trimethylbenzene	20.9	1.0	20	0	104	75-130	22.45	7.15	30	
Benzene	21.91	1.0	20	0	110	80-120	22.79	3.94	30	
Ethylbenzene	22.06	1.0	20	0	110	75-125	23.17	4.91	30	
Isopropylbenzene	24.26	1.0	20	0	121	75-125	25.74	5.92	30	
n-Propylbenzene	21.52	1.0	20	0	108	70-130	22.88	6.13	30	
Naphthalene	21.07	5.0	20	0	105	55-140	22.12	4.86	30	
p-Isopropyltoluene	20.32	2.0	20	0	102	75-130	21.56	5.92	30	
sec-Butylbenzene	19.99	2.0	20	0	100	70-125	21.84	8.85	30	
Toluene	21.09	1.0	20	0	105	75-120	22.21	5.17	30	
Xylenes, Total	66.34	2.0	60	0	111	75-130	69.46	4.59	30	
Surr: 1,2-Dichloroethane-d4	*110.4*	0	*100*	0	*110*	*70-120*	109.5	*0.782*	*30*	
Surr: 4-Bromofluorobenzene	*99.81*	0	*100*	0	*99.8*	*75-120*	100.2	*0.42*	*30*	
Surr: Dibromofluoromethane	*109.1*	0	*100*	0	*109*	*85-115*	108.4	*0.717*	*30*	
Surr: Toluene-d8	*104.4*	0	*100*	0	*104*	*85-120*	106	*1.54*	*30*	

MS Sample ID: **1010389-01A MS** Units: **µg/L** Analysis Date: **10/15/2010 12:44 PM**

Client ID: **WGE10141015BAW1** Run ID: **VMS7_101014B** SeqNo: **1451313** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	25.17	1.0	20	0	126	75-130	0			
1,3,5-Trimethylbenzene	20.91	1.0	20	0	105	75-130	0			
Benzene	21.89	1.0	20	0	109	80-120	0			
Ethylbenzene	22.16	1.0	20	0	111	75-125	0			
Isopropylbenzene	23.32	1.0	20	0	117	75-125	0			
n-Propylbenzene	21.22	1.0	20	0	106	70-130	0			
Naphthalene	32.37	5.0	20	0	162	55-140	0			S
p-Isopropyltoluene	18.43	2.0	20	0	92.2	75-130	0			
sec-Butylbenzene	19.47	2.0	20	0	97.4	70-125	0			
Toluene	20.67	1.0	20	0	103	75-120	0			
Xylenes, Total	65.35	2.0	60	0	109	75-130	0			
Surr: 1,2-Dichloroethane-d4	*115.6*	0	*100*	0	*116*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*104.2*	0	*100*	0	*104*	*75-120*	0			
Surr: Dibromofluoromethane	*112.5*	0	*100*	0	*112*	*85-115*	0			
Surr: Toluene-d8	*105.6*	0	*100*	0	*106*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82513** Instrument ID **VMS7** Method: **SW8260**

MSD Sample ID: **1010389-01A MSD** Units: **µg/L** Analysis Date: **10/15/2010 01:11 PM**

Client ID: **WGE10141015BAW1** Run ID: **VMS7_101014B** SeqNo: **1451356** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	21.89	1.0	20	0	109	75-130	25.17	13.9	30	
1,3,5-Trimethylbenzene	21.7	1.0	20	0	108	75-130	20.91	3.71	30	
Benzene	23.61	1.0	20	0	118	80-120	21.89	7.56	30	
Ethylbenzene	23.67	1.0	20	0	118	75-125	22.16	6.59	30	
Isopropylbenzene	25.23	1.0	20	0	126	75-125	23.32	7.87	30	S
n-Propylbenzene	22.36	1.0	20	0	112	70-130	21.22	5.23	30	
Naphthalene	22.62	5.0	20	0	113	55-140	32.37	35.5	30	R
p-Isopropyltoluene	19.92	2.0	20	0	99.6	75-130	18.43	7.77	30	
sec-Butylbenzene	20.94	2.0	20	0	105	70-125	19.47	7.28	30	
Toluene	22.36	1.0	20	0	112	75-120	20.67	7.85	30	
Xylenes, Total	69.48	2.0	60	0	116	75-130	65.35	6.13	30	
Surr: 1,2-Dichloroethane-d4	*117.8*	0	*100*	0	*118*	*70-120*	115.6	*1.91*	*30*	
Surr: 4-Bromofluorobenzene	*104*	0	*100*	0	*104*	*75-120*	104.2	*0.173*	*30*	
Surr: Dibromofluoromethane	*113.8*	0	*100*	0	*114*	*85-115*	112.5	*1.15*	*30*	
Surr: Toluene-d8	*106.7*	0	*100*	0	*107*	*85-120*	105.6	*1.01*	*30*	

The following samples were analyzed in this batch:

1010389-01A	1010389-03A	1010389-04A
1010389-05A	1010389-06A	1010389-07A
1010389-08A	1010389-09A	1010389-10A
1010389-11A	1010389-12A	1010389-13A
1010389-14A		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82566** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW1-101015-R82566** Units: **µg/L** Analysis Date: **10/15/2010 09:42 PM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1452021** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*103.3*	0	*100*	0	*103*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*99.11*	0	*100*	0	*99.1*	*75-120*	0			
Surr: Dibromofluoromethane	*99.89*	0	*100*	0	*99.9*	*85-115*	0			
Surr: Toluene-d8	*100.3*	0	*100*	0	*100*	*85-120*	0			

LCS Sample ID: **VLCSW1-101015-R82566** Units: **µg/L** Analysis Date: **10/15/2010 08:20 PM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1451901** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	18.93	1.0	20	0	94.6	75-130	0			
1,3,5-Trimethylbenzene	19.55	1.0	20	0	97.8	75-130	0			
Benzene	19.27	1.0	20	0	96.4	80-120	0			
Ethylbenzene	20.36	1.0	20	0	102	75-125	0			
Isopropylbenzene	22.66	1.0	20	0	113	75-125	0			
n-Propylbenzene	20.13	1.0	20	0	101	70-130	0			
Naphthalene	20.33	5.0	20	0	102	55-140	0			
p-Isopropyltoluene	19.01	2.0	20	0	95	75-130	0			
sec-Butylbenzene	19.05	2.0	20	0	95.2	70-125	0			
Toluene	19.39	1.0	20	0	97	75-120	0			
Xylenes, Total	61.12	2.0	60	0	102	75-130	0			
Surr: 1,2-Dichloroethane-d4	*109.4*	0	*100*	0	*109*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*96.1*	0	*100*	0	*96.1*	*75-120*	0			
Surr: Dibromofluoromethane	*106.9*	0	*100*	0	*107*	*85-115*	0			
Surr: Toluene-d8	*104.8*	0	*100*	0	*105*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82566** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW1-101015-R82566** Units: **µg/L** Analysis Date: **10/15/2010 08:48 PM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1451902** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	21.8	1.0	20	0	109	75-130	18.93	14.1	30	
1,3,5-Trimethylbenzene	22.14	1.0	20	0	111	75-130	19.55	12.4	30	
Benzene	19.65	1.0	20	0	98.2	80-120	19.27	1.95	30	
Ethylbenzene	20.51	1.0	20	0	103	75-125	20.36	0.734	30	
Isopropylbenzene	25.48	1.0	20	0	127	75-125	22.66	11.7	30	S
n-Propylbenzene	21.33	1.0	20	0	107	70-130	20.13	5.79	30	
Naphthalene	19.72	5.0	20	0	98.6	55-140	20.33	3.05	30	
p-Isopropyltoluene	22.59	2.0	20	0	113	75-130	19.01	17.2	30	
sec-Butylbenzene	22.52	2.0	20	0	113	70-125	19.05	16.7	30	
Toluene	19.49	1.0	20	0	97.4	75-120	19.39	0.514	30	
Xylenes, Total	64.58	2.0	60	0	108	75-130	61.12	5.51	30	
Surr: 1,2-Dichloroethane-d4	*98.93*	0	*100*	0	*98.9*	*70-120*	109.4	*10.1*	*30*	
Surr: 4-Bromofluorobenzene	*102.4*	0	*100*	0	*102*	*75-120*	96.1	*6.34*	*30*	
Surr: Dibromofluoromethane	*100.7*	0	*100*	0	*101*	*85-115*	106.9	*5.99*	*30*	
Surr: Toluene-d8	*100.2*	0	*100*	0	*100*	*85-120*	104.8	*4.57*	*30*	

The following samples were analyzed in this batch: 1010389-11A 1010389-13A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82551** Instrument ID **WETCHEM** Method: **A2320 B**

MBLK Sample ID: **WBLKW1-101015-R82551** Units: **mg/L** Analysis Date: **10/15/2010 12:05 PM**
Client ID: Run ID: **WETCHEM_101015E** SeqNo: **1451671** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	1	10								J
Alkalinity, Carbonate (as CaCO3)	1	10								J

LCS Sample ID: **WLCSW1-101015-R82551** Units: **mg/L** Analysis Date: **10/15/2010 12:05 PM**
Client ID: Run ID: **WETCHEM_101015E** SeqNo: **1451672** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	990	10	1000	0	99	80-120	0			
Alkalinity, Carbonate (as CaCO3)	990	10	1000	0	99	80-120	0			

LCSD Sample ID: **WLCSDW1-101015-R82551** Units: **mg/L** Analysis Date: **10/15/2010 12:05 PM**
Client ID: Run ID: **WETCHEM_101015E** SeqNo: **1451687** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	990	10	1000	0	99	80-120	990	0	20	
Alkalinity, Carbonate (as CaCO3)	990	10	1000	0	99	80-120	990	0	20	

DUP Sample ID: **1010389-01D DUP1** Units: **mg/L** Analysis Date: **10/15/2010 12:05 PM**
Client ID: **WGE10141015BAW1** Run ID: **WETCHEM_101015E** SeqNo: **1451674** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	237.3	10	0	0	0		235.5	0.761	20	
Alkalinity, Carbonate (as CaCO3)	1.6	10	0	0	0		1.4	0	20	J

DUP Sample ID: **1010389-01D DUP2** Units: **mg/L** Analysis Date: **10/15/2010 12:05 PM**
Client ID: **WGE10141015BAW1** Run ID: **WETCHEM_101015E** SeqNo: **1451675** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	236.4	10	0	0	0		235.5	0.381	20	
Alkalinity, Carbonate (as CaCO3)	1.5	10	0	0	0		1.4	0	20	J

DUP Sample ID: **1010389-12D DUP** Units: **mg/L** Analysis Date: **10/15/2010 12:05 PM**
Client ID: **WGC10141640BRH1** Run ID: **WETCHEM_101015E** SeqNo: **1451685** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	246.8	10	0	0	0		246.8	0	20	
Alkalinity, Carbonate (as CaCO3)	1.2	10	0	0	0		1.2	0	20	J

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82551** Instrument ID **WETCHEM** Method: **A2320 B**

The following samples were analyzed in this batch:

1010389-01D	1010389-02A	1010389-03D
1010389-04D	1010389-05D	1010389-08D
1010389-09D	1010389-10D	1010389-11D
1010389-12D	1010389-13D	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010389
Project: Marshall Oil Spill Hydrogeo Study 10/14/10

QC BATCH REPORT

Batch ID: **R82567** Instrument ID **IC3** Method: **SW9056**

MBLK Sample ID: **CCB/MBLK-R82567** Units: **mg/L** Analysis Date: **10/15/2010 09:17 AM**
Client ID: Run ID: **IC3_101015A** SeqNo: **1451994** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	0.3154	1.0								J
Sulfate	0.2956	1.0								J

LCS Sample ID: **CCV/LCS-R82567** Units: **mg/L** Analysis Date: **10/15/2010 09:37 AM**
Client ID: Run ID: **IC3_101015A** SeqNo: **1451995** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.652	1.0	10	0	96.5	80-120	0			
Sulfate	9.618	1.0	10	0	96.2	80-120	0			

LCSD Sample ID: **CCV/LCSD-R82567** Units: **mg/L** Analysis Date: **10/15/2010 09:56 AM**
Client ID: Run ID: **IC3_101015A** SeqNo: **1451996** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.646	1.0	10	0	96.5	80-120	9.652	0.0611	20	
Sulfate	9.562	1.0	10	0	95.6	80-120	9.618	0.588	20	

MS Sample ID: **1010389-01D MS** Units: **mg/L** Analysis Date: **10/15/2010 10:50 AM**
Client ID: **WGE10141015BAW1** Run ID: **IC3_101015A** SeqNo: **1451998** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	11.44	1.0	10	1.384	101	75-125	0			
Sulfate	15.59	1.0	10	5.803	97.8	75-125	0			

MSD Sample ID: **1010389-01D MSD** Units: **mg/L** Analysis Date: **10/15/2010 11:10 AM**
Client ID: **WGE10141015BAW1** Run ID: **IC3_101015A** SeqNo: **1451999** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	10.89	1.0	10	1.384	95	75-125	11.44	5	20	
Sulfate	14.88	1.0	10	5.803	90.8	75-125	15.59	4.65	20	

The following samples were analyzed in this batch:

1010389-01D	1010389-02A	1010389-03D
1010389-04D	1010389-05D	1010389-08D
1010389-09D	1010389-10D	1010389-11D
1010389-12D	1010389-13D	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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☐ **ALS Laboratory Group**
3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | **ALS Work Order #:** 10 10389

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G (BAV 10/14/10)	H	I	J	Hold
1	WGE10141015BAW1	01	10/14/10	1015	W	-	7	X	X	X	X	X	X	X	MWKR3680L03			
2	WGE10141015BAW3		10/14/10	1015	W	-	7	X	X	X	X	X	X	X	MWKR3680L03 (MS/MSD)			
3	WSE10141155BAW1	02	10/14/10	1155	W	-	2					X	X	X	SWKR3690L01			
4	WGE10141445BAW1	03	10/14/10	1445	W	-	7	X	X	X	X	X	X		MWKR3620L01			
5	WGE10141745TVF4	04	10/14/10	1745	W		7	X	X	X	X	X	X		Field Blank			
6	WGE10141800TVF4	05	10/14/10	1800	W		7	X	X	X	X	X	X		Equip Blank			
7	WGC10141730TVF5	06	↓				1	X							Trip Blank			
8	WGC10141735TVF5	07	↓				1	X							Trip Blank			
9																		
10																		

Sampler(s) Please Print & Sign: Bridget Walsh Bridget Walsh

Shipment Method:

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
Bridget Walsh	10/14/10		
Relinquished by:	Date:	Time:	Received by (Laboratory):
	10/14/10	2005	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):
	10/14/10	10:15pm	

Notes:

Cooler ID	Cooler Temp

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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Fax: +1 616 399 6185

ALS Project Manager: | **ALS Work Order #:** 1016889

Customer Information

Purchase Order	
Work Order	
Company Name	AECom Environment
Send Report To	Jim Tolbert
Address	5555 Glenwood Hills Pkwy
City/State/Zip	Grand Rapids, MI 49512
Phone	616-942-9600
Fax	
e-Mail Address	james.tolbert@aecom.com

Project Information

Project Name	Enbridge Line 6B, MP 608-Marshall MI
Project Number	Hydrogeo study
Bill To Company	Enbridge Energy
Invoice Attn	Accounts Payable
Address	1100 Louisiana Suite 1100
City/State/Zip	Houston, TX 77002
Phone	
Fax	
e-Mail Address	

Parameter/Method Request for Analysis

A	VOC's by EPA 8260 – groundwater list provided
B	PAH's by EPA 8270
C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab filtered)
E	Cl, SO4 by EPA 9056
F	Bicarbonate and carbonate Alkalinity by SM 2320
G	SW metals Fe, Na, K, Ca, Mg by EPA 6020
H	
I	
J	

No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	W6E1014 1020 BRH1	08	10/14/10	1020	W		7	X	X	X	X	X	X		mwkR36ØL Ø1			
2	W6E1014 1200 BRH1	09	10/14/10	1200	W		7	X	X	X	X	X	X		mwkR36ØL Ø2			
3	W6E1014 1200 BRH2 (Dup)	10	10/14/10	1200	W		7	X	X	X	X	X	X		mwkR36ØL Ø2 Dup			
4	W6C1014 1505 BRH1	11	10/14/10	1505	W		7	X	X	X	V	X	Y		mwkRØ25ØL Ø2			
5	W6C1014 1640 BRH1	12	10/14/10	1640	W		7	X	X	Y	Y	X	X		mwkRØ25ØL Ø1			
6	W6C1014 1810 BRH1	13	10/14/10	1810	W		7	Y	Y	Y	X	X	X		mwkRØ25ØL Ø3			
7	W6C1014 1810 BRH5	14	10/14/10	1810	W		1	X										
8																		
9																		
10																		

Sampler(s) Please Print & Sign: Brad Hoare Brad Hoare

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ____ ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by: Brad Hoare	Date: 10/14/10	Time: 7000 pm	Received by:
Relinquished by:	Date: 10/14/10	Time: 2005	Received by (Laboratory):
Logged by (Laboratory):	Date: 10/14/10	Time: 10:15pm	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other ____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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ALS Group USA, Corp

Sample Receipt Checklist

Client Name: **AECOM - GR** Date/Time Received: **14-Oct-10 20:05**

Work Order: **1010389** Received by: **AP**

Checklist completed by Ann Preston (eSignature) 14-Oct-10 (Date) Reviewed by: Ann Preston (eSignature) 14-Oct-10 (Date)

Matrices: water
Carrier name: ALSHN

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	4.2°C		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☑	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☑	No ☐	N/A ☐
pH adjusted?	Yes ☑	No ☐	N/A ☐
pH adjusted by:			

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

US EPA ARCHIVE DOCUMENT

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3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | **ALS Work Order #:** 10 10389

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G (BAV 10/14/10)	H	I	J	Hold
1	WGE10141015BAW1	01	10/14/10	1015	W	-	7	X	X	X	X	X	X	X	MWKR3680L03			
2	WGE10141015BAW3		10/14/10	1015	W	-	7	X	X	X	X	X	X	X	MWKR3680L03 (MS/MSD)			
3	WSE10141155BAW1	02	10/14/10	1155	W	-	2					X	X	X	SWKR3690L01			
4	WGE10141445BAW1	03	10/14/10	1445	W	-	7	X	X	X	X	X	X		MWKR3620L01			
5	WGE10141745TVF4	04	10/14/10	1745	W		7	X	X	X	X	X	X		Field Blank			
6	WGE10141800TVF4	05	10/14/10	1800	W		7	X	X	X	X	X	X		Equip Blank			
7	WGC10141730TVF5	06	↓				1	X							Trip Blank			
8	WGC10141735TVF5	07	↓				1	X							Trip Blank			
9																		
10																		

Sampler(s) Please Print & Sign: Bridget Walsh Bridget Walsh

Shipment Method:

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
Bridget Walsh	10/14/10		
Relinquished by:	Date:	Time:	Received by (Laboratory):
	10/14/10	2005	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):
	10/14/10	10:15pm	

Notes:

Cooler ID	Cooler Temp

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | **ALS Work Order #:** 1016889

Customer Information

Purchase Order	
Work Order	
Company Name	AECom Environment
Send Report To	Jim Tolbert
Address	5555 Glenwood Hills Pkwy
City/State/Zip	Grand Rapids, MI 49512
Phone	616-942-9600
Fax	
e-Mail Address	james.tolbert@aecom.com

Project Information

Project Name	Enbridge Line 6B, MP 608-Marshall MI
Project Number	Hydrogeo study
Bill To Company	Enbridge Energy
Invoice Attn	Accounts Payable
Address	1100 Louisiana Suite 1100
City/State/Zip	Houston, TX 77002
Phone	
Fax	
e-Mail Address	

Parameter/Method Request for Analysis

A	VOC's by EPA 8260 – groundwater list provided
B	PAH's by EPA 8270
C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab filtered)
E	Cl, SO4 by EPA 9056
F	Bicarbonate and carbonate Alkalinity by SM 2320
G	SW metals Fe, Na, K, Ca, Mg by EPA 6020
H	
I	
J	

No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	W6E1014 1020 BRH1	08	10/14/10	1020	W		7	X	X	X	X	X	X		mwkR36ØL Ø1			
2	W6E1014 1200 BRH1	09	10/14/10	1200	W		7	X	X	X	X	X	X		mwkR36ØL Ø2			
3	W6E1014 1200 BRH2 (Dup)	10	10/14/10	1200	W		7	X	X	X	X	X	X		mwkR36ØL Ø2 Dup			
4	W6C1014 1505 BRH1	11	10/14/10	1505	W		7	X	X	X	V	X	Y		mwkRØ25ØL Ø2			
5	W6C1014 1640 BRH1	12	10/14/10	1640	W		7	X	X	Y	Y	X	X		mwkRØ25ØL Ø1			
6	W6C1014 1810 BRH1	13	10/14/10	1810	W		7	Y	Y	Y	X	X	X		mwkRØ25ØL Ø3			
7	W6C1014 1810 BRH5	14	10/14/10	1810	W		1	X										
8																		
9																		
10																		

Sampler(s) Please Print & Sign: Brad Hoare Brad Hoare

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ____ ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by: Brad Hoare	Date: 10/14/10	Time: 7000 pm	Received by:
Relinquished by:	Date: 10/14/10	Time: 2005	Received by (Laboratory):
Logged by (Laboratory):	Date: 10/14/10	Time: 10:15pm	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other ____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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17-Oct-2010

Kris Nolan
AECOM Enviroment
5555 Glenwood Parkway SE
Grand Rapids, MI 49512

Re: **Marshall Oil Spill Hydrogeo Study 10/15/10** Work Order: **1010436**

Dear Kris,

ALS Group USA, Corp received 17 samples on 15-Oct-2010 08:00 PM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 54.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Ann Preston

Electronically approved by: Ann Preston

Ann Preston
Project Manager

Certificate No: IL100452

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 17-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Work Order: **1010436**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1010436-01	WGE10150935BAW1	Water		10/15/2010 09:35	10/13/2010 20:00	☐
1010436-02	WGE10151050BAW1	Water		10/15/2010 10:50	10/13/2010 20:00	☐
1010436-03	WGE10151050BAW2	Water		10/15/2010 10:50	10/13/2010 20:00	☐
1010436-04	WSE10151200BAW1	Water		10/15/2010 12:00	10/13/2010 20:00	☐
1010436-05	WGE10151405BAW1	Water		10/15/2010 14:05	10/13/2010 20:00	☐
1010436-06	WGE10151530BAW1	Water		10/15/2010 15:30	10/13/2010 20:00	☐
1010436-07	WGE10151600BAW5	Water		10/15/2010	10/13/2010 20:00	☐
1010436-08	WGE10151605BAW5	Water		10/15/2010	10/13/2010 20:00	☐
1010436-09	WGC10150950DJJ1	Water		10/15/2010 09:50	10/13/2010 20:00	☐
1010436-10	WGC10151120DJJ1	Water		10/15/2010 11:20	10/13/2010 20:00	☐
1010436-11	WGC10151310DJJ1	Water		10/15/2010 13:10	10/13/2010 20:00	☐
1010436-12	WSC10151712DJJ1	Water		10/15/2010 17:12	10/13/2010 20:00	☐
1010436-13	WSC10151555DJJ1	Water		10/15/2010 15:55	10/13/2010 20:00	☐
1010436-14	WSC10151448DJJ1	Water		10/15/2010 14:48	10/13/2010 20:00	☐
1010436-15	WGE10150935DJJ4	Water		10/15/2010 09:35	10/13/2010 20:00	☐
1010436-16	WGC10151830DJJ5	Water		10/15/2010	10/13/2010 20:00	☐
1010436-17	WGC10151835DJJ5	Water		10/15/2010	10/13/2010 20:00	☐

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Work Order: 1010436

Case Narrative

Batch 30000 sample WGC10150950DJJ1 MS recovery for Calcium is above control limits, but the amount of Calcium in the parent sample was greater than 4 times the amount spiked.

Batch 29999 LCS/LCSD Semi-Volatile surrogate, Phenol-d6, was below control limits. The other surrogates met quality control criteria.

Batch R82565 LCS recovery for Isopropylbenzene was above control limits, but all samples in this quality control batch were ND for this compound. Sample WGC10151120DJJ1 MS/MSD recoveries for p-Isopropyltoluene were below control limits due to matrix interference.. The reporting limit for this compound in the unspiked parent sample may be biased low de to this interference.

Batch R82566 LCSD recovery for Isopropylbenzene was above control limits, but all samples in this quality control batch were ND for this compound. The MS/MSD data for Volatiles is not related to this project's samples.

Batch 8584 LCS/LCSD recoveries for Bicarbonate and Carbonate Alkalinity were below control limits. Sample WGC050950DJJ1 MSMSD recoveries for Bicarbonate and Carbonate Alkalinity were below control limits due to matrix interference.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 17-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
WorkOrder: **1010436**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitation Limit
SD	Serial Dilution

Units Reported	Description
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10150935BAW1
Work Order: 1010436
Collection Date: 10/15/2010 9:35:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-01
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**76**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**14**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**110**	**2.0**	**1.0**		**mg/L**	10	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**75**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**14**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**110**	**2.0**	**1.0**		**mg/L**	10	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*47.9*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*47.1*	*50-110*		S	*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*29.5*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10150935BAW1
Work Order: 1010436 **Collection Date:** 10/15/2010 9:35:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-01 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*98.6*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*52.4*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*19.5*	*20-110*		S	*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*97.3*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*106*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*92.9*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*97.0*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**310**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**100**	**10**	**10**		**mg/L**	10	10/16/2010
Sulfate	**24**	**10**	**1.0**		**mg/L**	10	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

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ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10151050BAW1
Work Order: 1010436
Collection Date: 10/15/2010 10:50:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-02
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**77**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**18**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**24**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**75**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**17**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**24**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*53.0*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*57.4*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*33.5*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10151050BAW1
Work Order: 1010436 **Collection Date:** 10/15/2010 10:50:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-02 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*99.6*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*63.7*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*22.8*	*20-110*			*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*98.4*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*107*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*92.1*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*98.8*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**180**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**70**	**10**	**10**		**mg/L**	5	10/16/2010
Sulfate	**22**	**5.0**	**1.0**		**mg/L**	5	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

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ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10151050BAW2
Work Order: 1010436
Collection Date: 10/15/2010 10:50:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-03
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**75**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**17**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**24**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**75**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**17**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**23**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*64.5*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*66.3*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*37.6*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10151050BAW2
Work Order: 1010436 **Collection Date:** 10/15/2010 10:50:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-03 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*96.7*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*71.7*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*24.5*	*20-110*			*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*96.8*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*105*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*92.5*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*99.1*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**190**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**69**	**10**	**10**		**mg/L**	5	10/16/2010
Sulfate	**20**	**5.0**	**1.0**		**mg/L**	5	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WSE10151200BAW1
Work Order:	1010436	**Collection Date:**	10/15/2010 12:00:00 PM
Project:	Marshall Oil Spill Hydrogeo Study 10/15/10		
Lab ID:	1010436-04	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Calcium	**83**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**0.22**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**24**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**23**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**240**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**44**	**10**	**10**		**mg/L**	5	10/16/2010
Sulfate	**35**	**5.0**	**1.0**		**mg/L**	5	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10151405BAW1
Work Order: 1010436
Collection Date: 10/15/2010 2:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-05
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	**0.19**	**0.10**	**0.10**		**mg/L**	1	10/16/2010
Calcium	**120**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**5.0**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**20**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**23**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	**0.18**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**120**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**3.8**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**20**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**23**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*54.1*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*54.6*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*35.4*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10151405BAW1
Work Order: 1010436 **Collection Date:** 10/15/2010 2:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-05 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*68.8*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*57.4*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*22.7*	*20-110*			*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*96.7*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*104*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*92.9*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*98.5*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**350**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**26**	**10**	**10**		**mg/L**	2	10/16/2010
Sulfate	**20**	**2.0**	**1.0**		**mg/L**	2	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10151530BAW1
Work Order: 1010436
Collection Date: 10/15/2010 3:30:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-06
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	**0.17**	**0.10**	**0.10**		**mg/L**	1	10/16/2010
Calcium	**91**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**0.96**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**23**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**12**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	**0.16**	**0.10**	**0.10**		**mg/L**	1	10/15/2010
Calcium	**90**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	**0.75**	**0.20**	**0.20**		**mg/L**	1	10/15/2010
Magnesium	**23**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**12**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*62.4*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*64.9*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*36.1*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10151530BAW1
Work Order: 1010436 **Collection Date:** 10/15/2010 3:30:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-06 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*97.5*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*66.6*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*23.6*	*20-110*			*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*96.7*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*103*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*94.0*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*97.4*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**300**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**22**	**10**	**10**		**mg/L**	2	10/16/2010
Sulfate	**20**	**2.0**	**1.0**		**mg/L**	2	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10151600BAW5
Work Order: 1010436
Collection Date: 10/15/2010
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-07
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*98.9*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*108*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*92.7*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*98.2*	*85-120*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10151605BAW5
Work Order: 1010436
Collection Date: 10/15/2010
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-08
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*98.3*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*106*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*93.6*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*96.1*	*85-120*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10150950DJJ1
Work Order: 1010436
Collection Date: 10/15/2010 9:50:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-09
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**95**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**28**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**11**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/15/2010
Calcium	**91**	**10**	**10**		**mg/L**	1	10/15/2010
Iron	ND	0.20	0.20		mg/L	1	10/15/2010
Magnesium	**27**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Nickel	ND	0.020	0.020		mg/L	1	10/15/2010
Potassium	ND	10	10		mg/L	1	10/15/2010
Sodium	**11**	**1.0**	**1.0**		**mg/L**	1	10/15/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/15/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*47.7*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*43.3*	*50-110*		S	*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*30.1*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10150950DJJ1
Work Order: 1010436 **Collection Date:** 10/15/2010 9:50:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-09 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*97.3*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*51.7*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*18.7*	*20-110*		S	*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **AK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*98.9*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*102*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*95.4*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*97.5*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**300**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**18**	**10**	**10**		**mg/L**	4	10/16/2010
Sulfate	**35**	**4.0**	**1.0**		**mg/L**	4	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

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ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10151120DJJ1
Work Order: 1010436
Collection Date: 10/15/2010 11:20:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-10
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**80**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**23**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**11**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**77**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**22**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**10**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*57.8*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*61.8*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*32.2*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10151120DJJ1
Work Order: 1010436
Collection Date: 10/15/2010 11:20:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-10
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*89.5*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*61.9*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*19.7*	*20-110*		S	*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*89.5*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*98.4*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**11**	**10**	**10**		**mg/L**	10	10/16/2010
Sulfate	**25**	**10**	**1.0**		**mg/L**	10	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10151310DJJ1
Work Order: 1010436
Collection Date: 10/15/2010 1:10:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-11
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**93**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**0.30**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**26**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**12**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	**91**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	**26**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**11**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*52.5*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*51.9*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*32.0*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10151310DJJ1
Work Order: 1010436 **Collection Date:** 10/15/2010 1:10:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-11 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*96.8*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*55.0*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*20.7*	*20-110*			*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*104*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*90.1*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*96.1*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*101*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**290**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**33**	**10**	**10**		**mg/L**	10	10/16/2010
Sulfate	**33**	**10**	**1.0**		**mg/L**	10	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WSC10151712DJJ1
Work Order:	1010436	**Collection Date:**	10/15/2010 5:12:00 PM
Project:	Marshall Oil Spill Hydrogeo Study 10/15/10		
Lab ID:	1010436-12	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Calcium	**85**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**0.84**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**24**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**17**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**37**	**10**	**10**		**mg/L**	10	10/16/2010
Sulfate	**35**	**10**	**1.0**		**mg/L**	10	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WSC10151555DJJ1
Work Order:	1010436	**Collection Date:**	10/15/2010 3:55:00 PM
Project:	Marshall Oil Spill Hydrogeo Study 10/15/10		
Lab ID:	1010436-13	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Calcium	**81**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**0.23**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**24**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**16**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**290**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**37**	**10**	**10**		**mg/L**	10	10/16/2010
Sulfate	**37**	**10**	**1.0**		**mg/L**	10	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WSC10151448DJJ1
Work Order:	1010436	**Collection Date:**	10/15/2010 2:48:00 PM
Project:	Marshall Oil Spill Hydrogeo Study 10/15/10		
Lab ID:	1010436-14	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Calcium	**88**	**10**	**10**		**mg/L**	1	10/16/2010
Iron	**0.28**	**0.20**	**0.20**		**mg/L**	1	10/16/2010
Magnesium	**26**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	**17**	**1.0**	**1.0**		**mg/L**	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**36**	**10**	**10**		**mg/L**	10	10/16/2010
Sulfate	**37**	**10**	**1.0**		**mg/L**	10	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGE10150935DJJ4
Work Order: 1010436
Collection Date: 10/15/2010 9:35:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-15
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/15/2010**		Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	ND	10	10		mg/L	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	ND	1.0	1.0		mg/L	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **RH**
Barium	ND	0.10	0.10		mg/L	1	10/16/2010
Calcium	ND	10	10		mg/L	1	10/16/2010
Iron	ND	0.20	0.20		mg/L	1	10/16/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/16/2010
Nickel	ND	0.020	0.020		mg/L	1	10/16/2010
Potassium	ND	10	10		mg/L	1	10/16/2010
Sodium	ND	1.0	1.0		mg/L	1	10/16/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/16/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/15/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/16/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/16/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/16/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/16/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/16/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/16/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/16/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/16/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/16/2010
Surr: 2,4,6-Tribromophenol	*80.1*	*40-125*			*%REC*	1	10/16/2010
Surr: 2-Fluorobiphenyl	*77.1*	*50-110*			*%REC*	1	10/16/2010
Surr: 2-Fluorophenol	*46.0*	*20-110*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGE10150935DJJ4
Work Order: 1010436 **Collection Date:** 10/15/2010 9:35:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-15 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*95.7*	*50-125*			*%REC*	1	10/16/2010
Surr: Nitrobenzene-d5	*76.3*	*40-110*			*%REC*	1	10/16/2010
Surr: Phenol-d6	*28.4*	*20-110*			*%REC*	1	10/16/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*90.5*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*98.7*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*100*	*85-120*			*%REC*	1	10/16/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **NZ**
Alkalinity, Bicarbonate (as CaCO3)	**10**	**10**	**10**		**mg/L**	1	10/16/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/16/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	ND	10	10		mg/L	1	10/16/2010
Sulfate	ND	1.0	1.0		mg/L	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *17-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10151830DJJ5
Work Order: 1010436
Collection Date: 10/15/2010
Project: Marshall Oil Spill Hydrogeo Study 10/15/10
Lab ID: 1010436-16
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*98.7*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*106*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*92.8*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*95.9*	*85-120*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

ALS Group USA, Corp

Date: *17-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WGC10151835DJJ5
Work Order:	1010436	**Collection Date:**	10/15/2010
Project:	Marshall Oil Spill Hydrogeo Study 10/15/10		
Lab ID:	1010436-17	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **CW**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Benzene	ND	1.0	1.0		µg/L	1	10/16/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/16/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/16/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/16/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/16/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/16/2010
Toluene	ND	1.0	1.0		µg/L	1	10/16/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/16/2010
Surr: 1,2-Dichloroethane-d4	*97.6*	*70-120*			*%REC*	1	10/16/2010
Surr: 4-Bromofluorobenzene	*107*	*75-120*			*%REC*	1	10/16/2010
Surr: Dibromofluoromethane	*94.4*	*85-115*			*%REC*	1	10/16/2010
Surr: Toluene-d8	*96.0*	*85-120*			*%REC*	1	10/16/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 17-Oct-10

Client: AECOM Enviroment

QC BATCH REPORT

Work Order: 1010436

Project: Marshall Oil Spill Hydrogeo Study 10/15/10

Batch ID: **30000** Instrument ID **ICPMS2** Method: **SW6020A**

MBLK Sample ID: **MBLK-30000-30000** Units: **mg/L** Analysis Date: **10/16/2010 02:22 AM**

Client ID: Run ID: **ICPMS2_101016A** SeqNo: **1452375** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	ND	0.20								
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-30000-30000** Units: **mg/L** Analysis Date: **10/16/2010 02:36 AM**

Client ID: Run ID: **ICPMS2_101016A** SeqNo: **1452378** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1061	0.0050	0.1	0	106	80-120	0			
Calcium	11.21	0.50	10	0	112	80-120	0			
Iron	11.11	0.080	10	0	111	80-120	0			
Magnesium	11.17	0.20	10	0	112	80-120	0			
Nickel	0.1032	0.0050	0.1	0	103	80-120	0			
Potassium	11.13	0.20	10	0	111	80-120	0			
Sodium	11.1	0.20	10	0	111	80-120	0			
Vanadium	0.1089	0.0050	0.1	0	109	80-120	0			

LCSD Sample ID: **LCSD-30000-30000** Units: **mg/L** Analysis Date: **10/16/2010 02:41 AM**

Client ID: Run ID: **ICPMS2_101016A** SeqNo: **1452379** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1037	0.0050	0.1	0	104	80-120	0.1061	2.29	20	
Calcium	11.06	0.50	10	0	111	80-120	11.21	1.35	20	
Iron	11	0.080	10	0	110	80-120	11.11	0.995	20	
Magnesium	10.95	0.20	10	0	110	80-120	11.17	1.99	20	
Nickel	0.1011	0.0050	0.1	0	101	80-120	0.1032	2.06	20	
Potassium	10.93	0.20	10	0	109	80-120	11.13	1.81	20	
Sodium	10.87	0.20	10	0	109	80-120	11.1	2.09	20	
Vanadium	0.1065	0.0050	0.1	0	106	80-120	0.1089	2.23	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **30000** Instrument ID **ICPMS2** Method: **SW6020A**

MS Sample ID: **1010436-09CMS** Units: **mg/L** Analysis Date: **10/16/2010 03:39 AM**

Client ID: **WGC10150950DJJ1** Run ID: **ICPMS2_101016A** SeqNo: **1452390** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1374	0.0050	0.1	0.03465	103	80-120	0			
Calcium	107.6	0.50	10	94.89	127	80-120	0			SO
Iron	10.68	0.080	10	0.05955	106	80-120	0			
Magnesium	39.44	0.20	10	28.25	112	80-120	0			
Nickel	0.09775	0.0050	0.1	0.0022	95.6	80-120	0			
Potassium	12.28	0.20	10	1.444	108	80-120	0			
Sodium	22.04	0.20	10	10.91	111	80-120	0			
Vanadium	0.1062	0.0050	0.1	0.000341	106	80-120	0			

MSD Sample ID: **1010436-09CMSD** Units: **mg/L** Analysis Date: **10/16/2010 03:44 AM**

Client ID: **WGC10150950DJJ1** Run ID: **ICPMS2_101016A** SeqNo: **1452391** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1373	0.0050	0.1	0.03465	103	80-120	0.1374	0.0728	20	
Calcium	103.3	0.50	10	94.89	84.1	80-120	107.6	4.08	20	O
Iron	10.76	0.080	10	0.05955	107	80-120	10.68	0.746	20	
Magnesium	38.14	0.20	10	28.25	98.9	80-120	39.44	3.35	20	
Nickel	0.09844	0.0050	0.1	0.0022	96.2	80-120	0.09775	0.703	20	
Potassium	12.35	0.20	10	1.444	109	80-120	12.28	0.568	20	
Sodium	21.45	0.20	10	10.91	105	80-120	22.04	2.71	20	
Vanadium	0.1071	0.0050	0.1	0.000341	107	80-120	0.1062	0.844	20	

The following samples were analyzed in this batch:

1010436-01C	1010436-02C	1010436-03C
1010436-04A	1010436-05C	1010436-06C
1010436-09C	1010436-10C	1010436-11C
1010436-12A	1010436-13A	1010436-14A
1010436-15C		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82544** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MBLK Sample ID: **MBLK-R82544-R82544** Units: **mg/L** Analysis Date: **10/15/2010 01:18 PM**
Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451992** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	ND	0.20								
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-R82544-R82544** Units: **mg/L** Analysis Date: **10/15/2010 01:13 PM**
Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451991** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1062	0.0050	0.1	0	106	80-120	0			
Calcium	10.46	0.50	10	0	105	80-120	0			
Iron	10.75	0.080	10	0	108	80-120	0			
Magnesium	10.72	0.20	10	0	107	80-120	0			
Nickel	0.101	0.0050	0.1	0	101	80-120	0			
Potassium	10.68	0.20	10	0	107	80-120	0			
Sodium	10.58	0.20	10	0	106	80-120	0			
Vanadium	0.1062	0.0050	0.1	0	106	80-120	0			

LCSD Sample ID: **LCSD-R82544-R82544** Units: **mg/L** Analysis Date: **10/15/2010 02:17 PM**
Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451993** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1038	0.0050	0.1	0	104	80-120	0			
Calcium	10.29	0.50	10	0	103	80-120	0			
Iron	10.44	0.080	10	0	104	80-120	0			
Magnesium	10.32	0.20	10	0	103	80-120	0			
Nickel	0.09575	0.0050	0.1	0	95.8	80-120	0			
Potassium	10.37	0.20	10	0	104	80-120	0			
Sodium	10.2	0.20	10	0	102	80-120	0			
Vanadium	0.1025	0.0050	0.1	0	102	80-120	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82544** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MS Sample ID: **1010389-01DMS** Units: **mg/L** Analysis Date: **10/15/2010 01:28 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451615** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1173	0.0050	0.1	0.02219	95.1	80-120	0			
Calcium	77.81	0.50	10	69.33	84.8	80-120	0			O
Iron	9.787	0.080	10	0.02091	97.7	80-120	0			
Magnesium	23.7	0.20	10	14.5	92	80-120	0			
Nickel	0.08795	0.0050	0.1	0.002004	85.9	80-120	0			
Potassium	10.75	0.20	10	1.007	97.4	80-120	0			
Sodium	11.28	0.20	10	1.741	95.4	80-120	0			
Vanadium	0.09632	0.0050	0.1	0.0003998	95.9	80-120	0			

MS Sample ID: **1010436-09DMS** Units: **mg/L** Analysis Date: **10/16/2010 01:52 AM**

Client ID: **WGC10150950DJJ1** Run ID: **ICPMS2_101016A** SeqNo: **1452369** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1291	0.0050	0.1	0.03311	96	80-120	0			
Calcium	98.86	0.50	10	90.69	81.7	80-120	0			O
Iron	9.875	0.080	10	0.04648	98.3	80-120	0			
Magnesium	36.52	0.20	10	27.13	93.9	80-120	0			
Nickel	0.09005	0.0050	0.1	0.002419	87.6	80-120	0			
Potassium	11.7	0.20	10	1.909	97.9	80-120	0			
Sodium	20.34	0.20	10	10.51	98.3	80-120	0			
Vanadium	0.09973	0.0050	0.1	0.0007271	99	80-120	0			

MSD Sample ID: **1010389-01DMSD** Units: **mg/L** Analysis Date: **10/15/2010 01:33 PM**

Client ID: Run ID: **ICPMS2_101015A** SeqNo: **1451616** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1167	0.0050	0.1	0.02219	94.5	80-120	0.1173	0.513	20	
Calcium	77.99	0.50	10	69.33	86.6	80-120	77.81	0.231	20	O
Iron	9.775	0.080	10	0.02091	97.5	80-120	9.787	0.123	20	
Magnesium	23.55	0.20	10	14.5	90.5	80-120	23.7	0.635	20	
Nickel	0.08816	0.0050	0.1	0.002004	86.2	80-120	0.08795	0.238	20	
Potassium	10.68	0.20	10	1.007	96.7	80-120	10.75	0.653	20	
Sodium	11.28	0.20	10	1.741	95.4	80-120	11.28	0	20	
Vanadium	0.09592	0.0050	0.1	0.0003998	95.5	80-120	0.09632	0.416	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82544** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MSD Sample ID: **1010436-09DMSD** Units: **mg/L** Analysis Date: **10/16/2010 01:57 AM**

Client ID: **WGC10150950DJJ1** Run ID: **ICPMS2_101016A** SeqNo: **1452370** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1299	0.0050	0.1	0.03311	96.8	80-120	0.1291	0.618	20	
Calcium	100.2	0.50	10	90.69	95.1	80-120	98.86	1.35	20	O
Iron	10.06	0.080	10	0.04648	100	80-120	9.875	1.86	20	
Magnesium	36.63	0.20	10	27.13	95	80-120	36.52	0.301	20	
Nickel	0.09134	0.0050	0.1	0.002419	88.9	80-120	0.09005	1.42	20	
Potassium	11.93	0.20	10	1.909	100	80-120	11.7	1.95	20	
Sodium	20.53	0.20	10	10.51	100	80-120	20.34	0.93	20	
Vanadium	0.1015	0.0050	0.1	0.0007271	101	80-120	0.09973	1.76	20	

The following samples were analyzed in this batch:

1010436-01D	1010436-02D	1010436-03D
1010436-05D	1010436-06D	1010436-09D
1010436-10D	1010436-11D	1010436-15D

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **29999** Instrument ID **SVMS5** Method: **SW8270**

MBLK Sample ID: **SBLKW1-29999-29999** Units: **µg/L** Analysis Date: **10/16/2010 01:39 PM**

Client ID: Run ID: **SVMS5_101016A** SeqNo: **1452587** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	ND	5.0								
Acenaphthene	ND	5.0								
Acenaphthylene	ND	5.0								
Anthracene	ND	5.0								
Benzo(a)anthracene	ND	5.0								
Benzo(a)pyrene	ND	5.0								
Benzo(b)fluoranthene	ND	5.0								
Benzo(g,h,i)perylene	ND	5.0								
Benzo(k)fluoranthene	ND	5.0								
Chrysene	ND	5.0								
Dibenzo(a,h)anthracene	ND	5.0								
Fluoranthene	ND	5.0								
Fluorene	ND	5.0								
Indeno(1,2,3-cd)pyrene	ND	5.0								
Naphthalene	ND	5.0								
Phenanthrene	ND	5.0								
Pyrene	ND	5.0								
Surr: 2,4,6-Tribromophenol	*46.4*	0	*50*	0	*92.8*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*37.82*	0	*50*	0	*75.6*	*50-110*	0			
Surr: 2-Fluorophenol	*29.18*	0	*50*	0	*58.4*	*20-110*	0			
Surr: 4-Terphenyl-d14	*49.37*	0	*50*	0	*98.7*	*50-125*	0			
Surr: Nitrobenzene-d5	*40.42*	0	*50*	0	*80.8*	*40-110*	0			
Surr: Phenol-d6	*16.21*	0	*50*	0	*32.4*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **29999** Instrument ID **SVMS5** Method: **SW8270**

LCS Sample ID: **SLCSW1-29999-29999** Units: **µg/L** Analysis Date: **10/16/2010 11:13 AM**

Client ID: Run ID: **SVMS5_101016A** SeqNo: **1452583** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	34.12	5.0	40	0	85.3	45-105	0			
Acenaphthene	33.09	5.0	40	0	82.7	45-110	0			
Acenaphthylene	35.97	5.0	40	0	89.9	50-105	0			
Anthracene	39.05	5.0	40	0	97.6	55-110	0			
Benzo(a)anthracene	38.49	5.0	40	0	96.2	55-110	0			
Benzo(a)pyrene	39.7	5.0	40	0	99.2	55-110	0			
Benzo(b)fluoranthene	36.93	5.0	40	0	92.3	45-120	0			
Benzo(g,h,i)perylene	41.22	5.0	40	0	103	40-125	0			
Benzo(k)fluoranthene	36.73	5.0	40	0	91.8	45-125	0			
Chrysene	36.81	5.0	40	0	92	55-110	0			
Dibenzo(a,h)anthracene	41.43	5.0	40	0	104	40-125	0			
Fluoranthene	39.05	5.0	40	0	97.6	55-115	0			
Fluorene	36.04	5.0	40	0	90.1	50-110	0			
Indeno(1,2,3-cd)pyrene	41.69	5.0	40	0	104	45-125	0			
Naphthalene	33.81	5.0	40	0	84.5	40-100	0			
Phenanthrene	38.12	5.0	40	0	95.3	50-115	0			
Pyrene	40.88	5.0	40	0	102	50-130	0			
Surr: 2,4,6-Tribromophenol	*43.8*	0	*50*	0	*87.6*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*35.46*	0	*50*	0	*70.9*	*50-110*	0			
Surr: 2-Fluorophenol	*12.98*	0	*50*	0	*26*	*20-110*	0			
Surr: 4-Terphenyl-d14	*45.67*	0	*50*	0	*91.3*	*50-125*	0			
Surr: Nitrobenzene-d5	*36.65*	0	*50*	0	*73.3*	*40-110*	0			
Surr: Phenol-d6	*4.89*	0	*50*	0	*9.78*	*20-110*	0			*S*

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **29999** Instrument ID **SVMS5** Method: **SW8270**

LCSD Sample ID: **SLCSDW1-29999-29999** Units: **µg/L** Analysis Date: **10/16/2010 11:49 AM**

Client ID: Run ID: **SVMS5_101016A** SeqNo: **1452584** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	35.26	5.0	40	0	88.2	45-105	34.12	3.29	30	
Acenaphthene	34.46	5.0	40	0	86.2	45-110	33.09	4.06	30	
Acenaphthylene	37.1	5.0	40	0	92.8	50-105	35.97	3.09	30	
Anthracene	40.25	5.0	40	0	101	55-110	39.05	3.03	30	
Benzo(a)anthracene	38.87	5.0	40	0	97.2	55-110	38.49	0.982	30	
Benzo(a)pyrene	40.61	5.0	40	0	102	55-110	39.7	2.27	30	
Benzo(b)fluoranthene	41.43	5.0	40	0	104	45-120	36.93	11.5	30	
Benzo(g,h,i)perylene	41.99	5.0	40	0	105	40-125	41.22	1.85	30	
Benzo(k)fluoranthene	32.41	5.0	40	0	81	45-125	36.73	12.5	30	
Chrysene	37.29	5.0	40	0	93.2	55-110	36.81	1.3	30	
Dibenzo(a,h)anthracene	42.07	5.0	40	0	105	40-125	41.43	1.53	30	
Fluoranthene	39.4	5.0	40	0	98.5	55-115	39.05	0.892	30	
Fluorene	37.22	5.0	40	0	93	50-110	36.04	3.22	30	
Indeno(1,2,3-cd)pyrene	42.12	5.0	40	0	105	45-125	41.69	1.03	30	
Naphthalene	35.18	5.0	40	0	88	40-100	33.81	3.97	30	
Phenanthrene	39.06	5.0	40	0	97.6	50-115	38.12	2.44	30	
Pyrene	41.57	5.0	40	0	104	50-130	40.88	1.67	30	
Surr: 2,4,6-Tribromophenol	*37.62*	0	*50*	0	*75.2*	*40-125*	43.8	*15.2*	*40*	
Surr: 2-Fluorobiphenyl	*32.67*	0	*50*	0	*65.3*	*50-110*	35.46	*8.19*	*40*	
Surr: 2-Fluorophenol	*11.69*	0	*50*	0	*23.4*	*20-110*	12.98	*10.5*	*40*	
Surr: 4-Terphenyl-d14	*40.11*	0	*50*	0	*80.2*	*50-125*	45.67	*13*	*40*	
Surr: Nitrobenzene-d5	*33.32*	0	*50*	0	*66.6*	*40-110*	36.65	*9.52*	*40*	
Surr: Phenol-d6	*4.38*	0	*50*	0	*8.76*	*20-110*	4.89	*11*	*40*	*S*

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **29999** Instrument ID **SVMS5** Method: **SW8270**

MS Sample ID: **1010436-09B MS** Units: **µg/L** Analysis Date: **10/16/2010 12:26 PM**

Client ID: **WGC10150950DJJ1** Run ID: **SVMS5_101016A** SeqNo: **1452585** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	228.3	50	400	0	57.1	45-105	0			
Acenaphthene	252.9	50	400	0	63.2	45-110	0			
Acenaphthylene	284.1	50	400	0	71	50-105	0			
Anthracene	310.6	50	400	0	77.6	55-110	0			
Benzo(a)anthracene	303.6	50	400	0	75.9	55-110	0			
Benzo(a)pyrene	320.4	50	400	0	80.1	55-110	0			
Benzo(b)fluoranthene	332.5	50	400	0	83.1	45-120	0			
Benzo(g,h,i)perylene	341.2	50	400	0	85.3	40-125	0			
Benzo(k)fluoranthene	301.3	50	400	0	75.3	45-125	0			
Chrysene	313.1	50	400	0	78.3	55-110	0			
Dibenzo(a,h)anthracene	336.8	50	400	0	84.2	40-125	0			
Fluoranthene	314.6	50	400	0	78.6	55-115	0			
Fluorene	290.2	50	400	0	72.6	50-110	0			
Indeno(1,2,3-cd)pyrene	340.1	50	400	0	85	45-125	0			
Naphthalene	238.3	50	400	0	59.6	40-100	0			
Phenanthrene	308.5	50	400	0	77.1	50-115	0			
Pyrene	332.5	50	400	0	83.1	50-130	0			
Surr: 2,4,6-Tribromophenol	*327.7*	0	*500*	0	*65.5*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*273.4*	0	*500*	0	*54.7*	*50-110*	0			
Surr: 2-Fluorophenol	*191.1*	0	*500*	0	*38.2*	*20-110*	0			
Surr: 4-Terphenyl-d14	*361.7*	0	*500*	0	*72.3*	*50-125*	0			
Surr: Nitrobenzene-d5	*309.4*	0	*500*	0	*61.9*	*40-110*	0			
Surr: Phenol-d6	*127.2*	0	*500*	0	*25.4*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **29999** Instrument ID **SVMS5** Method: **SW8270**

MSD Sample ID: **1010436-09B MSD** Units: **µg/L** Analysis Date: **10/16/2010 01:02 PM**

Client ID: **WGC10150950DJJ1** Run ID: **SVMS5_101016A** SeqNo: **1452586** Prep Date: **10/15/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	298.4	50	400	0	74.6	45-105	228.3	26.6	30	
Acenaphthene	327.8	50	400	0	82	45-110	252.9	25.8	30	
Acenaphthylene	359.7	50	400	0	89.9	50-105	284.1	23.5	30	
Anthracene	396.6	50	400	0	99.2	55-110	310.6	24.3	30	
Benzo(a)anthracene	375.9	50	400	0	94	55-110	303.6	21.3	30	
Benzo(a)pyrene	396.8	50	400	0	99.2	55-110	320.4	21.3	30	
Benzo(b)fluoranthene	392.6	50	400	0	98.2	45-120	332.5	16.6	30	
Benzo(g,h,i)perylene	412	50	400	0	103	40-125	341.2	18.8	30	
Benzo(k)fluoranthene	344.4	50	400	0	86.1	45-125	301.3	13.3	30	
Chrysene	380.1	50	400	0	95	55-110	313.1	19.3	30	
Dibenzo(a,h)anthracene	416.3	50	400	0	104	40-125	336.8	21.1	30	
Fluoranthene	392	50	400	0	98	55-115	314.6	21.9	30	
Fluorene	367	50	400	0	91.8	50-110	290.2	23.4	30	
Indeno(1,2,3-cd)pyrene	419.7	50	400	0	105	45-125	340.1	21	30	
Naphthalene	305.3	50	400	0	76.3	40-100	238.3	24.7	30	
Phenanthrene	381.5	50	400	0	95.4	50-115	308.5	21.2	30	
Pyrene	412.3	50	400	0	103	50-130	332.5	21.4	30	
Surr: 2,4,6-Tribromophenol	*411.5*	0	*500*	0	*82.3*	*40-125*	327.7	*22.7*	*40*	
Surr: 2-Fluorobiphenyl	*368.5*	0	*500*	0	*73.7*	*50-110*	273.4	*29.6*	*40*	
Surr: 2-Fluorophenol	*230.8*	0	*500*	0	*46.2*	*20-110*	191.1	*18.8*	*40*	
Surr: 4-Terphenyl-d14	*445.5*	0	*500*	0	*89.1*	*50-125*	361.7	*20.8*	*40*	
Surr: Nitrobenzene-d5	*393*	0	*500*	0	*78.6*	*40-110*	309.4	*23.8*	*40*	
Surr: Phenol-d6	*150*	0	*500*	0	*30*	*20-110*	127.2	*16.5*	*40*	

The following samples were analyzed in this batch:

1010436-01B	1010436-02B	1010436-03B
1010436-05B	1010436-06B	1010436-09B
1010436-10B	1010436-11B	1010436-15B

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82565** Instrument ID **VMS5** Method: **SW8260**

MBLK Sample ID: **VBLKW1-101015-R82565** Units: **µg/L** Analysis Date: **10/15/2010 09:22 PM**

Client ID: Run ID: **VMS5_101015A** SeqNo: **1452110** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*102.2*	0	*100*	0	*102*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*93.94*	0	*100*	0	*93.9*	*75-120*	0			
Surr: Dibromofluoromethane	*94.91*	0	*100*	0	*94.9*	*85-115*	0			
Surr: Toluene-d8	*100.8*	0	*100*	0	*101*	*85-120*	0			

LCS Sample ID: **VLCSW1-101015-R82565** Units: **µg/L** Analysis Date: **10/15/2010 08:00 PM**

Client ID: Run ID: **VMS5_101015A** SeqNo: **1452107** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	22.5	1.0	20	0	112	75-130	0			
1,3,5-Trimethylbenzene	22.77	1.0	20	0	114	75-130	0			
Benzene	22.44	1.0	20	0	112	80-120	0			
Ethylbenzene	22.84	1.0	20	0	114	75-125	0			
Isopropylbenzene	25.74	1.0	20	0	129	75-125	0			S
n-Propylbenzene	20.02	1.0	20	0	100	70-130	0			
Naphthalene	23.03	5.0	20	0	115	55-140	0			
p-Isopropyltoluene	19.27	2.0	20	0	96.4	75-130	0			
sec-Butylbenzene	19.89	2.0	20	0	99.4	70-125	0			
Toluene	23.07	1.0	20	0	115	75-120	0			
Xylenes, Total	63.19	2.0	60	0	105	75-130	0			
Surr: 1,2-Dichloroethane-d4	*99.54*	0	*100*	0	*99.5*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*102.8*	0	*100*	0	*103*	*75-120*	0			
Surr: Dibromofluoromethane	*101*	0	*100*	0	*101*	*85-115*	0			
Surr: Toluene-d8	*100.6*	0	*100*	0	*101*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82565** Instrument ID **VMS5** Method: **SW8260**

LCSD Sample ID: **VLCSDW1-101015-R82565** Units: **µg/L** Analysis Date: **10/15/2010 08:27 PM**

Client ID: Run ID: **VMS5_101015A** SeqNo: **1452108** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	21.49	1.0	20	0	107	75-130	22.5	4.59	30	
1,3,5-Trimethylbenzene	21.8	1.0	20	0	109	75-130	22.77	4.35	30	
Benzene	21.72	1.0	20	0	109	80-120	22.44	3.26	30	
Ethylbenzene	21.9	1.0	20	0	110	75-125	22.84	4.2	30	
Isopropylbenzene	24.56	1.0	20	0	123	75-125	25.74	4.69	30	
n-Propylbenzene	18.8	1.0	20	0	94	70-130	20.02	6.29	30	
Naphthalene	22.27	5.0	20	0	111	55-140	23.03	3.36	30	
p-Isopropyltoluene	18.16	2.0	20	0	90.8	75-130	19.27	5.93	30	
sec-Butylbenzene	18.64	2.0	20	0	93.2	70-125	19.89	6.49	30	
Toluene	22.06	1.0	20	0	110	75-120	23.07	4.48	30	
Xylenes, Total	60.81	2.0	60	0	101	75-130	63.19	3.84	30	
Surr: 1,2-Dichloroethane-d4	*100*	0	*100*	0	*100*	*70-120*	99.54	*0.471*	*30*	
Surr: 4-Bromofluorobenzene	*102.7*	0	*100*	0	*103*	*75-120*	102.8	*0.107*	*30*	
Surr: Dibromofluoromethane	*101.4*	0	*100*	0	*101*	*85-115*	101	*0.385*	*30*	
Surr: Toluene-d8	*100.2*	0	*100*	0	*100*	*85-120*	100.6	*0.369*	*30*	

MS Sample ID: **1010436-10A MS** Units: **µg/L** Analysis Date: **10/16/2010 05:38 AM**

Client ID: **WGC10151120DJJ1** Run ID: **VMS5_101015A** SeqNo: **1452126** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	19.03	1.0	20	0	95.2	75-130	0			
1,3,5-Trimethylbenzene	19.33	1.0	20	0	96.6	75-130	0			
Benzene	20.52	1.0	20	0	103	80-120	0			
Ethylbenzene	19.27	1.0	20	0	96.4	75-125	0			
Isopropylbenzene	21.1	1.0	20	0	106	75-125	0			
n-Propylbenzene	16.34	1.0	20	0	81.7	70-130	0			
Naphthalene	19.24	5.0	20	0	96.2	55-140	0			
p-Isopropyltoluene	14.55	2.0	20	0	72.8	75-130	0			S
sec-Butylbenzene	15.72	2.0	20	0	78.6	70-125	0			
Toluene	20.04	1.0	20	0	100	75-120	0			
Xylenes, Total	53.29	2.0	60	0	88.8	75-130	0			
Surr: 1,2-Dichloroethane-d4	*102.3*	0	*100*	0	*102*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*101.2*	0	*100*	0	*101*	*75-120*	0			
Surr: Dibromofluoromethane	*103.9*	0	*100*	0	*104*	*85-115*	0			
Surr: Toluene-d8	*101*	0	*100*	0	*101*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82565** Instrument ID **VMS5** Method: **SW8260**

MSD Sample ID: **1010436-10A MSD** Units: **µg/L** Analysis Date: **10/16/2010 06:05 AM**

Client ID: **WGC10151120DJJ1** Run ID: **VMS5_101015A** SeqNo: **1452127** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	18.42	1.0	20	0	92.1	75-130	19.03	3.26	30	
1,3,5-Trimethylbenzene	18.57	1.0	20	0	92.8	75-130	19.33	4.01	30	
Benzene	19.49	1.0	20	0	97.4	80-120	20.52	5.15	30	
Ethylbenzene	18.46	1.0	20	0	92.3	75-125	19.27	4.29	30	
Isopropylbenzene	20.09	1.0	20	0	100	75-125	21.1	4.9	30	
n-Propylbenzene	15.54	1.0	20	0	77.7	70-130	16.34	5.02	30	
Naphthalene	19.65	5.0	20	0	98.2	55-140	19.24	2.11	30	
p-Isopropyltoluene	13.95	2.0	20	0	69.8	75-130	14.55	4.21	30	S
sec-Butylbenzene	15.03	2.0	20	0	75.2	70-125	15.72	4.49	30	
Toluene	19.1	1.0	20	0	95.5	75-120	20.04	4.8	30	
Xylenes, Total	50.83	2.0	60	0	84.7	75-130	53.29	4.73	30	
Surr: 1,2-Dichloroethane-d4	*100.4*	0	*100*	0	*100*	*70-120*	102.3	*1.84*	*30*	
Surr: 4-Bromofluorobenzene	*102.3*	0	*100*	0	*102*	*75-120*	101.2	*1.05*	*30*	
Surr: Dibromofluoromethane	*102.2*	0	*100*	0	*102*	*85-115*	103.9	*1.65*	*30*	
Surr: Toluene-d8	*100.1*	0	*100*	0	*100*	*85-120*	101	*0.886*	*30*	

The following samples were analyzed in this batch: 1010436-10A 1010436-11A 1010436-15A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82566** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW1-101015-R82566** Units: **µg/L** Analysis Date: **10/15/2010 09:42 PM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1452229** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*103.3*	0	*100*	0	*103*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*99.11*	0	*100*	0	*99.1*	*75-120*	0			
Surr: Dibromofluoromethane	*99.89*	0	*100*	0	*99.9*	*85-115*	0			
Surr: Toluene-d8	*100.3*	0	*100*	0	*100*	*85-120*	0			

LCS Sample ID: **VLCSW1-101015-R82566** Units: **µg/L** Analysis Date: **10/15/2010 08:20 PM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1452211** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.94	1.0	20	0	105	75-130	0			
1,3,5-Trimethylbenzene	21.21	1.0	20	0	106	75-130	0			
Benzene	18.84	1.0	20	0	94.2	80-120	0			
Ethylbenzene	19.8	1.0	20	0	99	75-125	0			
Isopropylbenzene	24.16	1.0	20	0	121	75-125	0			
n-Propylbenzene	20.38	1.0	20	0	102	70-130	0			
Naphthalene	20.13	5.0	20	0	101	55-140	0			
p-Isopropyltoluene	21.68	2.0	20	0	108	75-130	0			
sec-Butylbenzene	21.75	2.0	20	0	109	70-125	0			
Toluene	19.08	1.0	20	0	95.4	75-120	0			
Xylenes, Total	61.57	2.0	60	0	103	75-130	0			
Surr: 1,2-Dichloroethane-d4	*97.65*	0	*100*	0	*97.6*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*101.2*	0	*100*	0	*101*	*75-120*	0			
Surr: Dibromofluoromethane	*99.74*	0	*100*	0	*99.7*	*85-115*	0			
Surr: Toluene-d8	*101*	0	*100*	0	*101*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82566** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW1-101015-R82566** Units: **µg/L** Analysis Date: **10/15/2010 08:48 PM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1452212** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	21.8	1.0	20	0	109	75-130	20.94	4.02	30	
1,3,5-Trimethylbenzene	22.14	1.0	20	0	111	75-130	21.21	4.29	30	
Benzene	19.9	1.0	20	0	99.5	80-120	18.84	5.47	30	
Ethylbenzene	20.51	1.0	20	0	103	75-125	19.8	3.52	30	
Isopropylbenzene	25.48	1.0	20	0	127	75-125	24.16	5.32	30	S
n-Propylbenzene	21.33	1.0	20	0	107	70-130	20.38	4.56	30	
Naphthalene	19.72	5.0	20	0	98.6	55-140	20.13	2.06	30	
p-Isopropyltoluene	22.59	2.0	20	0	113	75-130	21.68	4.11	30	
sec-Butylbenzene	22.52	2.0	20	0	113	70-125	21.75	3.48	30	
Toluene	19.89	1.0	20	0	99.4	75-120	19.08	4.16	30	
Xylenes, Total	64.58	2.0	60	0	108	75-130	61.57	4.77	30	
Surr: 1,2-Dichloroethane-d4	*98.93*	0	*100*	0	*98.9*	*70-120*	97.65	*1.3*	*30*	
Surr: 4-Bromofluorobenzene	*102.4*	0	*100*	0	*102*	*75-120*	101.2	*1.18*	*30*	
Surr: Dibromofluoromethane	*100.7*	0	*100*	0	*101*	*85-115*	99.74	*0.918*	*30*	
Surr: Toluene-d8	*100.2*	0	*100*	0	*100*	*85-120*	101	*0.875*	*30*	

MS Sample ID: **1010436-09 MS** Units: **µg/L** Analysis Date: **10/16/2010 06:29 AM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1452244** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	28.46	1.0	20	0	142	75-130	0			S
1,3,5-Trimethylbenzene	28.53	1.0	20	0	143	75-130	0			S
Benzene	25.21	1.0	20	0	126	80-120	0			S
Ethylbenzene	26.96	1.0	20	0	135	75-125	0			S
Isopropylbenzene	33.04	1.0	20	0	165	75-125	0			S
n-Propylbenzene	27.75	1.0	20	0	139	70-130	0			S
Naphthalene	24.59	5.0	20	0	123	55-140	0			
p-Isopropyltoluene	29.69	2.0	20	0	148	75-130	0			S
sec-Butylbenzene	29.28	2.0	20	0	146	70-125	0			S
Toluene	25.51	1.0	20	0	128	75-120	0			S
Xylenes, Total	82.75	2.0	60	0	138	75-130	0			S
Surr: 1,2-Dichloroethane-d4	*95.49*	0	*100*	0	*95.5*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*105.1*	0	*100*	0	*105*	*75-120*	0			
Surr: Dibromofluoromethane	*98.1*	0	*100*	0	*98.1*	*85-115*	0			
Surr: Toluene-d8	*100.1*	0	*100*	0	*100*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82566** Instrument ID **VMS7** Method: **SW8260**

MSD Sample ID: **1010436-09 MSD** Units: **µg/L** Analysis Date: **10/16/2010 06:56 AM**

Client ID: Run ID: **VMS7_101015A** SeqNo: **1452245** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	18.67	1.0	20	0	93.4	75-130	28.46	41.5	30	R
1,3,5-Trimethylbenzene	19.03	1.0	20	0	95.2	75-130	28.53	39.9	30	R
Benzene	16.79	1.0	20	0	84	80-120	25.21	40.1	30	R
Ethylbenzene	17.59	1.0	20	0	88	75-125	26.96	42.1	30	R
Isopropylbenzene	21.89	1.0	20	0	109	75-125	33.04	40.6	30	R
n-Propylbenzene	18.35	1.0	20	0	91.8	70-130	27.75	40.8	30	R
Naphthalene	17.43	5.0	20	0	87.2	55-140	24.59	34.1	30	R
p-Isopropyltoluene	20.37	2.0	20	0	102	75-130	29.69	37.2	30	R
sec-Butylbenzene	19.87	2.0	20	0	99.4	70-125	29.28	38.3	30	R
Toluene	16.97	1.0	20	0	84.8	75-120	25.51	40.2	30	R
Xylenes, Total	54.63	2.0	60	0	91	75-130	82.75	40.9	30	R
Surr: 1,2-Dichloroethane-d4	*94.96*	0	*100*	0	*95*	*70-120*	95.49	*0.557*	*30*	
Surr: 4-Bromofluorobenzene	*103.8*	0	*100*	0	*104*	*75-120*	105.1	*1.26*	*30*	
Surr: Dibromofluoromethane	*96.84*	0	*100*	0	*96.8*	*85-115*	98.1	*1.29*	*30*	
Surr: Toluene-d8	*99.47*	0	*100*	0	*99.5*	*85-120*	100.1	*0.591*	*30*	

The following samples were analyzed in this batch:

1010436-01A	1010436-02A	1010436-03A
1010436-05A	1010436-06A	1010436-07A
1010436-08A	1010436-09A	1010436-16A
1010436-17A		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82577** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW1-101016-R82577** Units: **µg/L** Analysis Date: **10/16/2010 12:43 PM**

Client ID: Run ID: **VMS7_101016A** SeqNo: **1452571** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*98*	0	*100*	0	*98*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*102.6*	0	*100*	0	*103*	*75-120*	0			
Surr: Dibromofluoromethane	*95.29*	0	*100*	0	*95.3*	*85-115*	0			
Surr: Toluene-d8	*98.32*	0	*100*	0	*98.3*	*85-120*	0			

LCS Sample ID: **VLCSW1-101016-R82577** Units: **µg/L** Analysis Date: **10/16/2010 11:21 AM**

Client ID: Run ID: **VMS7_101016A** SeqNo: **1452281** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	21.27	1.0	20	0	106	75-130	0			
1,3,5-Trimethylbenzene	21.7	1.0	20	0	108	75-130	0			
Benzene	21.32	1.0	20	0	107	80-120	0			
Ethylbenzene	22.17	1.0	20	0	111	75-125	0			
Isopropylbenzene	24.18	1.0	20	0	121	75-125	0			
n-Propylbenzene	23.01	1.0	20	0	115	70-130	0			
Naphthalene	22.67	5.0	20	0	113	55-140	0			
p-Isopropyltoluene	23.1	2.0	20	0	116	75-130	0			
sec-Butylbenzene	22.56	2.0	20	0	113	70-125	0			
Toluene	21.28	1.0	20	0	106	75-120	0			
Xylenes, Total	68.8	2.0	60	0	115	75-130	0			
Surr: 1,2-Dichloroethane-d4	*95.38*	0	*100*	0	*95.4*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*102.5*	0	*100*	0	*103*	*75-120*	0			
Surr: Dibromofluoromethane	*96.9*	0	*100*	0	*96.9*	*85-115*	0			
Surr: Toluene-d8	*100.2*	0	*100*	0	*100*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82577** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW1-101016-R82577** Units: **µg/L** Analysis Date: **10/16/2010 11:49 AM**
Client ID: Run ID: **VMS7_101016A** SeqNo: **1452282** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.56	1.0	20	0	103	75-130	21.27	3.39	30	
1,3,5-Trimethylbenzene	20.75	1.0	20	0	104	75-130	21.7	4.48	30	
Benzene	20.47	1.0	20	0	102	80-120	21.32	4.07	30	
Ethylbenzene	21.44	1.0	20	0	107	75-125	22.17	3.35	30	
Isopropylbenzene	23.31	1.0	20	0	117	75-125	24.18	3.66	30	
n-Propylbenzene	22.14	1.0	20	0	111	70-130	23.01	3.85	30	
Naphthalene	22.29	5.0	20	0	111	55-140	22.67	1.69	30	
p-Isopropyltoluene	21.56	2.0	20	0	108	75-130	23.1	6.9	30	
sec-Butylbenzene	21.09	2.0	20	0	105	70-125	22.56	6.74	30	
Toluene	20.94	1.0	20	0	105	75-120	21.28	1.61	30	
Xylenes, Total	67.18	2.0	60	0	112	75-130	68.8	2.38	30	
Surr: 1,2-Dichloroethane-d4	*97.62*	0	*100*	0	*97.6*	*70-120*	95.38	*2.32*	*30*	
Surr: 4-Bromofluorobenzene	*102.8*	0	*100*	0	*103*	*75-120*	102.5	*0.273*	*30*	
Surr: Dibromofluoromethane	*97.49*	0	*100*	0	*97.5*	*85-115*	96.9	*0.607*	*30*	
Surr: Toluene-d8	*101.4*	0	*100*	0	*101*	*85-120*	100.2	*1.24*	*30*	

MS Sample ID: **1010436-09 MS** Units: **µg/L** Analysis Date: **10/16/2010 09:23 PM**
Client ID: Run ID: **VMS7_101016A** SeqNo: **1452695** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Benzene	20	1.0	20	0	100	70-130	0			
Toluene	19.92	1.0	20	0	99.6	70-130	0			
Xylenes, Total	63.75	3.0	60	0	106	70-130	0			
Surr: 1,2-Dichloroethane-d4	*101.9*	0	*100*	0	*102*	*70-130*	0			
Surr: 4-Bromofluorobenzene	*109.3*	0	*100*	0	*109*	*70-130*	0			
Surr: Dibromofluoromethane	*103.1*	0	*100*	0	*103*	*70-130*	0			
Surr: Toluene-d8	*103.1*	0	*100*	0	*103*	*70-130*	0			

MSD Sample ID: **1010436-09 MSD** Units: **µg/L** Analysis Date: **10/16/2010 09:50 PM**
Client ID: Run ID: **VMS7_101016A** SeqNo: **1452696** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Benzene	19.69	1.0	20	0	98.4	70-130	20	1.56	30	
Toluene	19.76	1.0	20	0	98.8	70-130	19.92	0.806	30	
Xylenes, Total	62.79	3.0	60	0	105	70-130	63.75	1.52	30	
Surr: 1,2-Dichloroethane-d4	*100.9*	0	*100*	0	*101*	*70-130*	101.9	*0.957*	*30*	
Surr: 4-Bromofluorobenzene	*108.5*	0	*100*	0	*108*	*70-130*	109.3	*0.799*	*30*	
Surr: Dibromofluoromethane	*102.1*	0	*100*	0	*102*	*70-130*	103.1	*0.926*	*30*	
Surr: Toluene-d8	*103.2*	0	*100*	0	*103*	*70-130*	103.1	*0.0485*	*30*	

The following samples were analyzed in this batch: 1010436-09A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82584** Instrument ID **WETCHEM** Method: **A2320 B**

MBLK Sample ID: **WBLKW1-101016-R82584** Units: **mg/L** Analysis Date: **10/16/2010 01:00 PM**
Client ID: Run ID: **WETCHEM_101016B** SeqNo: **1452548** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	4	10								J
Alkalinity, Carbonate (as CaCO3)	ND	10								

LCS Sample ID: **WLCSW1-101016-R82584** Units: **mg/L** Analysis Date: **10/16/2010 01:00 PM**
Client ID: Run ID: **WETCHEM_101016B** SeqNo: **1452549** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	340.5	10	1000	0	34	80-120	0			S
Alkalinity, Carbonate (as CaCO3)	531.2	10	1000	0	53.1	80-120	0			S

LCSD Sample ID: **WLCSDW1-101016-R82584** Units: **mg/L** Analysis Date: **10/16/2010 01:00 PM**
Client ID: Run ID: **WETCHEM_101016B** SeqNo: **1452565** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	345.4	10	1000	0	34.5	80-120	340.5	1.43	20	S
Alkalinity, Carbonate (as CaCO3)	526.5	10	1000	0	52.6	80-120	531.2	0.889	20	S

MS Sample ID: **1010436-09DMS** Units: **mg/L** Analysis Date: **10/16/2010 01:00 PM**
Client ID: **WGC10150950DJJ1** Run ID: **WETCHEM_101016B** SeqNo: **1452557** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	306.1	10	1000	301.1	0.5	75-125	0			S
Alkalinity, Carbonate (as CaCO3)	3.8	10	1000	3.8	0	75-125	0			JS

MSD Sample ID: **1010436-09DMSD** Units: **mg/L** Analysis Date: **10/16/2010 01:00 PM**
Client ID: **WGC10150950DJJ1** Run ID: **WETCHEM_101016B** SeqNo: **1452558** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	301.4	10	1000	301.1	0.03	75-125	306.1	1.55	35	S
Alkalinity, Carbonate (as CaCO3)	3.6	10	1000	3.8	-0.02	75-125	3.8	0	35	JS

DUP Sample ID: **1010436-01D DUP** Units: **mg/L** Analysis Date: **10/16/2010 01:00 PM**
Client ID: **WGE10150935BAW1** Run ID: **WETCHEM_101016B** SeqNo: **1452570** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	315.5	10	0	0	0		314.1	0.445	20	
Alkalinity, Carbonate (as CaCO3)	4.4	10	0	0	0		3.8	0	20	J

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82584** Instrument ID **WETCHEM** Method: **A2320 B**

The following samples were analyzed in this batch:

1010436-01D	1010436-02D	1010436-03D
1010436-04B	1010436-05D	1010436-06D
1010436-09D	1010436-10D	1010436-11D
1010436-12B	1010436-13B	1010436-14B
1010436-15D		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010436
Project: Marshall Oil Spill Hydrogeo Study 10/15/10

QC BATCH REPORT

Batch ID: **R82591** Instrument ID **IC3** Method: **SW9056**

MBLK Sample ID: **CCB/MBLK-R82591** Units: **mg/L** Analysis Date: **10/16/2010 11:20 AM**
Client ID: Run ID: **IC3_101016B** SeqNo: **1452697** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	0.2134	1.0								J
Sulfate	0.1194	1.0								J

LCS Sample ID: **CCV/LCS-R82591** Units: **mg/L** Analysis Date: **10/16/2010 11:40 AM**
Client ID: Run ID: **IC3_101016B** SeqNo: **1452698** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.946	1.0	10	0	99.5	80-120	0			
Sulfate	9.914	1.0	10	0	99.1	80-120	0			

LCSD Sample ID: **CCV/LCSD-R82591** Units: **mg/L** Analysis Date: **10/16/2010 11:59 AM**
Client ID: Run ID: **IC3_101016B** SeqNo: **1452699** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.618	1.0	10	0	96.2	80-120	9.946	3.35	20	
Sulfate	9.622	1.0	10	0	96.2	80-120	9.914	2.99	20	

MS Sample ID: **1010436-09D MS** Units: **mg/L** Analysis Date: **10/16/2010 02:40 PM**
Client ID: **WGC10150950DJJ1** Run ID: **IC3_101016B** SeqNo: **1452707** Prep Date: DF: **4**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	26.67	4.0	10	18.27	84	75-125	0			
Sulfate	44.2	4.0	10	35.01	91.9	75-125	0			

MSD Sample ID: **1010436-09D MSD** Units: **mg/L** Analysis Date: **10/16/2010 03:00 PM**
Client ID: **WGC10150950DJJ1** Run ID: **IC3_101016B** SeqNo: **1452708** Prep Date: DF: **4**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	27.02	4.0	10	18.27	87.6	75-125	26.67	1.32	20	
Sulfate	44.72	4.0	10	35.01	97	75-125	44.2	1.15	20	

The following samples were analyzed in this batch:

1010436-01D	1010436-02D	1010436-03D
1010436-04B	1010436-05D	1010436-06D
1010436-09D	1010436-10D	1010436-11D
1010436-12B	1010436-13B	1010436-14B
1010436-15D		

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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☒ ALS Laboratory Group
3352 128th Ave.
Holland, MI 49424-9263
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Fax: +1 616 399 6185

ALS Project Manager: | ALS Work Order #: 1010436

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filter)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGE10150935BAW1	10/15/10	0935	W	-	7	X	X	X	X	X	X		MWKR3620L03			
2	WGE10151050BAW1	10/15/10	1050	W	-	7	X	X	X	X	X	X		MWKR3620L02			
3	WGE10151050BAW2	10/15/10	1050	W	-	7	X	X	X	X	X	X					
4	WSE10151200BAW1	10/15/10	1200	W	-	2					X	X	X	SWKR3630L01			
5	WGE10151405BAW1	10/15/10	1405	W	-	7	X	X	X	X	X	X		MWKR3450L02			
6	WGE10151530BAW1	10/15/10	1530	W	-	7	X	X	X	X	X	X		MWKR3460L01			
7	WGE10151600BAW5	10/15/10		W		1	X							Trip Blank			
8	WGE10151605BAW5	10/15/10		W		1	X							Trip Blank			
9																	
10																	

Sampler(s) Please Print & Sign: Bridget Walsh Bridget Walsh

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ____ ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by: Bridget Walsh	Date: 10/15/10	Time: 1635	Received by: Brad Hoare
Relinquished by: Brad Hoare	Date: 10/15/10	Time: 2000	Received by (Laboratory):
Logged by (Laboratory): JR	Date: 1-15-10	Time: 2130	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	3.6 C

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other ____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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ALS Project Manager: | **ALS Work Order #:** 1010436

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 Clab filtered
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGC101509 50DJJ1	(9)	10/15/10	950	w	—	7	X	X	X	X	X	X		mwkR⌀57⌀R⌀1			
2	WGC10150950DJJ3	(9) (ms/msD)	10/15/10	950	w	—	7	X	X	X	X	X	X		mwkR⌀57⌀R⌀1			
3	WGC1015 1120DJJ1	10	10/15/10	1120	w	—	7	X	X	X	X	X	X		mwkR⌀57⌀R⌀2			
4	WGC1015 1310DJJ1	11	10/15/10	1310	w	—	7	X	X	X	X	X	X		mwkR⌀58⌀L⌀1			
5	WSC101 1712DJJ1	12	10/15/10	1712	w	—	2					X	X	X	swkR1525R⌀1			
6	WSC10151555DJJ1	13	10/15/10	1555	w	—	2					X	X	X	swkR⌀25⌀L⌀1			
7	WSC1015 1448DJJ1	14	10/15/10	1448	w	—	2					X	X	X	swkR⌀57⌀R⌀1			
8	WGE10150935DJJ4	15	10/15/10	935	w	—	7	X	X	X	X	X	X		Equipment rinse			
9	WGC1015 1830 DJJ5	16	10/15/10		w		1	X							Trip Blank			
10	WGC 1015 1635 DJJ5	17	10/15/10		w		1	X							Trip Blank			

Sampler(s) Please Print & Sign: DON JOHNSON / [signature]

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other _____ ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by: [signature]	Date: 10/15/2010	Time: 1835	Received by: [signature]	
Relinquished by: [signature]	Date: 10/15/10	Time: 2000	Received by (Laboratory): [signature]	
Logged by (Laboratory): JK	Date: 10/15/10	Time: 2130	Checked By (Laboratory): [signature]	

Notes:

Cooler ID	Cooler Temp
	3.6c

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other _____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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Sample Receipt Checklist

Client Name: **AECOM - GR** Date/Time Received: **15-Oct-10 20:00**

Work Order: **1010436** Received by: **MA**

Checklist completed by Joseph Ribar (eSignature) 15-Oct-10 (Date) Reviewed by: Ann Preston (eSignature) 16-Oct-10 (Date)

Matrices: WATER
Carrier name: ALSHN

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	3.6 c		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☑	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☑	No ☐	N/A ☐
pH adjusted?	Yes ☐	No ☑	N/A ☐
pH adjusted by:	-		

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

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Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | ALS Work Order #: 1010436

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filter)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGE10150935BAW1	10/15/10	0935	W	-	7	X	X	X	X	X	X		MWKR3620L03			
2	WGE10151050BAW1	10/15/10	1050	W	-	7	X	X	X	X	X	X		MWKR3620L02			
3	WGE10151050BAW2	10/15/10	1050	W	-	7	X	X	X	X	X	X					
4	WSE10151200BAW1	10/15/10	1200	W	-	2					X	X	X	SWKR3630L01			
5	WGE10151405BAW1	10/15/10	1405	W	-	7	X	X	X	X	X	X		MWKR3450L02			
6	WGE10151530BAW1	10/15/10	1530	W	-	7	X	X	X	X	X	X		MWKR3460L01			
7	WGE10151600BAW5	10/15/10		W		1	X							Trip Blank			
8	WGE10151605BAW5	10/15/10		W		1	X							Trip Blank			
9																	
10																	

Sampler(s) Please Print & Sign: Bridget Walsh Bridget Walsh

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ____ ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by: Bridget Walsh	Date: 10/15/10	Time: 1635	Received by: Brad Hoare
Relinquished by: Brad Hoare	Date: 10/15/10	Time: 2000	Received by (Laboratory):
Logged by (Laboratory): JR	Date: 1-15-10	Time: 2130	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	3.6 C

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other ____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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Tel: +1 616 399 6070
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ALS Project Manager: | **ALS Work Order #:** 1010436

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo Study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 Clab filtered
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGC101509 50DJJ1	(9)	10/15/10	950	w	—	7	X	X	X	X	X	X		mwkR⌀57⌀R⌀1			
2	WGC10150950DJJ3	(9) (ms/msD)	10/15/10	950	w	—	7	X	X	X	X	X	X		mwkR⌀57⌀R⌀1			
3	WGC1015 1120DJJ1	10	10/15/10	1120	w	—	7	X	X	X	X	X	X		mwkR⌀57⌀R⌀2			
4	WGC1015 1310DJJ1	11	10/15/10	1310	w	—	7	X	X	X	X	X	X		mwkR⌀58⌀L⌀1			
5	WSC101 1712DJJ1	12	10/15/10	1712	w	—	2					X	X	X	swkR1525R⌀1			
6	WSC10151555DJJ1	13	10/15/10	1555	w	—	2					X	X	X	swkR⌀25⌀L⌀1			
7	WSC1015 1448DJJ1	14	10/15/10	1448	w	—	2					X	X	X	swkR⌀57⌀R⌀1			
8	WGE10150935DJJ4	15	10/15/10	935	w	—	7	X	X	X	X	X	X		Equipment rinse			
9	WGC1015 1830 DJJ5	16	10/15/10		w		1	X							Trip Blank			
10	WGC 1015 1635 DJJ5	17	10/15/10		w		1	X							Trip Blank			

Sampler(s) Please Print & Sign: DON JOHNSON / [signature]

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other _____ ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by: [signature]	Date: 10/15/2010	Time: 1835	Received by: [signature]	
Relinquished by: [signature]	Date: 10/15/10	Time: 2000	Received by (Laboratory): [signature]	
Logged by (Laboratory): JK	Date: 10/15/10	Time: 2130	Checked By (Laboratory): [signature]	

Notes:

Cooler ID	Cooler Temp
	3.6c

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other _____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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18-Oct-2010

Kris Nolan
AECOM Enviroment
5555 Glenwood Parkway SE
Grand Rapids, MI 49512

Re: **Marshall Oil Spill Hydrogeo Study 10/16/10** Work Order: **1010453**

Dear Kris,

ALS Group USA, Corp received 14 samples on 16-Oct-2010 07:55 PM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 44.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Ann Preston

Electronically approved by: Ann Preston

Ann Preston
Project Manager

Certificate No: IL100452

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 18-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Work Order: **1010453**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
1010453-01	WGC10160955BRH1	Water		10/16/2010 09:55	10/16/2010 19:55	☐
1010453-02	WGC10161000DJJ1	Water		10/16/2010 10:00	10/16/2010 19:55	☐
1010453-03	WGC10161100DJJ1	Water		10/16/2010 11:00	10/16/2010 19:55	☐
1010453-04	WGC10161100DJJ2	Water		10/16/2010 11:00	10/16/2010 19:55	☐
1010453-05	WGD10161345DJJ1	Water		10/16/2010 13:45	10/16/2010 19:55	☐
1010453-06	WGD10161405BRH1	Water		10/16/2010 14:05	10/16/2010 19:55	☐
1010453-07	WGD10161505BRH1	Water		10/16/2010 15:05	10/16/2010 19:55	☐
1010453-08	WSD10161450DJJ1	Water		10/16/2010 14:50	10/16/2010 19:55	☐
1010453-09	WSD10161640DJJ1	Water		10/16/2010 16:40	10/16/2010 19:55	☐
1010453-10	WGD10161730BRH1	Water		10/16/2010 17:30	10/16/2010 19:55	☐
1010453-11	WGC10161405BRH4	Water		10/16/2010 14:05	10/16/2010 19:55	☐
1010453-12	WGC10161925BRH5	Water		10/16/2010	10/16/2010 19:55	☐
1010453-13	WGC10161930BRH5	Water		10/16/2010	10/16/2010 19:55	☐
1010453-14	WGC10161935BRH5	Water		10/16/2010	10/16/2010 19:55	☐

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: 18-Oct-10

Client: AECOM Enviroment
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
WorkOrder: **1010453**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitation Limit
SD	Serial Dilution

Units Reported	Description
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10160955BRH1
Work Order: 1010453
Collection Date: 10/16/2010 9:55:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-01
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	**0.16**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**110**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**15**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**20**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**44**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	**0.11**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**100**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**0.44**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**19**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**42**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*58.7*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*56.7*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*37.1*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10160955BRH1
Work Order: 1010453
Collection Date: 10/16/2010 9:55:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-01
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*70.2*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*57.0*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*21.7*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*107*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*93.6*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*103*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*99.4*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**360**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**82**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**3.7**	**1.0**	**1.0**		**mg/L**	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161000DJJ1
Work Order: 1010453
Collection Date: 10/16/2010 10:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-02
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	**0.51**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**130**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**26**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**30**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**16**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	**0.28**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**120**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**1.8**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**30**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**16**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*63.8*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*71.1*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*44.6*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10161000DJJ1
Work Order: 1010453 **Collection Date:** 10/16/2010 10:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-02 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*49.2*	*50-125*		S	*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*70.9*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*26.2*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*98.8*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*104*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*98.5*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**480**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**33**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	ND	1.0	1.0		mg/L	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161100DJJ1
Work Order: 1010453
Collection Date: 10/16/2010 11:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-03
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	**0.28**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**130**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**23**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**28**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**19**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	**0.18**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**130**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**1.6**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**28**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**20**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*67.3*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*63.0*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*42.1*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10161100DJJ1
Work Order: 1010453 **Collection Date:** 10/16/2010 11:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-03 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*60.1*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*64.4*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*24.2*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*98.6*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*104*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.3*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**490**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**41**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**4.1**	**1.0**	**1.0**		**mg/L**	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161100DJJ2
Work Order: 1010453
Collection Date: 10/16/2010 11:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-04
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	**0.27**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**130**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**21**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**28**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**19**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	**0.17**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**120**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**0.66**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**28**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**19**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*68.3*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*65.5*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*37.0*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161100DJJ2
Work Order: 1010453
Collection Date: 10/16/2010 11:00:00 AM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-04
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*66.3*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*65.0*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*21.2*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*107*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*96.5*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*105*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.2*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**490**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**39**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**3.9**	**1.0**	**1.0**		**mg/L**	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGD10161345DJJ1
Work Order: 1010453
Collection Date: 10/16/2010 1:45:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-05
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	**110**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**4.4**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**14**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**9.2**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	**100**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	ND	0.20	0.20		mg/L	1	10/17/2010
Magnesium	**13**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**8.7**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*65.7*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*66.0*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*40.3*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGD10161345DJJ1
Work Order: 1010453 **Collection Date:** 10/16/2010 1:45:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-05 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*76.1*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*66.3*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*24.2*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*108*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*98.0*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*105*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.3*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**320**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**19**	**10**	**10**		**mg/L**	1	10/17/2010
Sulfate	**13**	**1.0**	**1.0**		**mg/L**	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGD10161405BRH1
Work Order: 1010453
Collection Date: 10/16/2010 2:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-06
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	**0.18**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**77**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**1.2**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**21**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**11**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	**0.17**	**0.10**	**0.10**		**mg/L**	1	10/17/2010
Calcium	**73**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	ND	0.20	0.20		mg/L	1	10/17/2010
Magnesium	**21**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**10**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*53.4*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*58.8*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*36.9*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGD10161405BRH1
Work Order: 1010453
Collection Date: 10/16/2010 2:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-06
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*72.6*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*60.0*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*22.7*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*96.4*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*104*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*98.7*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**23**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**36**	**10**	**1.0**		**mg/L**	10	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGD10161505BRH1
Work Order: 1010453
Collection Date: 10/16/2010 3:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-07
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	**65**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**1.1**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**13**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**12**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	**62**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**0.66**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**12**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**11**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*59.0*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*55.4*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*33.6*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGD10161505BRH1
Work Order: 1010453 **Collection Date:** 10/16/2010 3:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-07 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*97.1*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*54.5*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*21.5*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*96.0*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*105*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.0*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**210**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**22**	**10**	**10**		**mg/L**	2	10/17/2010
Sulfate	**8.0**	**2.0**	**1.0**		**mg/L**	2	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *18-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WSD10161450DJJ1
Work Order:	1010453	**Collection Date:**	10/16/2010 2:50:00 PM
Project:	Marshall Oil Spill Hydrogeo Study 10/16/10		
Lab ID:	1010453-08	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Calcium	**78**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**0.23**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**23**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**22**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**50**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**38**	**10**	**1.0**		**mg/L**	10	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client:	AECOM Enviroment	**Client Sample ID:**	WSD10161640DJJ1
Work Order:	1010453	**Collection Date:**	10/16/2010 4:40:00 PM
Project:	Marshall Oil Spill Hydrogeo Study 10/16/10		
Lab ID:	1010453-09	**Matrix:**	WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Calcium	**74**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	ND	0.20	0.20		mg/L	1	10/17/2010
Magnesium	**21**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**22**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**260**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**46**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**35**	**10**	**1.0**		**mg/L**	10	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGD10161730BRH1
Work Order: 1010453
Collection Date: 10/16/2010 5:30:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-10
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	**74**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	**32**	**0.20**	**0.20**		**mg/L**	1	10/17/2010
Magnesium	**20**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	**0.025**	**0.020**	**0.020**		**mg/L**	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**34**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	**0.11**	**0.0040**	**0.0040**		**mg/L**	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	**69**	**10**	**10**		**mg/L**	1	10/17/2010
Iron	ND	0.20	0.20		mg/L	1	10/17/2010
Magnesium	**16**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	**35**	**1.0**	**1.0**		**mg/L**	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*63.7*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*63.8*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*37.5*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGD10161730BRH1
Work Order: 1010453 **Collection Date:** 10/16/2010 5:30:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-10 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*62.4*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*65.5*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*23.9*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*99.1*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*104*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.4*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	**230**	**10**	**10**		**mg/L**	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	**55**	**10**	**10**		**mg/L**	10	10/17/2010
Sulfate	**48**	**10**	**1.0**		**mg/L**	10	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161405BRH4
Work Order: 1010453
Collection Date: 10/16/2010 2:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-11
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
METALS BY ICP-MS			**SW6020A**		Prep Date: **10/16/2010**		Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	ND	10	10		mg/L	1	10/17/2010
Iron	ND	0.20	0.20		mg/L	1	10/17/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	ND	1.0	1.0		mg/L	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
METALS BY ICP-MS (DISSOLVED)			**SW6020A**				Analyst: **CES**
Barium	ND	0.10	0.10		mg/L	1	10/17/2010
Calcium	ND	10	10		mg/L	1	10/17/2010
Iron	ND	0.20	0.20		mg/L	1	10/17/2010
Magnesium	ND	1.0	1.0		mg/L	1	10/17/2010
Nickel	ND	0.020	0.020		mg/L	1	10/17/2010
Potassium	ND	10	10		mg/L	1	10/17/2010
Sodium	ND	1.0	1.0		mg/L	1	10/17/2010
Vanadium	ND	0.0040	0.0040		mg/L	1	10/17/2010
SEMI-VOLATILE ORGANIC COMPOUNDS			**SW8270**		Prep Date: **10/16/2010**		Analyst: **HL**
2-Methylnaphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthene	ND	5.0	5.0		µg/L	1	10/17/2010
Acenaphthylene	ND	5.0	5.0		µg/L	1	10/17/2010
Anthracene	ND	5.0	5.0		µg/L	1	10/17/2010
Benzo(a)anthracene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(a)pyrene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(b)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(g,h,i)perylene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzo(k)fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Chrysene	ND	1.0	1.0		µg/L	1	10/17/2010
Dibenzo(a,h)anthracene	ND	2.0	2.0		µg/L	1	10/17/2010
Fluoranthene	ND	1.0	1.0		µg/L	1	10/17/2010
Fluorene	ND	5.0	5.0		µg/L	1	10/17/2010
Indeno(1,2,3-cd)pyrene	ND	2.0	2.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
Phenanthrene	ND	2.0	2.0		µg/L	1	10/17/2010
Pyrene	ND	5.0	5.0		µg/L	1	10/17/2010
Surr: 2,4,6-Tribromophenol	*77.0*	*40-125*			*%REC*	1	10/17/2010
Surr: 2-Fluorobiphenyl	*79.7*	*50-110*			*%REC*	1	10/17/2010
Surr: 2-Fluorophenol	*50.6*	*20-110*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

Client: AECOM Enviroment **Client Sample ID:** WGC10161405BRH4
Work Order: 1010453 **Collection Date:** 10/16/2010 2:05:00 PM
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-11 **Matrix:** WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
Surr: 4-Terphenyl-d14	*81.5*	*50-125*			*%REC*	1	10/17/2010
Surr: Nitrobenzene-d5	*80.3*	*40-110*			*%REC*	1	10/17/2010
Surr: Phenol-d6	*30.1*	*20-110*			*%REC*	1	10/17/2010
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*98.0*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*105*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.8*	*85-120*			*%REC*	1	10/17/2010
ALKALINITY (AS CACO3)			**A2320 B**				Analyst: **JJG**
Alkalinity, Bicarbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
Alkalinity, Carbonate (as CaCO3)	ND	10	10		mg/L	1	10/17/2010
ANIONS BY ION CHROMATOGRAPHY			**SW9056**				Analyst: **ED**
Chloride	ND	10	10		mg/L	1	10/17/2010
Sulfate	ND	1.0	1.0		mg/L	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

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ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161925BRH5
Work Order: 1010453
Collection Date: 10/16/2010
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-12
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*97.2*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*100*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*97.6*	*85-120*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161930BRH5
Work Order: 1010453
Collection Date: 10/16/2010
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-13
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*107*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*97.0*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*103*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*98.0*	*85-120*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

US EPA ARCHIVE DOCUMENT

ALS Group USA, Corp

Date: *18-Oct-10*

Client: AECOM Enviroment
Client Sample ID: WGC10161935BRH5
Work Order: 1010453
Collection Date: 10/16/2010
Project: Marshall Oil Spill Hydrogeo Study 10/16/10
Lab ID: 1010453-14
Matrix: WATER

Analyses	Result	Report Limit	MDEQ OP Memo 2 TDL	Qual	Units	Dilution Factor	Date Analyzed
VOLATILE ORGANIC COMPOUNDS			**SW8260**				Analyst: **MK**
1,2,3-Trimethylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
1,2,4-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
1,3,5-Trimethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Benzene	ND	1.0	1.0		µg/L	1	10/17/2010
Cyclohexane	ND	5.0	5.0		µg/L	1	10/17/2010
Ethylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Isopropylbenzene	ND	5.0	5.0		µg/L	1	10/17/2010
n-Propylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Naphthalene	ND	5.0	5.0		µg/L	1	10/17/2010
p-Isopropyltoluene	ND	5.0	5.0		µg/L	1	10/17/2010
sec-Butylbenzene	ND	1.0	1.0		µg/L	1	10/17/2010
Toluene	ND	1.0	1.0		µg/L	1	10/17/2010
Xylenes, Total	ND	3.0	3.0		µg/L	1	10/17/2010
Surr: 1,2-Dichloroethane-d4	*106*	*70-120*			*%REC*	1	10/17/2010
Surr: 4-Bromofluorobenzene	*97.4*	*75-120*			*%REC*	1	10/17/2010
Surr: Dibromofluoromethane	*102*	*85-115*			*%REC*	1	10/17/2010
Surr: Toluene-d8	*98.6*	*85-120*			*%REC*	1	10/17/2010

Note: See Qualifiers page for a list of qualifiers and their definitions.

ALS Group USA, Corp

Date: 18-Oct-10

Client: AECOM Enviroment

QC BATCH REPORT

Work Order: 1010453

Project: Marshall Oil Spill Hydrogeo Study 10/16/10

Batch ID: **30017** Instrument ID **ICPMS2** Method: **SW6020A**

MBLK Sample ID: **MBLK-30017-30017** Units: **mg/L** Analysis Date: **10/17/2010 07:42 PM**

Client ID: Run ID: **ICPMS2_101017A** SeqNo: **1453319** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	0.001253	0.0050								J
Potassium	0.0102	0.20								J
Sodium	0.01301	0.20								J
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-30017-30017** Units: **mg/L** Analysis Date: **10/17/2010 07:47 PM**

Client ID: Run ID: **ICPMS2_101017A** SeqNo: **1453320** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1001	0.0050	0.1	0	100	80-120	0			
Calcium	10.12	0.50	10	0	101	80-120	0			
Iron	10.35	0.080	10	0	104	80-120	0			
Magnesium	10.5	0.20	10	0	105	80-120	0			
Nickel	0.09912	0.0050	0.1	0	99.1	80-120	0			
Potassium	10.15	0.20	10	0	102	80-120	0			
Sodium	10.44	0.20	10	0	104	80-120	0			
Vanadium	0.1002	0.0050	0.1	0	100	80-120	0			

LCSD Sample ID: **LCSD-30017-30017** Units: **mg/L** Analysis Date: **10/17/2010 07:52 PM**

Client ID: Run ID: **ICPMS2_101017A** SeqNo: **1453321** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1011	0.0050	0.1	0	101	80-120	0.1001	0.994	20	
Calcium	10.41	0.50	10	0	104	80-120	10.12	2.83	20	
Iron	10.46	0.080	10	0	105	80-120	10.35	1.06	20	
Magnesium	10.61	0.20	10	0	106	80-120	10.5	1.04	20	
Nickel	0.1006	0.0050	0.1	0	101	80-120	0.09912	1.48	20	
Potassium	10.32	0.20	10	0	103	80-120	10.15	1.66	20	
Sodium	10.52	0.20	10	0	105	80-120	10.44	0.763	20	
Vanadium	0.1027	0.0050	0.1	0	103	80-120	0.1002	2.46	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **30017** Instrument ID **ICPMS2** Method: **SW6020A**

MS Sample ID: **1010453-07CMS** Units: **mg/L** Analysis Date: **10/17/2010 09:55 PM**

Client ID: **WGD10161505BRH1** Run ID: **ICPMS2_101017A** SeqNo: **1453348** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1813	0.0050	0.1	0.08368	97.6	80-120	0			
Calcium	72.7	0.50	10	64.51	81.9	80-120	0			O
Iron	11.03	0.080	10	1.082	99.5	80-120	0			
Magnesium	22.19	0.20	10	12.6	95.9	80-120	0			
Nickel	0.09637	0.0050	0.1	0.001364	95	80-120	0			
Potassium	12.14	0.20	10	2.246	98.9	80-120	0			
Sodium	21.2	0.20	10	11.68	95.2	80-120	0			
Vanadium	0.09954	0.0050	0.1	0.0002333	99.3	80-120	0			

MSD Sample ID: **1010453-07CMSD** Units: **mg/L** Analysis Date: **10/17/2010 10:00 PM**

Client ID: **WGD10161505BRH1** Run ID: **ICPMS2_101017A** SeqNo: **1453349** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1841	0.0050	0.1	0.08368	100	80-120	0.1813	1.53	20	
Calcium	73.19	0.50	10	64.51	86.8	80-120	72.7	0.672	20	O
Iron	11.09	0.080	10	1.082	100	80-120	11.03	0.542	20	
Magnesium	22.35	0.20	10	12.6	97.5	80-120	22.19	0.718	20	
Nickel	0.097	0.0050	0.1	0.001364	95.6	80-120	0.09637	0.652	20	
Potassium	12.29	0.20	10	2.246	100	80-120	12.14	1.23	20	
Sodium	21.58	0.20	10	11.68	99	80-120	21.2	1.78	20	
Vanadium	0.1007	0.0050	0.1	0.0002333	100	80-120	0.09954	1.16	20	

The following samples were analyzed in this batch:

1010453-01C	1010453-02C	1010453-03C
1010453-04C	1010453-05C	1010453-06C
1010453-07C	1010453-08B	1010453-09B
1010453-10C	1010453-11C	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82605** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MBLK Sample ID: **MBLK-R82605-R82605** Units: **mg/L** Analysis Date: **10/17/2010 07:37 PM**
Client ID: Run ID: **ICPMS2_101017A** SeqNo: **1453335** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	ND	0.0050								
Calcium	ND	0.50								
Iron	ND	0.080								
Magnesium	ND	0.20								
Nickel	ND	0.0050								
Potassium	ND	0.20								
Sodium	ND	0.20								
Vanadium	ND	0.0050								

LCS Sample ID: **LCS-R82605-R82605** Units: **mg/L** Analysis Date: **10/17/2010 07:33 PM**
Client ID: Run ID: **ICPMS2_101017A** SeqNo: **1453336** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1011	0.0050	0.1	0	101	80-120	0			
Calcium	9.943	0.50	10	0	99.4	80-120	0			
Iron	10.03	0.080	10	0	100	80-120	0			
Magnesium	10.14	0.20	10	0	101	80-120	0			
Nickel	0.09861	0.0050	0.1	0	98.6	80-120	0			
Potassium	9.958	0.20	10	0	99.6	80-120	0			
Sodium	10.21	0.20	10	0	102	80-120	0			
Vanadium	0.0991	0.0050	0.1	0	99.1	80-120	0			

LCSD Sample ID: **LCSD-R82605-R82605** Units: **mg/L** Analysis Date: **10/17/2010 08:37 PM**
Client ID: Run ID: **ICPMS2_101017A** SeqNo: **1453338** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1014	0.0050	0.1	0	101	80-120	0.1011	0.296	20	
Calcium	9.799	0.50	10	0	98	80-120	9.943	1.46	20	
Iron	9.894	0.080	10	0	98.9	80-120	10.03	1.37	20	
Magnesium	10.1	0.20	10	0	101	80-120	10.14	0.395	20	
Nickel	0.09686	0.0050	0.1	0	96.9	80-120	0.09861	1.79	20	
Potassium	9.868	0.20	10	0	98.7	80-120	9.958	0.908	20	
Sodium	10.11	0.20	10	0	101	80-120	10.21	0.984	20	
Vanadium	0.09863	0.0050	0.1	0	98.6	80-120	0.0991	0.475	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82605** Instrument ID **ICPMS2** Method: **SW6020A** **(Dissolve)**

MS Sample ID: **1010453-07DMS** Units: **mg/L** Analysis Date: **10/17/2010 08:47 PM**

Client ID: **WGD10161505BRH1** Run ID: **ICPMS2_101017A** SeqNo: **1453331** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.181	0.0050	0.1	0.07861	102	80-120	0			
Calcium	71.19	0.50	10	61.53	96.6	80-120	0			O
Iron	11.32	0.080	10	0.6641	107	80-120	0			
Magnesium	22.6	0.20	10	12.02	106	80-120	0			
Nickel	0.1006	0.0050	0.1	0.003245	97.4	80-120	0			
Potassium	13.03	0.20	10	2.585	104	80-120	0			
Sodium	21.73	0.20	10	11.15	106	80-120	0			
Vanadium	0.1059	0.0050	0.1	0.0006031	105	80-120	0			

MSD Sample ID: **1010453-07DMSD** Units: **mg/L** Analysis Date: **10/17/2010 08:51 PM**

Client ID: **WGD10161505BRH1** Run ID: **ICPMS2_101017A** SeqNo: **1453332** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Barium	0.1736	0.0050	0.1	0.07861	95	80-120	0.181	4.17	20	
Calcium	69.73	0.50	10	61.53	82	80-120	71.19	2.07	20	O
Iron	10.59	0.080	10	0.6641	99.3	80-120	11.32	6.66	20	
Magnesium	21.8	0.20	10	12.02	97.8	80-120	22.6	3.6	20	
Nickel	0.09358	0.0050	0.1	0.003245	90.3	80-120	0.1006	7.23	20	
Potassium	12.39	0.20	10	2.585	98	80-120	13.03	5.04	20	
Sodium	20.83	0.20	10	11.15	96.8	80-120	21.73	4.23	20	
Vanadium	0.09921	0.0050	0.1	0.0006031	98.6	80-120	0.1059	6.52	20	

The following samples were analyzed in this batch:

1010453-01D	1010453-02D	1010453-03D
1010453-04D	1010453-05D	1010453-06D
1010453-07D	1010453-10D	1010453-11D

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **30015** Instrument ID **SVMS5** Method: **SW8270**

MBLK Sample ID: **SBLKW1-30015-30015** Units: **µg/L** Analysis Date: **10/17/2010 06:22 PM**

Client ID: Run ID: **SVMS5_101017A** SeqNo: **1453428** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	ND	5.0								
Acenaphthene	ND	5.0								
Acenaphthylene	ND	5.0								
Anthracene	ND	5.0								
Benzo(a)anthracene	ND	5.0								
Benzo(a)pyrene	ND	5.0								
Benzo(b)fluoranthene	ND	5.0								
Benzo(g,h,i)perylene	ND	5.0								
Benzo(k)fluoranthene	ND	5.0								
Chrysene	ND	5.0								
Dibenzo(a,h)anthracene	ND	5.0								
Fluoranthene	ND	5.0								
Fluorene	ND	5.0								
Indeno(1,2,3-cd)pyrene	ND	5.0								
Naphthalene	ND	5.0								
Phenanthrene	ND	5.0								
Pyrene	ND	5.0								
Surr: 2,4,6-Tribromophenol	*39.65*	0	*50*	0	*79.3*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*38.86*	0	*50*	0	*77.7*	*50-110*	0			
Surr: 2-Fluorophenol	*29.98*	0	*50*	0	*60*	*20-110*	0			
Surr: 4-Terphenyl-d14	*42.14*	0	*50*	0	*84.3*	*50-125*	0			
Surr: Nitrobenzene-d5	*38.31*	0	*50*	0	*76.6*	*40-110*	0			
Surr: Phenol-d6	*17.49*	0	*50*	0	*35*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **30015** Instrument ID **SVMS5** Method: **SW8270**

LCS Sample ID: **SLCSW1-30015-30015** Units: **µg/L** Analysis Date: **10/17/2010 03:57 PM**

Client ID: Run ID: **SVMS5_101017A** SeqNo: **1453424** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	31.68	5.0	40	0	79.2	45-105	0			
Acenaphthene	32.71	5.0	40	0	81.8	45-110	0			
Acenaphthylene	35.82	5.0	40	0	89.6	50-105	0			
Anthracene	40.32	5.0	40	0	101	55-110	0			
Benzo(a)anthracene	38.87	5.0	40	0	97.2	55-110	0			
Benzo(a)pyrene	40.12	5.0	40	0	100	55-110	0			
Benzo(b)fluoranthene	39.41	5.0	40	0	98.5	45-120	0			
Benzo(g,h,i)perylene	46.25	5.0	40	0	116	40-125	0			
Benzo(k)fluoranthene	39.03	5.0	40	0	97.6	45-125	0			
Chrysene	36.28	5.0	40	0	90.7	55-110	0			
Dibenzo(a,h)anthracene	43.99	5.0	40	0	110	40-125	0			
Fluoranthene	41.44	5.0	40	0	104	55-115	0			
Fluorene	35.25	5.0	40	0	88.1	50-110	0			
Indeno(1,2,3-cd)pyrene	44.6	5.0	40	0	112	45-125	0			
Naphthalene	31.81	5.0	40	0	79.5	40-100	0			
Phenanthrene	38.96	5.0	40	0	97.4	50-115	0			
Pyrene	41.92	5.0	40	0	105	50-130	0			
Surr: 2,4,6-Tribromophenol	*43.56*	0	*50*	0	*87.1*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*37.39*	0	*50*	0	*74.8*	*50-110*	0			
Surr: 2-Fluorophenol	*25.53*	0	*50*	0	*51.1*	*20-110*	0			
Surr: 4-Terphenyl-d14	*39.4*	0	*50*	0	*78.8*	*50-125*	0			
Surr: Nitrobenzene-d5	*35.64*	0	*50*	0	*71.3*	*40-110*	0			
Surr: Phenol-d6	*14.85*	0	*50*	0	*29.7*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **30015** Instrument ID **SVMS5** Method: **SW8270**

LCSD Sample ID: **SLCSDW1-30015-30015** Units: **µg/L** Analysis Date: **10/17/2010 04:33 PM**

Client ID: Run ID: **SVMS5_101017A** SeqNo: **1453425** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	31.61	5.0	40	0	79	45-105	31.68	0.221	30	
Acenaphthene	33.1	5.0	40	0	82.8	45-110	32.71	1.19	30	
Acenaphthylene	35.97	5.0	40	0	89.9	50-105	35.82	0.418	30	
Anthracene	39	5.0	40	0	97.5	55-110	40.32	3.33	30	
Benzo(a)anthracene	38.47	5.0	40	0	96.2	55-110	38.87	1.03	30	
Benzo(a)pyrene	39.17	5.0	40	0	97.9	55-110	40.12	2.4	30	
Benzo(b)fluoranthene	38.71	5.0	40	0	96.8	45-120	39.41	1.79	30	
Benzo(g,h,i)perylene	45.44	5.0	40	0	114	40-125	46.25	1.77	30	
Benzo(k)fluoranthene	37.54	5.0	40	0	93.8	45-125	39.03	3.89	30	
Chrysene	35.77	5.0	40	0	89.4	55-110	36.28	1.42	30	
Dibenzo(a,h)anthracene	42.97	5.0	40	0	107	40-125	43.99	2.35	30	
Fluoranthene	39.88	5.0	40	0	99.7	55-115	41.44	3.84	30	
Fluorene	35.7	5.0	40	0	89.2	50-110	35.25	1.27	30	
Indeno(1,2,3-cd)pyrene	43.45	5.0	40	0	109	45-125	44.6	2.61	30	
Naphthalene	32.05	5.0	40	0	80.1	40-100	31.81	0.752	30	
Phenanthrene	37.97	5.0	40	0	94.9	50-115	38.96	2.57	30	
Pyrene	41.18	5.0	40	0	103	50-130	41.92	1.78	30	
Surr: 2,4,6-Tribromophenol	*43*	0	*50*	0	*86*	*40-125*	43.56	*1.29*	*40*	
Surr: 2-Fluorobiphenyl	*39.13*	0	*50*	0	*78.3*	*50-110*	37.39	*4.55*	*40*	
Surr: 2-Fluorophenol	*26.66*	0	*50*	0	*53.3*	*20-110*	25.53	*4.33*	*40*	
Surr: 4-Terphenyl-d14	*39.48*	0	*50*	0	*79*	*50-125*	39.4	*0.203*	*40*	
Surr: Nitrobenzene-d5	*36.77*	0	*50*	0	*73.5*	*40-110*	35.64	*3.12*	*40*	
Surr: Phenol-d6	*16.04*	0	*50*	0	*32.1*	*20-110*	14.85	*7.7*	*40*	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **30015** Instrument ID **SVMS5** Method: **SW8270**

MS Sample ID: **1010453-07B MS** Units: **µg/L** Analysis Date: **10/17/2010 05:09 PM**

Client ID: **WGD10161505BRH1** Run ID: **SVMS5_101017A** SeqNo: **1453426** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	311.6	50	400	0	77.9	45-105	0			
Acenaphthene	321.5	50	400	0	80.4	45-110	0			
Acenaphthylene	353.7	50	400	0	88.4	50-105	0			
Anthracene	380.8	50	400	0	95.2	55-110	0			
Benzo(a)anthracene	371.5	50	400	0	92.9	55-110	0			
Benzo(a)pyrene	374.9	50	400	0	93.7	55-110	0			
Benzo(b)fluoranthene	348.2	50	400	0	87	45-120	0			
Benzo(g,h,i)perylene	428.5	50	400	0	107	40-125	0			
Benzo(k)fluoranthene	387.2	50	400	0	96.8	45-125	0			
Chrysene	333.6	50	400	0	83.4	55-110	0			
Dibenzo(a,h)anthracene	407.8	50	400	0	102	40-125	0			
Fluoranthene	381.1	50	400	0	95.3	55-115	0			
Fluorene	351.4	50	400	0	87.8	50-110	0			
Indeno(1,2,3-cd)pyrene	412.6	50	400	0	103	45-125	0			
Naphthalene	321.5	50	400	0	80.4	40-100	0			
Phenanthrene	360.1	50	400	0	90	50-115	0			
Pyrene	391.3	50	400	0	97.8	50-130	0			
Surr: 2,4,6-Tribromophenol	*406.3*	0	*500*	0	*81.3*	*40-125*	0			
Surr: 2-Fluorobiphenyl	*385.1*	0	*500*	0	*77*	*50-110*	0			
Surr: 2-Fluorophenol	*231.3*	0	*500*	0	*46.3*	*20-110*	0			
Surr: 4-Terphenyl-d14	*392.2*	0	*500*	0	*78.4*	*50-125*	0			
Surr: Nitrobenzene-d5	*365.2*	0	*500*	0	*73*	*40-110*	0			
Surr: Phenol-d6	*147.5*	0	*500*	0	*29.5*	*20-110*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **30015** Instrument ID **SVMS5** Method: **SW8270**

MSD Sample ID: **1010453-07B MSD** Units: **µg/L** Analysis Date: **10/17/2010 05:45 PM**

Client ID: **WGD10161505BRH1** Run ID: **SVMS5_101017A** SeqNo: **1453427** Prep Date: **10/16/2010** DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
2-Methylnaphthalene	336.6	50	400	0	84.2	45-105	311.6	7.71	30	
Acenaphthene	343.4	50	400	0	85.8	45-110	321.5	6.59	30	
Acenaphthylene	376.5	50	400	0	94.1	50-105	353.7	6.24	30	
Anthracene	402	50	400	0	100	55-110	380.8	5.42	30	
Benzo(a)anthracene	385.7	50	400	0	96.4	55-110	371.5	3.75	30	
Benzo(a)pyrene	395.2	50	400	0	98.8	55-110	374.9	5.27	30	
Benzo(b)fluoranthene	398.6	50	400	0	99.6	45-120	348.2	13.5	30	
Benzo(g,h,i)perylene	447.3	50	400	0	112	40-125	428.5	4.29	30	
Benzo(k)fluoranthene	372.6	50	400	0	93.2	45-125	387.2	3.84	30	
Chrysene	353	50	400	0	88.2	55-110	333.6	5.65	30	
Dibenzo(a,h)anthracene	427.2	50	400	0	107	40-125	407.8	4.65	30	
Fluoranthene	401.2	50	400	0	100	55-115	381.1	5.14	30	
Fluorene	370.8	50	400	0	92.7	50-110	351.4	5.37	30	
Indeno(1,2,3-cd)pyrene	431.8	50	400	0	108	45-125	412.6	4.55	30	
Naphthalene	350.4	50	400	0	87.6	40-100	321.5	8.6	30	
Phenanthrene	382.5	50	400	0	95.6	50-115	360.1	6.03	30	
Pyrene	406.8	50	400	0	102	50-130	391.3	3.88	30	
Surr: 2,4,6-Tribromophenol	*433.5*	0	*500*	0	*86.7*	*40-125*	406.3	*6.48*	*40*	
Surr: 2-Fluorobiphenyl	*407.3*	0	*500*	0	*81.5*	*50-110*	385.1	*5.6*	*40*	
Surr: 2-Fluorophenol	*265.1*	0	*500*	0	*53*	*20-110*	231.3	*13.6*	*40*	
Surr: 4-Terphenyl-d14	*411.2*	0	*500*	0	*82.2*	*50-125*	392.2	*4.73*	*40*	
Surr: Nitrobenzene-d5	*399.8*	0	*500*	0	*80*	*40-110*	365.2	*9.05*	*40*	
Surr: Phenol-d6	*173*	0	*500*	0	*34.6*	*20-110*	147.5	*15.9*	*40*	

The following samples were analyzed in this batch:

1010453-01B	1010453-02B	1010453-03B
1010453-04B	1010453-05B	1010453-06B
1010453-07B	1010453-10B	1010453-11B

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82587** Instrument ID **VMS7** Method: **SW8260**

MBLK Sample ID: **VBLKW2-101016-R82587** Units: **µg/L** Analysis Date: **10/17/2010 01:40 AM**

Client ID: Run ID: **VMS7_101016B** SeqNo: **1452889** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,3-Trimethylbenzene	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
Benzene	ND	1.0								
Cyclohexane	ND	5.0								
Ethylbenzene	ND	1.0								
Isopropylbenzene	ND	1.0								
n-Propylbenzene	ND	1.0								
Naphthalene	ND	5.0								
p-Isopropyltoluene	ND	2.0								
sec-Butylbenzene	ND	2.0								
Toluene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 1,2-Dichloroethane-d4	*104.1*	0	*100*	0	*104*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*97.45*	0	*100*	0	*97.4*	*75-120*	0			
Surr: Dibromofluoromethane	*99.5*	0	*100*	0	*99.5*	*85-115*	0			
Surr: Toluene-d8	*97.54*	0	*100*	0	*97.5*	*85-120*	0			

LCS Sample ID: **VLCSW3-101016-R82587** Units: **µg/L** Analysis Date: **10/17/2010 12:46 PM**

Client ID: Run ID: **VMS7_101016B** SeqNo: **1452627** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.98	1.0	20	0	105	75-130	0			
1,3,5-Trimethylbenzene	20.53	1.0	20	0	103	75-130	0			
Benzene	19.93	1.0	20	0	99.6	80-120	0			
Ethylbenzene	20.6	1.0	20	0	103	75-125	0			
Isopropylbenzene	22.01	1.0	20	0	110	75-125	0			
n-Propylbenzene	21.73	1.0	20	0	109	70-130	0			
Naphthalene	19.58	5.0	20	0	97.9	55-140	0			
p-Isopropyltoluene	19.92	2.0	20	0	99.6	75-130	0			
sec-Butylbenzene	20.35	2.0	20	0	102	70-125	0			
Toluene	19.94	1.0	20	0	99.7	75-120	0			
Xylenes, Total	64.15	2.0	60	0	107	75-130	0			
Surr: 1,2-Dichloroethane-d4	*99.26*	0	*100*	0	*99.3*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*107.3*	0	*100*	0	*107*	*75-120*	0			
Surr: Dibromofluoromethane	*101.9*	0	*100*	0	*102*	*85-115*	0			
Surr: Toluene-d8	*103.1*	0	*100*	0	*103*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82587** Instrument ID **VMS7** Method: **SW8260**

LCSD Sample ID: **VLCSDW2-101016-R82587** Units: **µg/L** Analysis Date: **10/16/2010 11:52 PM**

Client ID: Run ID: **VMS7_101016B** SeqNo: **1452604** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	19.66	1.0	20	0	98.3	75-130	20.98	6.5	30	
1,3,5-Trimethylbenzene	19.33	1.0	20	0	96.6	75-130	20.53	6.02	30	
Benzene	19.1	1.0	20	0	95.5	80-120	19.93	4.25	30	
Ethylbenzene	19.35	1.0	20	0	96.8	75-125	20.6	6.26	30	
Isopropylbenzene	20.84	1.0	20	0	104	75-125	22.01	5.46	30	
n-Propylbenzene	20.32	1.0	20	0	102	70-130	21.73	6.71	30	
Naphthalene	20.12	5.0	20	0	101	55-140	19.58	2.72	30	
p-Isopropyltoluene	18.77	2.0	20	0	93.8	75-130	19.92	5.94	30	
sec-Butylbenzene	19.36	2.0	20	0	96.8	70-125	20.35	4.99	30	
Toluene	19.02	1.0	20	0	95.1	75-120	19.94	4.72	30	
Xylenes, Total	60.76	2.0	60	0	101	75-130	64.15	5.43	30	
Surr: 1,2-Dichloroethane-d4	*100.5*	0	*100*	0	*100*	*70-120*	99.26	*1.2*	*30*	
Surr: 4-Bromofluorobenzene	*106.3*	0	*100*	0	*106*	*75-120*	107.3	*0.927*	*30*	
Surr: Dibromofluoromethane	*100.6*	0	*100*	0	*101*	*85-115*	101.9	*1.3*	*30*	
Surr: Toluene-d8	*102.6*	0	*100*	0	*103*	*85-120*	103.1	*0.515*	*30*	

MS Sample ID: **1010453-07A MS** Units: **µg/L** Analysis Date: **10/17/2010 09:23 AM**

Client ID: **WGD10161505BRH1** Run ID: **VMS7_101016B** SeqNo: **1452904** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.77	1.0	20	0	104	75-130	0			
1,3,5-Trimethylbenzene	20.97	1.0	20	0	105	75-130	0			
Benzene	22.05	1.0	20	0	110	80-120	0			
Ethylbenzene	21.76	1.0	20	0	109	75-125	0			
Isopropylbenzene	23.05	1.0	20	0	115	75-125	0			
n-Propylbenzene	22.44	1.0	20	0	112	70-130	0			
Naphthalene	18.45	5.0	20	0	92.2	55-140	0			
p-Isopropyltoluene	19.83	2.0	20	0	99.2	75-130	0			
sec-Butylbenzene	20.59	2.0	20	0	103	70-125	0			
Toluene	20.97	1.0	20	0	105	75-120	0			
Xylenes, Total	67.37	2.0	60	0	112	75-130	0			
Surr: 1,2-Dichloroethane-d4	*106*	0	*100*	0	*106*	*70-120*	0			
Surr: 4-Bromofluorobenzene	*103.5*	0	*100*	0	*104*	*75-120*	0			
Surr: Dibromofluoromethane	*108.6*	0	*100*	0	*109*	*85-115*	0			
Surr: Toluene-d8	*101.7*	0	*100*	0	*102*	*85-120*	0			

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82587** Instrument ID **VMS7** Method: **SW8260**

MSD Sample ID: **1010453-07A MSD** Units: **µg/L** Analysis Date: **10/17/2010 09:50 AM**

Client ID: **WGD10161505BRH1** Run ID: **VMS7_101016B** SeqNo: **1452907** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
1,2,4-Trimethylbenzene	20.48	1.0	20	0	102	75-130	20.77	1.41	30	
1,3,5-Trimethylbenzene	20.84	1.0	20	0	104	75-130	20.97	0.622	30	
Benzene	21.16	1.0	20	0	106	80-120	22.05	4.12	30	
Ethylbenzene	21.32	1.0	20	0	107	75-125	21.76	2.04	30	
Isopropylbenzene	23	1.0	20	0	115	75-125	23.05	0.217	30	
n-Propylbenzene	22.18	1.0	20	0	111	70-130	22.44	1.17	30	
Naphthalene	19.28	5.0	20	0	96.4	55-140	18.45	4.4	30	
p-Isopropyltoluene	20.2	2.0	20	0	101	75-130	19.83	1.85	30	
sec-Butylbenzene	20.65	2.0	20	0	103	70-125	20.59	0.291	30	
Toluene	20.15	1.0	20	0	101	75-120	20.97	3.99	30	
Xylenes, Total	66.46	2.0	60	0	111	75-130	67.37	1.36	30	
Surr: 1,2-Dichloroethane-d4	*104.1*	0	*100*	0	*104*	*70-120*	106	*1.79*	*30*	
Surr: 4-Bromofluorobenzene	*103.4*	0	*100*	0	*103*	*75-120*	103.5	*0.145*	*30*	
Surr: Dibromofluoromethane	*105.2*	0	*100*	0	*105*	*85-115*	108.6	*3.22*	*30*	
Surr: Toluene-d8	*100.9*	0	*100*	0	*101*	*85-120*	101.7	*0.789*	*30*	

The following samples were analyzed in this batch:

1010453-01A	1010453-02A	1010453-03A
1010453-04A	1010453-05A	1010453-06A
1010453-07A	1010453-10A	1010453-11A
1010453-12A	1010453-13A	1010453-14A

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82604** Instrument ID **IC3** Method: **SW9056**

MBLK Sample ID: **CCB/MBLK-R82604** Units: **mg/L** Analysis Date: **10/17/2010 07:23 AM**
Client ID: Run ID: **IC3_101017A** SeqNo: **1453261** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	ND	1.0								
Sulfate	ND	1.0								

LCS Sample ID: **CCV/LCS-R82604** Units: **mg/L** Analysis Date: **10/17/2010 07:43 AM**
Client ID: Run ID: **IC3_101017A** SeqNo: **1453262** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.666	1.0	10	0	96.7	80-120	0			
Sulfate	9.756	1.0	10	0	97.6	80-120	0			

LCSD Sample ID: **CCV/LCSD-R82604** Units: **mg/L** Analysis Date: **10/17/2010 08:03 AM**
Client ID: Run ID: **IC3_101017A** SeqNo: **1453263** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	9.705	1.0	10	0	97	80-120	9.666	0.399	20	
Sulfate	9.872	1.0	10	0	98.7	80-120	9.756	1.19	20	

MS Sample ID: **1010453-07D MS** Units: **mg/L** Analysis Date: **10/17/2010 09:06 AM**
Client ID: **WGD10161505BRH1** Run ID: **IC3_101017A** SeqNo: **1453266** Prep Date: DF: **2**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	31.52	2.0	10	21.7	98.1	75-125	0			
Sulfate	17.68	2.0	10	7.956	97.3	75-125	0			

MSD Sample ID: **1010453-07D MSD** Units: **mg/L** Analysis Date: **10/17/2010 09:25 AM**
Client ID: **WGD10161505BRH1** Run ID: **IC3_101017A** SeqNo: **1453267** Prep Date: DF: **2**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Chloride	31.14	2.0	10	21.7	94.3	75-125	31.52	1.21	20	
Sulfate	17.6	2.0	10	7.956	96.5	75-125	17.68	0.453	20	

The following samples were analyzed in this batch:

1010453-01D	1010453-02D	1010453-03D
1010453-04D	1010453-05D	1010453-06D
1010453-07D	1010453-08A	1010453-09A
1010453-10D	1010453-11D	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82606** Instrument ID **WETCHEM** Method: **A2320 B**

MBLK Sample ID: **WBLKW1-101017-R82606** Units: **mg/L** Analysis Date: **10/17/2010 09:50 PM**
Client ID: Run ID: **WETCHEM_101017A** SeqNo: **1453358** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	1	10								J
Alkalinity, Carbonate (as CaCO3)	1	10								J

LCS Sample ID: **WLCSW1-101017-R82606** Units: **mg/L** Analysis Date: **10/17/2010 09:50 PM**
Client ID: Run ID: **WETCHEM_101017A** SeqNo: **1453359** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	900	10	1000	0	90	80-120	0			
Alkalinity, Carbonate (as CaCO3)	900	10	1000	0	90	80-120	0			

LCSD Sample ID: **WLCSDW1-101017-R82606** Units: **mg/L** Analysis Date: **10/17/2010 09:50 PM**
Client ID: Run ID: **WETCHEM_101017A** SeqNo: **1453374** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	980	10	1000	0	98	80-120	900	8.51	20	
Alkalinity, Carbonate (as CaCO3)	980	10	1000	0	98	80-120	900	8.51	20	

DUP Sample ID: **1010453-07DDUP1** Units: **mg/L** Analysis Date: **10/17/2010 09:50 PM**
Client ID: **WGD10161505BRH1** Run ID: **WETCHEM_101017A** SeqNo: **1453367** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	214.9	10	0	0	0		212.8	0.982	20	
Alkalinity, Carbonate (as CaCO3)	3	10	0	0	0		3.1	0	20	J

DUP Sample ID: **1010453-07DDUP2** Units: **mg/L** Analysis Date: **10/17/2010 09:50 PM**
Client ID: **WGD10161505BRH1** Run ID: **WETCHEM_101017A** SeqNo: **1453368** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	213	10	0	0	0		212.8	0.0939	20	
Alkalinity, Carbonate (as CaCO3)	3	10	0	0	0		3.1	0	20	J

DUP Sample ID: **1010453-11D DUP** Units: **mg/L** Analysis Date: **10/17/2010 09:50 PM**
Client ID: **WGC10161405BRH4** Run ID: **WETCHEM_101017A** SeqNo: **1453373** Prep Date: DF: **1**

Analyte	Result	PQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Alkalinity, Bicarbonate (as CaCO3)	6	10	0	0	0		6	0	20	J
Alkalinity, Carbonate (as CaCO3)	ND	10	0	0	0		0	0	20	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

Client: AECOM Enviroment
Work Order: 1010453
Project: Marshall Oil Spill Hydrogeo Study 10/16/10

QC BATCH REPORT

Batch ID: **R82606** Instrument ID **WETCHEM** Method: **A2320 B**

The following samples were analyzed in this batch:

1010453-01D	1010453-02D	1010453-03D
1010453-04D	1010453-05D	1010453-06D
1010453-07D	1010453-08A	1010453-09A
1010453-10D	1010453-11D	

Note: See Qualifiers Page for a list of Qualifiers and their explanation.

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Chain of Custody Form

Page 1 of 2

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Holland, MI 49424-9263
Tel: +1 616 399 6070
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ALS Project Manager: | **ALS Work Order #:** 1010453

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydro geo study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filtered)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGC10160955BRH1 ✓ 01	10/16/10	955	W	—	7	X	X	X	X	X	X		mwKR1525R			
2	WGC10161000DJJ1 ✓ 02	10/16/10	1000 1100	W	—	7	X	X	X	X	X	X		mwKR1525R			
3	WGC10161100pJJ1 ✓ 03	10/16/10	1100	W	—	7	X	X	X	X	X	X		mwKR1525R			
4	WGC10161100DJJ2 ✓ 04	10/16/10	1100	W	—	7	X	X	X	X	X	X		mwKR1525R			
5	WGD10161345DJJ1 ✓ 05	10/16/10	1345	W	—	7	X	X	X	X	X	X		mwKR2680R			
6	WGD10161405BRH1 ✓ 06	10/16/10	1405	W	—	7	X	X	X	X	X	✓		mwKR2760R			10/23/10
7	WGD10161505BRH1 ✓ 07	10/16/10	1505	W	—	7	X	X	X	X	X	✓		mwKR2760R			
8	WGD10161505BRH3 ✓	10/16/10	1505	W	—	7	X	X	X	X	X	X		mwKR2760R			
9	WSD10161450DJJ1 ✓ 08	10/16/10	1450	W	—	2						X	X	swKR2760R			
10	WSD10161640DJJ1 ✓ 09	10/16/10	1640	W	—	2						X	X	swKR2260R			

Sampler(s) Please Print & Sign: Brady Hoore Brady Hoore

Shipment Method: courier

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
Brady Hoore	10/16/10	1955	
Relinquished by:	Date:	Time:	Received by (Laboratory):
Logged by (Laboratory): JTR	Date: 10/16/10	Time: 2100	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	4.8c

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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Chain of Custody Form

Page 2 of 2

☒ **ALS Laboratory Group**
3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | **ALS Work Order #:** 1010453

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydrogeo study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filter)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGD101617 30BRH1 10	10/16/10	1730	W	—	7	X	X	X	X	X	X		mwkR2275R@1			
2	WGC101614 05BRH4 11	10/16/10	1405	W	—	7	X	X	X	X	X	X		equipment rinse			
3	WGC101619 25BRH5 12	10/16/10		W	—	1	X							trip blank			
4	WGC101619 30BRH5 13	10/16/10		W	—	1	X							trip blank			
5	WGC101619 35BRH5 14	10/16/10		W	—	1	X							trip blank			
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Brad Hoare Brad Hoare

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
Brad Hoare	10/16/10	1955	
Relinquished by:	Date:	Time:	Received by (Laboratory):
Logged by (Laboratory): JR	Date: 10/16/10	Time: 2100	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	4.8c

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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ALS Group USA, Corp

Sample Receipt Checklist

Client Name: **AECOM - GR** Date/Time Received: **16-Oct-10 19:55**

Work Order: **1010453** Received by: **MA**

Checklist completed by Joseph Ribar (eSignature) 16-Oct-10 (Date) Reviewed by: Ann Preston (eSignature) 17-Oct-10 (Date)

Matrices: WATER
Carrier name: ALSHN

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	4.8 °C		
Cooler(s)/Kit(s):			
Water - VOA vials have zero headspace?	Yes ☑	No ☐	No VOA vials submitted ☐
Water - pH acceptable upon receipt?	Yes ☑	No ☐	N/A ☐
pH adjusted?	Yes ☐	No ☑	N/A ☐
pH adjusted by:			

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

CorrectiveAction:

US EPA ARCHIVE DOCUMENT

Ann Preston

From: Nolan, Kris [Kris.Nolan@aecom.com]

Sent: Wednesday, October 20, 2010 8:03 PM

To: Ann Preston

Cc: Wolf, Michael G.; Herberich, Jim; Kennedy, Robert; Vanderkam, Lori A.; Harding, Barry; Wait, James; Hoare, Brad; Nolan, Kris

Subject: Modification of Data Report: Invalid Well IDs

Ann,
When the groundwater samples were being collected during the HydroGeo investigation, two of the well IDs were switched, and subsequently the laboratory data is switched. While in the field, the sampler was issued a well ID table with an error on it. The sampler did not know this was an error, and subsequently switched the manholes and lables on the wells.

Target Area #3

Sample ID: Well ID
WGC10161100DJJ1: MWKR1525R01
WGC10161100DJJ2: MWKR1525R01
WGC10161000DJJ1: MWKR1525R02

The correct is as follows:
WGC10161100DJJ1: MWKR1525R02
WGC10161100DJJ2: MWKR1525R02
WGC10161000DJJ1: MWKR1525R01

Please make the above adjustment. This error only effects the groundwater analytical data and the static water level data collected for these two wells (SWL collection Date 10/18/2010).

v/r
Kris

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☒ **ALS Laboratory Group**
3352 128th Ave.
Holland, MI 49424-9263
Tel: +1 616 399 6070
Fax: +1 616 399 6185

ALS Project Manager: | **ALS Work Order #:** 1010453

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order		Project Name	Enbridge Line 6B, MP608-Marshall,M	A	Volatiles by EPA 8260-Groundwater List provided
Work Order		Project Number	Hydro geo study	B	PAHs by EPA 8270
Company Name	AECOM Enviroment	Bill To Company	Enbridge Energy	C	Total Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020
Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filtered)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGC10160955BRH1 ✓ 01	10/16/10	955	W	—	7	X	X	X	X	X	X		mwKR1525R			
2	WGC10161000DJJ1 ✓ 02	10/16/10	1000 1100	W	—	7	X	X	X	X	X	X		mwKR1525R			
3	WGC10161100pJJ1 ✓ 03	10/16/10	1100	W	—	7	X	X	X	X	X	X		mwKR1525R			
4	WGC10161100DJJ2 ✓ 04	10/16/10	1100	W	—	7	X	X	X	X	X	X		mwKR1525R			
5	WGD10161345DJJ1 ✓ 05	10/16/10	1345	W	—	7	X	X	X	X	X	X		mwKR2680R			
6	WGD10161405BRH1 ✓ 06	10/16/10	1405	W	—	7	X	X	X	X	X	✓		mwKR2760R			10/23/10
7	WGD10161505BRH1 ✓ 07	10/16/10	1505	W	—	7	X	X	X	X	X	✓		mwKR2760R			
8	WGD10161505BRH3 ✓	10/16/10	1505	W	—	7	X	X	X	X	X	X		mwKR2760R			
9	WSD10161450DJJ1 ✓ 08	10/16/10	1450	W	—	2						X	X	swKR2760R			
10	WSD10161640DJJ1 ✓ 09	10/16/10	1640	W	—	2						X	X	swKR2260R			

Sampler(s) Please Print & Sign: Brady Hoore Brady Hoore

Shipment Method: courier

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
Brady Hoore	10/16/10	1955	
Relinquished by:	Date:	Time:	Received by (Laboratory):
Logged by (Laboratory): JTR	Date: 10/16/10	Time: 2100	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	4.8c

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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3352 128th Ave.
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ALS Project Manager: | **ALS Work Order #:** 1010453

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Work Order		Project Number	Hydrogeo study	B	PAHs by EPA 8270
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Send Report To	Jim Tolbert	Invoice Attn	Accounts Payable	D	Dissolved Ba, Ni, V, Fe, Na, K, Ca, Mg by EPA 6020 (Lab Filter)
Address	5555 Glenwood Parkway SE	Address	1100 Louisiana Suite 1100	E	Cl, SO4 by EPA 9056
				F	Bicarbonate and Carbonate Alkalinity by SM 2320
City/State/Zip	Grand Rapids, MI 49512	City/State/Zip	Houston, TX 77002	G	SW Metals: Fe, Na, K, Ca, Mg by EPA 6020
Phone	(616) 942-9600	Phone		H	
Fax		Fax		I	
e-Mail Address	james.tolbert@aecom.com	e-Mail Address		J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	WGD101617 30BRH1 10	10/16/10	1730	W	—	7	X	X	X	X	X	X		mwkR2275R@1			
2	WGC101614 05BRH4 11	10/16/10	1405	W	—	7	X	X	X	X	X	X		equipment rinse			
3	WGC101619 25BRH5 12	10/16/10		W	—	1	X							trip blank			
4	WGC101619 30BRH5 13	10/16/10		W	—	1	X							trip blank			
5	WGC101619 35BRH5 14	10/16/10		W	—	1	X							trip blank			
6																	
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8																	
9																	
10																	

Sampler(s) Please Print & Sign: Brad Hoare Brad Hoare

Shipment Method: Courier

Required Turnaround Time: (Check Box) ☐ Other ☐ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☒ 24 Hour

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Relinquished by:	Date:	Time:	Received by:
Brad Hoare	10/16/10	1955	
Relinquished by:	Date:	Time:	Received by (Laboratory):
Logged by (Laboratory): JR	Date: 10/16/10	Time: 2100	Checked by (Laboratory):

Notes:

Cooler ID	Cooler Temp
	4.8c

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Date ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

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Ann Preston

From: Nolan, Kris [Kris.Nolan@aecom.com]

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To: Ann Preston

Cc: Wolf, Michael G.; Herberich, Jim; Kennedy, Robert; Vanderkam, Lori A.; Harding, Barry; Wait, James; Hoare, Brad; Nolan, Kris

Subject: Modification of Data Report: Invalid Well IDs

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The correct is as follows:
WGC10161100DJJ1: MWKR1525R02
WGC10161100DJJ2: MWKR1525R02
WGC10161000DJJ1: MWKR1525R01

Please make the above adjustment. This error only effects the groundwater analytical data and the static water level data collected for these two wells (SWL collection Date 10/18/2010).

v/r
Kris

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US EPA ARCHIVE DOCUMENT

Appendix E

Production and Municipal Wells

MUNICIPAL WELL SUMMARY (MARSHALL TO MORROW LAKE)
Enbridge Pipeline 6B Release Marshall, Michigan

System Name	Well ID	Well Diameter (in)	Well Depth (ft)	Casing Diameter (in)	Casing Depth (in)	LAT	LONG	Capacity (GPM)
MARSHALL	WELL 2 GREEN ST (CENTER)	12	100	12	95	42.270624	-84.9471	1285
MARSHALL	WELL 3 GREEN ST (SOUTH)	12	100	12	32	42.270311	-84.94711	1201
MARSHALL	WELL 1 GREEN ST (NORTH)	12	100	12	41	42.270813	-84.9471	1201
MARSHALL	WELL 4 GREEN ST (EAST)	12	100	12	30	42.270546	-84.94689	1153
					System PumpingCapacity			**4840**
PENNFIELD TOWNSHIP	WELL 96-6	16	240	16	75	42.359944	-85.15533	1200
PENNFIELD TOWNSHIP	WELL 96-3	16	220	16	66	42.359694	-85.15317	1200
					System PumpingCapacity			**2400**
BATTLE CREEK - VERONA SYSTEM	WELL 53	16	147	16	102	42.351695	-85.13378	1180
BATTLE CREEK - VERONA SYSTEM	WELL 52	16	145	16	102	42.349926	-85.13469	1180
BATTLE CREEK - VERONA SYSTEM	WELL 51	16	148	16	95	42.34847	-85.13591	1180
BATTLE CREEK - VERONA SYSTEM	WELL 50	16	154	16	53	42.347251	-85.13742	1389
BATTLE CREEK - VERONA SYSTEM	WELL 49	16	158	16	64	42.346041	-85.13927	1389
BATTLE CREEK - VERONA SYSTEM	WELL 48	16	151	16	56	42.346198	-85.13927	1389
BATTLE CREEK - VERONA SYSTEM	WELL 47	16	148	16	56	42.346182	-85.14084	1389
BATTLE CREEK - VERONA SYSTEM	WELL 40	16	148	16	42	42.34502	-85.13711	1000
BATTLE CREEK - VERONA SYSTEM	WELL 41	16	148	16	44	42.345239	-85.13919	1000
BATTLE CREEK - VERONA SYSTEM	WELL 42	16	150	16	21	42.345071	-85.14122	1000
BATTLE CREEK - VERONA SYSTEM	WELL 43	16	148	16	26	42.345059	-85.14324	1000
BATTLE CREEK - VERONA SYSTEM	WELL 39	16	145	16	37	42.34386	-85.13788	1000
BATTLE CREEK - VERONA SYSTEM	WELL 38	16	152	16	60	42.3441	-85.13975	1000
BATTLE CREEK - VERONA SYSTEM	WELL 36	16	147	16	60	42.343961	-85.14174	1000
BATTLE CREEK - VERONA SYSTEM	WELL 13	12	127	12	18	42.343463	-85.14311	750
BATTLE CREEK - VERONA SYSTEM	WELL 37	16	145	16	44	42.343791	-85.1444	1000
BATTLE CREEK - VERONA SYSTEM	WELL 30	8	151	8	60	42.343213	-85.14571	299
BATTLE CREEK - VERONA SYSTEM	WELL 17	12	133	12	52	42.342389	-85.14802	749
BATTLE CREEK - VERONA SYSTEM	WELL 15	12	141	12	42	42.342402	-85.15183	750
BATTLE CREEK - VERONA SYSTEM	WELL 14	12	129	12	55	42.342511	-85.1542	750
					System PumpingCapacity			**20394**
BEDFORD HILLS	WELL 3	6	195			42.36135	-85.22845	1762
BEDFORD HILLS	WELL 1	4	180			42.36135	-85.22845	1763
BEDFORD HILLS	WELL 2	Not Available	Not Available			42.36135	-85.22845	1764
					System PumpingCapacity			**5289**
AUGUSTA	WELL 2	12	110	12	85	42.337485	-85.34548	340
AUGUSTA	WELL 1	12	108	12	83	42.336742	-85.34641	750
					System PumpingCapacity			**1090**
GALESBURG	WELL 2	12	66	12	46	42.2926	-85.4185	750
GALESBURG	WELL 1	12	63.5	12	39	42.292284	-85.41851	750
					System PumpingCapacity			**1500**
KALAMAZOO	PUMP STATION 39, WELL 1	108	58	108	Not Available	42.272012	-85.45453	2600
					System PumpingCapacity			**2600**

Enbridge Energy, Limited Partnership
77 East Michigan Avenue
Commerce Pointe Building
Battle Creek, MI 49017-7041

US EPA ARCHIVE DOCUMENT

October 21, 2010

Mr. Glen Davis
Village of Augusta
108 Chestnut St
Augusta, MI 49012

Dear Mr. Davis,

Per your request, please find enclosed a copy of the results from water well sampling performed at the following locations: Augusta PW-01 and Augusta PW-02. Enbridge retained the Center for Toxicology and Environmental Health, L.L.C. (CTEH) to conduct the sample collection. Below is a summary of the attached results from the water well.

- NO hydrocarbons (most common compounds in oil) were detected in the sample collected at the above locations.

We apologize for the delay in sending these results out to you. Each sample was subjected to an independent quality control review before being sent to you.

If you have any further questions or concerns, please contact the Enbridge Call Center Hotline at 1-800-306-6837. This toll-free number will be available 24 hours, seven days a week.

We thank you for your patience and understanding in this matter.

Respectfully,
Todd Romaine, MCIP, SR/WA

Manager, Lands & Right of Way

cc: County Health Department

Center for Toxicology and Environmental Health, L.L.C.

5120 North Shore Drive North Little Rock, AR 72118 Phone: 501.801.8500 Fax: 501.801.8501 www.cteh.com

October 21, 2010

PROPERTY OWNER
[redacted] **Augusta, MI 49012**

On July 30, 2010, two well water samples were obtained from your residence for water quality testing. The samples contained no detectable crude oil-related chemical. The samples were collected by representatives from Superior Environmental Corp and/or Center for Toxicology and Environmental Health, L.L.C. (CTEH), acting on behalf of Enbridge Energy, Limited Partnership. The water samples from your well were sent to an outside laboratory for analysis, and to a third-party data validation organization, eDATApro. The water was tested for organic chemicals, some of which may be associated with crude oil, total petroleum hydrocarbons (TPH) found in gasoline (TPH-GRO) and diesel fuel (TPH-DRO), and for naturally-occurring metals (nickel and vanadium) that may also be found in crude oil. Attached to this letter are the validated results received from eDATApro. Data validation is a process developed by the United States Environmental Protection Agency to ensure that the testing of environmental samples such as your well water has been performed according to established guidelines. The results of your testing are also being forwarded to your county Health Department.

Since you may not be familiar with laboratory reports, I want to direct your attention to the pages titled "Form 1 Data Sheet." The next-to-last column on these pages ("Ver.Qual") indicates whether the chemical was detected or not. If any chemical has a "U" or a "UJ" in that column, this means it was not detected in your sample. If it is blank or has a "J" in that column, this means it was detected, at the concentration indicated by the number in the column just to the left, titled "Verified Result." If it is has a "B" in that column, this means it was detected, at the concentration indicated by the number in the column just to the left, titled "Verified Result," but that it was also present in a "blank" (i.e., clean) sample of water tested by the lab for quality assurance purposes.

No crude oil-related chemicals were detected in your well samples. You should continue to follow the direction of your county Health Department as we continue to assess the risk to the area water wells.

Regards,

Phillip T. Goad, Ph.D.
Partner and Principal Toxicologist
Center for Toxicology and Environmental Health, L.L.C.

US EPA ARCHIVE DOCUMENT

DATA REVIEW FINDINGS SUMMARY

I. General Package:

The data package was complete and no resubmissions were requested.

II. Volatile Organic Compounds – SW8260

No qualifications.

III. Semi-volatile Organic Compounds – SW8270

No qualifications.

IV. Diesel Range Organics – SW8015M

No qualifications.

V. Gasoline Range Organics – SW8015

No qualifications.

VI. Metals - Nickel, Vanadium & Hardness (calculation) – SW6020A

Please note that the level 2 laboratory report does not contain any information to confirm the calculation for Hardness.

No qualifications.

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - Volatiles **Enbridge Energy**

SDG: 1007670

Sample Name: **WS07301100RTV1** Sample Matrix Code: **W** Total/Dissolved: **T**
Location ID: **NA** Sample Date: **7/30/2010 11:00:00 AM** Lab: **ALS Environmental**
Sample Type: **Site Sample** Analysis Date: **7/31/2010 5:20:00 AM**
Lab Sample ID: **1007670-06B**
Method: **SW8260**

CAS	Parameter Name	DF	RL	Lab Result	LabQual	Verified Result	Ver.Qual	Units
95-63-6	1,2,4-Trimethylbenzene	1	1	1	U	1	U	ug/L
108-67-8	1,3,5-Trimethylbenzene	1	1	1	U	1	U	ug/L
91-57-6	2-Methylnaphthalene	1	5	5	U	5	U	ug/L
71-43-2	Benzene	1	1	1	U	1	U	ug/L
100-41-4	Ethylbenzene	1	1	1	U	1	U	ug/L
M/PXYL-EN-E	m,p-Xylene	1	1	1	U	1	U	ug/L
95-47-6	o-Xylene	1	1	1	U	1	U	ug/L
108-88-3	Toluene	1	1	1	U	1	U	ug/L
1330-20-7	Xylenes, Total	1	3	3	U	3	U	ug/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
N = Presumptive evidence
* = Modified by Validation

eDATApro Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - Semivolatiles **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301100RTV1**	Sample Matrix Code:	**W**	Total/Dissolved:	**T**
Location ID:	**NA**	Sample Date:	**7/30/2010 11:00:00 AM**	Lab Code:	**ALSHN**
Sample Type:	**Site Sample**	Analysis Date:	**7/31/2010 4:59:00 PM**		
Lab Sample ID:	**1007670-06C**				
Method:	**SW8270**				

CAS	Parameter Name	DF	RL	Lab Result	LabQual	Verified Result	Ver.Qual	Units
91-58-7	2-Chloronaphthalene	1	5	5	U	5	U	ug/L
91-57-6	2-Methylnaphthalene	1	5	5	U	5	U	ug/L
83-32-9	Acenaphthene	1	5	5	U	5	U	ug/L
208-96-8	Acenaphthylene	1	5	5	U	5	U	ug/L
120-12-7	Anthracene	1	5	5	U	5	U	ug/L
56-55-3	Benzo(a)anthracene	1	1	1	U	1	U	ug/L
50-32-8	Benzo(a)pyrene	1	1	1	U	1	U	ug/L
205-99-2	Benzo(b)fluoranthene	1	1	1	U	1	U	ug/L
191-24-2	Benzo(g,h,i)perylene	1	1	1	U	1	U	ug/L
207-08-9	Benzo(k)fluoranthene	1	1	1	U	1	U	ug/L
218-01-9	Chrysene	1	1	1	U	1	U	ug/L
53-70-3	Dibenzo(a,h)anthracene	1	2	2	U	2	U	ug/L
206-44-0	Fluoranthene	1	1	1	U	1	U	ug/L
86-73-7	Fluorene	1	5	5	U	5	U	ug/L
193-39-5	Indeno(1,2,3-cd)pyrene	1	2	2	U	2	U	ug/L
91-20-3	Naphthalene	1	5	5	U	5	U	ug/L
85-01-8	Phenanthrene	1	2	2	U	2	U	ug/L
129-00-0	Pyrene	1	5	5	U	5	U	ug/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
* = Modified by Validation



Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - TPH **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301100RTV1**	Sample Matrix Code:	**W**	Total/Dissolved:	**T**
Location ID:	**NA**	Sample Date:	**7/30/2010 11:00:00 AM**	Lab Code:	**ALSHN**
Sample Type:	**Site Sample**	Analysis Date:	**7/31/2010**		
Lab Sample ID:	**1007670-06C**				

CAS	Parameter Name	Method	DF	RL	Lab Result	LabQual	VerifiedResult	Ver.Qual	Units
DROC10-C3-8	DRO (C10-C38)	SW8015M	1	0.1	0.1	U	0.1	U	mg/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
* = Modified by Validation

eDATApro Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - TPH **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301100RTV1**	Sample Matrix Code:	**W**	Total/Dissolved:	**T**
Location ID:	**NA**	Sample Date:	**7/30/2010 11:00:00 AM**	Lab Code:	**ALSHN**
Sample Type:	**Site Sample**	Analysis Date:	**7/31/2010**		
Lab Sample ID:	**1007670-06B**				

CAS	Parameter Name	Method	DF	RL	Lab Result	LabQual	VerifiedResult	Ver.Qual	Units
GROC5-C1-0	GRO (C5-C10)	SW8015	1	200	200	U	200	U	ug/L

US EPA ARCHIVE DOCUMENT

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
* = Modified by Validation

Form 1 Data Sheet - Metals **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301100RTV1**	Sample Matrix Code:	**W**
Location ID:	**NA**	Total/Dissolved:	**T**
Sample Type:	**Site Sample**	Lab Code:	**ALSHN**
Lab Sample ID:	**1007670-06A**		

CAS	Parameter Name	Method	Sample Date	DF	RL	Lab Result	LabQual	VerifiedResult	Ver.Qual	Units
000011-02-9	**Hardness (Calculation)**	**SW6020A**	**7/30/2010 11:00:00 AM**	**1**	0	**250**		**250**		**mg/L**
7440-02-0	Nickel	SW6020A	**7/30/2010 11:00:00 AM**	1	0.02	0.02	U	0.02	U	mg/L
7440-62-2	Vanadium	SW6020A	**7/30/2010 11:00:00 AM**	1	0.004	0.004	U	0.004	U	mg/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
B = Analyte detected in method blank (lab Qualifier)
* = Modified by Validation

eDATApro Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - Volatiles

Enbridge Energy

SDG: 1007670

Sample Name: **WS07301110RTV1**
Location ID: **NA**
Sample Type: **Site Sample**
Lab Sample ID: **1007670-07B**
Method: **SW8260**

Sample Matrix Code: **W**
Sample Date: **7/30/2010 11:10:00 AM**
Analysis Date: **7/31/2010 5:48:00 AM**

Total/Dissolved: **T**
Lab: **ALS Environmental**

CAS	Parameter Name	DF	RL	Lab Result	LabQual	Verified Result	Ver.Qual	Units
95-63-6	1,2,4-Trimethylbenzene	1	1	1	U	1	U	ug/L
108-67-8	1,3,5-Trimethylbenzene	1	1	1	U	1	U	ug/L
91-57-6	2-Methylnaphthalene	1	5	5	U	5	U	ug/L
71-43-2	Benzene	1	1	1	U	1	U	ug/L
100-41-4	Ethylbenzene	1	1	1	U	1	U	ug/L
M/PXYL-EN-E	m,p-Xylene	1	1	1	U	1	U	ug/L
95-47-6	o-Xylene	1	1	1	U	1	U	ug/L
108-88-3	Toluene	1	1	1	U	1	U	ug/L
1330-20-7	Xylenes, Total	1	1	1	U	1	U	ug/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
N = Presumptive evidence
* = Modified by Validation

Form 1 Data Sheet - Semivolatiles **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301110RTV1**	Sample Matrix Code:	**W**	Total/Dissolved:	**T**
Location ID:	**NA**	Sample Date:	**7/30/2010 11:10:00 AM**	Lab Code:	**ALSHN**
Sample Type:	**Site Sample**	Analysis Date:	**7/31/2010 5:36:00 PM**		
Lab Sample ID:	**1007670-07C**				
Method:	**SW8270**				

CAS	Parameter Name	DF	RL	Lab Result	LabQual	Verified Result	Ver.Qual	Units
91-58-7	2-Chloronaphthalene	1	5	5	U	5	U	ug/L
91-57-6	2-Methylnaphthalene	1	5	5	U	5	U	ug/L
83-32-9	Acenaphthene	1	5	5	U	5	U	ug/L
208-96-8	Acenaphthylene	1	5	5	U	5	U	ug/L
120-12-7	Anthracene	1	5	5	U	5	U	ug/L
56-55-3	Benzo(a)anthracene	1	1	1	U	1	U	ug/L
50-32-8	Benzo(a)pyrene	1	1	1	U	1	U	ug/L
205-99-2	Benzo(b)fluoranthene	1	1	1	U	1	U	ug/L
191-24-2	Benzo(g,h,i)perylene	1	1	1	U	1	U	ug/L
207-08-9	Benzo(k)fluoranthene	1	1	1	U	1	U	ug/L
218-01-9	Chrysene	1	1	1	U	1	U	ug/L
53-70-3	Dibenzo(a,h)anthracene	1	2	2	U	2	U	ug/L
206-44-0	Fluoranthene	1	1	1	U	1	U	ug/L
86-73-7	Fluorene	1	5	5	U	5	U	ug/L
193-39-5	Indeno(1,2,3-cd)pyrene	1	2	2	U	2	U	ug/L
91-20-3	Naphthalene	1	5	5	U	5	U	ug/L
85-01-8	Phenanthrene	1	2	2	U	2	U	ug/L
129-00-0	Pyrene	1	5	5	U	5	U	ug/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
* = Modified by Validation



Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - TPH **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301110RTV1**	Sample Matrix Code:	**W**	Total/Dissolved:	**T**
Location ID:	**NA**	Sample Date:	**7/30/2010 11:10:00 AM**	Lab Code:	**ALSHN**
Sample Type:	**Site Sample**	Analysis Date:	**7/31/2010**		
Lab Sample ID:	**1007670-07C**				

CAS	Parameter Name	Method	DF	RL	Lab Result	LabQual	VerifiedResult	Ver.Qual	Units
DROC10-C3-8	DRO (C10-C38)	SW8015M	1	0.1	0.1	U	0.1	U	mg/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
* = Modified by Validation

eDATApro Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - TPH **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301110RTV1**	Sample Matrix Code:	**W**	Total/Dissolved:	**T**
Location ID:	**NA**	Sample Date:	**7/30/2010 11:10:00 AM**	Lab Code:	**ALSHN**
Sample Type:	**Site Sample**	Analysis Date:	**7/31/2010**		
Lab Sample ID:	**1007670-07B**				

CAS	Parameter Name	Method	DF	RL	Lab Result	LabQual	VerifiedResult	Ver.Qual	Units
GROC5-C1-0	GRO (C5-C10)	SW8015	1	200	200	U	200	U	ug/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
* = Modified by Validation

eDATApro Environmental Data Professional, LLC

US EPA ARCHIVE DOCUMENT

Form 1 Data Sheet - Metals **Enbridge Energy**

SDG: 1007670

Sample Name:	**WS07301110RTV1**	Sample Matrix Code:	**W**
Location ID:	**NA**	Total/Dissolved:	**T**
Sample Type:	**Site Sample**	Lab Code:	**ALSHN**
Lab Sample ID:	**1007670-07A**		

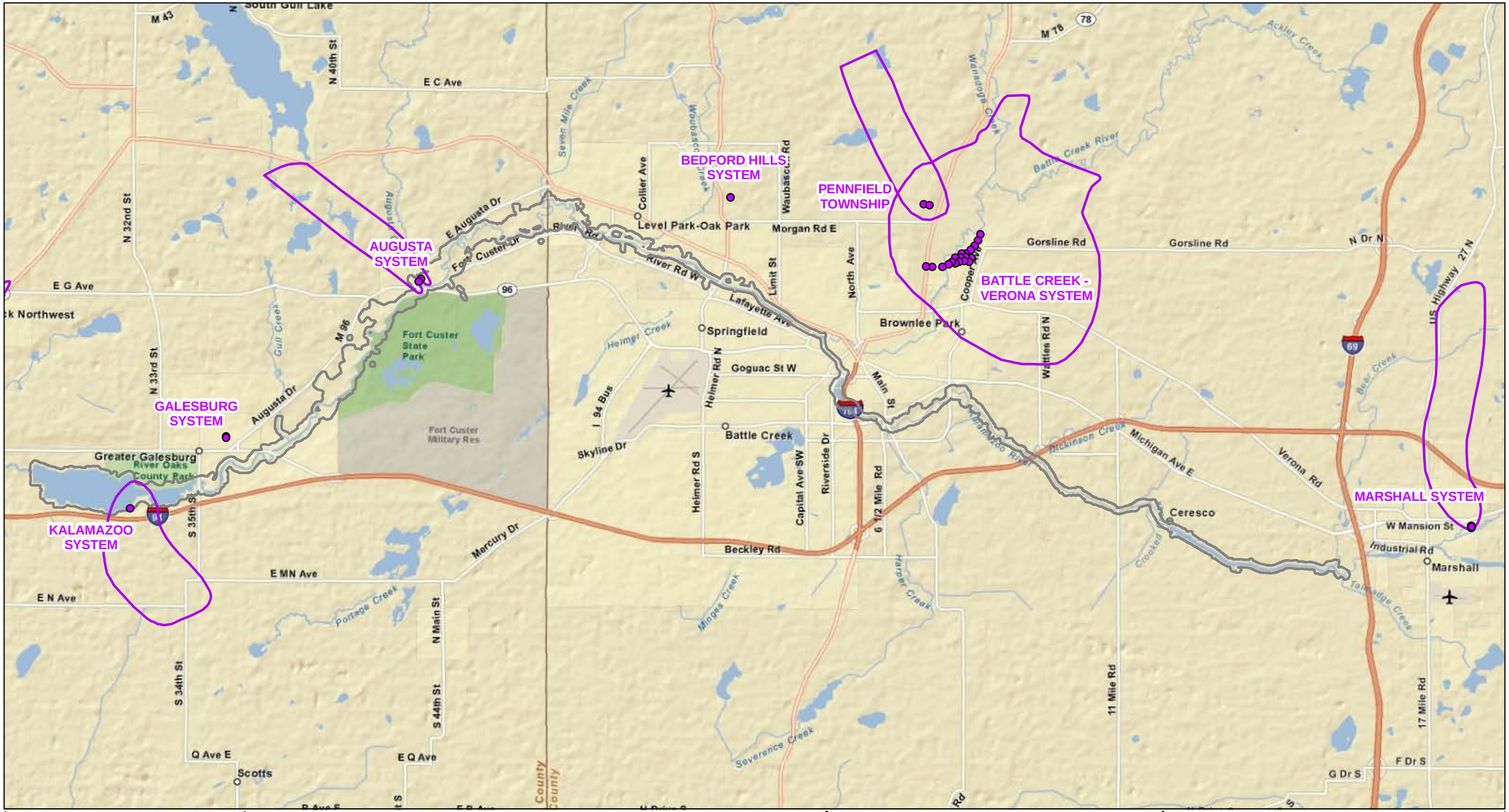
CAS	Parameter Name	Method	Sample Date	DF	RL	Lab Result	LabQual	VerifiedResult	Ver.Qual	Units
000011-02-9	**Hardness (Calculation)**	**SW6020A**	**7/30/2010 11:10:00 AM**	**1**	0	**250**		**250**		**mg/L**
7440-02-0	Nickel	SW6020A	**7/30/2010 11:10:00 AM**	1	0.02	0.02	U	0.02	U	mg/L
7440-62-2	Vanadium	SW6020A	**7/30/2010 11:10:00 AM**	1	0.004	0.004	U	0.004	U	mg/L

DF = Dilution Factor
RL = Reporting Limit
U = Non-Detect
J = Estimated
R = Rejected
B = Analyte detected in method blank (lab Qualifier)
* = Modified by Validation

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AECOM

October 2010

N

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Miles

Legend

- Municipal Well Location
- Wellhead Protection Areas
- High Water Mark Buffer

MUNICIPAL WELL LOCATIONS AND WELLHEAD PROTECTION AREAS ALONG THE KALAMAZOO RIVER

Appendix F

Soil Boring and Well Construction Logs

US EPA ARCHIVE DOCUMENT

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L01**

WELL ID: **MWKR0250L01**

TOTAL DEPTH: **110'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.50
Ground Elevation: 891.83
X Coordinate: 12951049.10
Y Coordinate: 276724.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/4/10
Time Finished: 1700 Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 13:26
Method: Vac truck
Volume Purged: 399 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–5		SP	Tan medium sand, trace clay, silt and gravel; dry; loose Dark tan medium-coarse sand, trace fine-coarse gravel; dry; loose Dark tan medium-coarse sand, trace fine gravel; slightly moist Tan gravelly medium-coarse sand, trace silt; slightly moist; loose Brownish-grayish-tan gravelly fine-medium sand; saturated; loose						
5–9		CL	Brown gravelly medium-coarse sand, trace silt; saturated Gray clay; saturated; firm						
9–19		SP	Brownish-tan clay; saturated; firm Light tan fine-medium sand, trace fine gravel; grading to tan gravelly fine-medium sand, trace silt; slightly moist; very firm <2" lenses of silty fine sand				▽		
19–20		SP	Light tan fine-medium sand; slightly moist						

NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L01**
WELL ID: **MWKR0250L01**
TOTAL DEPTH: **110'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.50
Ground Elevation: 891.83
X Coordinate: 12951049.10
Y Coordinate: 276724.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/4/10
Time Finished: 1700 Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 13:26
Method: Vac truck
Volume Purged: 399 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
20–40		SP	Tan fine-medium sand, some silt; saturated at 22.5'						
29			Gray medium-coarse sand; saturated						
30			Gray medium-coarse sand, trace fine gravel; saturated						
35			Gray sandy silt and clay; saturated						
37		ML-CL	Gray sandy silt and clay, some medium sand; saturated						
39			Gray silty fine sand, some clay; saturated						
40		SP							

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L01**
WELL ID: **MWKR0250L01**
TOTAL DEPTH: **110'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.50
Ground Elevation: 891.83
X Coordinate: 12951049.10
Y Coordinate: 276724.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/4/10
Time Finished: 1700 Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 13:26
Method: Vac truck
Volume Purged: 399 gallons

▽ Water level during drilling
▼ Water level in completed well

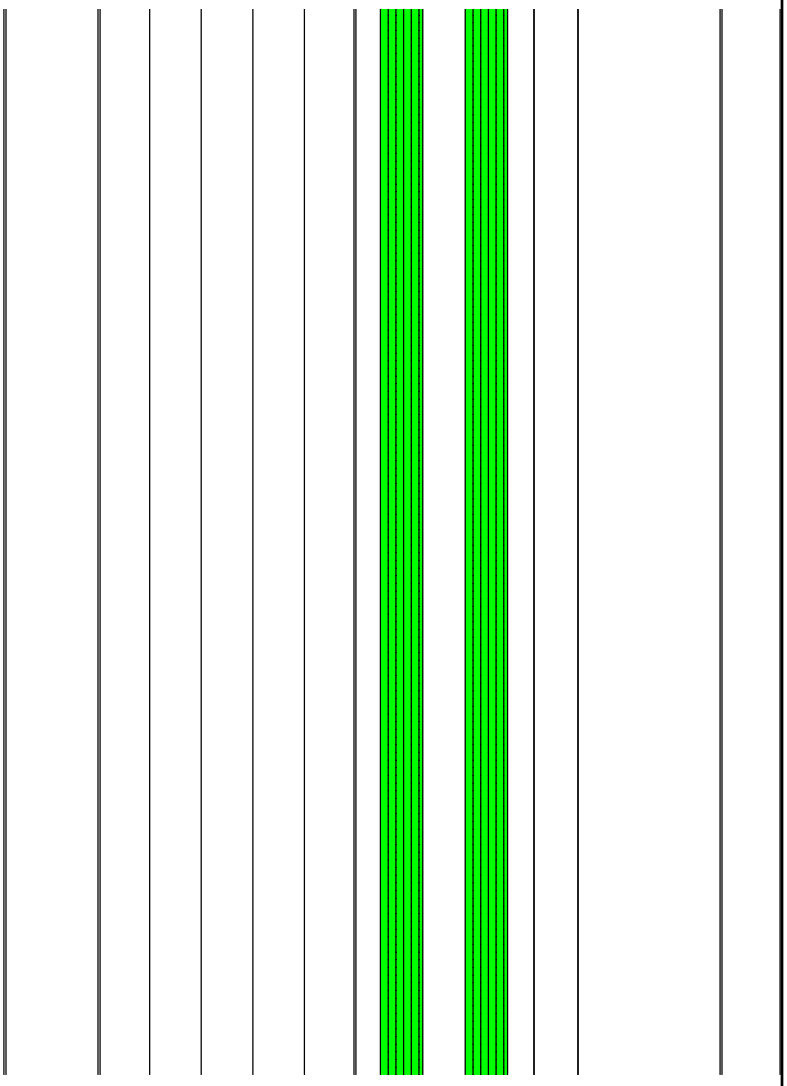
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
40		SP	Gray fine sand, some silt, trace fine gravel; saturated
41			
42			
43		ML	Gray sandy silt, trace clay with thin gravel lens
44			
45			Gray fine sand, some silt, some fine gravel; very firm
46			Gray silty fine sand, some fine-coarse gravel, trace clay; slightly moist; very firm; very tightly packed
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60		SP	

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L01**
WELL ID: **MWKR0250L01**
TOTAL DEPTH: **110'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.50
Ground Elevation: 891.83
X Coordinate: 12951049.10
Y Coordinate: 276724.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/4/10
Time Finished: 1700 Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 13:26
Method: Vac truck
Volume Purged: 399 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
60–80		SP	Gray 5 Y 7/2 silty fine sand, some fine gravel, trace coarse gravel; moist; lens of gravelly medium-coarse sand, some silt at 67-68'						
70			5 Y 7/2 light gray fine sand, some silt, some fine gravel; moist						
73			5 Y 7/2 light gray fine-medium sand, some silt, some fine gravel; moist						
76			5 Y 7/2 light gray medium sand; moist						
79			Light gray silty fine sand, trace fine gravel						

NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L01**
WELL ID: **MWKR0250L01**
TOTAL DEPTH: **110'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.50
Ground Elevation: 891.83
X Coordinate: 12951049.10
Y Coordinate: 276724.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/4/10
Time Finished: 1700 Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 13:26
Method: Vac truck
Volume Purged: 399 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
80			Light gray silt and fine sand, some fine-coarse gravel; slightly moist; firm						
90		ML	Gray silt, some fine gravel, some fine sand in lenses at 93-93.5' and 95-95/5'; moist; N6; material is platy and firm						
98			Gray silt and fine sand, some clay, some fine gravel; very moist; firm N7						
100									

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L01**
WELL ID: **MWKR0250L01**
TOTAL DEPTH: **110'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.50
Ground Elevation: 891.83
X Coordinate: 12951049.10
Y Coordinate: 276724.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/4/10
Time Finished: 1700 Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 13:26
Method: Vac truck
Volume Purged: 399 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
100									
101			Gray platy, sandy silt, some clay; firm; 31 moist; N6 to N4 color						
102									
103									
104									
105									
106									
107									
108									
109									
110									

NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L02**

WELL ID: **MWKR0250L02**

TOTAL DEPTH: **30'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 891.24
Ground Elevation: 891.60
X Coordinate: 12951039.50
Y Coordinate: 276721.40
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1700 Date Started: 10/5/10
Time Finished: 1000 Date Finished: 10/6/10

Well Development Information

Date: 10/10/10
Time Started: 17:55
Method: Vac truck
Volume Purged: 70 gallons

▽ Water level during drilling
▼ Water level in completed well

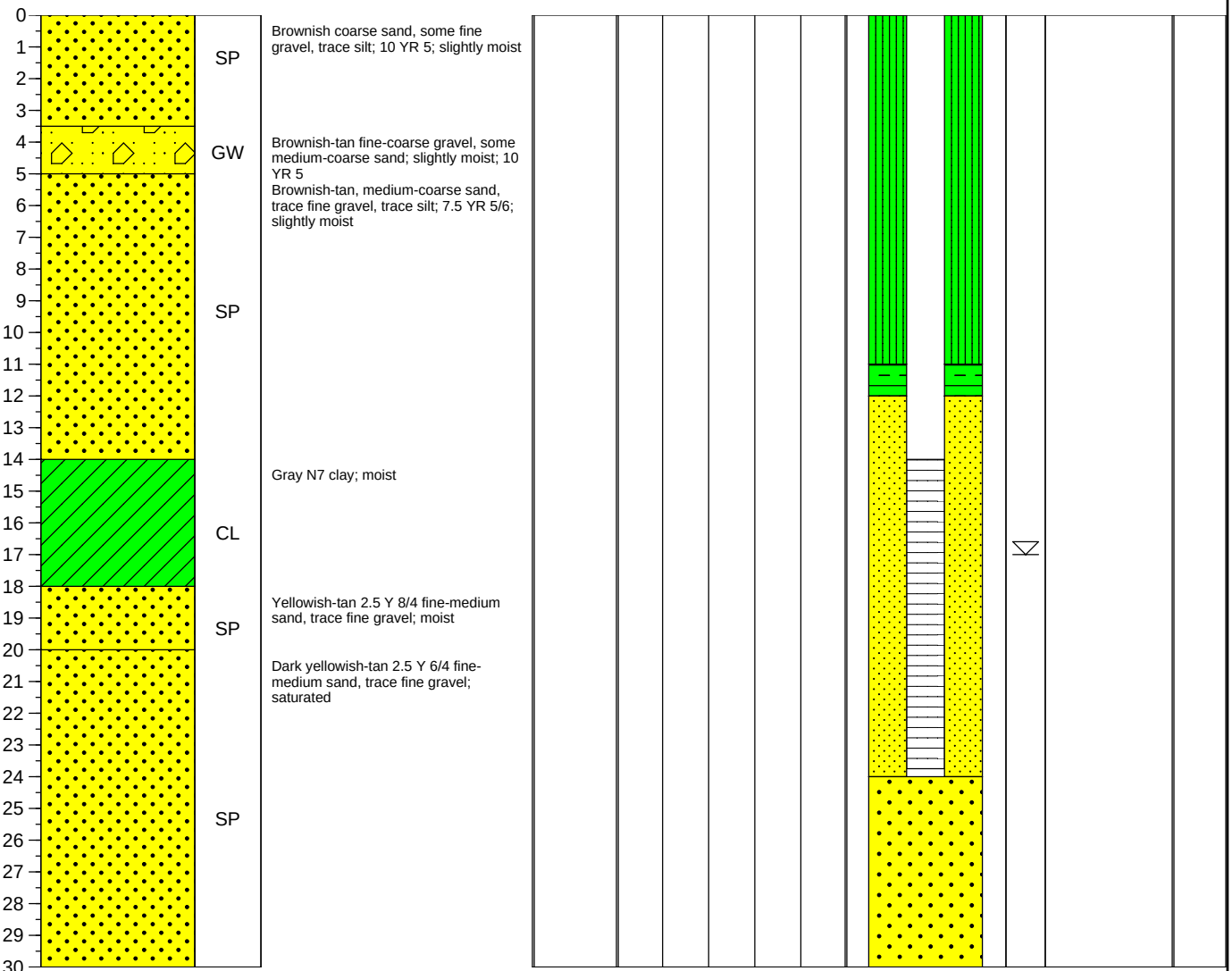
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–3		SP	Brownish coarse sand, some fine gravel, trace silt; 10 YR 5; slightly moist
4–5		GW	Brownish-tan fine-coarse gravel, some medium-coarse sand; slightly moist; 10 YR 5
5–9		SP	Brownish-tan, medium-coarse sand, trace fine gravel, trace silt; 7.5 YR 5/6; slightly moist
14–18		CL	Gray N7 clay; moist
18–20		SP	Yellowish-tan 2.5 Y 8/4 fine-medium sand, trace fine gravel; moist
20–30		SP	Dark yellowish-tan 2.5 Y 6/4 fine-medium sand, trace fine gravel; saturated

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L03**
WELL ID: **MWKR0250L03**
TOTAL DEPTH: **45'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 895.94
Ground Elevation: 896.30
X Coordinate: 12951051.80
Y Coordinate: 276492.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1000 Date Started: 10/6/10
Time Finished: 1400 Date Finished: 10/6/10

Well Development Information

Date: 10/10/10
Time Started: 16:20
Method: Vac truck
Volume Purged: 199 gallons

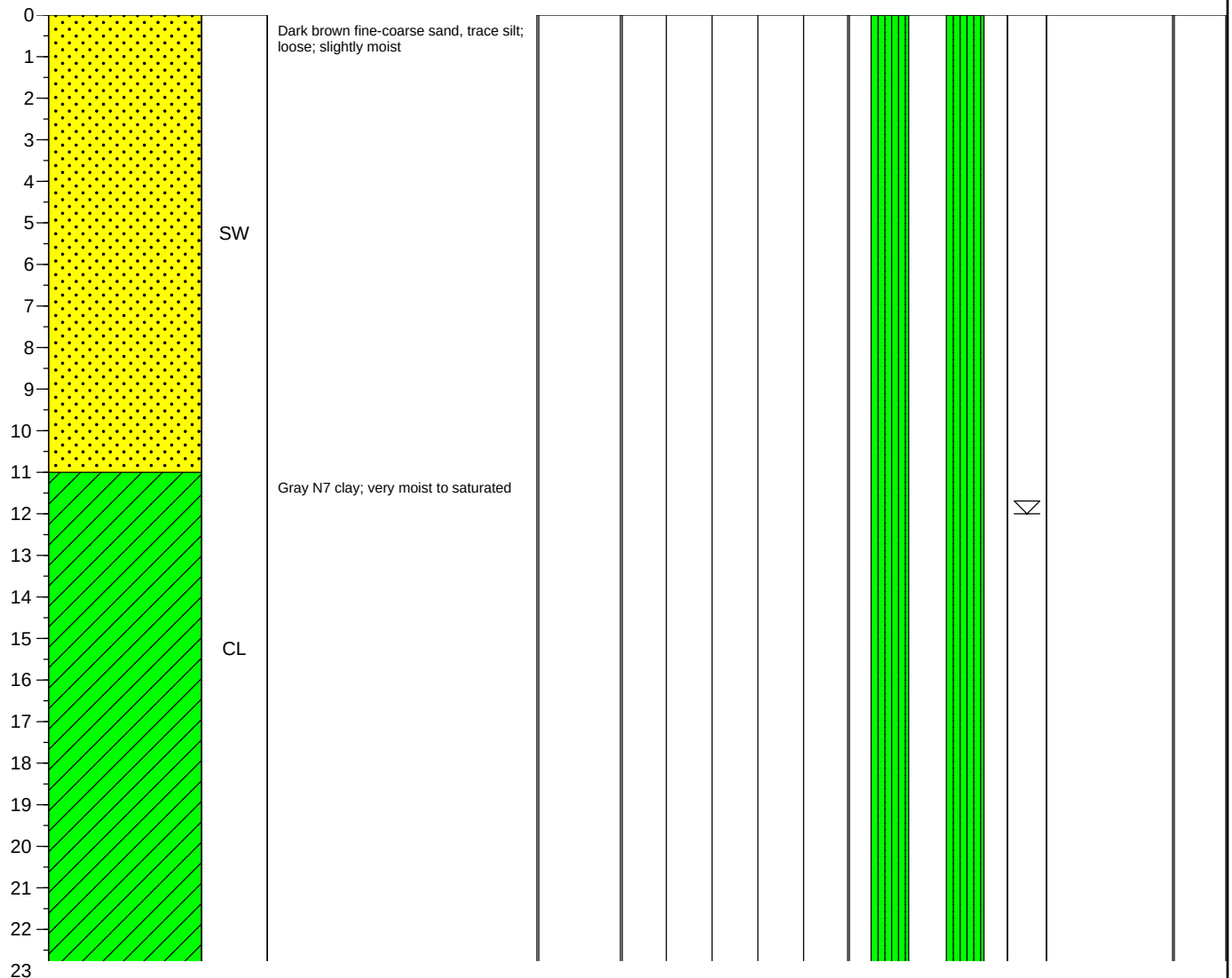
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–11		SW	Dark brown fine-coarse sand, trace silt; loose; slightly moist						
11–45		CL	Gray N7 clay; very moist to saturated				▽		



NOTES:Default listing

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0250L03**

WELL ID: **MWKR0250L03**

TOTAL DEPTH: **45'**

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 895.94
Ground Elevation: 896.30
X Coordinate: 12951051.80
Y Coordinate: 276492.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/10/10
Time Started: 16:20
Method: Vac truck
Volume Purged: 199 gallons

Time Started: 1000 Date Started: 10/6/10
Time Finished: 1400 Date Finished: 10/6/10

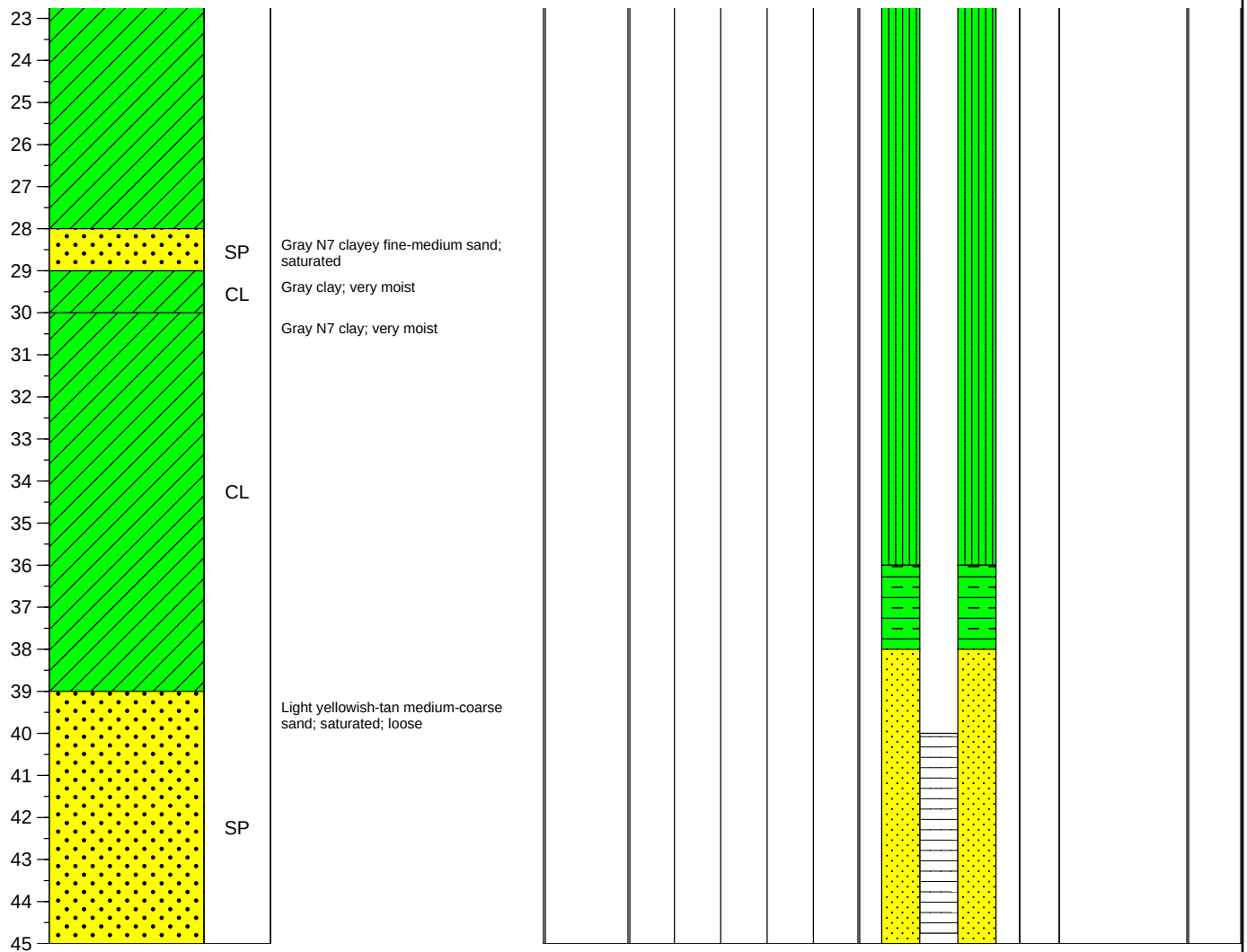
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
28		SP	Gray N7 clayey fine-medium sand; saturated
29		CL	Gray clay; very moist
30			Gray N7 clay; very moist
34		CL	
39			Light yellowish-tan medium-coarse sand; saturated; loose
42		SP	



PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS

NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0570R01**

WELL ID: **MWKR0570R01**

TOTAL DEPTH: **35'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 875.34
Ground Elevation: 875.62
X Coordinate: 12936148.10
Y Coordinate: 281319.40
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/11/10
Time Started: 16:00
Method: Vac truck
Volume Purged: 261 gallons

Time Started: 1500 Date Started: 10/6/10
Time Finished: 0845 Date Finished: 10/7/10

▽ Water level during drilling
▼ Water level in completed well

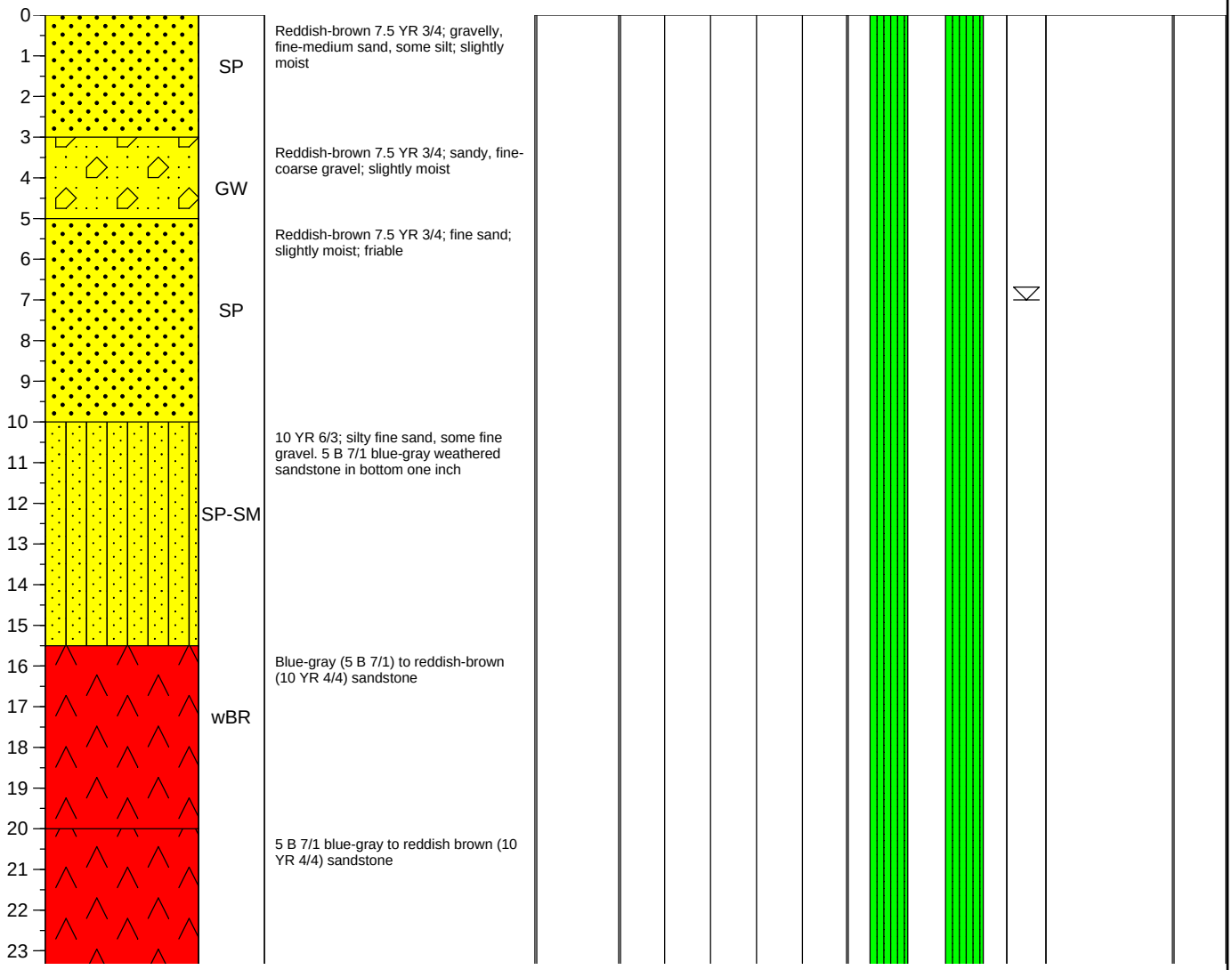
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–3		SP	Reddish-brown 7.5 YR 3/4; gravelly, fine-medium sand, some silt; slightly moist
3–5		GW	Reddish-brown 7.5 YR 3/4; sandy, fine-coarse gravel; slightly moist
5–10		SP	Reddish-brown 7.5 YR 3/4; fine sand; slightly moist; friable
10–16		SP-SM	10 YR 6/3; silty fine sand, some fine gravel. 5 B 7/1 blue-gray weathered sandstone in bottom one inch
16–20		wBR	Blue-gray (5 B 7/1) to reddish-brown (10 YR 4/4) sandstone
20–23			5 B 7/1 blue-gray to reddish brown (10 YR 4/4) sandstone

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0570R01**
WELL ID: **MWKR0570R01**
TOTAL DEPTH: **35'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 875.34
Ground Elevation: 875.62
X Coordinate: 12936148.10
Y Coordinate: 281319.40
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1500 Date Started: 10/6/10
Time Finished: 0845 Date Finished: 10/7/10

Well Development Information

Date: 10/11/10
Time Started: 16:00
Method: Vac truck
Volume Purged: 261 gallons

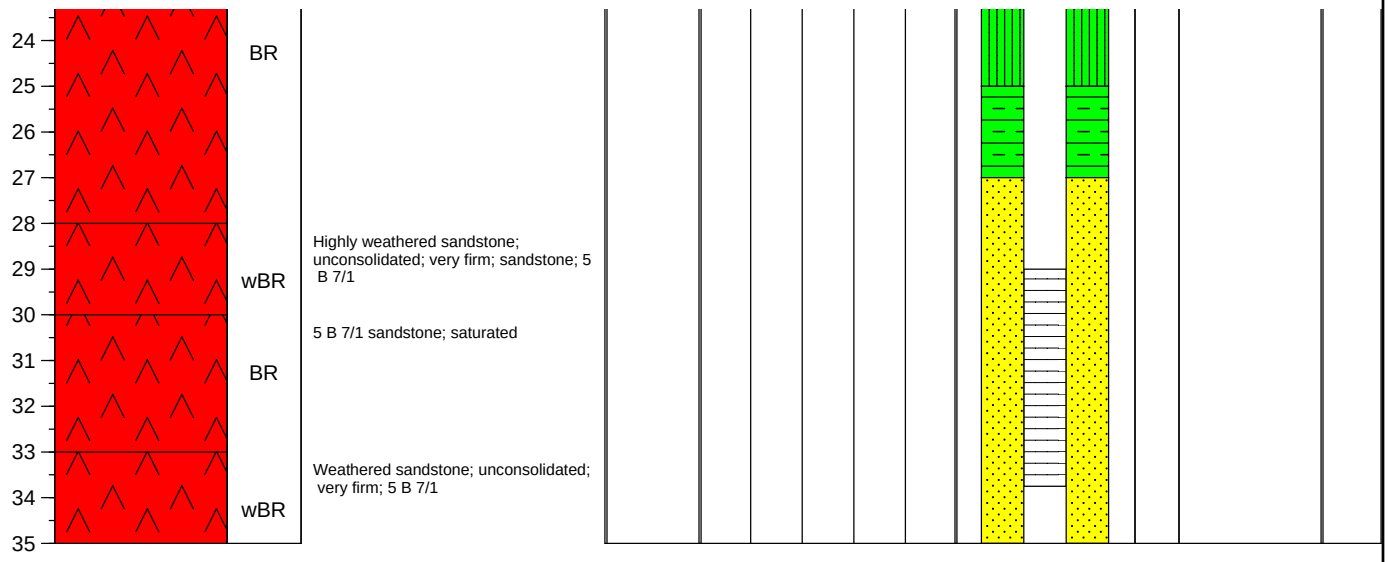
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
24–28		BR							
28–30		wBR	Highly weathered sandstone; unconsolidated; very firm; sandstone; 5 B 7/1						
30–33		BR	5 B 7/1 sandstone; saturated						
33–35		wBR	Weathered sandstone; unconsolidated; very firm; 5 B 7/1						



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0570R02**

WELL ID: **MWKR0570R02**

TOTAL DEPTH: **18.5'**

State: MI | County:Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 874.93
Ground Elevation: 875.32
X Coordinate: 12936140.20
Y Coordinate: 281326.40
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 0845 Date Started: 10/7/10
Time Finished: 0945 Date Finished: 10/7/10

Well Development Information

Date: 10/11/10
Time Started: 17:00
Method: Vac truck
Volume Purged: 176 gallons

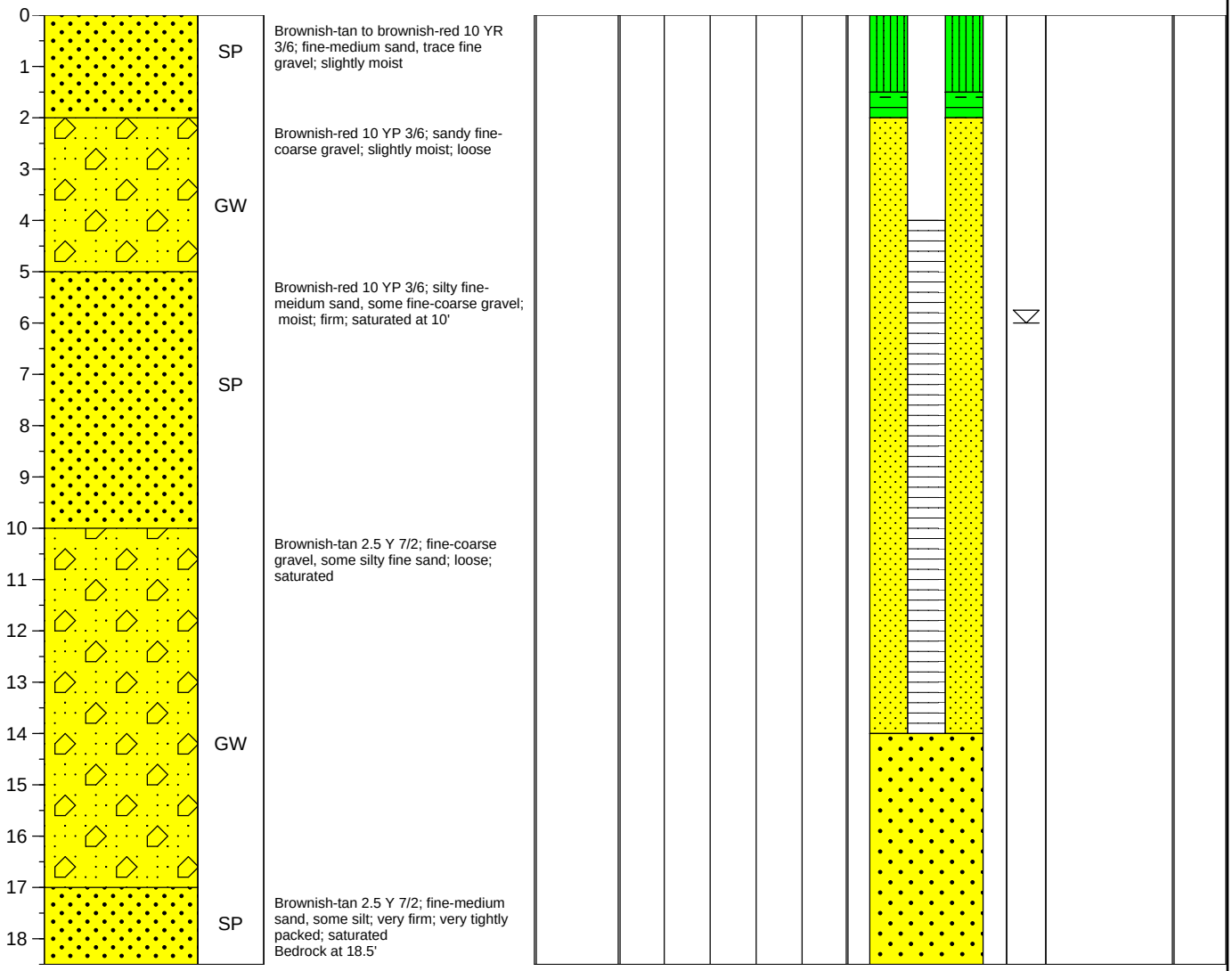
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–1		SP	Brownish-tan to brownish-red 10 YR 3/6; fine-medium sand, trace fine gravel; slightly moist
2–4		GW	Brownish-red 10 YP 3/6; sandy fine-coarse gravel; slightly moist; loose
5–7		SP	Brownish-red 10 YP 3/6; silty fine-meidum sand, some fine-coarse gravel; moist; firm; saturated at 10'
10–14		GW	Brownish-tan 2.5 Y 7/2; fine-coarse gravel, some silty fine sand; loose; saturated
17–18		SP	Brownish-tan 2.5 Y 7/2; fine-medium sand, some silt; very firm; very tightly packed; saturated Bedrock at 18.5'



NOTES:Default Listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0570R03**
WELL ID: **MWKR0570R03**
TOTAL DEPTH: **20'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 881.97
Ground Elevation: 882.40
X Coordinate: 12936213.60
Y Coordinate: 281478.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/8/10
Time Started: 15:30
Method: Grundfos
Volume Purged: 4 gallons

Time Started: 1000 Date Started: 10/7/10
Time Finished: 1200 Date Finished: 10/7/10

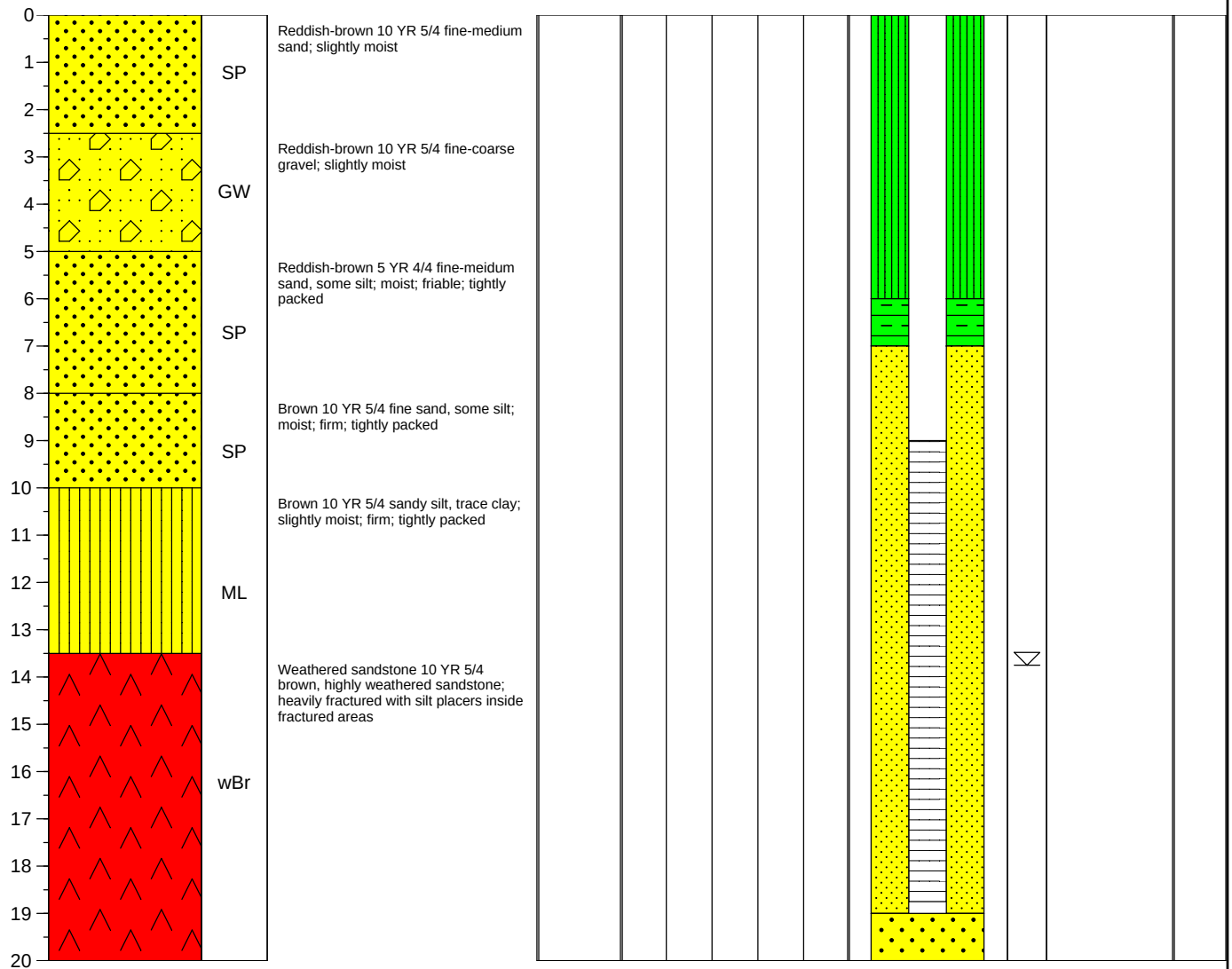
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–2		SP	Reddish-brown 10 YR 5/4 fine-medium sand; slightly moist
2–4		GW	Reddish-brown 10 YR 5/4 fine-coarse gravel; slightly moist
4–7		SP	Reddish-brown 5 YR 4/4 fine-meidum sand, some silt; moist; friable; tightly packed
7–9		SP	Brown 10 YR 5/4 fine sand, some silt; moist; firm; tightly packed
9–12		ML	Brown 10 YR 5/4 sandy silt, trace clay; slightly moist; firm; tightly packed
12–20		wBr	Weathered sandstone 10 YR 5/4 brown, highly weathered sandstone; heavily fractured with silt placers inside fractured areas



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580L01**

WELL ID: **MWKR0580L01**

TOTAL DEPTH: **47'**

State: MI | County:Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 883.35
Ground Elevation: 883.97
X Coordinate: 12935474.80
Y Coordinate: 281086.70
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1500 Date Started: 10/7/10
Time Finished: - Date Finished: 10/8/10

Well Development Information

Date: 10/11/10
Time Started: 15:15
Method: Vac truck
Volume Purged: 250 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–5		GW	10 YR light brown fine-coarse gravel, some silt, some fine-medium sand; loose to 3'; very firm 3'-5'; dry						
5–8		ML	10 YR 5/6 light brown sandy silt, some gravel; very dry; mostly loose; very firm 7.5'-8'						
8–10			No recovery - only slough						
10–18		GW	5 Y 8/2 light brownish-yellow fine-coarse gravel, some medium-coarse sand, trace silt						
18–20		ML	2.5 Y 5/2 brownish yellow sandy silt; slightly moist; very firm; tightly packed				▽		
20–24			5 B 6/1 blue-gray sandstone, weathered heavily at various depths. Weathere portiosn of competent rock tend to weather to 5 B 6/1 silty, fine-medium sand, some clay						

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580L01**
WELL ID: **MWKR0580L01**
TOTAL DEPTH: **47'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 883.35
Ground Elevation: 883.97
X Coordinate: 12935474.80
Y Coordinate: 281086.70
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1500 Date Started: 10/7/10
Time Finished: - Date Finished: 10/8/10

Well Development Information

Date: 10/11/10
Time Started: 15:15
Method: Vac truck
Volume Purged: 250 gallons

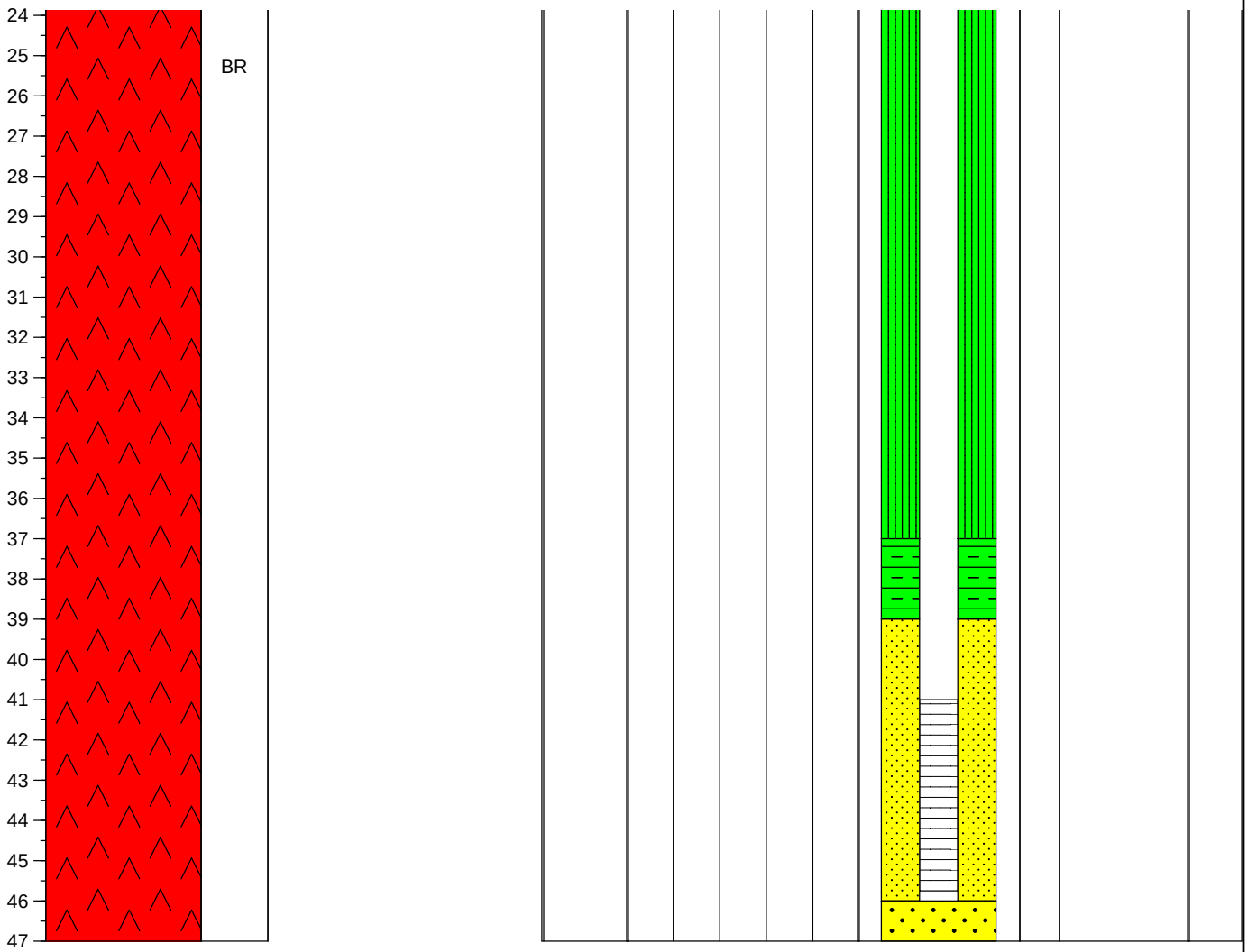
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580L02**
WELL ID: **MWKR0580L02**
TOTAL DEPTH: **26'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: -
TOC Elevation: 883.16
Ground Elevation: 883.77
X Coordinate: 12935471.50
Y Coordinate: 281081.20
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

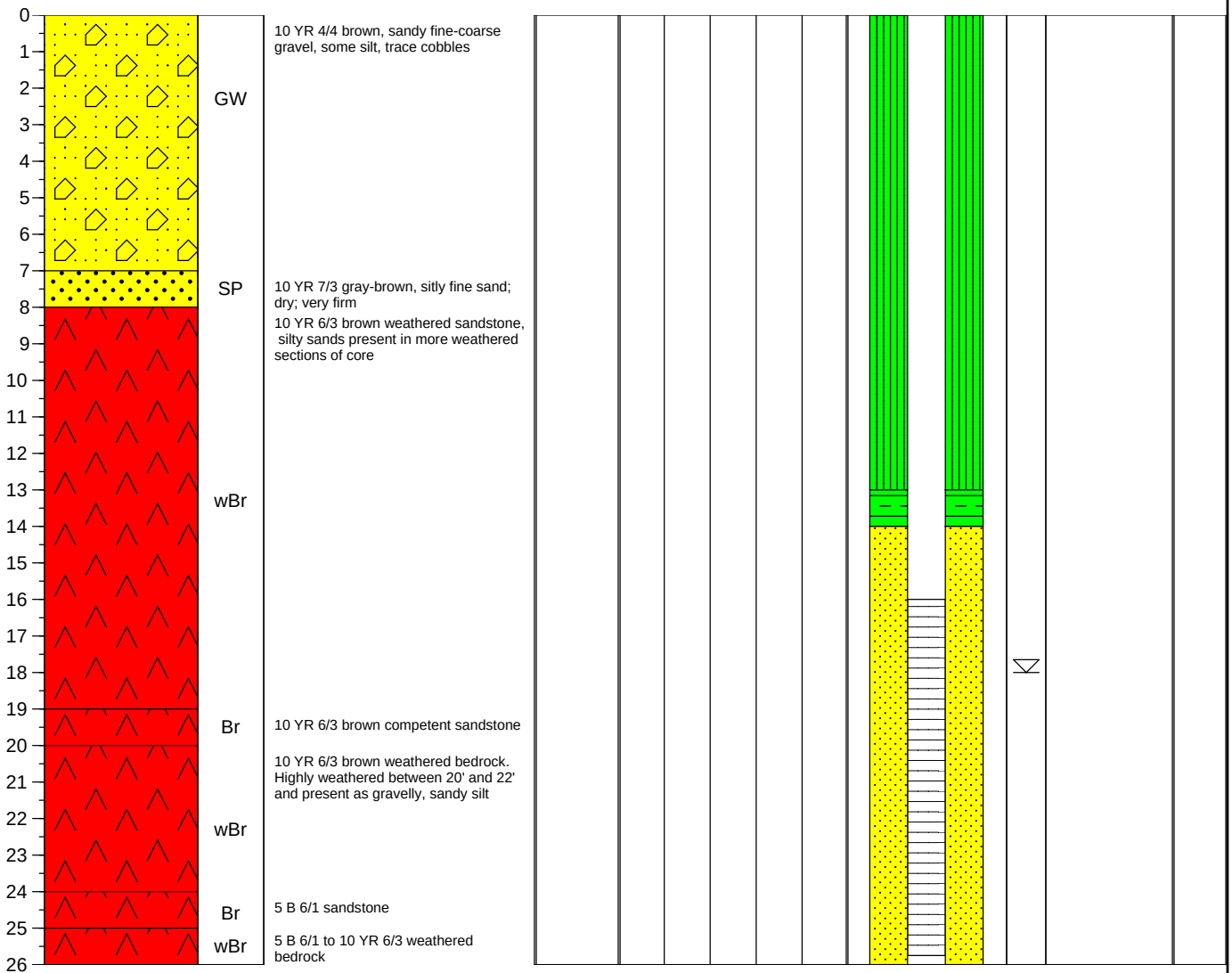
Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/9/10
Time Started: -
Method: -
Volume Purged: 0

Time Started: 0915 Date Started: 10/8/10
Time Finished: 1100 Date Finished: 10/8/10

▽ Water level during drilling
▼ Water level in completed well
NC Not Collected
OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected
Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–7		GW	10 YR 4/4 brown, sandy fine-coarse gravel, some silt, trace cobbles
7–8		SP	10 YR 7/3 gray-brown, sitly fine sand; dry; very firm
8–19		wBr	10 YR 6/3 brown weathered sandstone, silty sands present in more weathered sections of core
19–20		Br	10 YR 6/3 brown competent sandstone
20–22		wBr	10 YR 6/3 brown weathered bedrock. Highly weathered between 20' and 22' and present as gravelly, sandy silt
24–25		Br	5 B 6/1 sandstone
25–26		wBr	5 B 6/1 to 10 YR 6/3 weathered bedrock



PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS

NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580L03**
WELL ID: **MWKR0580L03**
TOTAL DEPTH: **30'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 883.78
Ground Elevation: 884.18
X Coordinate: 12935464.80
Y Coordinate: 281038.10
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/9/10
Time Started: -
Method: -
Volume Purged: 0

Time Started: 1100 Date Started: 10/8/10
Time Finished: 1600 Date Finished: 10/8/10

▽ Water level during drilling
▼ Water level in completed well

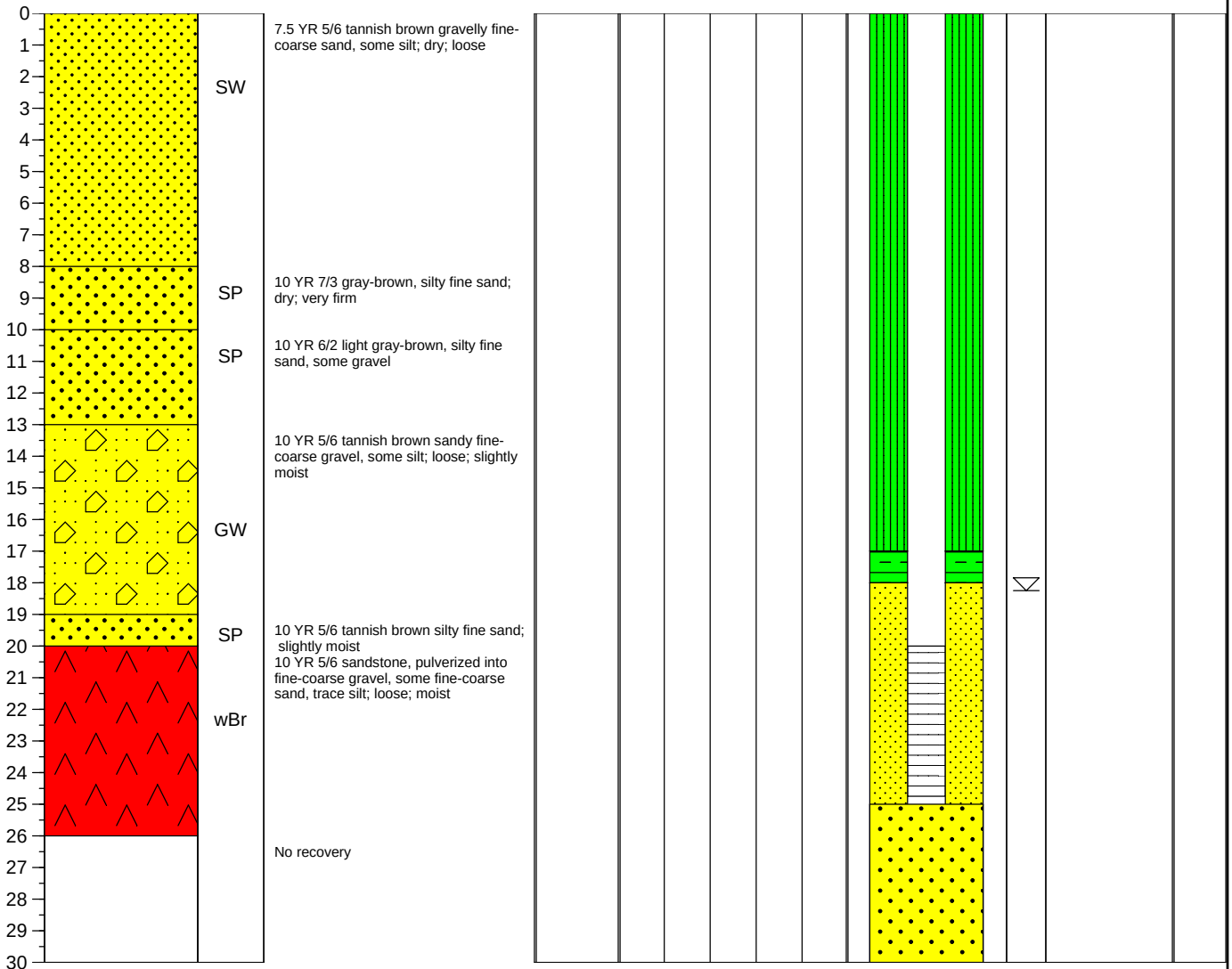
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–8		SW	7.5 YR 5/6 tannish brown gravelly fine-coarse sand, some silt; dry; loose
8–9		SP	10 YR 7/3 gray-brown, silty fine sand; dry; very firm
9–10		SP	10 YR 6/2 light gray-brown, silty fine sand, some gravel
10–19		GW	10 YR 5/6 tannish brown sandy fine-coarse gravel, some silt; loose; slightly moist
19–20		SP	10 YR 5/6 tannish brown silty fine sand; slightly moist
20–26		wBr	10 YR 5/6 sandstone, pulverized into fine-coarse gravel, some fine-coarse sand, trace silt; loose; moist
26–30			No recovery

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580R01**

WELL ID: **MWKR0580R01**

TOTAL DEPTH: **20'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 885.32
Ground Elevation: 885.65
X Coordinate: 12935894.30
Y Coordinate: 281433.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1100 Date Started: 10/9/10
Time Finished: 1400 Date Finished: 10/9/10

Well Development Information

Date: 10/11/10
Time Started: 17:45
Method: Vac truck
Volume Purged: Purged dry

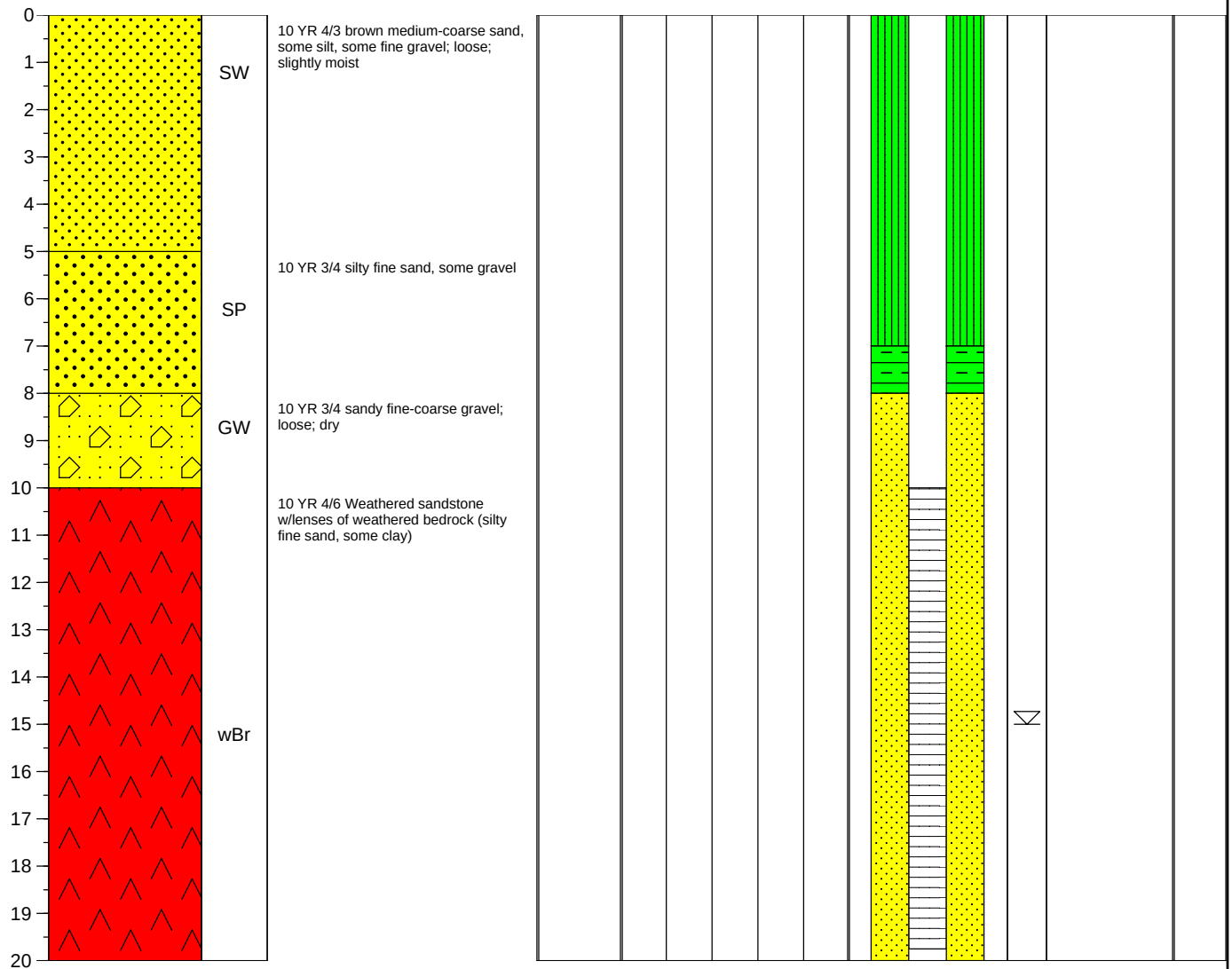
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–5		SW	10 YR 4/3 brown medium-coarse sand, some silt, some fine gravel; loose; slightly moist
5–8		SP	10 YR 3/4 silty fine sand, some gravel
8–10		GW	10 YR 3/4 sandy fine-coarse gravel; loose; dry
10–20		wBr	10 YR 4/6 Weathered sandstone w/lenses of weathered bedrock (silty fine sand, some clay)



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580R02**
WELL ID: **MWKR0580R02**
TOTAL DEPTH: **20'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 887.50
Ground Elevation: 887.82
X Coordinate: 12935892.80
Y Coordinate: 281534.70
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1430 Date Started: 10/9/10
Time Finished: 1730 Date Finished: 10/9/10

Well Development Information

Date: 10/11/10
Time Started: 18:15
Method: Vac truck
Volume Purged: Purged dry

▽ Water level during drilling
▼ Water level in completed well

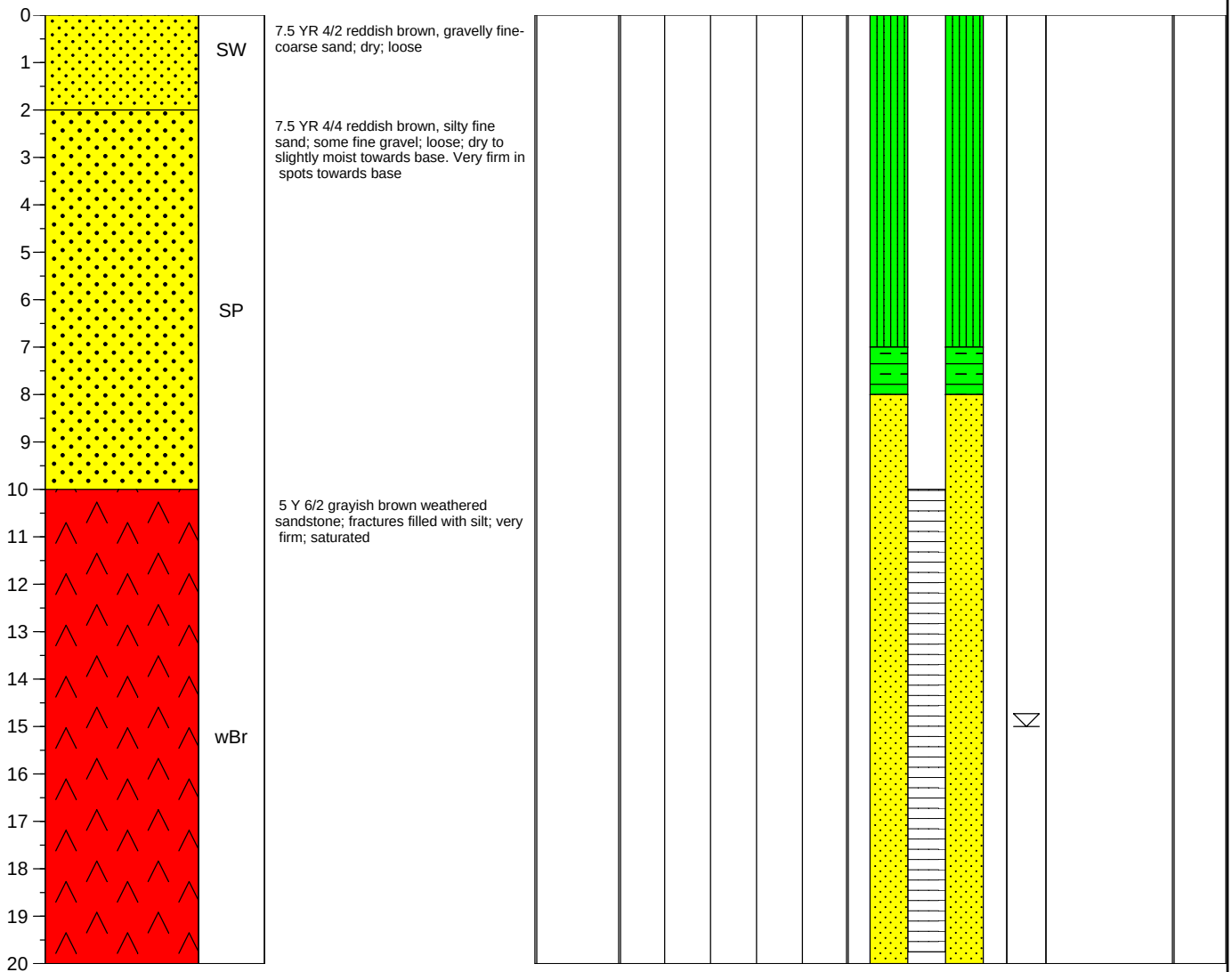
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–2		SW	7.5 YR 4/2 reddish brown, gravelly fine-coarse sand; dry; loose
2–10		SP	7.5 YR 4/4 reddish brown, silty fine sand; some fine gravel; loose; dry to slightly moist towards base. Very firm in spots towards base
10–20		wBr	5 Y 6/2 grayish brown weathered sandstone; fractures filled with silt; very firm; saturated

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR0580R03**
WELL ID: **MWKR0580R03**
TOTAL DEPTH: **30'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 892.62
Ground Elevation: 892.95
X Coordinate: 12935847.60
Y Coordinate: 281706.90
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

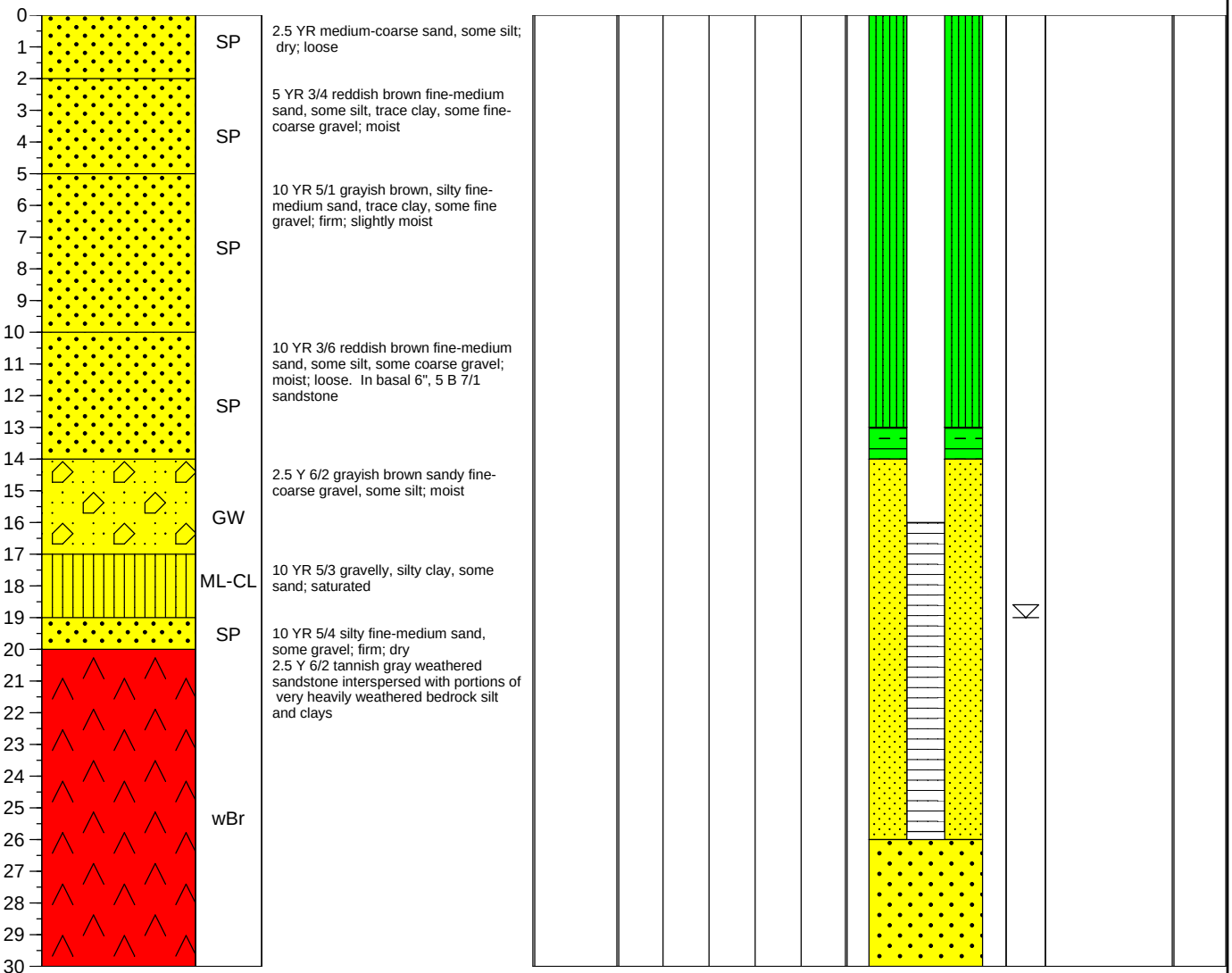
Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/11/10
Time Started: 18:45
Method: Vac truck
Volume Purged: Purged dry

Time Started: - Date Started: 10/9/10
Time Finished: - Date Finished: 10/9/10

▽ Water level during drilling
▼ Water level in completed well
NC Not Collected
OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected
Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–2		SP	2.5 YR medium-coarse sand, some silt; dry; loose
2–5		SP	5 YR 3/4 reddish brown fine-medium sand, some silt, trace clay, some fine-coarse gravel; moist
5–10		SP	10 YR 5/1 grayish brown, silty fine-medium sand, trace clay, some fine gravel; firm; slightly moist
10–14		SP	10 YR 3/6 reddish brown fine-medium sand, some silt, some coarse gravel; moist; loose. In basal 6", 5 B 7/1 sandstone
14–16		GW	2.5 Y 6/2 grayish brown sandy fine-coarse gravel, some silt; moist
16–18		ML-CL	10 YR 5/3 gravelly, silty clay, some sand; saturated
18–20		SP	10 YR 5/4 silty fine-medium sand, some gravel; firm; dry
20–30		wBr	2.5 Y 6/2 tannish gray weathered sandstone interspersed with portions of very heavily weathered bedrock silt and clays



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR1525R01**
WELL ID: **MWKR1525R01**
TOTAL DEPTH: **87'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 831.38
Ground Elevation: 831.60
X Coordinate: 12901627.40
Y Coordinate: 295799.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/11/10
Time Finished: 1500 Date Finished: 10/11/10

Well Development Information

Date: 10/12/10
Time Started: 18:05
Method: Vac truck
Volume Purged: 628 gallons

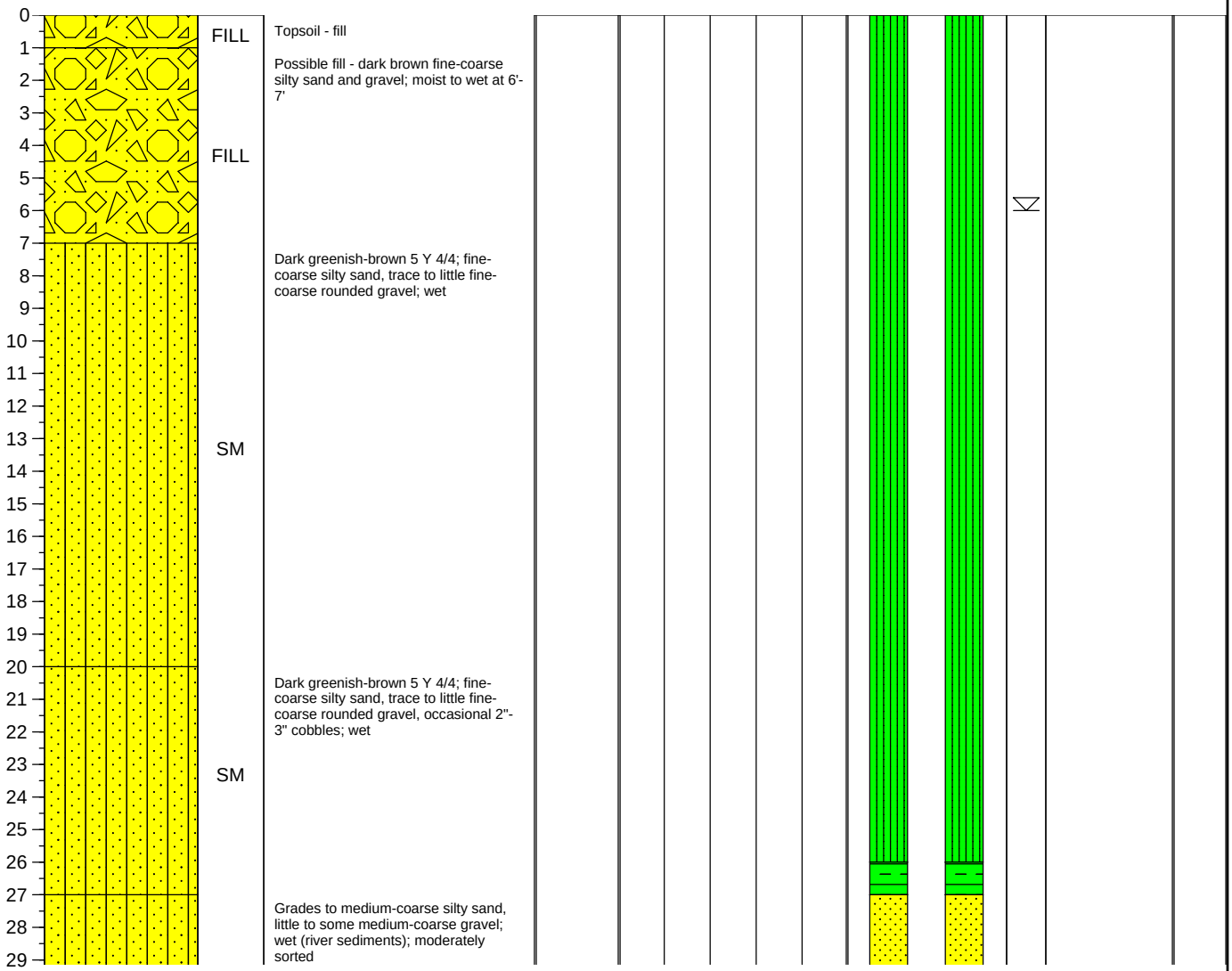
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–4		FILL	Topsoil - fill Possible fill - dark brown fine-coarse silty sand and gravel; moist to wet at 6'-7'
4–7		FILL	
7–20		SM	Dark greenish-brown 5 Y 4/4; fine-coarse silty sand, trace to little fine-coarse rounded gravel; wet
20–27		SM	Dark greenish-brown 5 Y 4/4; fine-coarse silty sand, trace to little fine-coarse rounded gravel, occasional 2"-3" cobbles; wet
27–29			Grades to medium-coarse silty sand, little to some medium-coarse gravel; wet (river sediments); moderately sorted



NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR1525R01**

WELL ID: **MWKR1525R01**

TOTAL DEPTH: **87'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 831.38
Ground Elevation: 831.60
X Coordinate: 12901627.40
Y Coordinate: 295799.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/12/10
Time Started: 18:05
Method: Vac truck
Volume Purged: 628 gallons

Time Started: 1200 Date Started: 10/11/10
Time Finished: 1500 Date Finished: 10/11/10

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
29–58		SM	Grades to fine-medium sand, trace fine gravel; light brown 5 Y 7/2; wet; moderately sorted						
		SM-SP							

NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR1525R01**

WELL ID: **MWKR1525R01**

TOTAL DEPTH: **87'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 831.38
Ground Elevation: 831.60
X Coordinate: 12901627.40
Y Coordinate: 295799.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/11/10
Time Finished: 1500 Date Finished: 10/11/10

Well Development Information

Date: 10/12/10
Time Started: 18:05
Method: Vac truck
Volume Purged: 628 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
58									
59									
60									
61									
62									
63									
64									
65									
66									
67			Light to dark gray; sandy silt, little to some fine-coarse sand, trace to little fine-medium subrounded gravel, trace clay; wet; soft; glacial till; 1" sandstone cobbles 76'-77'						
68									
69									
70									
71									
72		ML							
73									
74									
75									
76									
77									
78									
79									
80									
81			Dark gray; sandy silt, trace fine-medium gravel, trace to little clay; dry; till; sandstone 1"-3" cobbles at 81'						
82									
83		ML							
84									
85									
86									
87									

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR1525R02**
WELL ID: **MWKR1525R02**
TOTAL DEPTH: **14'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 831.31
Ground Elevation: 831.66
X Coordinate: 12901625.60
Y Coordinate: 295798.20
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/11/10
Time Finished: - Date Finished: 10/11/10

Well Development Information

Date: 10/12/10
Time Started: 18:40
Method: Vac truck
Volume Purged: 106 gallons

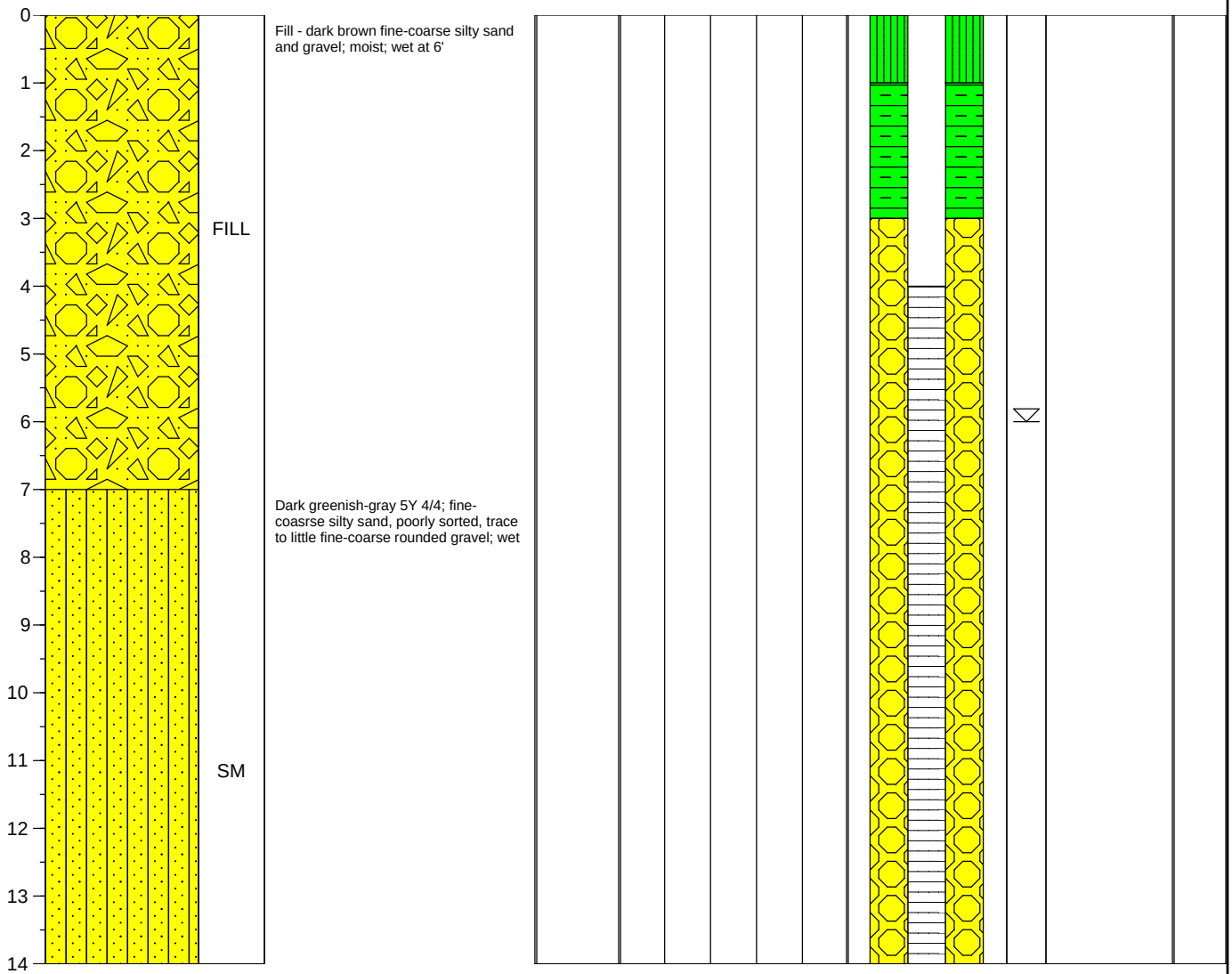
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–6		FILL	Fill - dark brown fine-coarse silty sand and gravel; moist; wet at 6'						
7–14		SM	Dark greenish-gray 5Y 4/4; fine-coasrse silty sand, poorly sorted, trace to little fine-coarse rounded gravel; wet						



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR1525R03**

WELL ID: **MWKR1525R03**

TOTAL DEPTH: **17'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 831.01
Ground Elevation: 831.43
X Coordinate: 12901730.60
Y Coordinate: 295791.80
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1730 Date Started: 10/11/10
Time Finished: 1830 Date Finished: 10/11/10

Well Development Information

Date: 10/12/10
Time Started: 17:02
Method: Vac truck
Volume Purged: 119 gallons

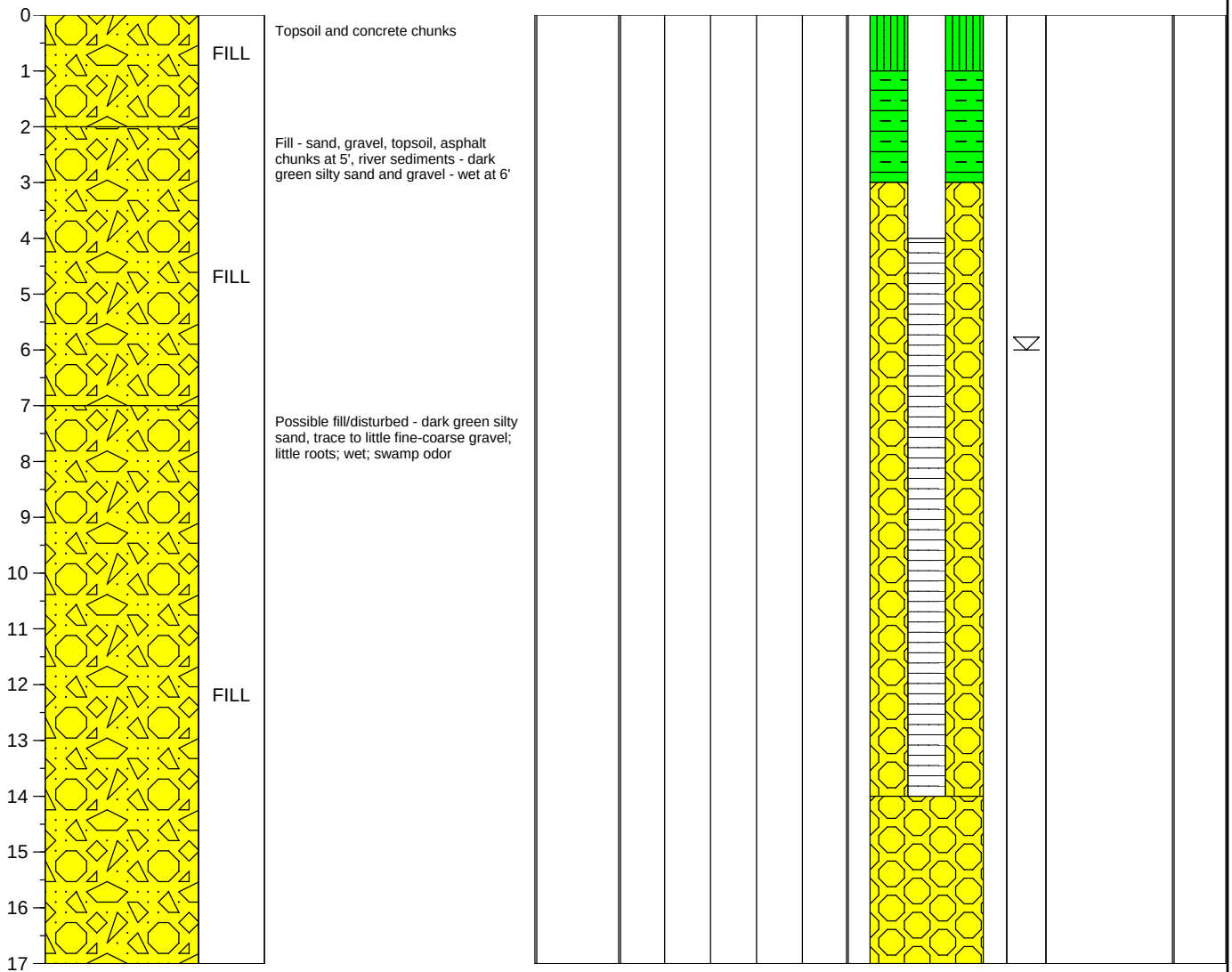
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–1		FILL	Topsoil and concrete chunks						
1–5		FILL	Fill - sand, gravel, topsoil, asphalt chunks at 5', river sediments - dark green silty sand and gravel - wet at 6'						
5–12		FILL	Possible fill/disturbed - dark green silty sand, trace to little fine-coarse gravel; little roots; wet; swamp odor						



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2260R01**
WELL ID: **MWKR2260R01**
TOTAL DEPTH: **60'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 809.96
Ground Elevation: 810.32
X Coordinate: 12873865.10
Y Coordinate: 314746.90
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1500 Date Started: 10/11/10
Time Finished: 0900 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 17:22
Method: Vac truck
Volume Purged: 237 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–2		SW	10 YR 5/2; light brownish-gray, gravelly fine-coarse sand, trace silt; dry; loose
2–10		SP	10 YR 6/6; tan medium sand, trace silt; wet
10–15		SP-ML	10 YR 4/2; grayish-brown silt and fine sand; moist; firm; tightly packed
15–22		SP-ML	5 YR 4/6 to 5 B 7/1 reddish-brown to bluish-gray; silt and sand; firm; moist
22–26		SP-ML	5 B 7/1 bluish-gray; gravelly silt and fine-medium sand, trace clay; saturated; loose to very firm; saturated water-bearing section 26'-28'
26–30		SP-ML	7.5 YR 5/4 brown; silt and fine sand, some fine gravel, trace clay; moist; very firm

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2260R01**
WELL ID: **MWKR2260R01**
TOTAL DEPTH: **60'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 809.96
Ground Elevation: 810.32
X Coordinate: 12873865.10
Y Coordinate: 314746.90
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1500 Date Started: 10/11/10
Time Finished: 0900 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 17:22
Method: Vac truck
Volume Purged: 237 gallons

▽ Water level during drilling
▼ Water level in completed well

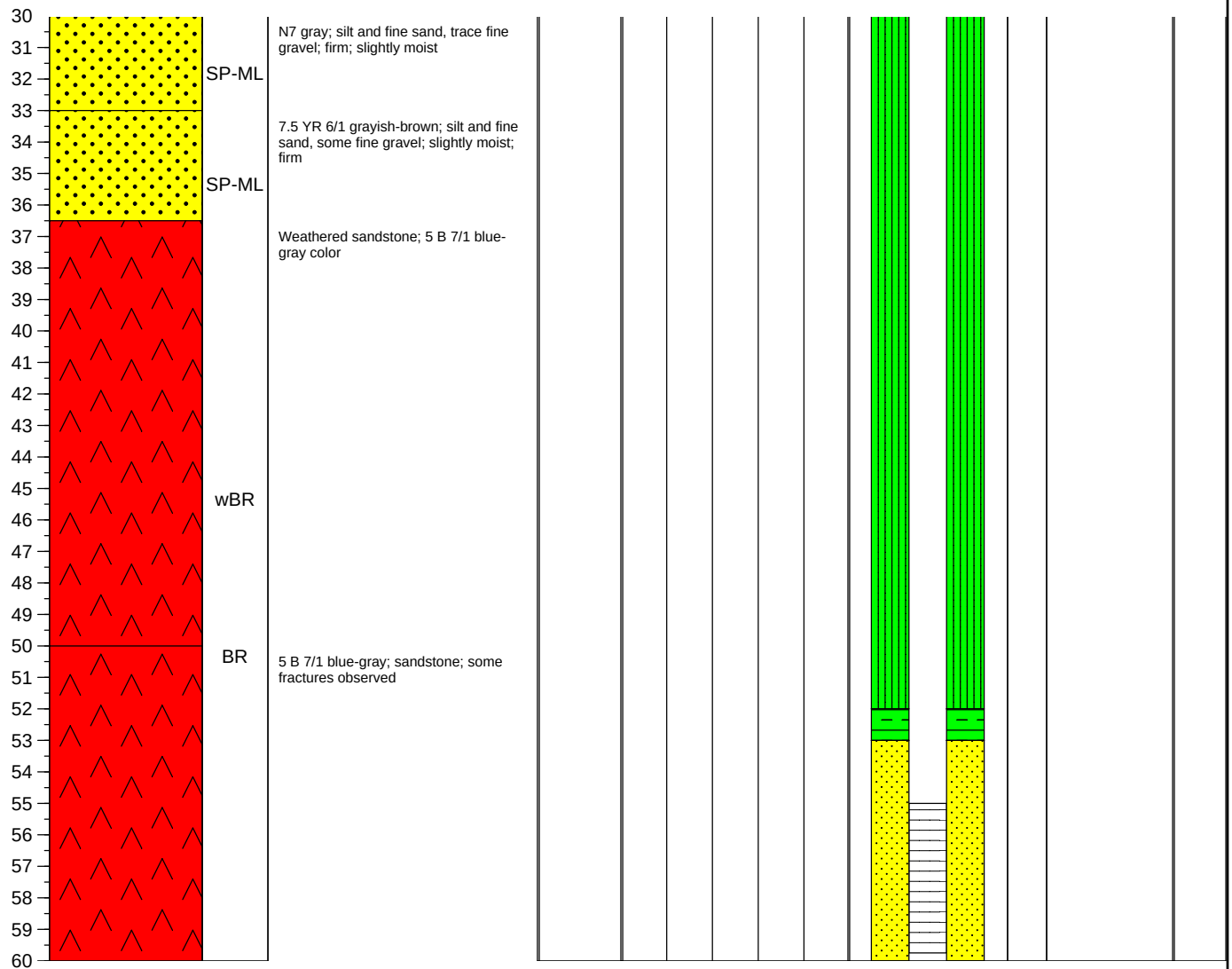
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
30–36		SP-ML	N7 gray; silt and fine sand, trace fine gravel; firm; slightly moist
33–36		SP-ML	7.5 YR 6/1 grayish-brown; silt and fine sand, some fine gravel; slightly moist; firm
36–50		wBR	Weathered sandstone; 5 B 7/1 blue-gray color
50–60		BR	5 B 7/1 blue-gray; sandstone; some fractures observed

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2260R02**

WELL ID: **MWKR2260R02**

TOTAL DEPTH: **27'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: Richard Staron
TOC Elevation: 809.63
Ground Elevation: 810.02
X Coordinate: 12873867.30
Y Coordinate: 314743.60
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1000 Date Started: 10/12/10
Time Finished: 1200 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 18:03
Method: Vac truck
Volume Purged: 294 gallons

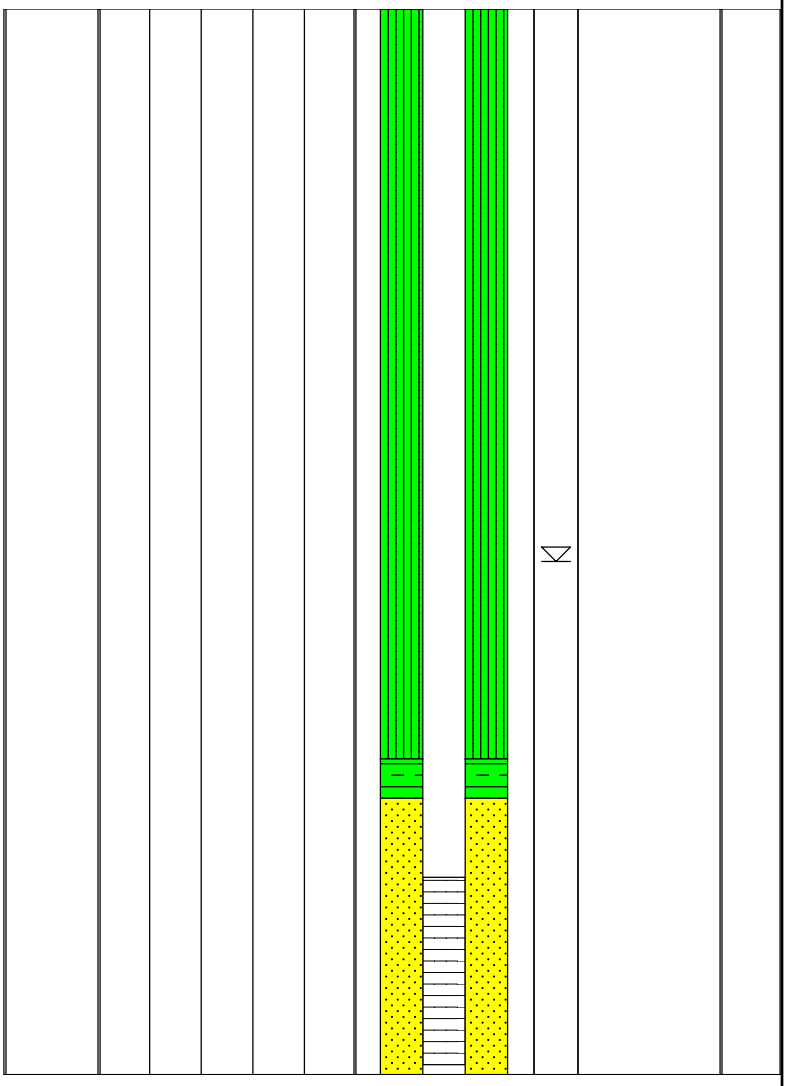
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–2		SW	2.5 Y 5/2 light brownish-gray; gravelly, fine-coarse sand, trace silt; dry; loose
2–11		SP	10 YR 5/6 tan; medium-coarse sand, trace silt; moist; loose
11–21		SP-ML	2.5 YR 6/4 grayish brown; silt and fine sand; moist; firm
21–23		SP	5 B 7/1 bluish gray; silty gravel; saturated; loose
23–27		SP	10 YR 4/4 brown; fine-medium sand, some silt; moist; firm



PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS

NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2275R01**

WELL ID: **MWKR2275R01**

TOTAL DEPTH: **28'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Staron
TOC Elevation: 814.72
Ground Elevation: 815.19
X Coordinate: 12873707.90
Y Coordinate: 314922.70
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/13/10
Time Started: 15:55
Method: Vac truck
Volume Purged: 59 gallons

Time Started: 1300 Date Started: 10/12/10
Time Finished: 1430 Date Finished: 10/12/10

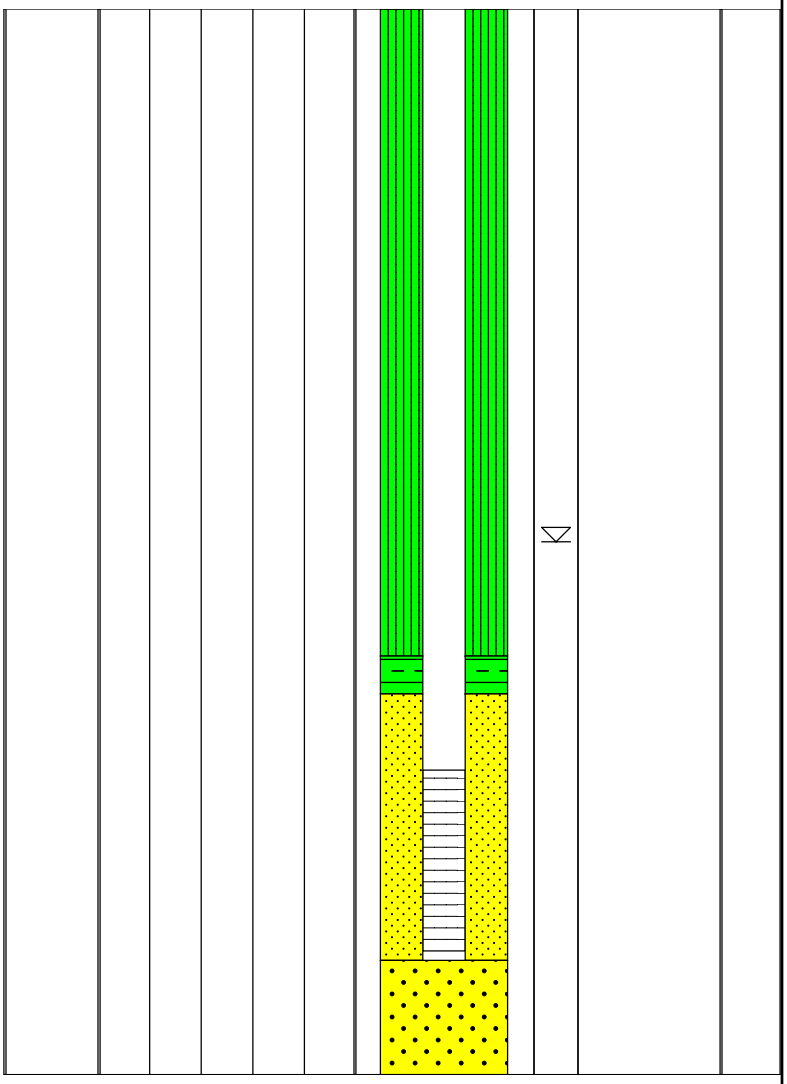
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–2		SP	2.5 Y 5/2 light brownish-gray; fine-coarse sand, some silt, some fine gravel; loose; dry
2–4		SP	10 YR 5/6 tan; medium sand, trace fine gravel, trace cobbles; loose; moist
4–7		SP	10 YR 5/6 tan; medium sand, trace fine gravel, trace cobbles; loose; wet
7–10		GP	10 YR 6/4 light reddish-brown; silty fine-medium sand and fine gravel; loose; slightly moist
10–15		SP-ML	2.5 YR 6/4 grayish-brown; silt and fine sand; moist; firm
15–21		SP	5 B 7/1 blue-gray; fine sand, some silt, trace fine gravel; loose; wet
21–28		SP-ML	10 YR 4/4 brown; silt and fine sand; moist; firm



PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS

NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2680R01**

WELL ID: **MWKR2680R01**

TOTAL DEPTH: **12'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 791.26
Ground Elevation: 791.59
X Coordinate: 12862834.70
Y Coordinate: 310490.60
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/12/10
Time Started: 15:28
Method: Vac truck
Volume Purged: 60 gallons

Time Started: 1715 Date Started: 10/8/10
Time Finished: - Date Finished: 10/8/10

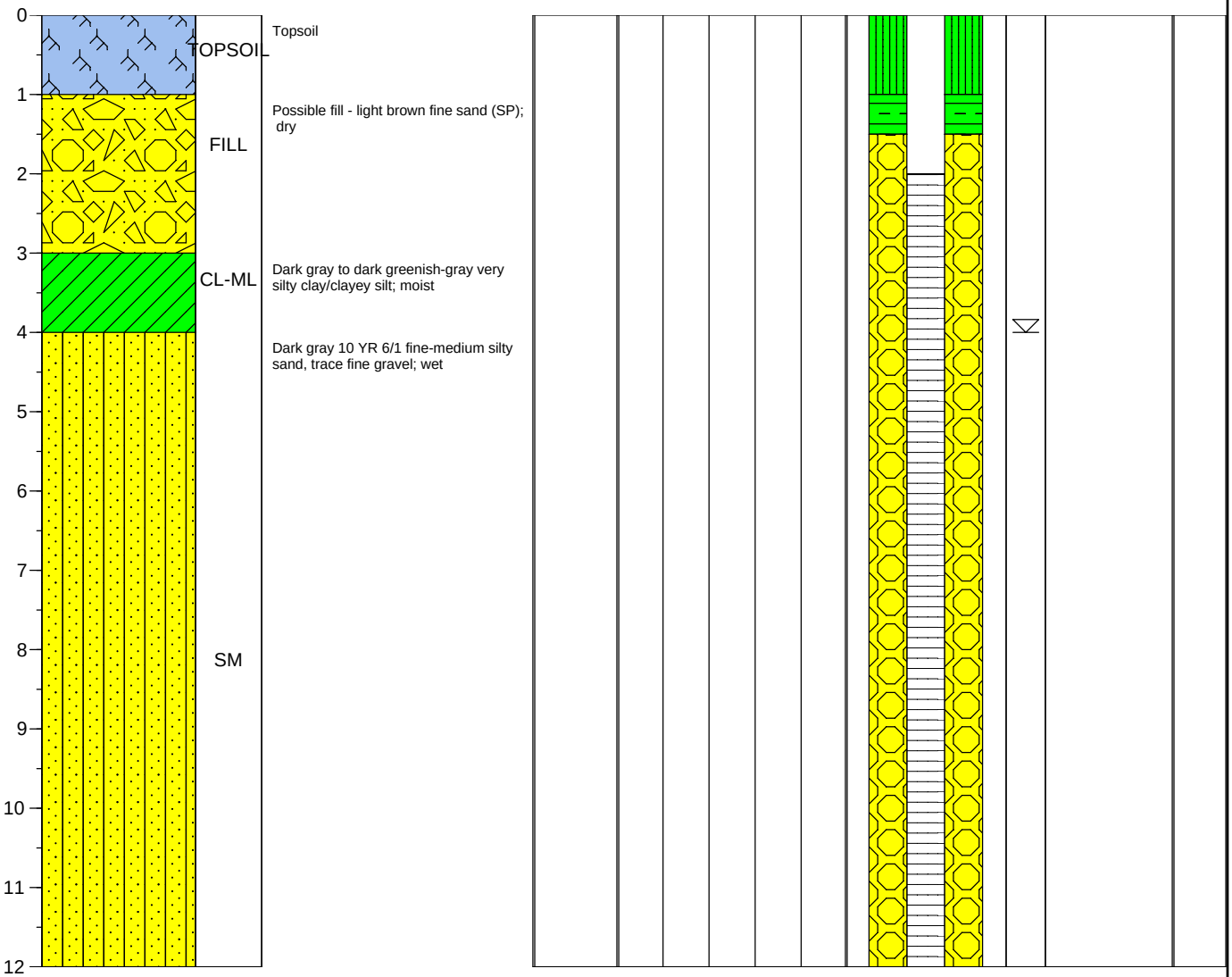
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–1	TOPSOIL		Topsoil
1–3	FILL		Possible fill - light brown fine sand (SP); dry
3–4	CL-ML		Dark gray to dark greenish-gray very silty clay/clayey silt; moist
4–12	SM		Dark gray 10 YR 6/1 fine-medium silty sand, trace fine gravel; wet



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2700R01**

WELL ID: **MWKR2700R01**

TOTAL DEPTH: **37'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 790.65
Ground Elevation: 790.98
X Coordinate: 12862693.40
Y Coordinate: 310364.20
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1145 Date Started: 10/8/10
Time Finished: 1500 Date Finished: 10/8/10

Well Development Information

Date: 10/12/10
Time Started: 14:45
Method: Vac truck
Volume Purged: 694 gallons

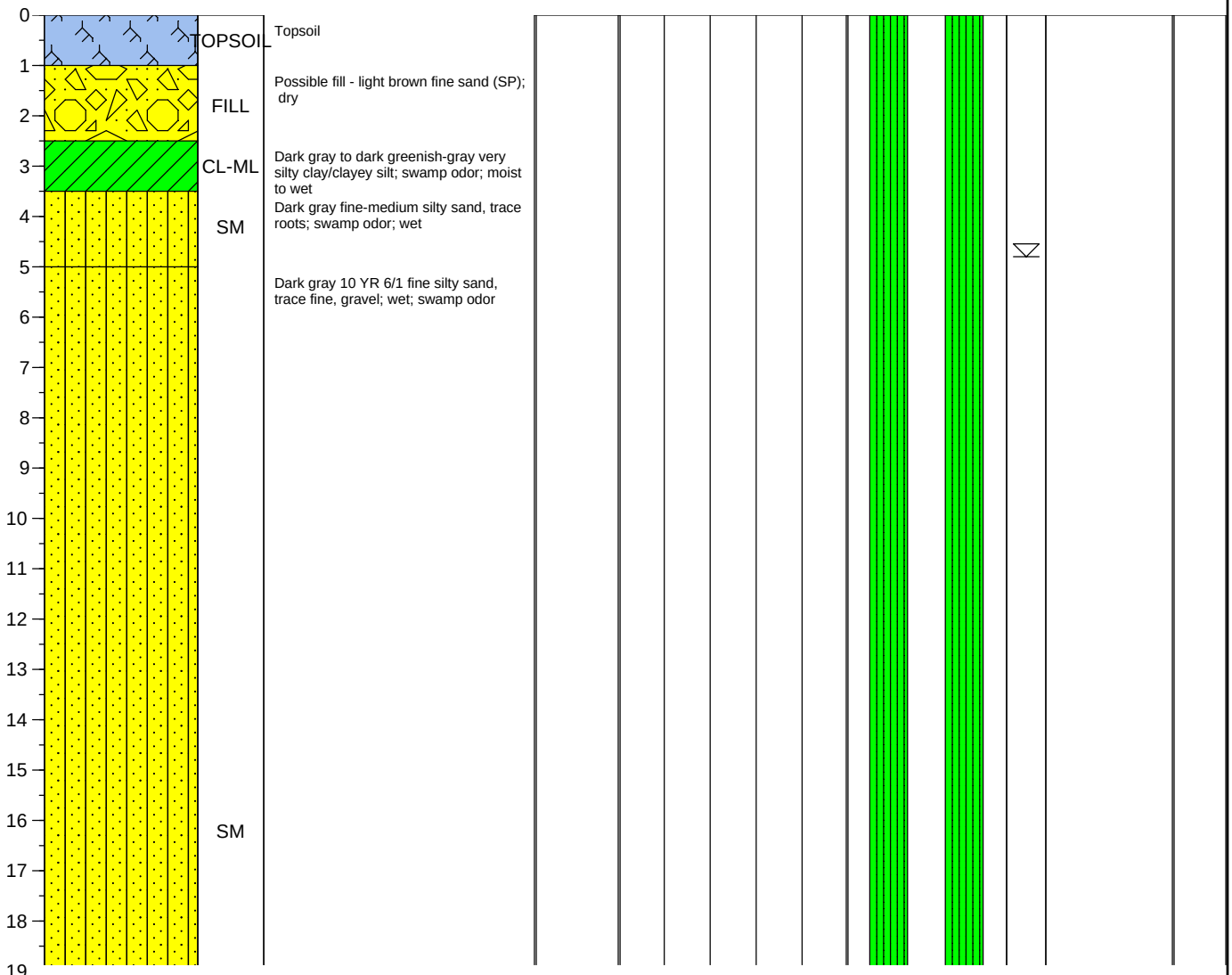
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0	TOPSOIL		Topsoil
1	FILL		Possible fill - light brown fine sand (SP); dry
2			
3	CL-ML		Dark gray to dark greenish-gray very silty clay/clayey silt; swamp odor; moist to wet
4	SM		Dark gray fine-medium silty sand, trace roots; swamp odor; wet
5			
6			Dark gray 10 YR 6/1 fine silty sand, trace fine, gravel; wet; swamp odor
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	SM		
17			
18			
19			



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2700R01**
WELL ID: **MWKR2700R01**
TOTAL DEPTH: **37'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 790.65
Ground Elevation: 790.98
X Coordinate: 12862693.40
Y Coordinate: 310364.20
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1145 Date Started: 10/8/10
Time Finished: 1500 Date Finished: 10/8/10

Well Development Information

Date: 10/12/10
Time Started: 14:45
Method: Vac truck
Volume Purged: 694 gallons

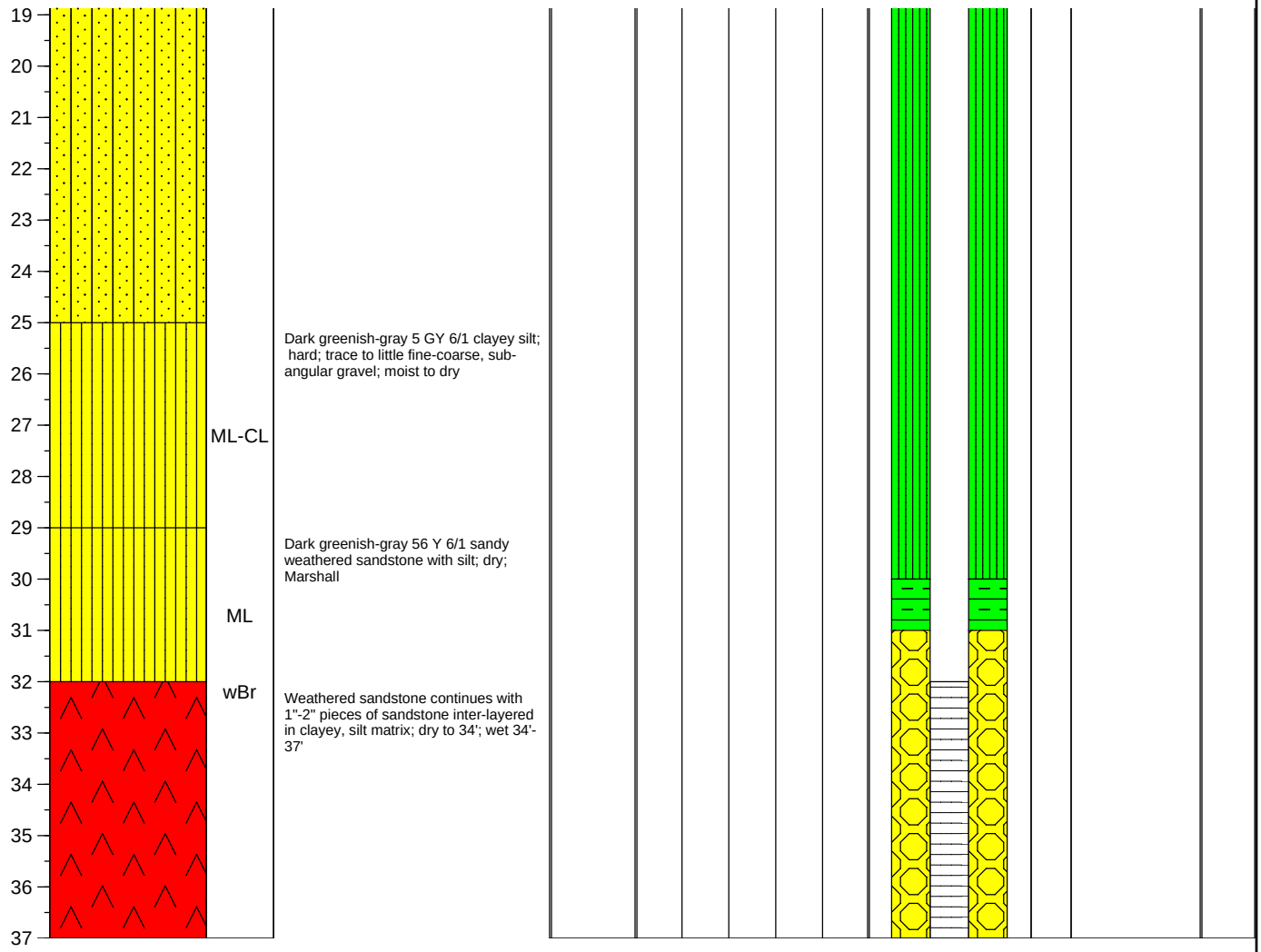
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
19–37		ML-CL	Dark greenish-gray 5 GY 6/1 clayey silt; hard; trace to little fine-coarse, sub-angular gravel; moist to dry						
		ML	Dark greenish-gray 56 Y 6/1 sandy weathered sandstone with silt; dry; Marshall						
		wBr	Weathered sandstone continues with 1"-2" pieces of sandstone inter-layered in clayey, silt matrix; dry to 34'; wet 34'-37'						



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR2700R02**
WELL ID: **MWKR2700R02**
TOTAL DEPTH: **12'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 790.64
Ground Elevation: 790.93
X Coordinate: 12862695.20
Y Coordinate: 310360.90
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/8/10
Time Finished: 1645 Date Finished: 10/8/10

Well Development Information

Date: 10/12/10
Time Started: 15:05
Method: Vac truck
Volume Purged: 411 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0		TOPSOIL	Topsoil
1		FILL	Possible fill - light brown fine sand (SP); dry
2			
3		SM	Dark gray fine to medium silty sand, trace to little fine gravel; wet
4			
5			
6			
7			
8			
9			
10			
11			
12			

PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
			▽		

NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L01**
WELL ID: **MWKR3450L01**
TOTAL DEPTH: **147'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.64
Ground Elevation: 783.02
X Coordinate: 12842415.70
Y Coordinate: 288548.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/4/10
Time Finished: 1100 Date Finished: 10/5/10

Well Development Information

Date: 10/12/10
Time Started: 12:30
Method: Vac truck
Volume Purged: 530 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–4		FILL	Fill - dark brown to black sand and gravel, trace topsoil; bottles 3'-4'
4–10		OL	Dark gray clayey organic silt, trace to little very fine sand; wet at 5'; trace roots
10–17		SP	Light gray to light brown fine-medium well-sorted sand, trace silt; wet
17–27		SP	Light gray to light brown fine-medium well-sorted sand, trace silt; wet; with occasional 1/2"-1" rounded gravel
27–37		SP	Grades to light brown fine sand, well sorted, trace silt, occasional 1" gravel; wet

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS

NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L01**
WELL ID: **MWKR3450L01**
TOTAL DEPTH: **147'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.64
Ground Elevation: 783.02
X Coordinate: 12842415.70
Y Coordinate: 288548.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/4/10
Time Finished: 1100 Date Finished: 10/5/10

Well Development Information

Date: 10/12/10
Time Started: 12:30
Method: Vac truck
Volume Purged: 530 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
37–74		SP	Light brown, well-sorted fine sand, trace silt, occasional 1/2"-1" gravel; wet						
50–61		SW	Grades to dark brown medium-coarse gravelly sand, trace silt; wet						
61–74		SM	Grades to light brown fine-medium moderately sorted silty sand; wet						

NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L01**

WELL ID: **MWKR3450L01**

TOTAL DEPTH: **147'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.64
Ground Elevation: 783.02
X Coordinate: 12842415.70
Y Coordinate: 288548.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/4/10
Time Finished: 1100 Date Finished: 10/5/10

Well Development Information

Date: 10/12/10
Time Started: 12:30
Method: Vac truck
Volume Purged: 530 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
74–111		SM	Grades to brown fine-medium silty sand with some medium-coarse gravel						
		ML	Dark gray very fine sandy silt, trace to some clay, little to some fine-medium gravel; sample disturbed 88'-90' due to drilling; hard; glacial till						
		ML	Dark gray very fine sandy silt; hard; trace 1/2"-1" rounded gravel; dry; till						

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L01**
WELL ID: **MWKR3450L01**
TOTAL DEPTH: **147'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.64
Ground Elevation: 783.02
X Coordinate: 12842415.70
Y Coordinate: 288548.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1200 Date Started: 10/4/10
Time Finished: 1100 Date Finished: 10/5/10

Well Development Information

Date: 10/12/10
Time Started: 12:30
Method: Vac truck
Volume Purged: 530 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
111–147		ML	As above but more sandy with 1'-2' sand lenses at 123', 125'-126'; sand lenses moist						
		ML/SM	1"-2" gravel, cobbles; wet Light gray fine-medium sandy silt/silty sand, poorly sorted with little to some fine-medium rounded gravel; sand seams at 140'; moist-wet						
		ML/SM							

NOTES:Default listing

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L02**

WELL ID: **MWKR3450L02**

TOTAL DEPTH: **12'**

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.68
Ground Elevation: 782.99
X Coordinate: 12842419.90
Y Coordinate: 288543.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/11/10
Time Started: 17:02
Method: Vac truck
Volume Purged: 54 gallons

Time Started: 1230 Date Started: 10/4/10
Time Finished: - Date Finished: 10/5/10

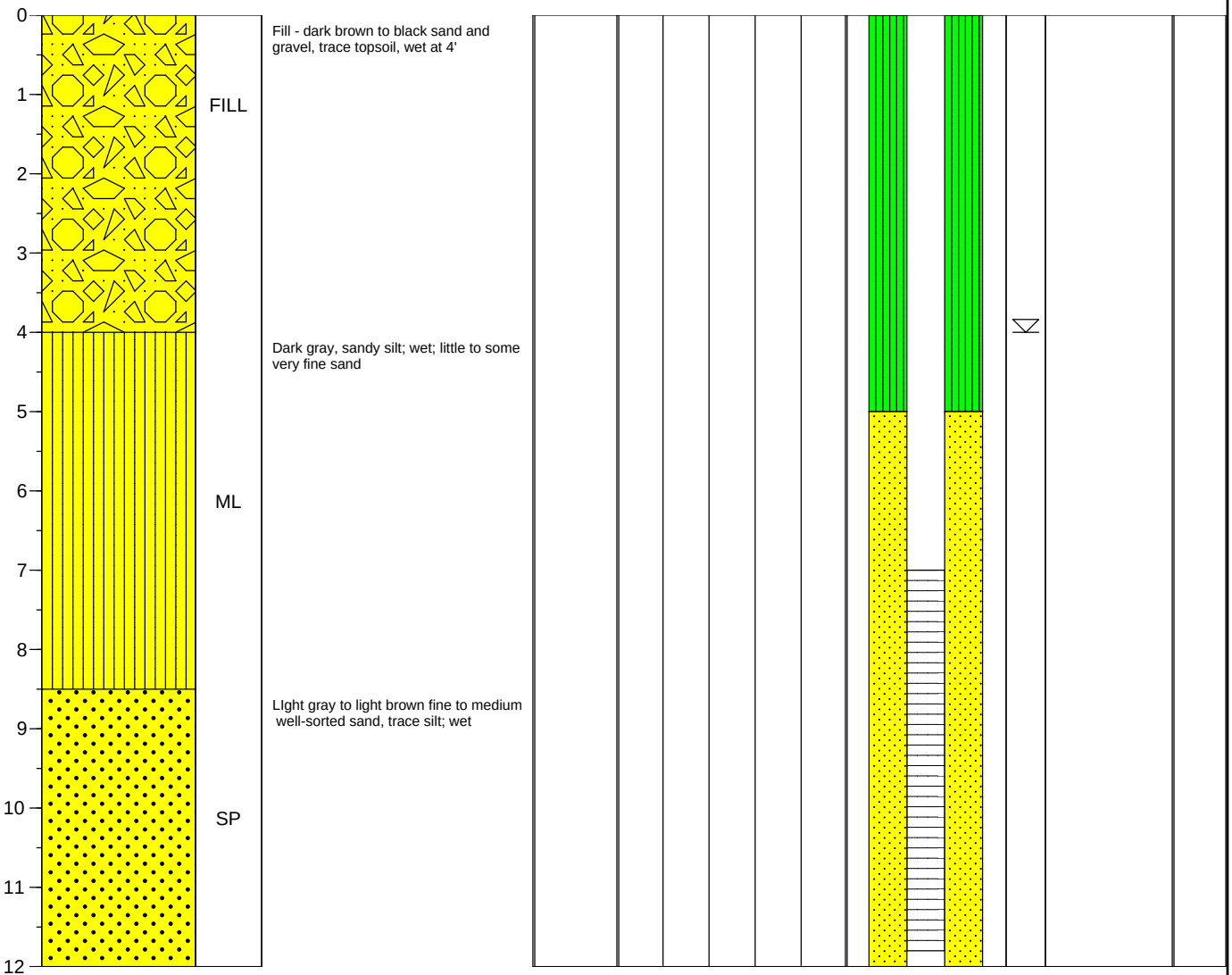
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–4		FILL	Fill - dark brown to black sand and gravel, trace topsoil, wet at 4'
4–8		ML	Dark gray, sandy silt; wet; little to some very fine sand
8–12		SP	LIght gray to light brown fine to medium well-sorted sand, trace silt; wet



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L03**
WELL ID: **MWKR3450L03**
TOTAL DEPTH: **97'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.65
Ground Elevation: 783.05
X Coordinate: 12842413.10
Y Coordinate: 288551.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/12/10
Time Finished: 1800 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 12:10
Method: Vac truck
Volume Purged: 683 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–5		FILL	Fill - dark brown to black sand and gravel, trace topsoil; wet at 4'				▽		
5–20		SP	Dark gray fine-coarse sand, trace silt, little to some fine-coarse gravel, rounded; swamp odor; wet; moderately sorted						
20–33			Grades to light brown fine-medium sand, trace to little fine-medium gravel, trace silt; wet						

NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L03**
WELL ID: **MWKR3450L03**
TOTAL DEPTH: **97'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.65
Ground Elevation: 783.05
X Coordinate: 12842413.10
Y Coordinate: 288551.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/12/10
Time Finished: 1800 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 12:10
Method: Vac truck
Volume Purged: 683 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
33–50		SP							
50–65		SM	Grades to brown fine-coarse silty sand, little to some fine-coarse gravel; light red mottling at 50'-51'; wet						

NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L03**
WELL ID: **MWKR3450L03**
TOTAL DEPTH: **97'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.65
Ground Elevation: 783.05
X Coordinate: 12842413.10
Y Coordinate: 288551.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1400 Date Started: 10/12/10
Time Finished: 1800 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 12:10
Method: Vac truck
Volume Purged: 683 gallons

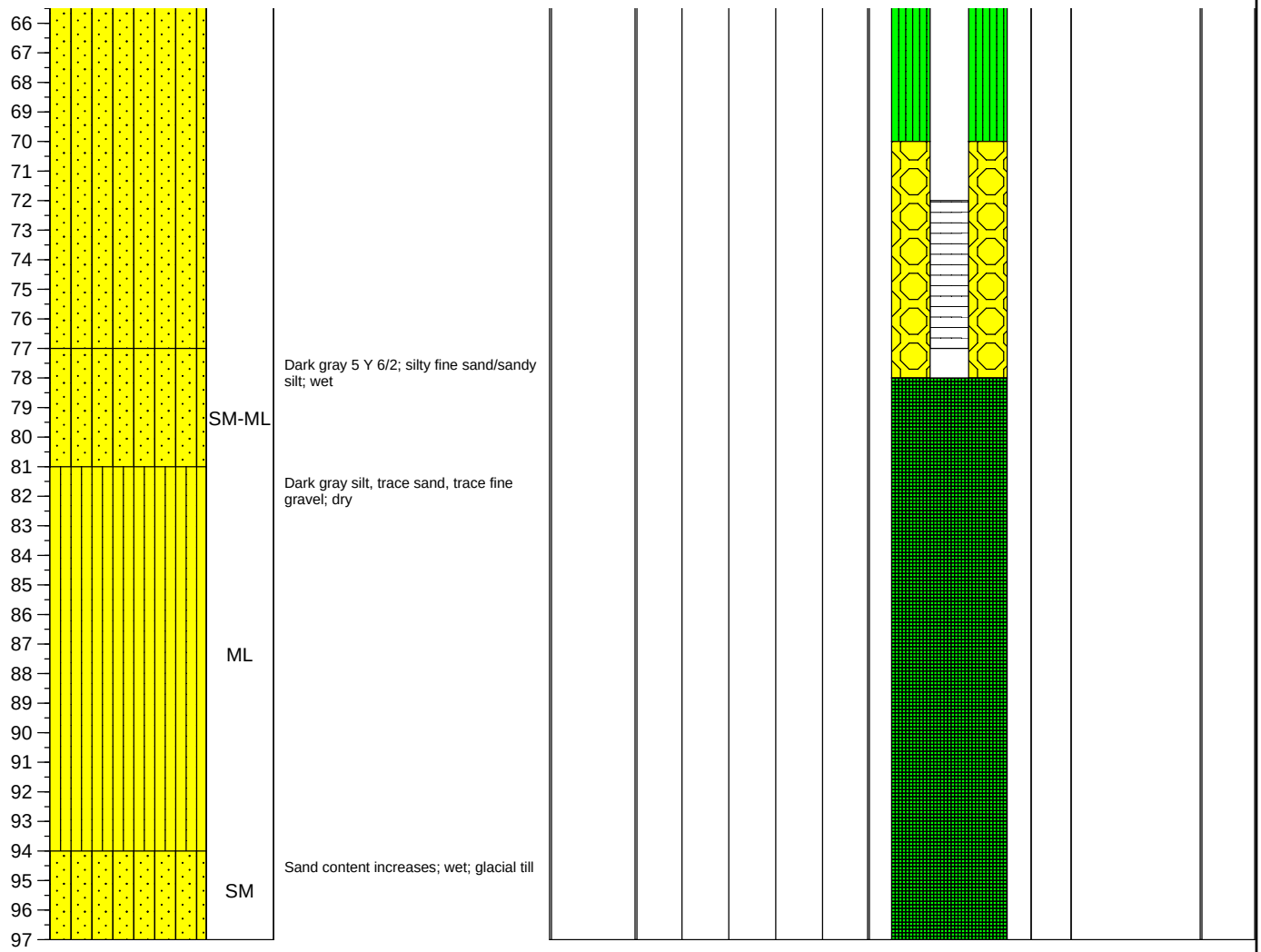
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
66–97		SM-ML	Dark gray 5 Y 6/2; silty fine sand/sandy silt; wet						
		ML	Dark gray silt, trace sand, trace fine gravel; dry						
		SM	Sand content increases; wet; glacial till						



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3450L04**
WELL ID: **MWKR3450L04**
TOTAL DEPTH: **12'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 782.57
Ground Elevation: 783.07
X Coordinate: 12842425.10
Y Coordinate: 288538.30
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

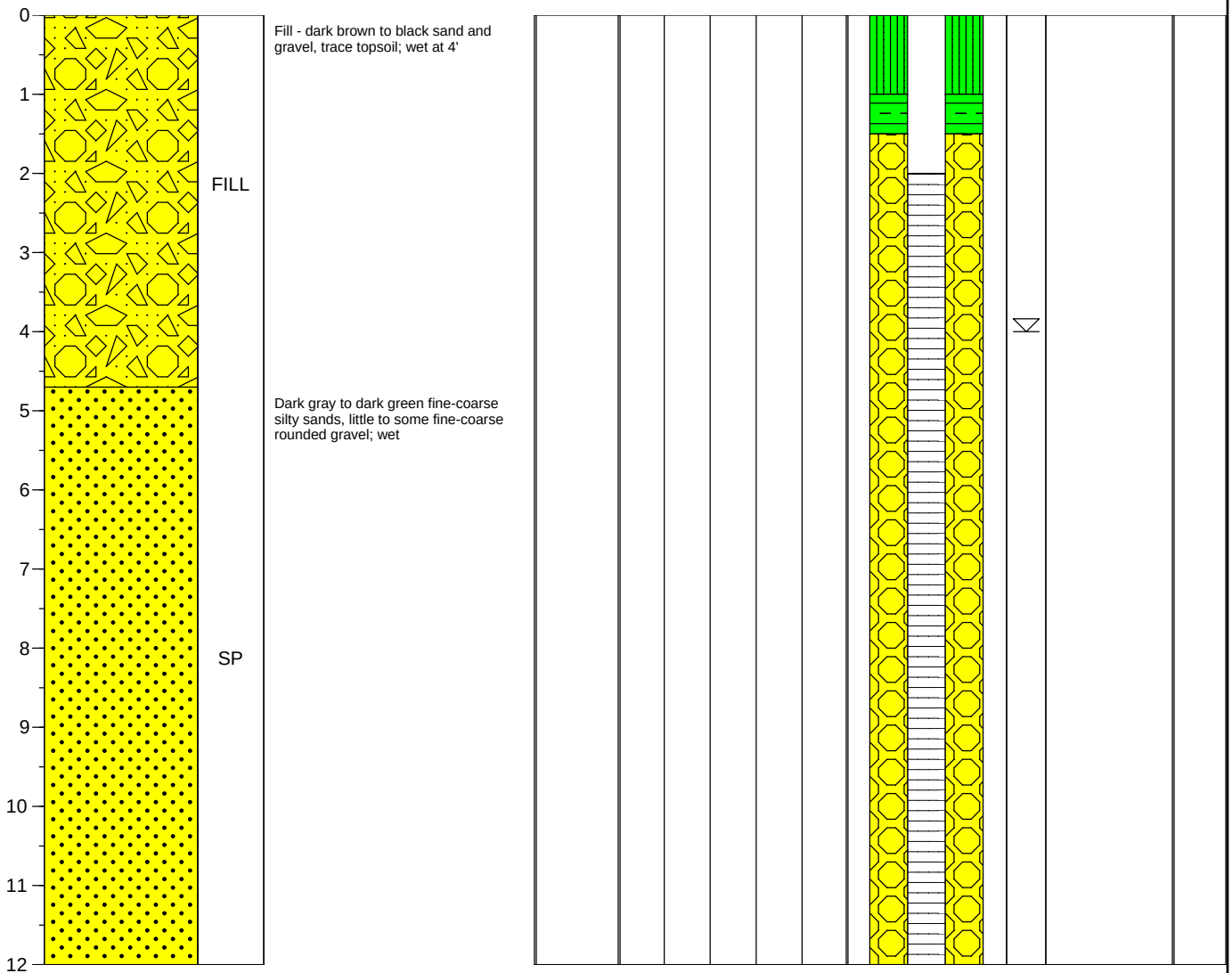
Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/13/10
Time Started: 14:04
Method: Vac truck
Volume Purged: 922 gallons

Time Started: 1400 Date Started: 10/12/10
Time Finished: 1600 Date Finished: 10/12/10

▽ Water level during drilling
▼ Water level in completed well
NC Not Collected
OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected
Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–4		FILL	Fill - dark brown to black sand and gravel, trace topsoil; wet at 4'				▽		
4–12		SP	Dark gray to dark green fine-coarse silty sands, little to some fine-coarse rounded gravel; wet						



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3460L01**
WELL ID: **MWKR3460L01**
TOTAL DEPTH: **12'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 783.31
Ground Elevation: 783.67
X Coordinate: 12842307.10
Y Coordinate: 288685.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1230 Date Started: 10/4/10
Time Finished: - Date Finished: 10/5/10

Well Development Information

Date: 10/11/10
Time Started: 17:23
Method: Vac truck
Volume Purged: 55 gallons

▽ Water level during drilling
▼ Water level in completed well

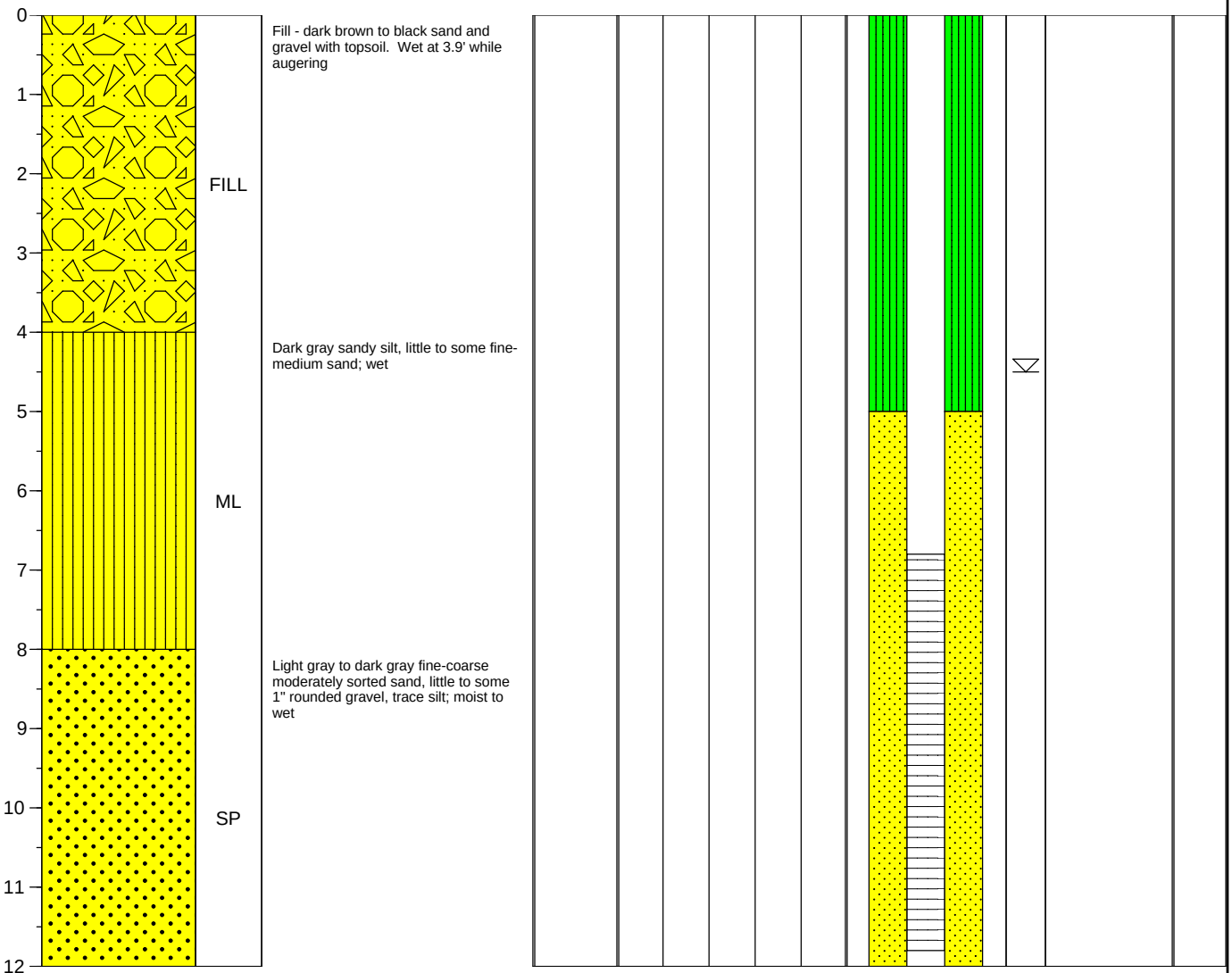
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–4		FILL	Fill - dark brown to black sand and gravel with topsoil. Wet at 3.9' while augering
4–8		ML	Dark gray sandy silt, little to some fine-medium sand; wet
8–12		SP	Light gray to dark gray fine-coarse moderately sorted sand, little to some 1" rounded gravel, trace silt; moist to wet

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3460L02**
WELL ID: **MWKR3460L02**
TOTAL DEPTH: **12'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 783.19
Ground Elevation: 783.70
X Coordinate: 12842309.60
Y Coordinate: 288681.00
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1130 Date Started: 10/12/10
Time Finished: 1340 Date Finished: 10/12/10

Well Development Information

Date: 10/13/10
Time Started: 14:35
Method: Vac truck
Volume Purged: 177 gallons

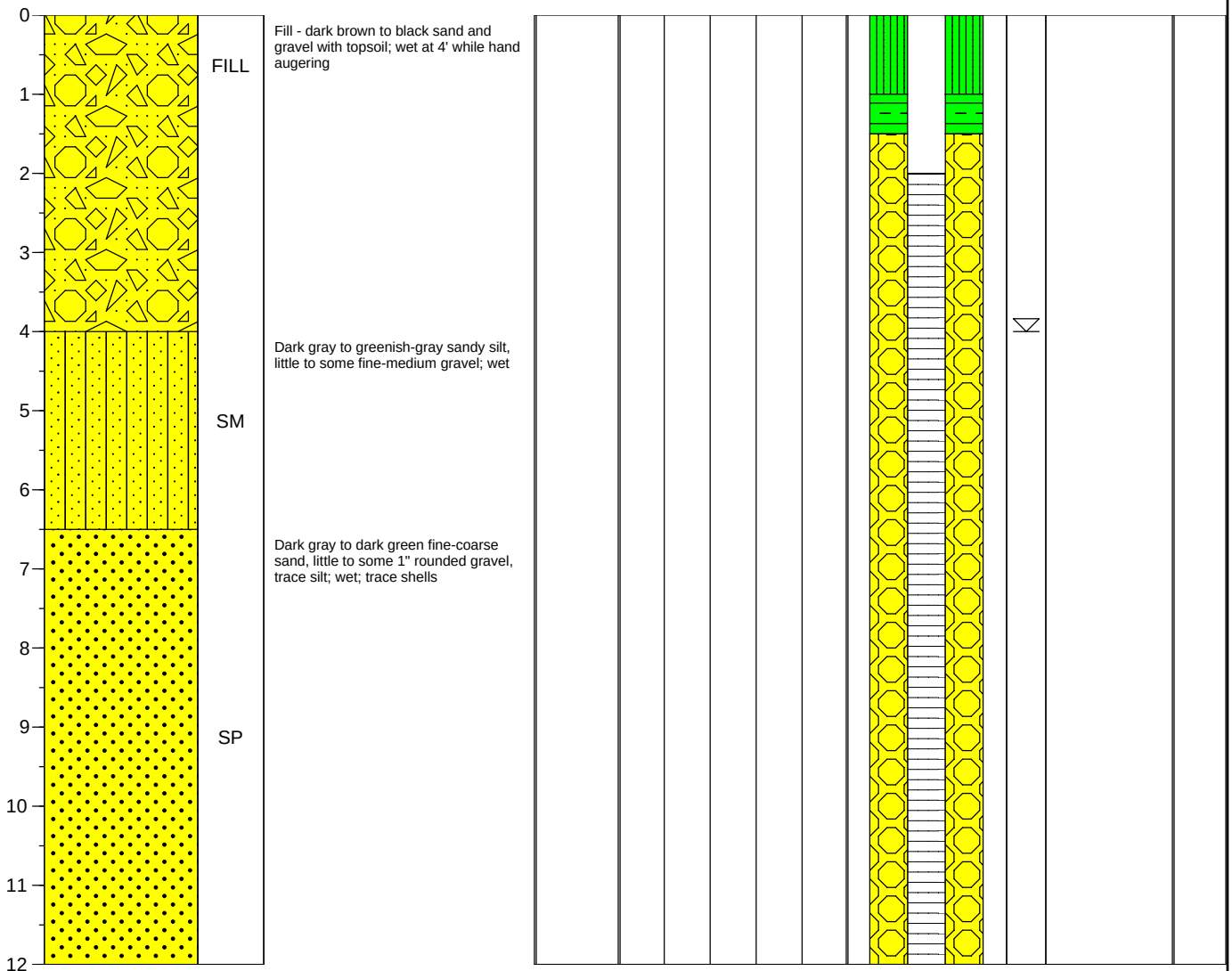
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–4		FILL	Fill - dark brown to black sand and gravel with topsoil; wet at 4' while hand augering
4–6.5		SM	Dark gray to greenish-gray sandy silt, little to some fine-medium gravel; wet
6.5–12		SP	Dark gray to dark green fine-coarse sand, little to some 1" rounded gravel, trace silt; wet; trace shells



NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3620L01**

WELL ID: **MWKR3620L01**

TOTAL DEPTH: **67'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 786.97
Ground Elevation: 787.41
X Coordinate: 12836877.80
Y Coordinate: 284792.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1000 Date Started: 10/6/10
Time Finished: 1300 Date Finished: 10/6/10

Well Development Information

Date: 10/11/10
Time Started: 12:40
Method: Vac truck
Volume Purged: 235 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–7		FILL	Fill - light-dark brown fine-medium silty sand, trace to little fine-medium rounded gravel; dry						
7–20		SM	Brown fine-medium 10 YR 7/4 sand, trace to little silt, trace fine gravel; moist-wet; moderately saturated; wet at 14'				▽		
20–23			Grades to brown 10 YR 6/4 fine sand, trace silt, trace fine gravel, well-sorted; wet						

NOTES: Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3620L01**
WELL ID: **MWKR3620L01**
TOTAL DEPTH: **67'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 786.97
Ground Elevation: 787.41
X Coordinate: 12836877.80
Y Coordinate: 284792.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/11/10
Time Started: 12:40
Method: Vac truck
Volume Purged: 235 gallons

Time Started: 1000 Date Started: 10/6/10
Time Finished: 1300 Date Finished: 10/6/10

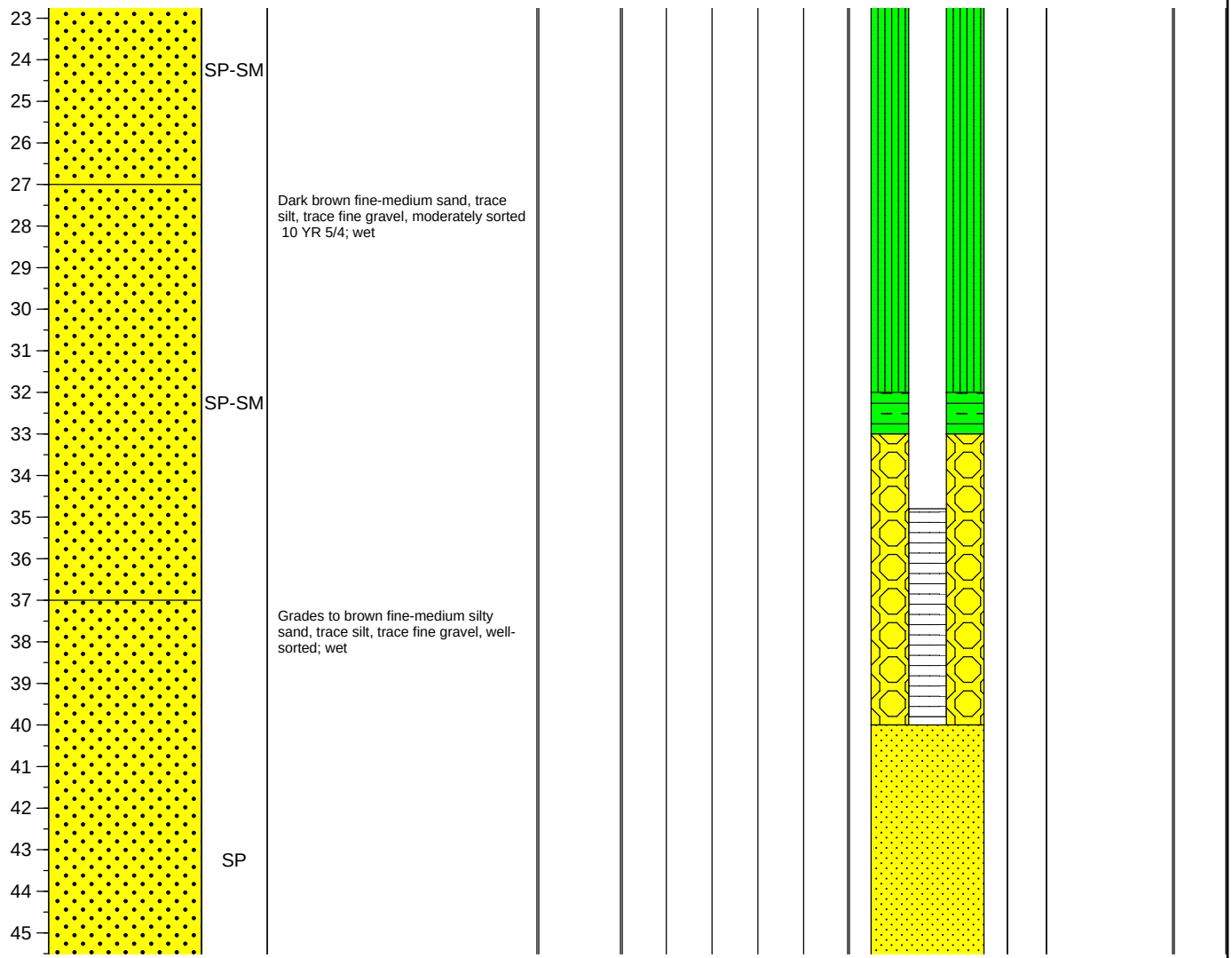
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
23–45		SP-SM	Dark brown fine-medium sand, trace silt, trace fine gravel, moderately sorted 10 YR 5/4; wet						
27–37		SP-SM	Grades to brown fine-medium silty sand, trace silt, trace fine gravel, well-sorted; wet						
37–45		SP							



NOTES:Default listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3620L01**

WELL ID: **MWKR3620L01**

TOTAL DEPTH: **67'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 786.97
Ground Elevation: 787.41
X Coordinate: 12836877.80
Y Coordinate: 284792.50
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/11/10
Time Started: 12:40
Method: Vac truck
Volume Purged: 235 gallons

Time Started: 1000 Date Started: 10/6/10
Time Finished: 1300 Date Finished: 10/6/10

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
46–67		SM	Light brown to light gray silty fine-coarse sand, moderately graded; wet						
51–55		SW	Medium-coarse sand and medium gravel, some light brown mottling; wet						
55–67		ML-CL	Dark gray 5 B 61 silty clay to clayey silt, little to some fine-medium sand, some fine-medium rounded gravel; moist to dry; glacial till						

NOTES: Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3620L02**
WELL ID: **MWKR3620L02**
TOTAL DEPTH: **17'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 786.97
Ground Elevation: 787.42
X Coordinate: 12836874.60
Y Coordinate: 284793.90
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

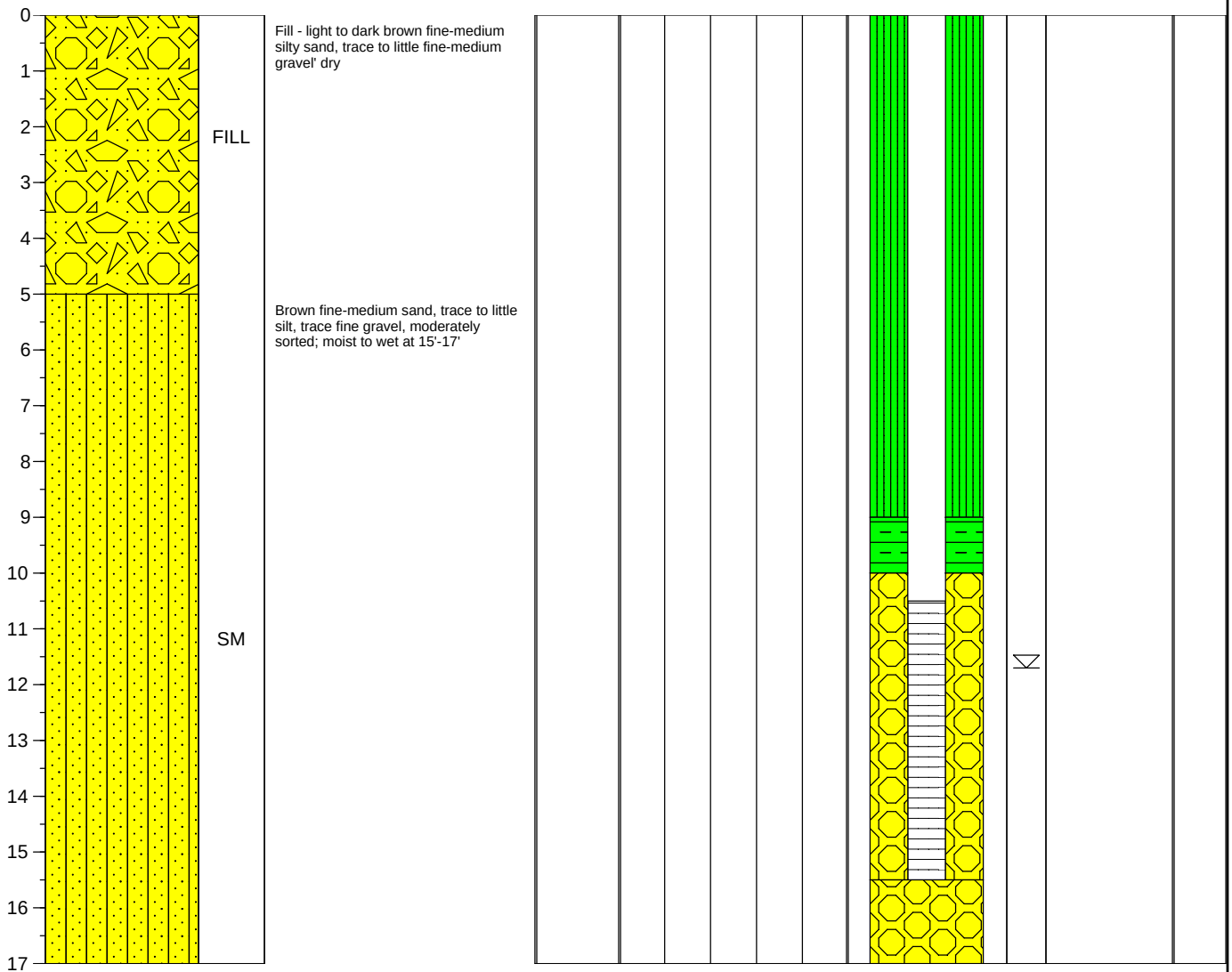
Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/11/10
Time Started: 14:27
Method: Vac truck
Volume Purged: 101 gallons

Time Started: 1030 Date Started: 10/6/10
Time Finished: 1530 Date Finished: 10/6/10

▽ Water level during drilling
▼ Water level in completed well
NC Not Collected
OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected
Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–17		FILL	Fill - light to dark brown fine-medium silty sand, trace to little fine-medium gravel' dry						
		SM	Brown fine-medium sand, trace to little silt, trace fine gravel, moderately sorted; moist to wet at 15'-17'				▽		



NOTES:Default listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3620L03**
WELL ID: **MWKR3620L03**
TOTAL DEPTH: **17'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 786.84
Ground Elevation: 787.23
X Coordinate: 12836831.20
Y Coordinate: 284673.80
Protective Casing Material: Steel
Type: Flush Mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1600 Date Started: 10/8/10
Time Finished: - Date Finished: 10/8/10

Well Development Information

Date: 10/11/10
Time Started: 15:50
Method: Vac truck
Volume Purged: 103 gallons

▽ Water level during drilling
▼ Water level in completed well

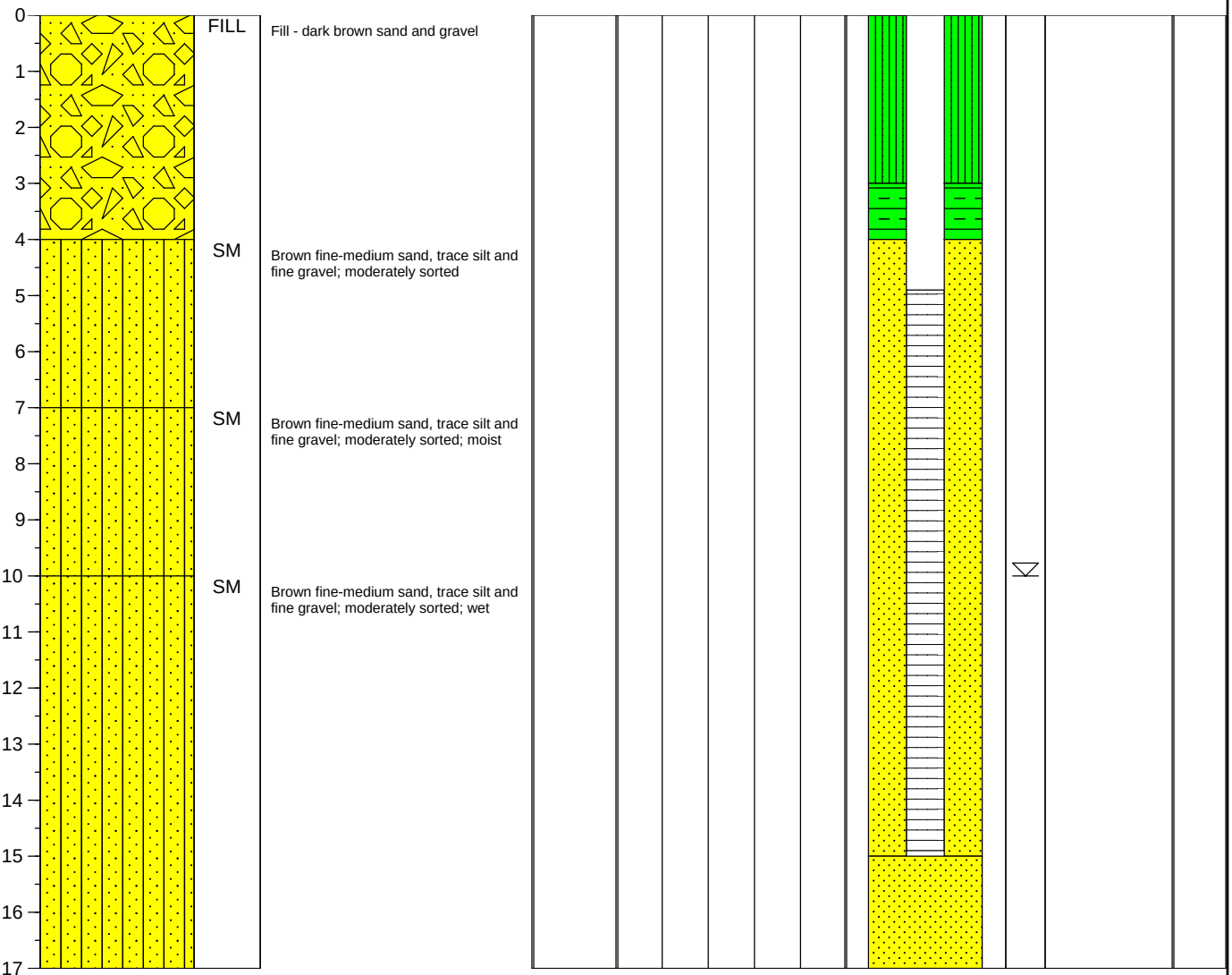
NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0		FILL	Fill - dark brown sand and gravel
4		SM	Brown fine-medium sand, trace silt and fine gravel; moderately sorted
7		SM	Brown fine-medium sand, trace silt and fine gravel; moderately sorted; moist
10		SM	Brown fine-medium sand, trace silt and fine gravel; moderately sorted; wet
17			

PID (ppm) | PID Curve (250 ppm) | Boring/Well Completion | WL | Sample | OSS



NOTES: Default Listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3680L01**

WELL ID: **MWKR3680L01**

TOTAL DEPTH: **97'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 781.30
Ground Elevation: 781.68
X Coordinate: 12834380.50
Y Coordinate: 284322.80
Protective Casing Material: Steel
Type: Flush Mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1045 Date Started: 10/7/10
Time Finished: - Date Finished: 10/7/10

Well Development Information

Date: 10/10/10
Time Started: 17:05
Method: Vac truck
Volume Purged: 270 gallons

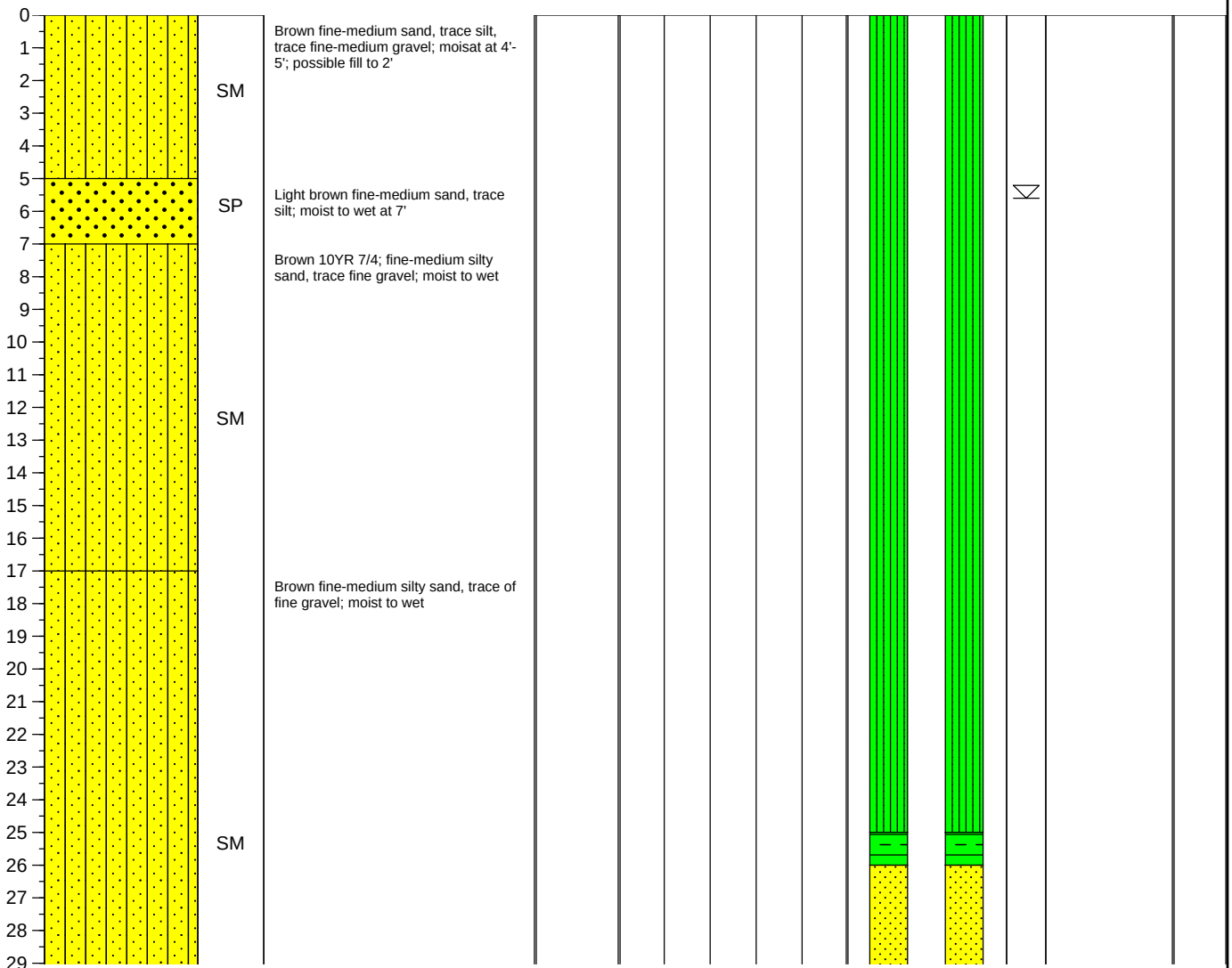
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description
0–4		SM	Brown fine-medium sand, trace silt, trace fine-medium gravel; moisat at 4'-5'; possible fill to 2'
5–6		SP	Light brown fine-medium sand, trace silt; moist to wet at 7'
7–16		SM	Brown 10YR 7/4; fine-medium silty sand, trace fine gravel; moist to wet
17–29		SM	Brown fine-medium silty sand, trace of fine gravel; moist to wet



NOTES: Default Listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3680L01**
WELL ID: **MWKR3680L01**
TOTAL DEPTH: **97'**

State: MI | County: Calhoun | Township / City: Marshall | Client: Enbridge | Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 781.30
Ground Elevation: 781.68
X Coordinate: 12834380.50
Y Coordinate: 284322.80
Protective Casing Material: Steel
Type: Flush Mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1045 Date Started: 10/7/10
Time Finished: - Date Finished: 10/7/10

Well Development Information

Date: 10/10/10
Time Started: 17:05
Method: Vac truck
Volume Purged: 270 gallons

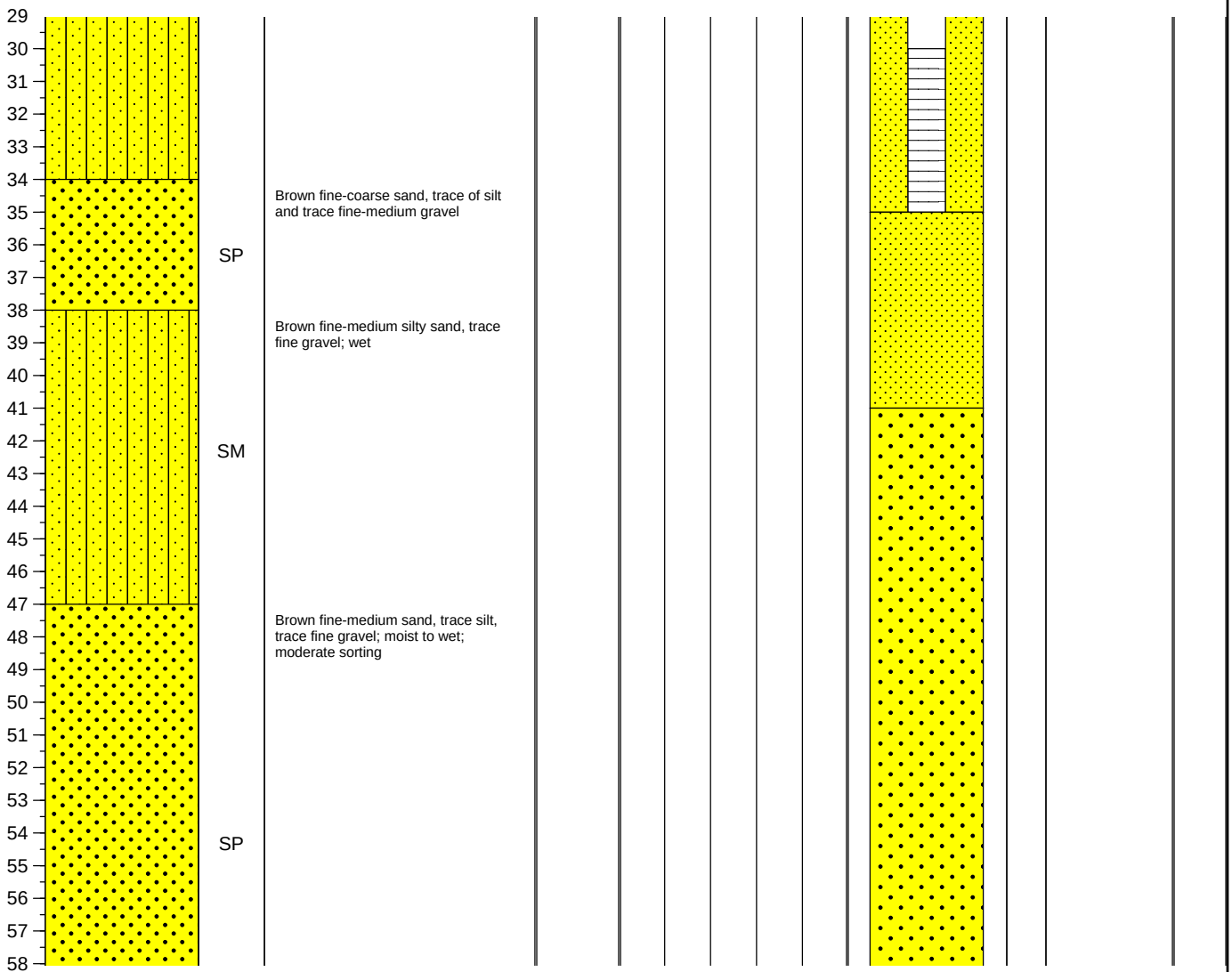
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
29–58		SP	Brown fine-coarse sand, trace of silt and trace fine-medium gravel						
		SM	Brown fine-medium silty sand, trace fine gravel; wet						
		SP	Brown fine-medium sand, trace silt, trace fine gravel; moist to wet; moderate sorting						



NOTES: Default Listing

AECOM

5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3680L01**
WELL ID: **MWKR3680L01**
TOTAL DEPTH: **97'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 781.30
Ground Elevation: 781.68
X Coordinate: 12834380.50
Y Coordinate: 284322.80
Protective Casing Material: Steel
Type: Flush Mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1045 Date Started: 10/7/10
Time Finished: - Date Finished: 10/7/10

Well Development Information

Date: 10/10/10
Time Started: 17:05
Method: Vac truck
Volume Purged: 270 gallons

▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
58–61		SW	Brown medium-coarse sand with gravel, trace silt; well sorted; 2" cobble; wet						
61–67		SW	Brown medium-coarse sand/sand-gravel; moderately well sorted; 1"-2" gravel; wet						
77–87		GP	Brown coarse sand and gravel, trace of fine gravel; well sorted subangular gravel, trace silt; wet						

NOTES:Default Listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3680L01**
WELL ID: **MWKR3680L01**
TOTAL DEPTH: **97'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 781.30
Ground Elevation: 781.68
X Coordinate: 12834380.50
Y Coordinate: 284322.80
Protective Casing Material: Steel
Type: Flush Mount
Lock #: -
Bolted: Yes

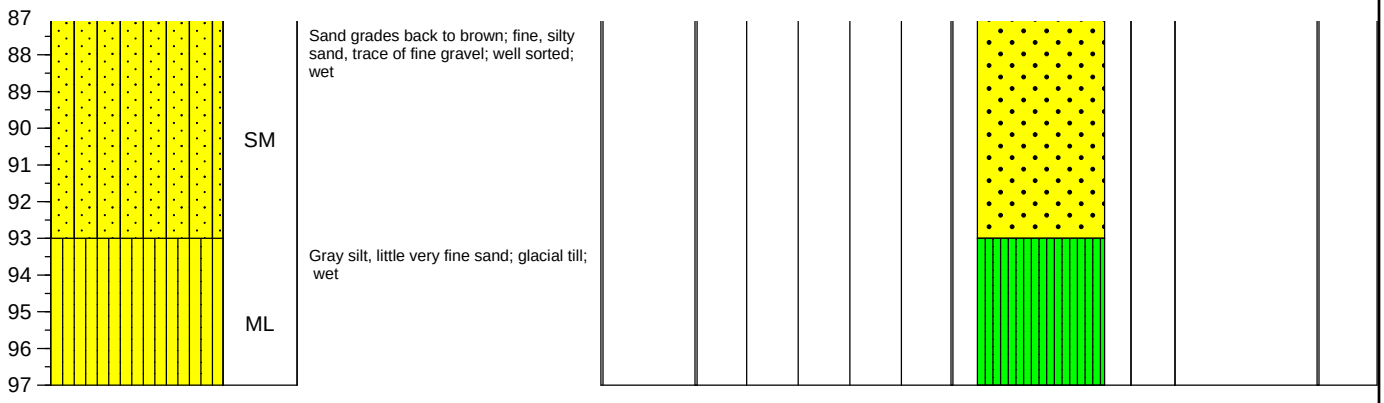
Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information
Date: 10/10/10
Time Started: 17:05
Method: Vac truck
Volume Purged: 270 gallons

Time Started: 1045 Date Started: 10/7/10
Time Finished: - Date Finished: 10/7/10

▽ Water level during drilling
▼ Water level in completed well
NC Not Collected
OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected
Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS



NOTES:Default Listing

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3680L02**
WELL ID: **MWKR3680L02**
TOTAL DEPTH: **13'**

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 781.47
Ground Elevation: 781.82
X Coordinate: 12834381.30
Y Coordinate: 284318.70
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Time Started: 1045 Date Started: 10/7/10
Time Finished: 1600 Date Finished: 10/7/10

Well Development Information

Date: 10/10/10
Time Started: 17:25
Method: Vac truck
Volume Purged: 96 gallons

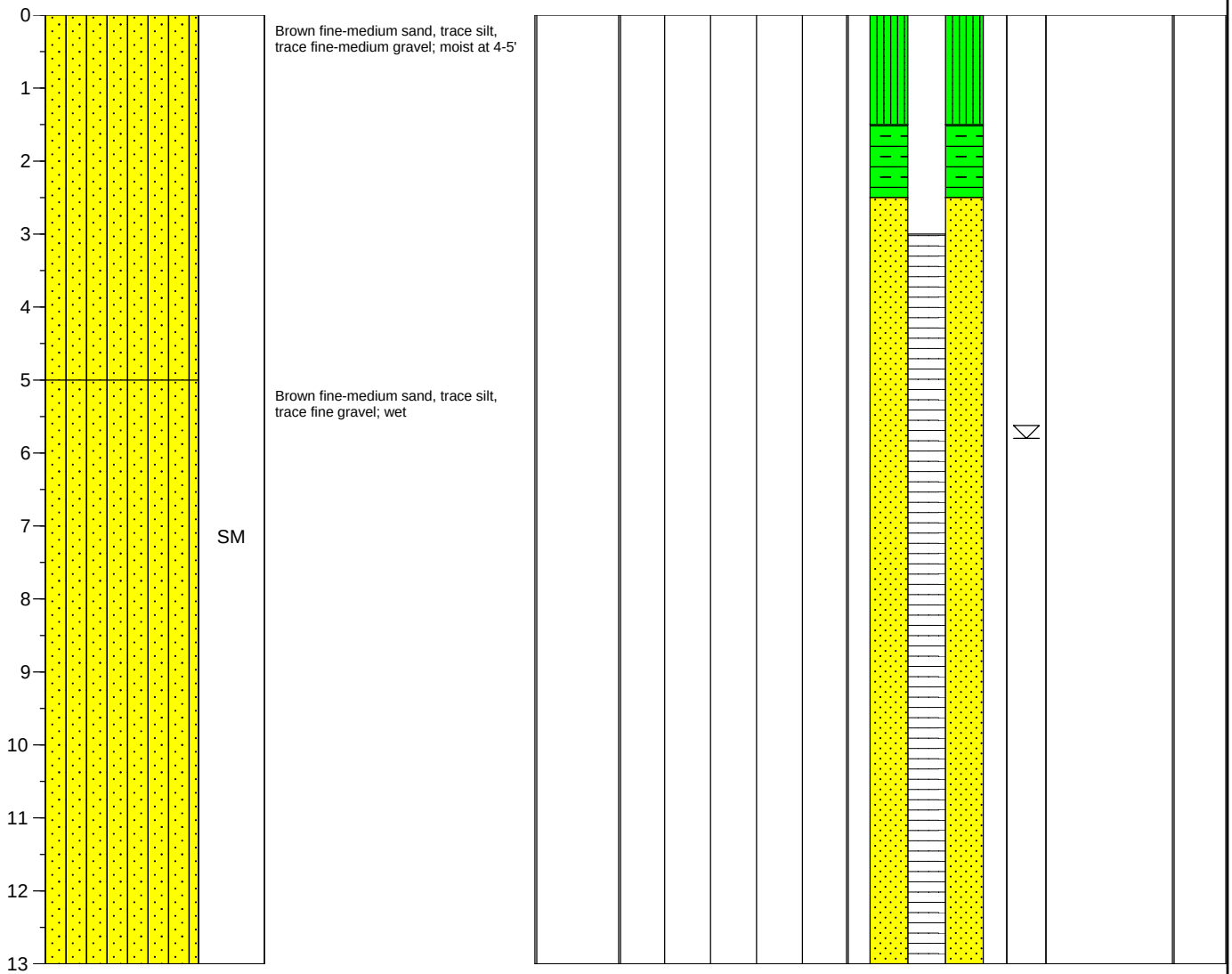
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–5		SM	Brown fine-medium sand, trace silt, trace fine-medium gravel; moist at 4-5'						
5–13		SM	Brown fine-medium sand, trace silt, trace fine gravel; wet						



NOTES:Default listing

BOREHOLE / WELL LOG

BOREHOLE ID: **MWKR3680L03**

WELL ID: **MWKR3680L03**

TOTAL DEPTH: **15'**

AECOM
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49512

State: MI County:Calhoun Township / City: Marshall Client: Enbridge Project Number: 60162778

Project Name: Enbridge (Marshall Site)
AECOM Staff Onsite: R. Mottl
TOC Elevation: 781.92
Ground Elevation: 782.30
X Coordinate: 12834384.40
Y Coordinate: 284184.40
Protective Casing Material: Steel
Type: Flush mount
Lock #: -
Bolted: Yes

Contractor: Boart Longyear
Address: 6215 Lehman Drive
Flint, MI, 48507
Crew Chief: Doug Oakley
Equipment: Rotosonic T300
Drilling Method: 6" Sonicore

Well Development Information

Date: 10/10/10
Time Started: 17:50
Method: Vac truck
Volume Purged: 198 gallons

Time Started: 1600 Date Started: 10/7/10
Time Finished: - Date Finished: 10/7/10

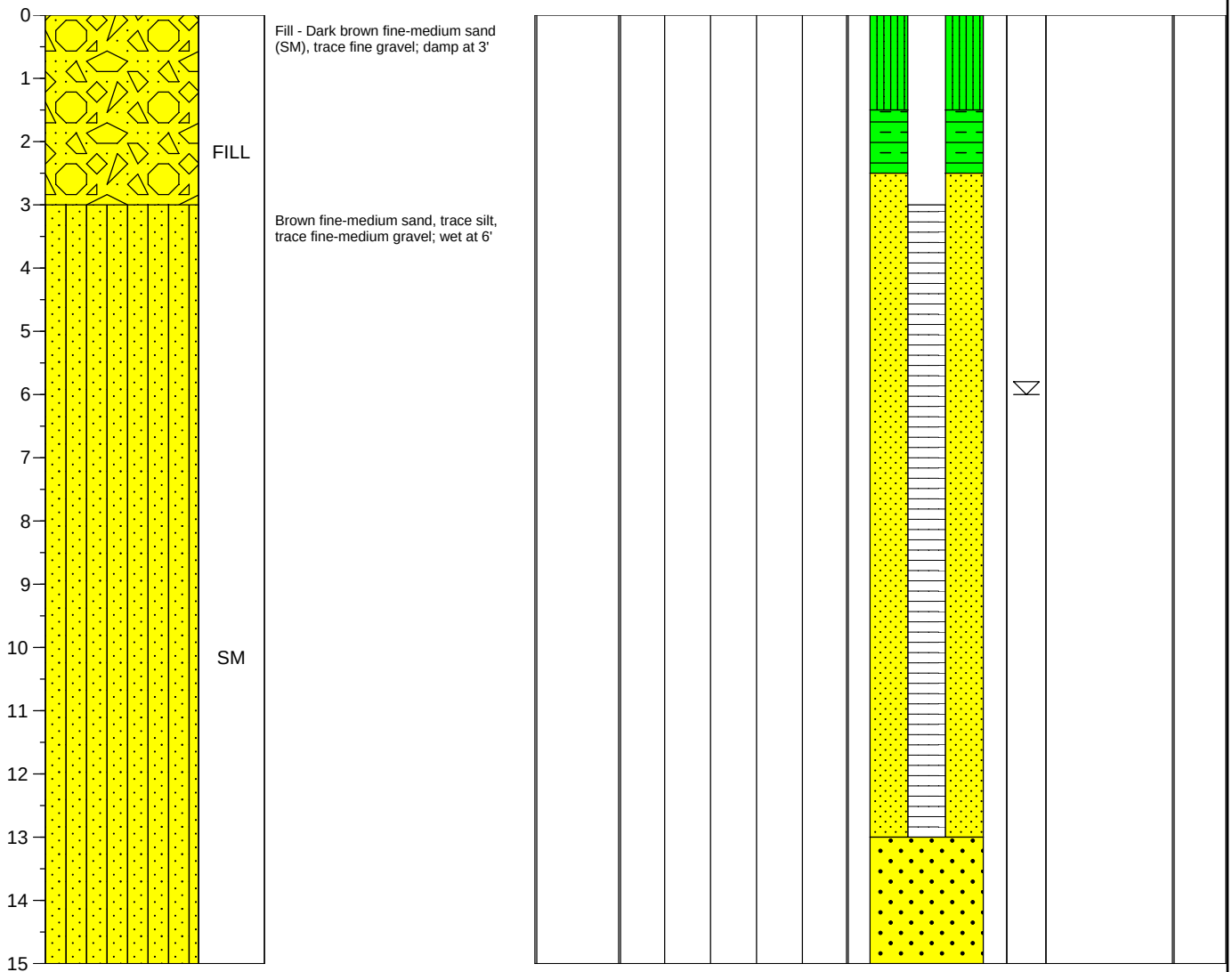
▽ Water level during drilling
▼ Water level in completed well

NC Not Collected

OilScreenSoil (OSS) Results:
+ = Product Detected
- = No Product Detected

Sample Key: collected for analysis of-
VOC = Volatile Organic Compounds
PAH = Polynuclear Aromatics
Metals
Field Parameters

Depth (feet)	Soil Symbols	USCS	Soil Description	PID (ppm)	PID Curve (250 ppm)	Boring/Well Completion	WL	Sample	OSS
0–3		FILL	Fill - Dark brown fine-medium sand (SM), trace fine gravel; damp at 3'						
3–15		SM	Brown fine-medium sand, trace silt, trace fine-medium gravel; wet at 6'						



NOTES:Default listing

US EPA ARCHIVE DOCUMENT

Appendix G

Slug Test Summary

US EPA ARCHIVE DOCUMENT

Slug Test Results
Enbridge Line 6B MP 608 Pipeline Release
Marshall Michigan

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Screen Type	Screen Interval (bgs)	Soil Type Around Screen (USCS)
Target Area 1						
MWKR0250L01	Falling	1.33E-02	33.89	2" PVC	74.4 - 79.5 ft	SP
MWKR0250L01	Falling	4.79E-03	12.17	2" PVC	74.4 - 79.5 ft	SP
MWKR0250L01	Rising	4.81E-03	12.21	2" PVC	74.4 - 79.5 ft	SP
MWKR0250L01	Rising	4.51E-03	11.46	2" PVC	74.4 - 79.5 ft	SP
MWKR0250L02	Rising	4.97E-03	12.62	2" PVC	14 - 24 ft	SP, CL
MWKR0250L02	Rising	6.23E-03	15.81	2" PVC	14 - 24 ft	SP, CL
Average		5.92E-03	15.03			
Target Area 2						
MWKR0570R01	Falling	1.21E-01	343.90	2" PVC	29 - 34 ft	Sand stone
MWKR0570R01	Falling	7.82E-02	221.80	2" PVC	29 - 34 ft	Sand stone
MWKR0570R01	Rising	1.05E-01	296.30	2" PVC	29 - 34 ft	Sand stone
MWKR0570R01	Rising	1.17E-01	331.40	2" PVC	29 - 34 ft	Sand stone
Average		1.04E-01	2.94E+02			
MWKR0570R02	Rising	3.48E-02	98.61	2" PVC	4 - 14 ft	SP/GW
MWKR0570R02	Rising	3.48E-02	98.61	2" PVC	4 - 14 ft	SP/GW
Average		6.19E-02	9.86E+01			
Target Area 3						
MWKR1525R01	Falling	7.82E-02	221.80	2" PVC	30 - 35 ft	SM
MWKR1525R01	Falling	1.26E-01	356.20	2" PVC	30 - 35 ft	SM
MWKR1525R01	Rising	7.32E-02	207.50	2" PVC	30 - 35 ft	SM
MWKR1525R01	Rising	1.21E-01	344.20	2" PVC	30 - 35 ft	SM
Average		9.67E-02	2.74E+02			
MWKR1525R02	Rising	1.17E-02	33.27	2" PVC	4 - 14 ft	SM
MWKR1525R02	Rising	1.60E-02	45.32	2" PVC	4 - 14 ft	SM
Average		1.37E-02	3.88E+01			

US EPA ARCHIVE DOCUMENT

Slug Test Results
Enbridge Line 6B MP 608 Pipeline Release
Marshall Michigan

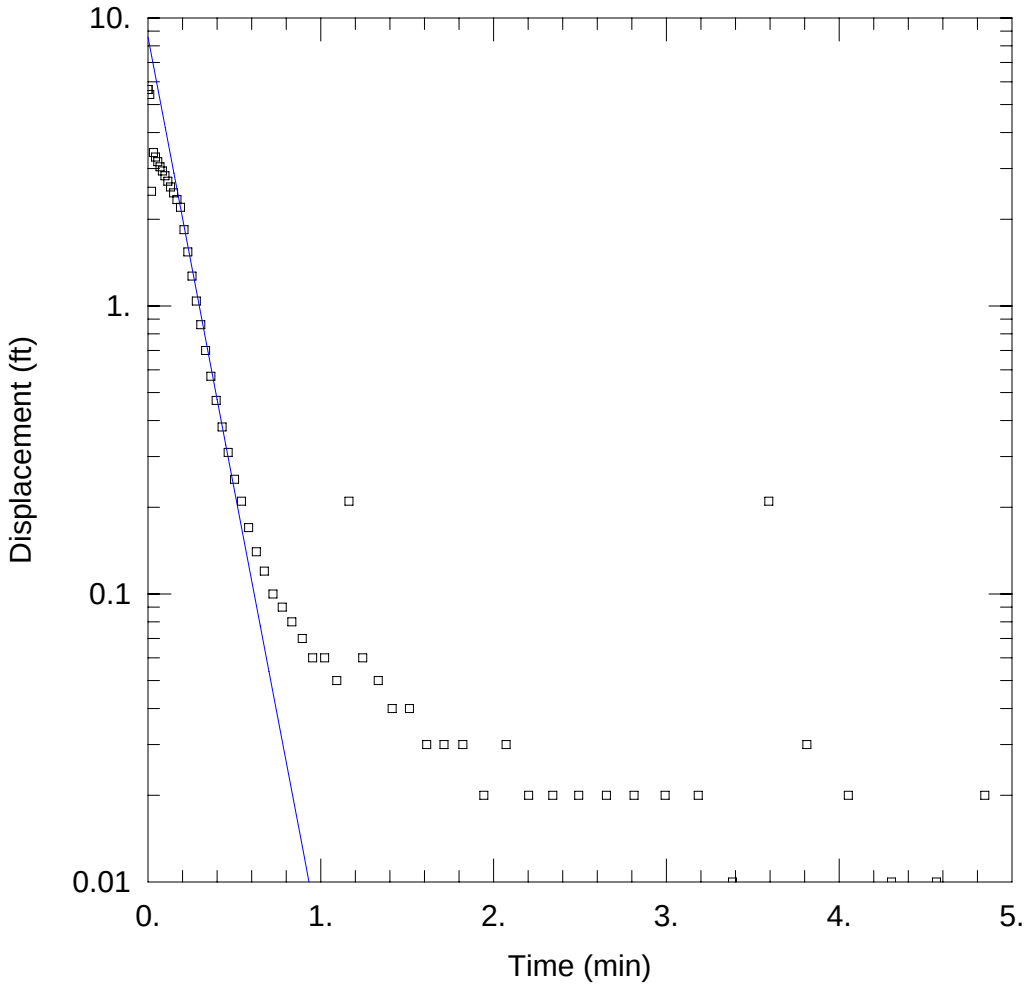
Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Screen Type	Screen Interval (bgs)	Soil Type Around Screen (USCS)
Target Area 4						
MWKR2260R01	Rising	6.17E-03	17.49	2" PVC	55 - 60 ft	Sandstone
MWKR2260R02	Falling	4.16E-03	11.79	2" PVC	22 - 27 ft	SP
MWKR2260R02	Rising	5.32E-03	15.08	2" PVC	22 - 27 ft	SP
Average		4.70E-03	1.33E+01			
Target Area 5						
MWKR2700R01	Falling	1.26E-01	358.20	2" PVC	32 - 37 ft	Sandstone
MWKR2700R01	Falling	8.03E-02	227.70	2" PVC	33 - 37 ft	Sandstone
MWKR2700R01	Rising	1.91E-01	541.70	2" PVC	34 - 37 ft	Sandstone
MWKR2700R01	Rising	1.12E-01	316.80	2" PVC	35 - 37 ft	Sandstone
Average		1.21E-01	3.44E+02			
MWKR2700R02	Rising	8.18E-03	23.20	2" PVC	2 - 12 ft	SM
MWKR2700R02	Rising	6.22E-03	17.63	2" PVC	2 - 12 ft	SM
Average		7.13E-03	2.02E+01			
Target Area 6						
MWKR3450L03	Falling	4.54E-03	12.87	2" PVC	72 - 77 ft	SM
MWKR3450L03	Rising	4.35E-03	12.32	2" PVC	72 - 77 ft	SM
MWKR3450L04	Rising	9.27E-03	26.28	2" PVC	2 - 12 ft	SP
Average		5.68E-03	1.61E+01			
Target Area 7						
MWKR3620L01	Falling	2.49E-02	70.50	2" PVC	35 - 40 ft	SP
MWKR3620L01	Rising	4.75E-02	134.80	2" PVC	35 - 40 ft	SP
Average		3.44E-02	9.75E+01			
MWKR3620L02	Rising	4.80E-03	13.62	2" PVC	11 - 16 ft	SM
MWKR3620L02	Rising	4.27E-03	12.11	2" PVC	11 - 16 ft	SM
Average		4.53E-03	1.28E+01			

US EPA ARCHIVE DOCUMENT

Slug Test Results
Enbridge Line 6B MP 608 Pipeline Release
Marshall Michigan

Monitoring Well ID	Type of Test	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Screen Type	Screen Interval (bgs)	Soil Type Around Screen (USCS)
Target Area 8						
MWKR3680L01	Falling	5.06E-02	143.40	2" PVC	30 - 35 ft	SP
MWKR3680L01	Rising	8.81E-02	249.70	2" PVC	30 - 35 ft	SP
Average		6.67E-02	1.89E+02			
MWKR3680L02	Rising	8.69E-03	24.65	2" PVC	3 - 13 ft	SM
MWKR3680L02	Rising	1.03E-02	29.20	2" PVC	3 - 13 ft	SM
Average		9.46E-03	2.68E+01			

US EPA ARCHIVE DOCUMENT



MWKR0250L01 FALLING HEAD 1

Data Set: \...\MWKR0250L01Falling01_2010-10-19_09-51-31-765.aqt
Date: 10/24/10 Time: 13:25:56

PROJECT INFORMATION

Company: AECOM
Location: Target Area 1
Test Well: MWKR0250L01
Test Date: 10/19/10

AQUIFER DATA

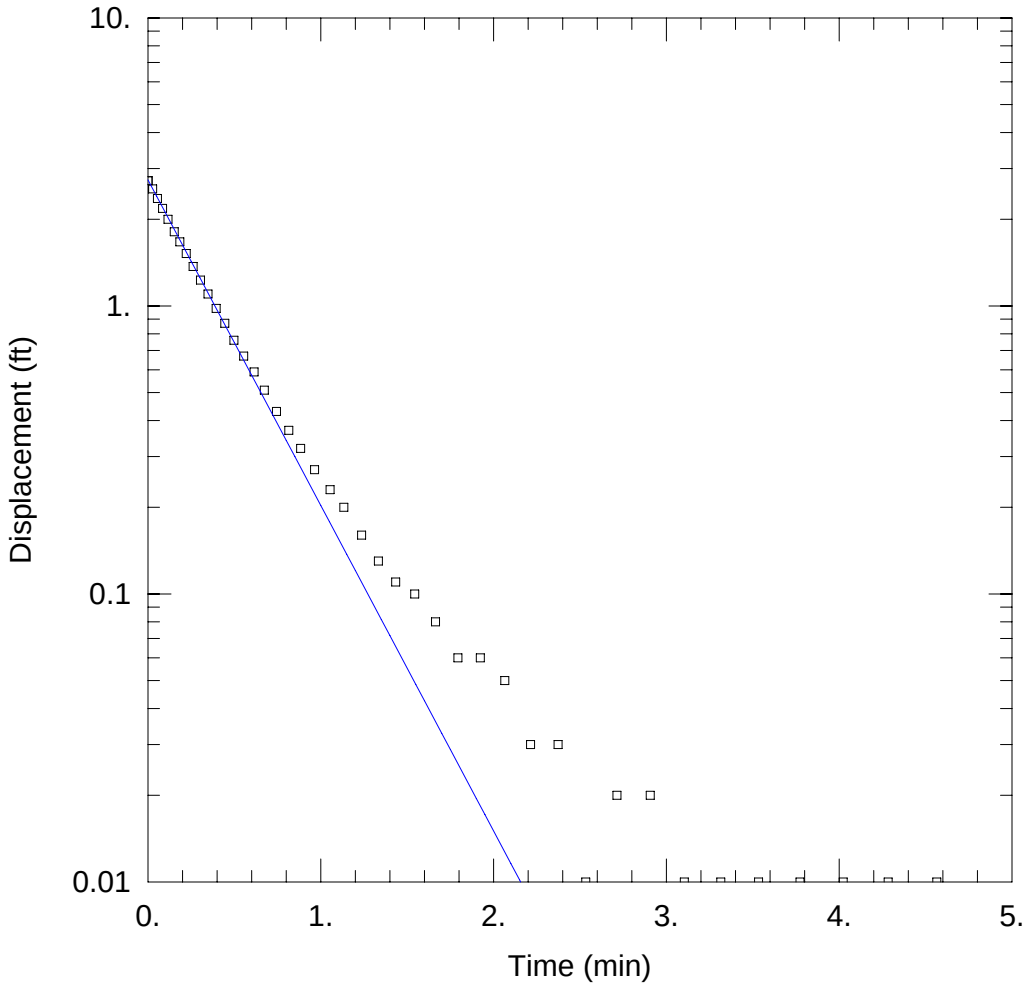
Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR0250L01)

Initial Displacement: 5.64 ft
Total Well Penetration Depth: 62.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 62.89 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 33.89 ft/day
Solution Method: Bouwer-Rice
y0 = 8.583 ft



MWKR0250L01 FALLING HEAD 2

Data Set: \...\MWKR0250L01Falling02_2010-10-19_10-18-21-687.aqt
Date: 10/24/10 Time: 13:31:10

PROJECT INFORMATION

Company: AECOM
Location: Target Area 1
Test Well: MWKR0250L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR0250L01)

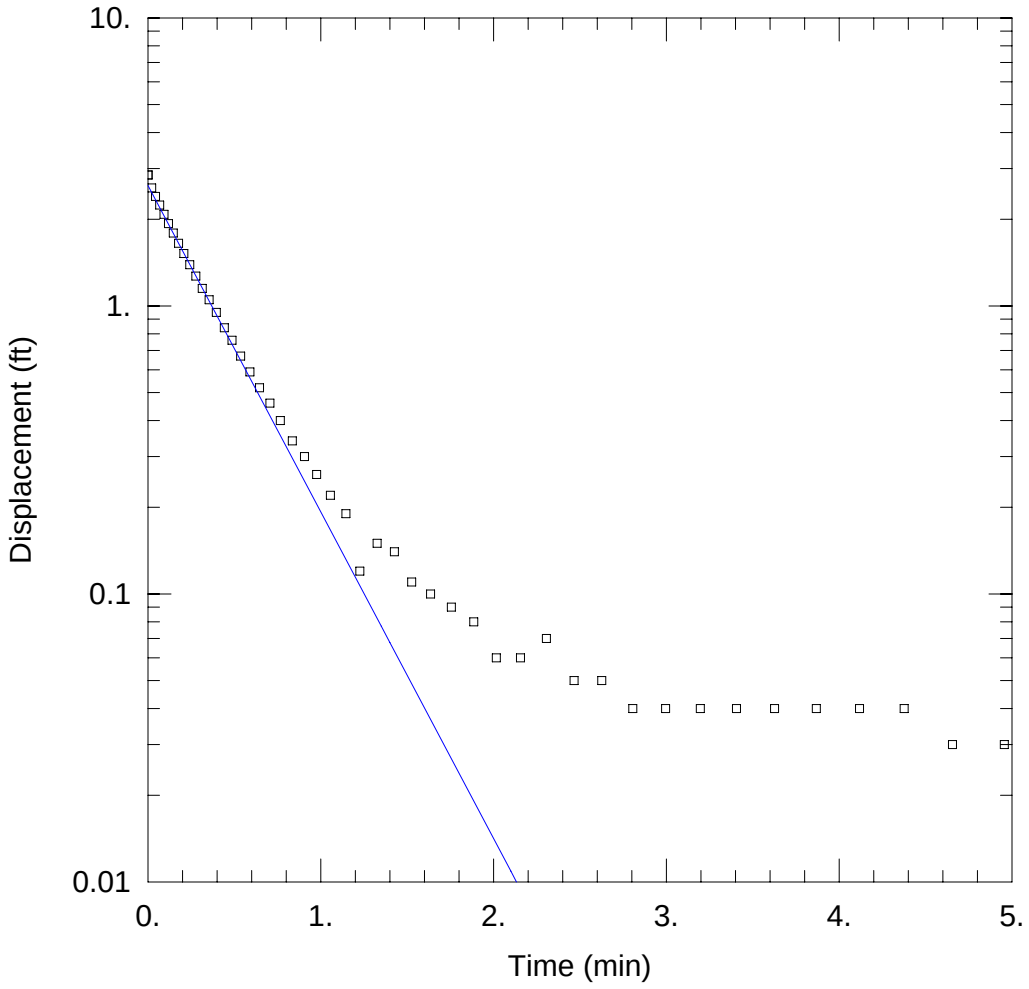
Initial Displacement: 2.72 ft
Total Well Penetration Depth: 62.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 62.89 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 12.17 ft/day
Solution Method: Bouwer-Rice
y0 = 2.738 ft

US EPA ARCHIVE DOCUMENT

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MWKR0250L01 RISING HEAD 1

Data Set: \...\MWKR0250L01Rising01_2010-10-19_10-07-00-093.aqt
Date: 10/24/10 Time: 13:31:40

PROJECT INFORMATION

Company: AECOM
Location: Target Area 1
Test Well: MWKR0250L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

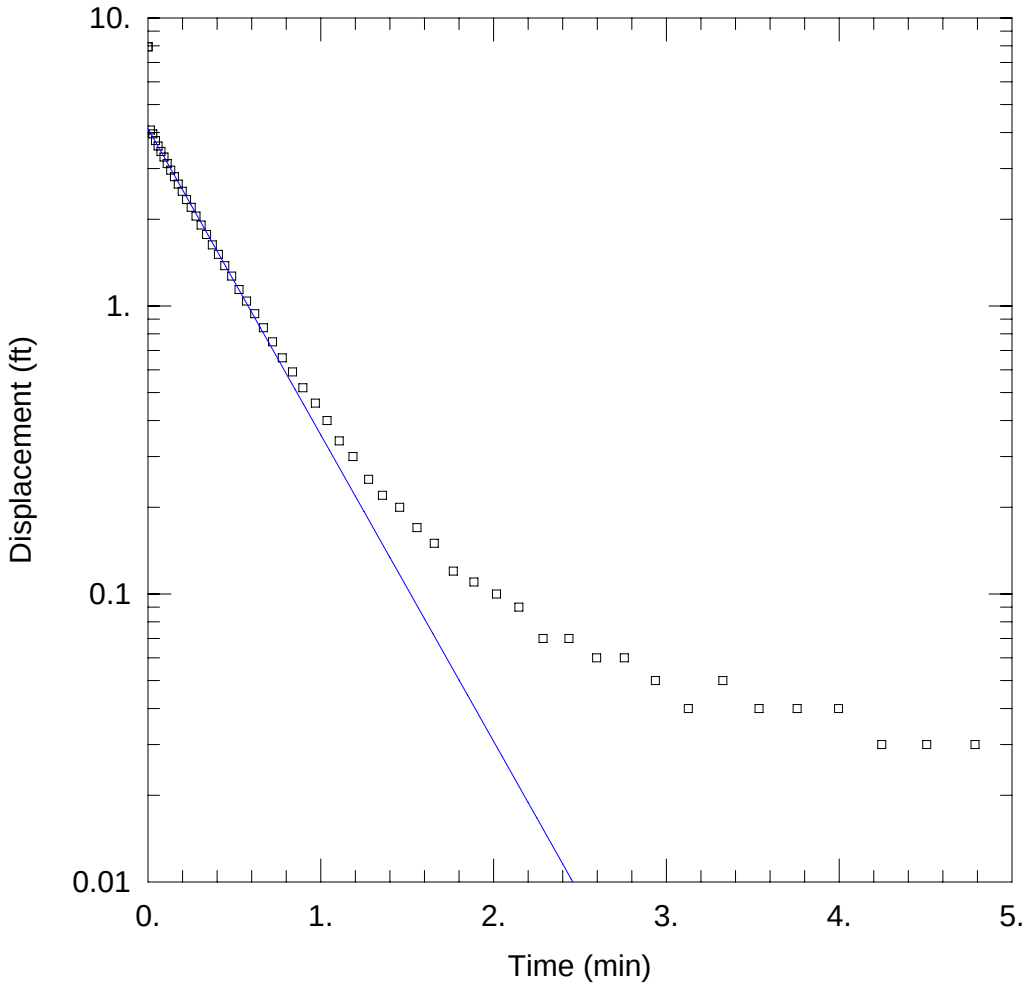
WELL DATA (MWKR0250L01)

Initial Displacement: 2.85 ft
Total Well Penetration Depth: 62.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 62.89 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 12.21 ft/day
Solution Method: Bouwer-Rice
y0 = 2.619 ft

US EPA ARCHIVE DOCUMENT



MWKR0250L01 RISING HEAD 2

Data Set: \...\MWKR0250L01Rising02_2010-10-19_10-28-33-812.aqt
Date: 10/24/10 Time: 13:32:18

PROJECT INFORMATION

Company: AECOM
Location: Target Area 1
Test Well: MWKR0250L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

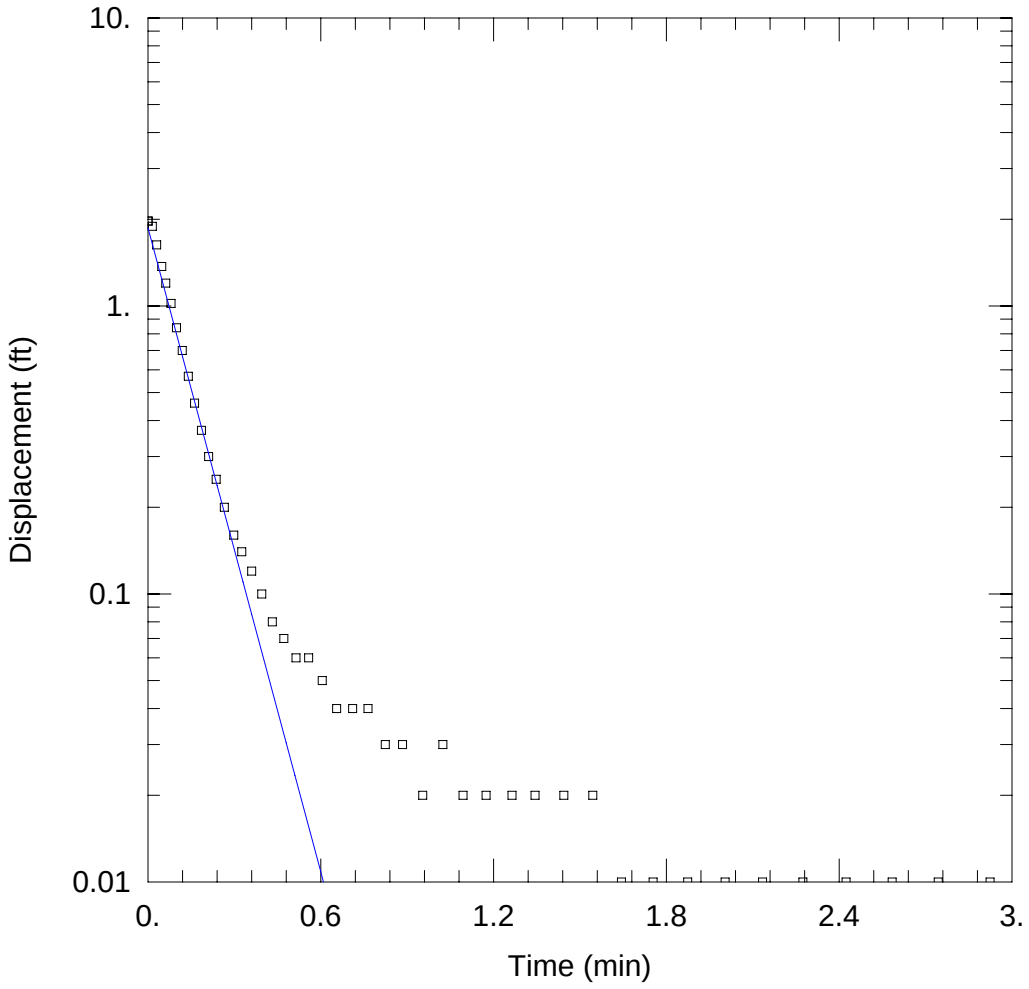
WELL DATA (MWKR0250L01)

Initial Displacement: 7.94 ft
Total Well Penetration Depth: 62.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 62.89 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 11.46 ft/day
y0 = 4.13 ft

US EPA ARCHIVE DOCUMENT



MWKR0250L02 RISING HEAD 1

Data Set: \...\MWKR0250L02Rising01_2010-10-19_10-48-00-625.aqt
Date: 10/26/10 Time: 19:43:03

PROJECT INFORMATION

Company: AECOM
Location: Target Area 1
Test Well: MWKR0250L02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

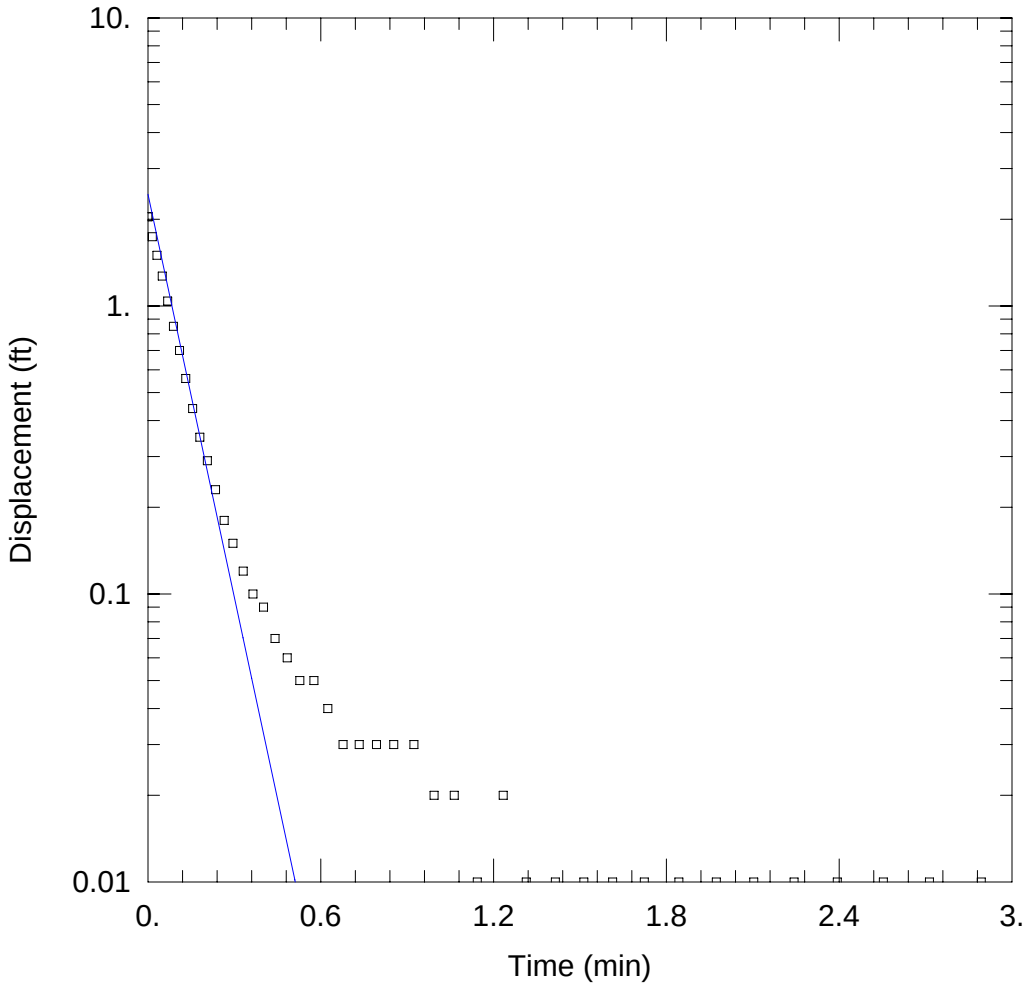
WELL DATA (MWKR0250L02)

Initial Displacement: 1.97 ft
Total Well Penetration Depth: 5.37 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 5.37 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 12.62 ft/day
Solution Method: Bouwer-Rice
y0 = 1.866 ft

US EPA ARCHIVE DOCUMENT



MWKR0250L02 RISING HEAD 2

Data Set: \...\MWKR0250L02Rising02_2010-10-19_11-11-58-171.aqt
Date: 10/26/10 Time: 19:44:27

PROJECT INFORMATION

Company: AECOM
Location: Target Area 1
Test Well: MWKR0250L02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

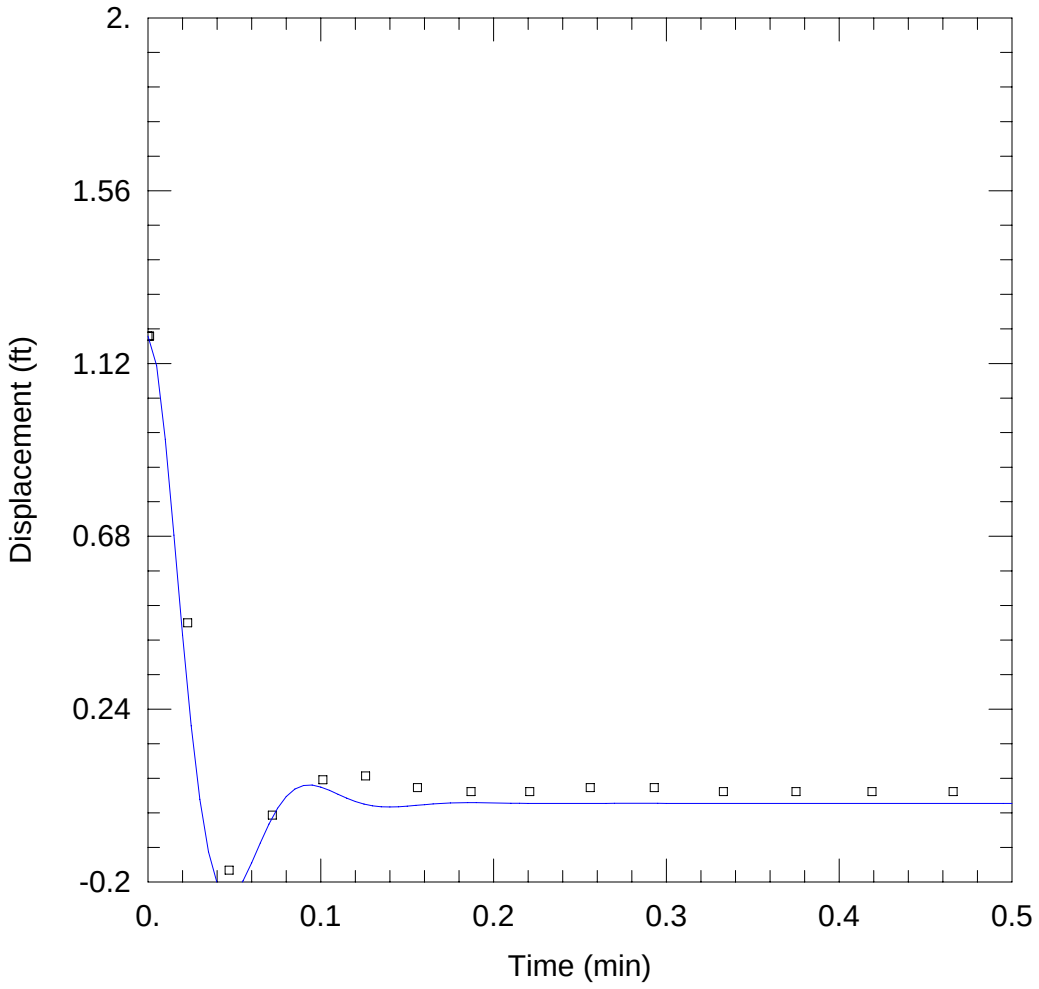
WELL DATA (MWKR0250L02)

Initial Displacement: 2.04 ft
Total Well Penetration Depth: 5.37 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 5.37 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 15.81 ft/day
y0 = 2.441 ft

US EPA ARCHIVE DOCUMENT



MWKR0570R01 FALLING HEAD 1

Data Set: \...\MWKR0570R01Falling01_2010-10-19_11-58-19-390.aqt
Date: 10/26/10 Time: 19:40:06

PROJECT INFORMATION

Company: AECOM
Location: Target Area 2
Test Well: MWKR0570R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

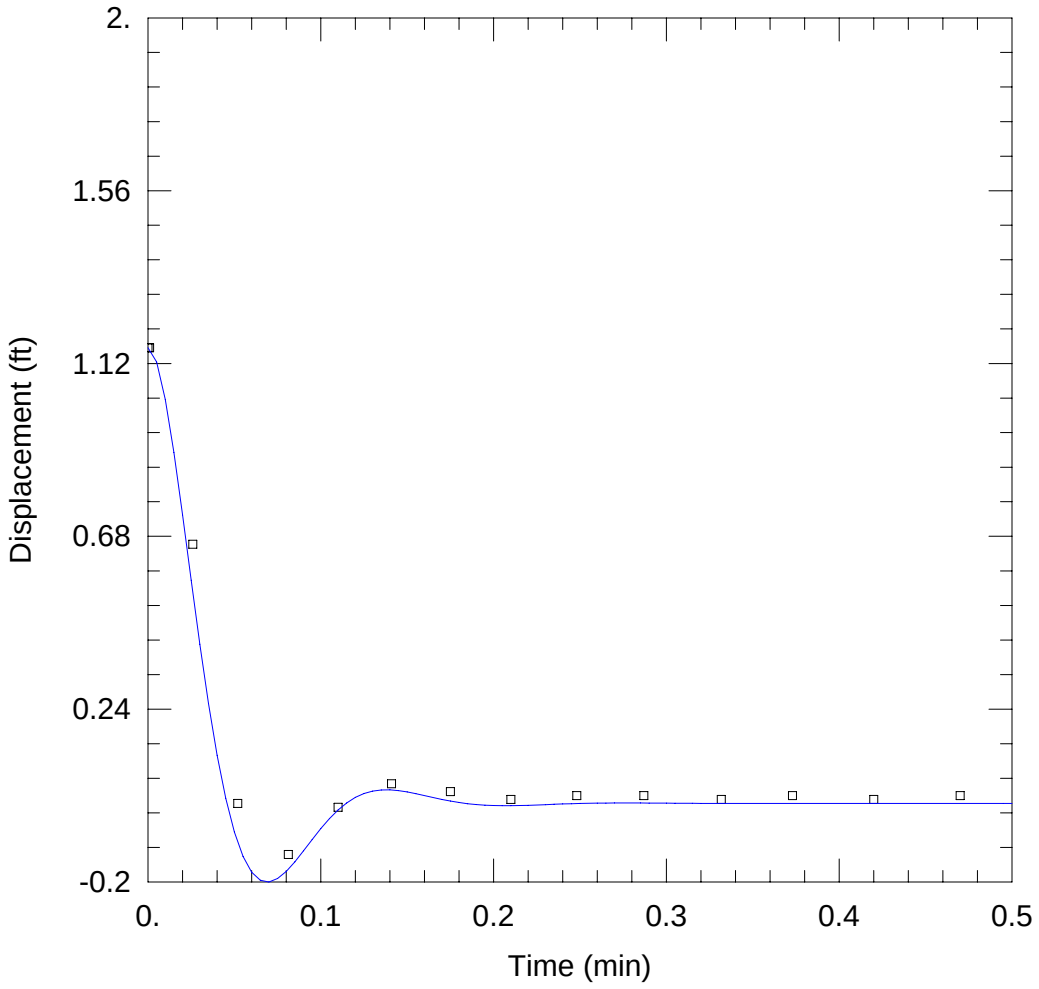
WELL DATA (MWKR0570R01)

Initial Displacement: 1.19 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 343.9 ft/day
C(D) = 0.4575

US EPA ARCHIVE DOCUMENT



MWKR0570R01 FALLING HEAD 2

Data Set: \...\MWKR0570R01Falling02_2010-10-19_12-10-52-640.aqt
Date: 10/26/10 Time: 19:37:25

PROJECT INFORMATION

Company: AECOM
Location: Target Area 2
Test Well: MWKR0570R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

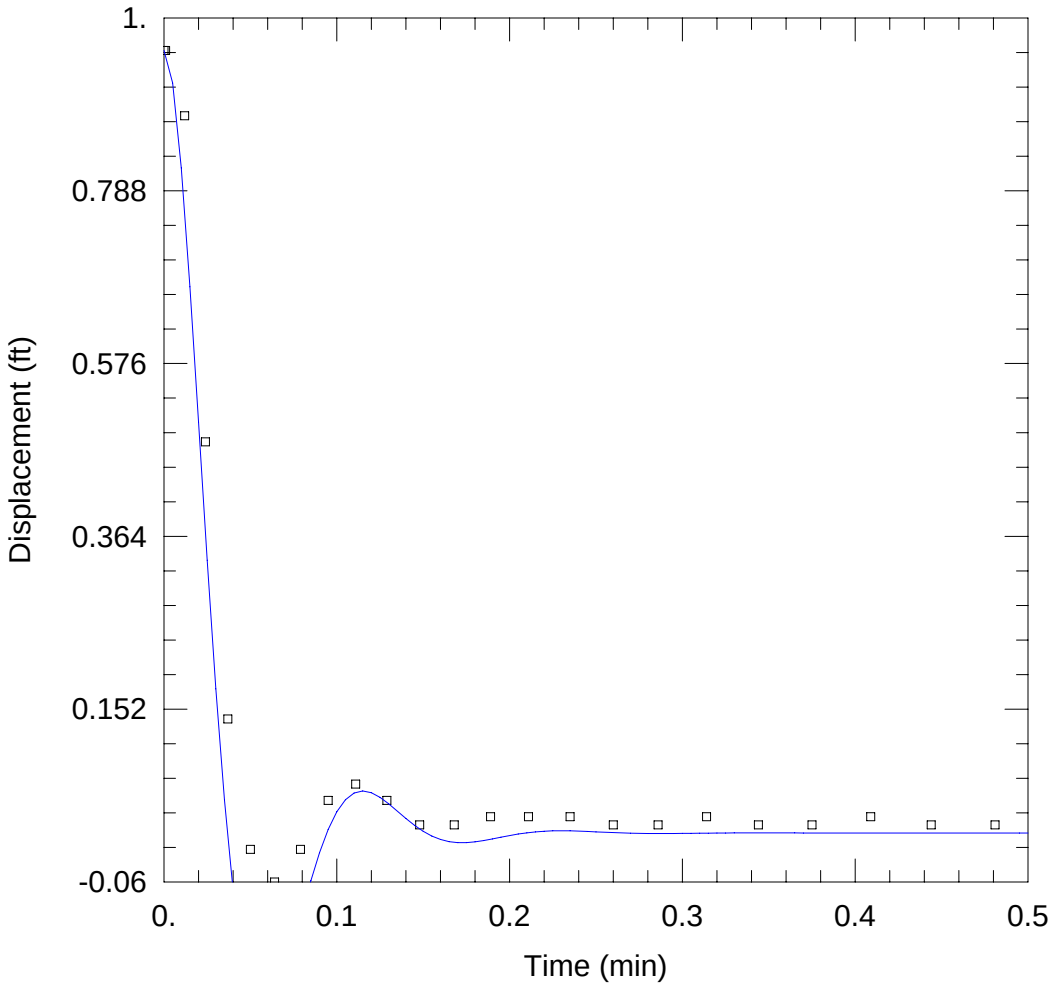
WELL DATA (MWKR0570R01)

Initial Displacement: 1.16 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 221.8 ft/day
C(D) = 0.4879

US EPA ARCHIVE DOCUMENT



MWKR0570R01 RISING HEAD 1

Data Set: \...\MWKR0570R01Rising01_2010-10-19_12-05-48-109.aqt
Date: 10/26/10 Time: 19:36:20

PROJECT INFORMATION

Company: AECOM
Location: Target Area 2
Test Well: MWKR0570R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

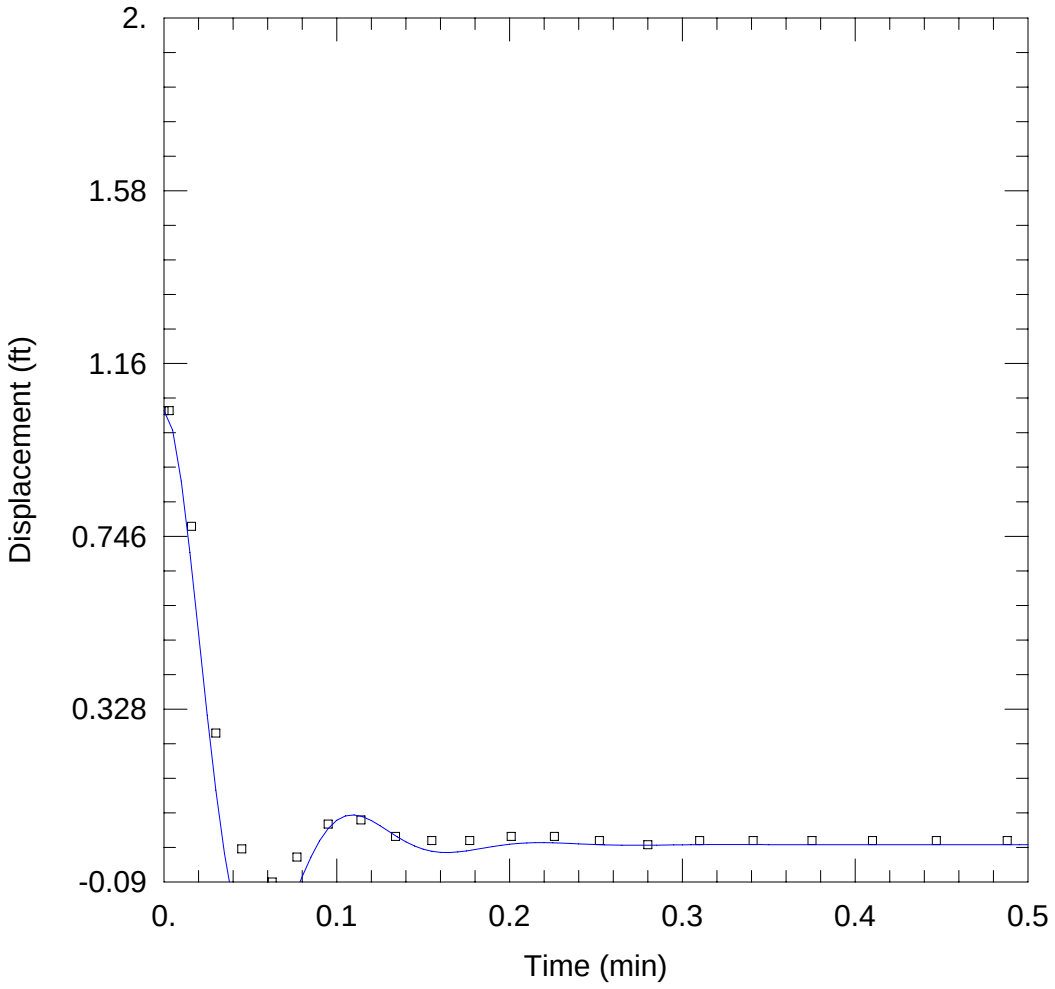
WELL DATA (MWKR0570R01)

Initial Displacement: 0.96 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 296.3 ft/day
C(D) = 0.422

US EPA ARCHIVE DOCUMENT



MWKR0570R01 RISING HEAD 2

Data Set: \...\MWKR0570R01Rising02_2010-10-19_12-17-00-562.aqt
Date: 10/26/10 Time: 19:34:11

PROJECT INFORMATION

Company: AECOM
Location: Target Area 2
Test Well: MWKR0570R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

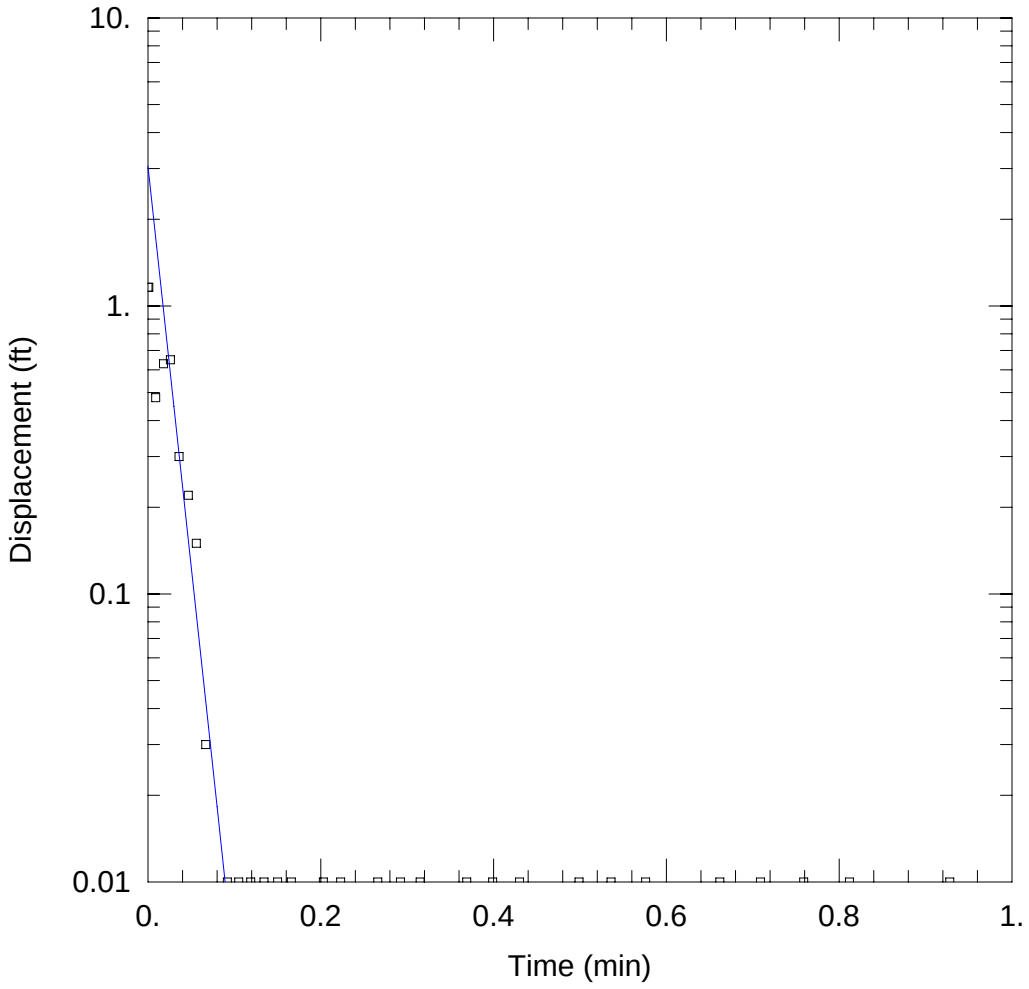
WELL DATA (MWKR0570R01)

Initial Displacement: 1.05 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 331.4 ft/day
C(D) = 0.392

US EPA ARCHIVE DOCUMENT



MWKR0570R02 RISING HEAD 1

Data Set: \...\MWKR0570R02Rising01_2010-10-19_12-39-20-562.aqt
Date: 10/26/10 Time: 19:32:52

PROJECT INFORMATION

Company: AECOM
Location: Target Area 2
Test Well: MWKR0570R02
Test Date: 10/19/10

AQUIFER DATA

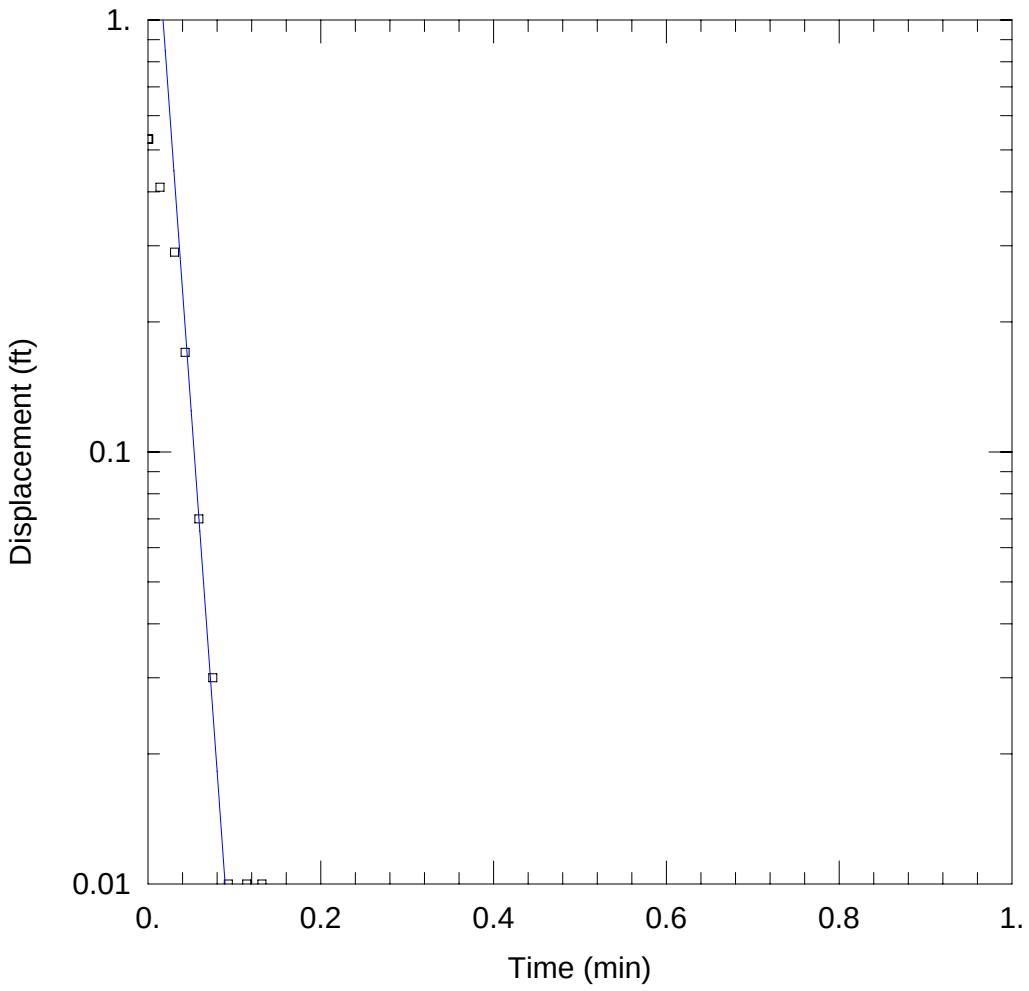
Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR0570R02)

Initial Displacement: 1.16 ft
Total Well Penetration Depth: 6.99 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.99 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 98.61 ft/day
y0 = 3.052 ft



MWKR0570R02 RISING HEAD 2

Data Set: \...\MWKR0570R02Rising02_2010-10-19_12-54-06-781.aqt
Date: 10/26/10 Time: 19:31:22

PROJECT INFORMATION

Company: AECOM
Location: Target Area 2
Test Well: MWKR0570R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR0570R02)

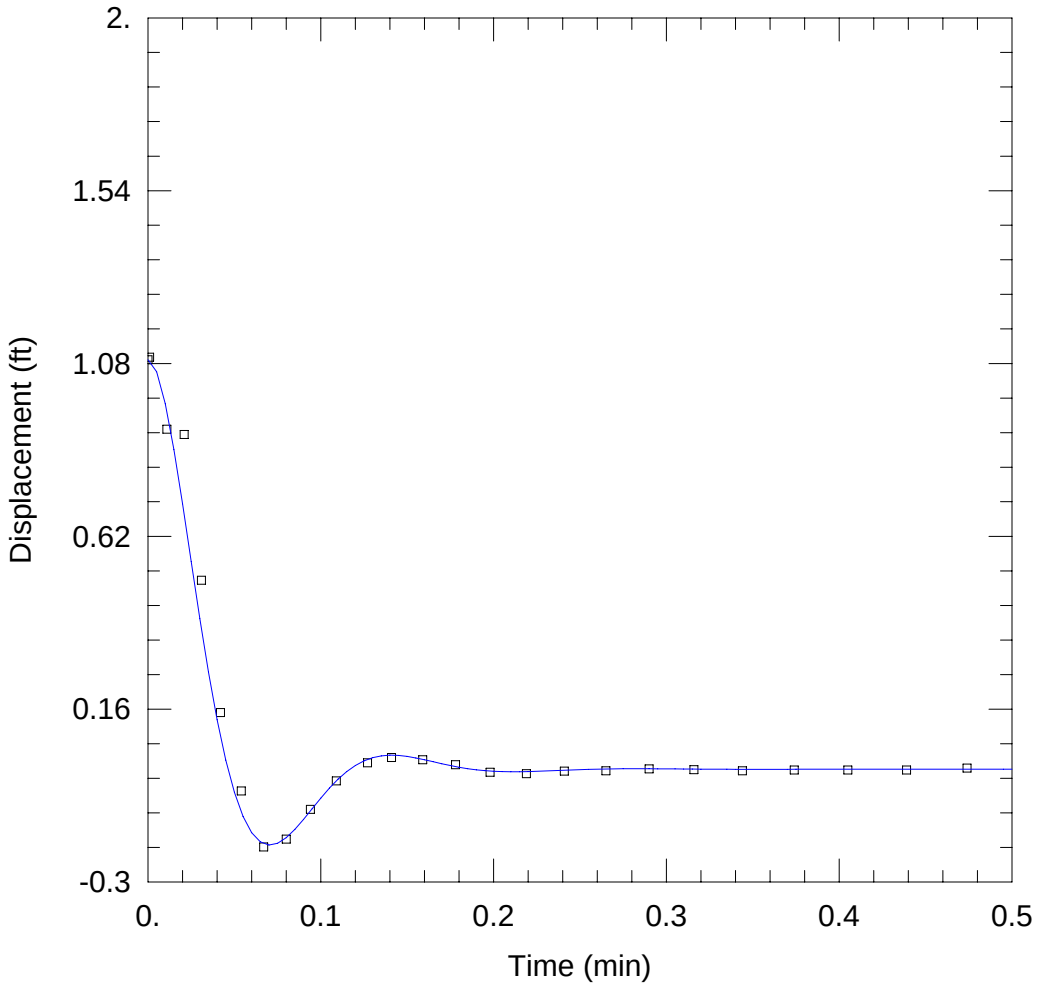
Initial Displacement: 0.53 ft
Total Well Penetration Depth: 6.99 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.99 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 98.61 ft/day
Solution Method: Bouwer-Rice
y0 = 3.052 ft

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT



MWKR1525R01 FALLING HEAD 1

Data Set: \...\MWKR1525R01Falling01_2010-10-19_13-52-14-140.aqt
Date: 10/26/10 Time: 19:48:10

PROJECT INFORMATION

Company: AECOM
Location: Target Area 3
Test Well: MWKR1525R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 58. ft
Anisotropy Ratio (Kz/Kr): 0.1

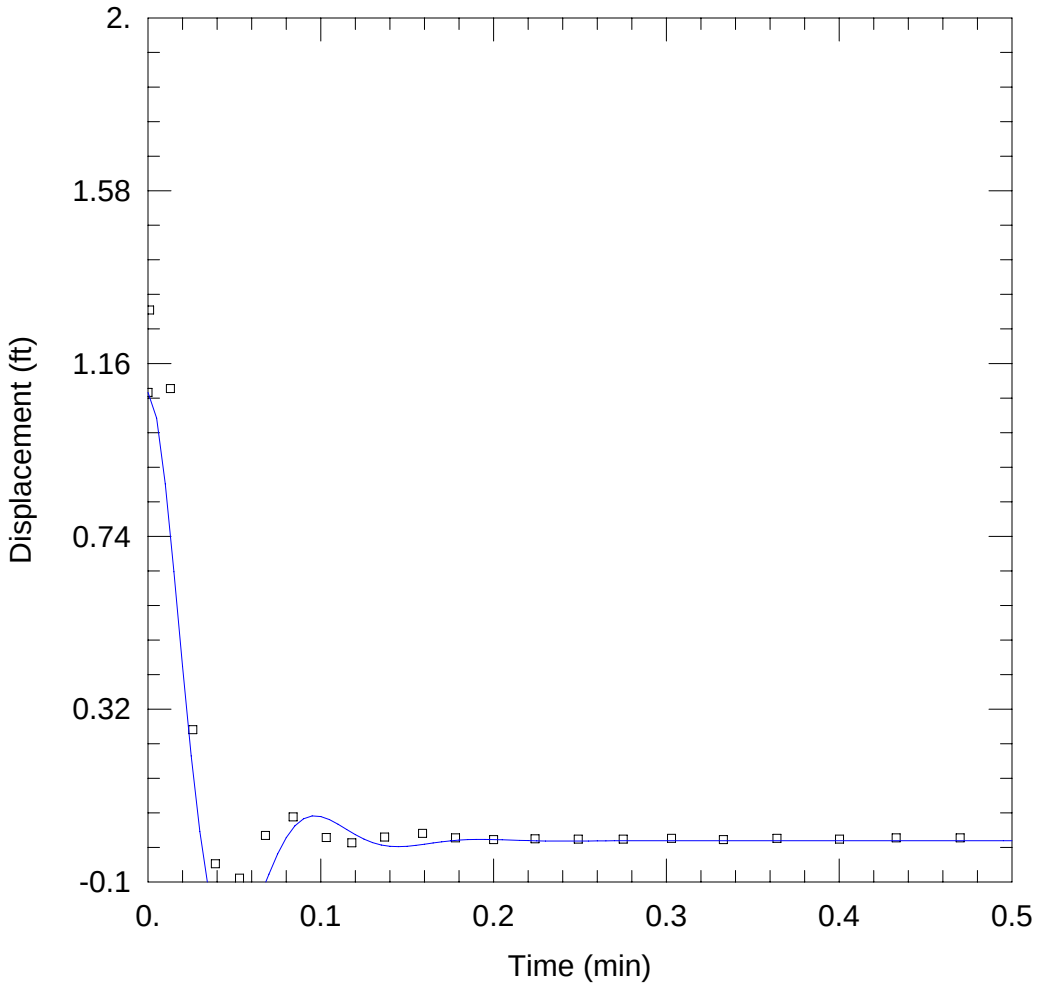
WELL DATA (MWKR1525R01)

Initial Displacement: 1.09 ft
Total Well Penetration Depth: 26.78 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 221.8 ft/day
C(D) = 0.473

US EPA ARCHIVE DOCUMENT



MWKR1525R01 FALLING HEAD 2

Data Set: \...\MWKR1525R01Falling02_2010-10-19_14-05-02-890.aqt
Date: 10/26/10 Time: 19:49:33

PROJECT INFORMATION

Company: AECOM
Location: Target Area 3
Test Well: MWKR1525R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 58. ft
Anisotropy Ratio (Kz/Kr): 0.1

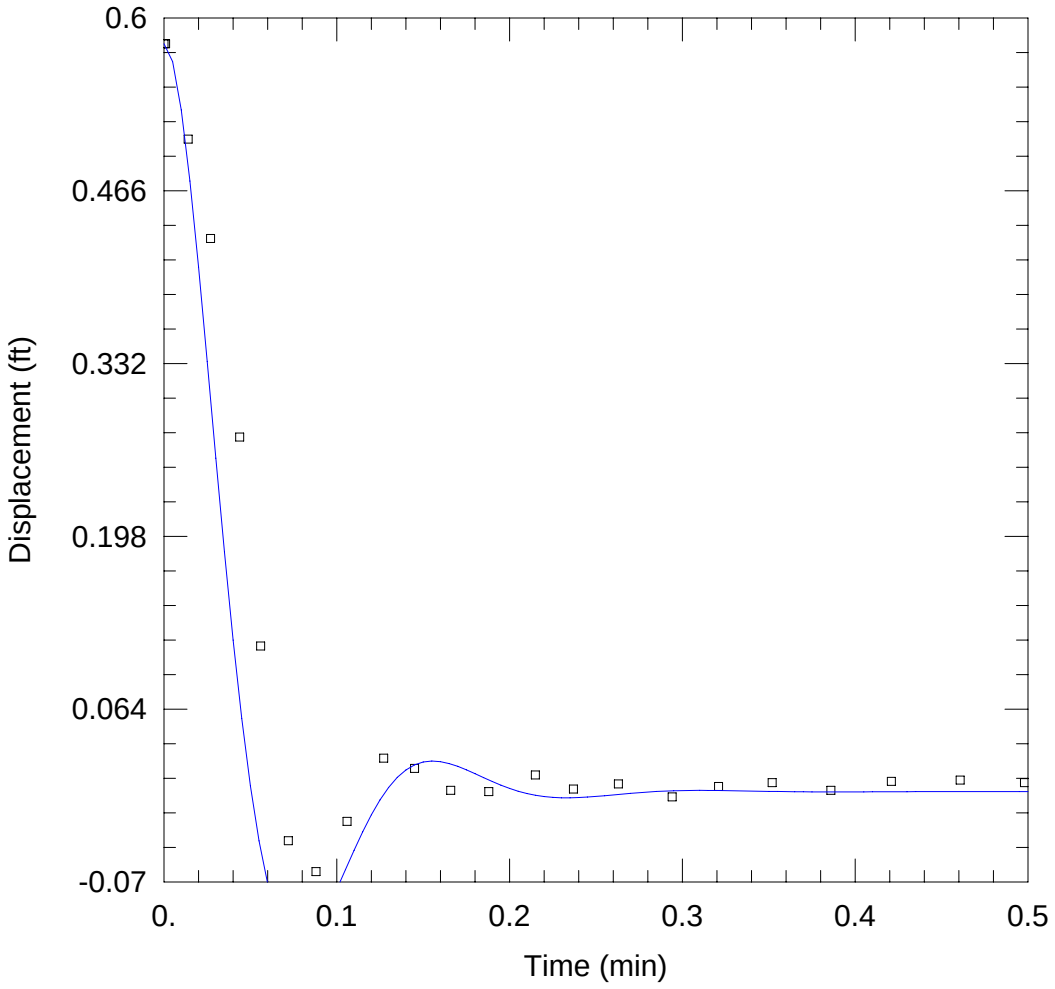
WELL DATA (MWKR1525R01)

Initial Displacement: 1.09 ft
Total Well Penetration Depth: 26.78 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 356.2 ft/day
C(D) = 0.4174

US EPA ARCHIVE DOCUMENT



MWKR1525R01 RISING HEAD 1

Data Set: \...\MWKR1525R01Rising01_2010-10-19_13-58-23-468.aqt
Date: 10/26/10 Time: 19:50:43

PROJECT INFORMATION

Company: AECOM
Location: Target Area 3
Test Well: MWKR1525R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 58. ft
Anisotropy Ratio (Kz/Kr): 0.1

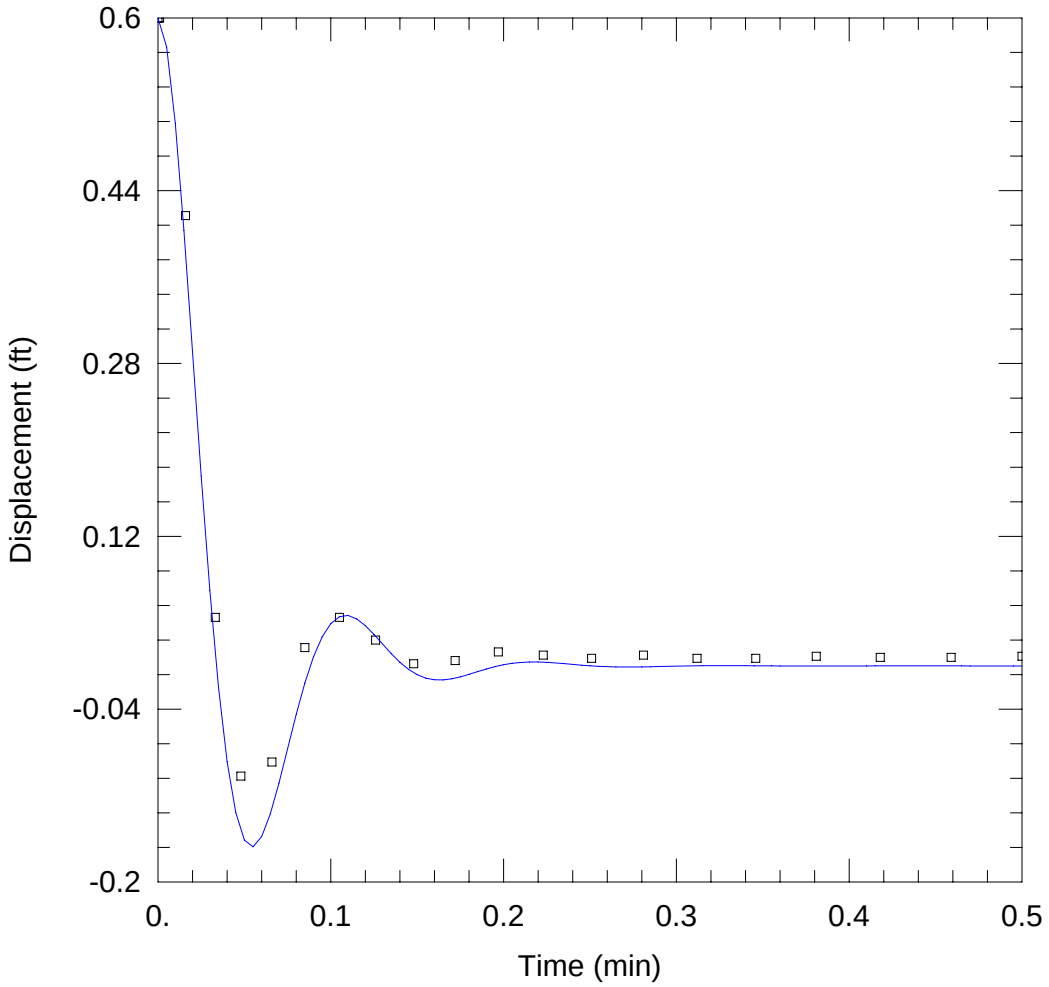
WELL DATA (MWKR1525R01)

Initial Displacement: 0.58 ft
Total Well Penetration Depth: 26.78 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 207.5 ft/day
C(D) = 0.4533

US EPA ARCHIVE DOCUMENT



MWKR1525R01 RISING HEAD 2

Data Set: \...\MWKR1525R01Rising02_2010-10-19_14-08-59-062.aqt
Date: 10/26/10 Time: 19:52:03

PROJECT INFORMATION

Company: AECOM
Location: Target Area 3
Test Well: MWKR1525R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 58. ft
Anisotropy Ratio (Kz/Kr): 0.1

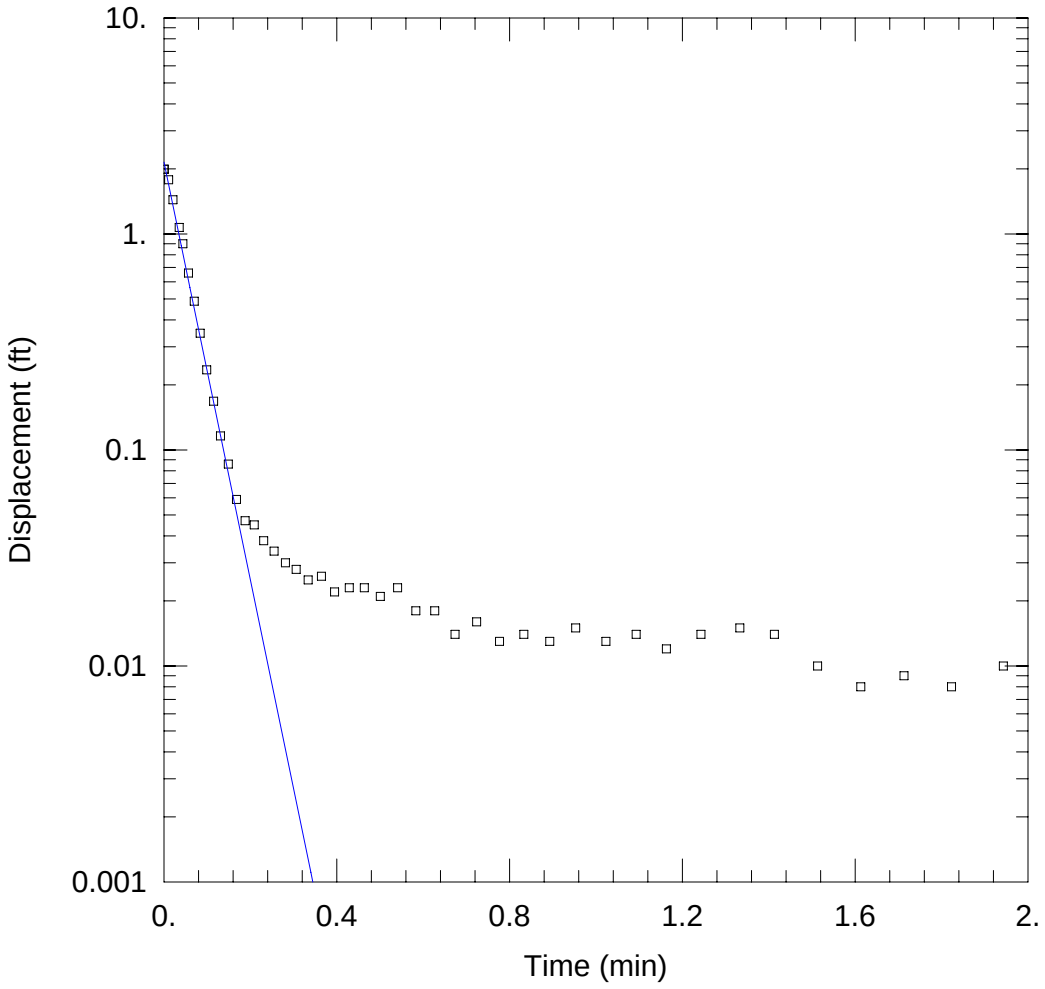
WELL DATA (MWKR1525R01)

Initial Displacement: 0.6 ft
Total Well Penetration Depth: 26.78 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 344.2 ft/day
C(D) = 0.3761

US EPA ARCHIVE DOCUMENT



MWKR1525R02 RISING HEAD 1

Data Set: \...\MWKR1525R02Rising01_2010-10-19_14-26-51-343.aqt
Date: 10/26/10 Time: 19:53:29

PROJECT INFORMATION

Company: AECOM
Location: Target Area 3
Test Well: MWKR1525R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 58. ft
Anisotropy Ratio (Kz/Kr): 0.1

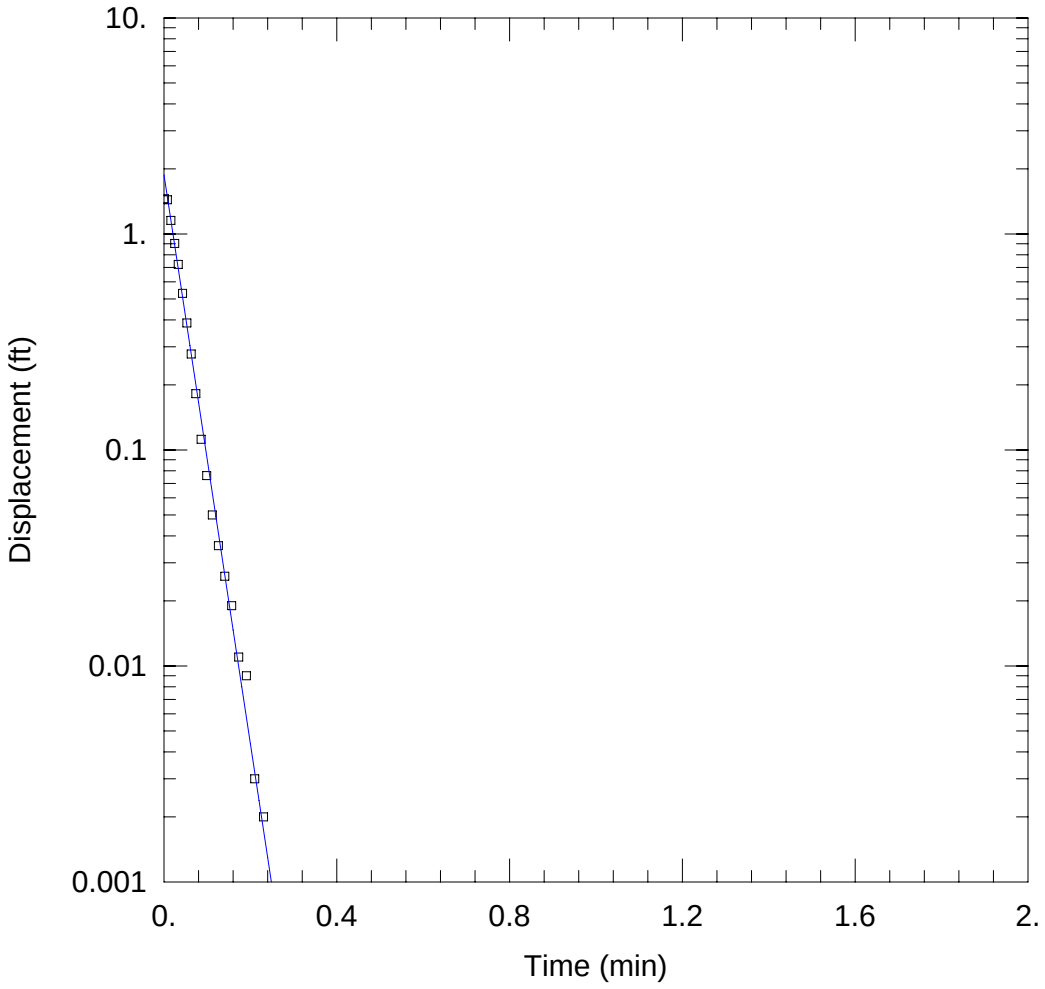
WELL DATA (MWKR1525R02)

Initial Displacement: 1.992 ft
Total Well Penetration Depth: 5.86 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 33.27 ft/day
Solution Method: Bouwer-Rice
y0 = 2.148 ft

US EPA ARCHIVE DOCUMENT



MWKR1525R02 RISING HEAD 2

Data Set: \...\MWKR1525R02Rising02_2010-10-19_14-40-58-812.aqt
Date: 10/26/10 Time: 19:55:00

PROJECT INFORMATION

Company: AECOM
Location: Target Area 3
Test Well: MWKR1525R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 58. ft
Anisotropy Ratio (Kz/Kr): 0.1

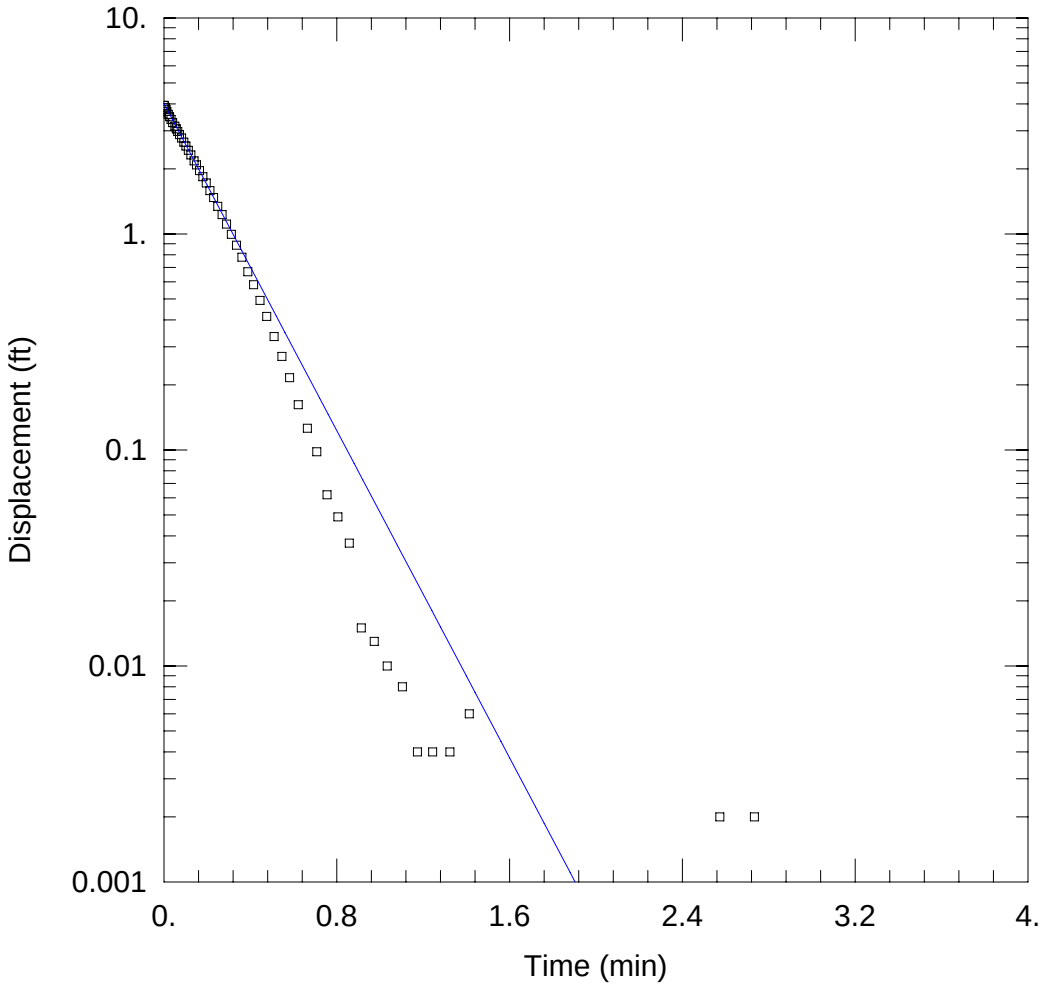
WELL DATA (MWKR1525R02)

Initial Displacement: 1.45 ft
Total Well Penetration Depth: 5.86 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 45.32 ft/day
y0 = 1.878 ft

US EPA ARCHIVE DOCUMENT



MWKR2260R01 RISING HEAD 1

Data Set: \...\MWKR2260R01Rising01_2010-10-19_15-39-27-062.aqt
Date: 10/26/10 Time: 20:03:52

PROJECT INFORMATION

Company: AECOM
Location: Target Area 4
Test Well: MWKR2260R01
Test Date: 10/19/10

AQUIFER DATA

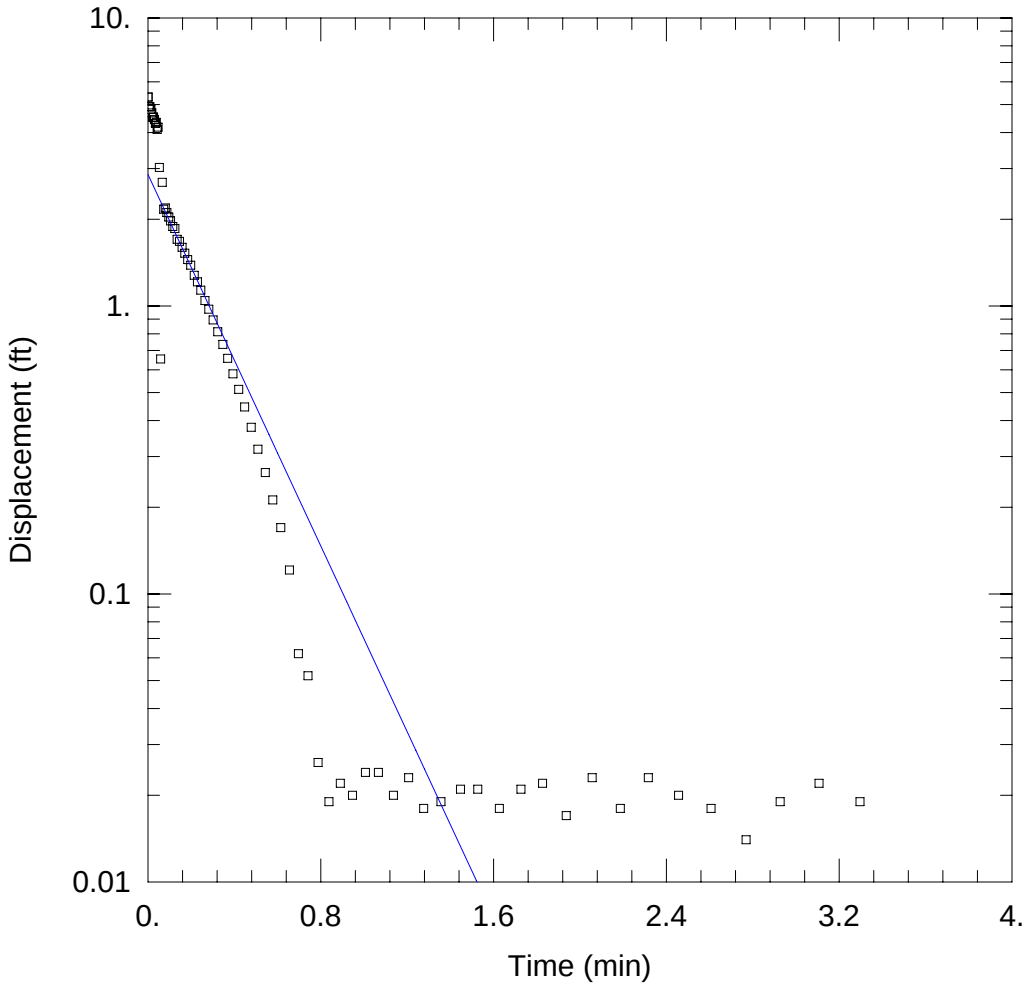
Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR2660R01)

Initial Displacement: 3.94 ft
Total Well Penetration Depth: 48.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 26.5 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 17.49 ft/day
Solution Method: Bouwer-Rice
y0 = 4.017 ft



MWKR2260R02 FALLING HEAD 1

Data Set: \...\MWKR2260R02Falling01_2010-10-19_16-08-45-203.aqt
Date: 10/26/10 Time: 20:03:07

PROJECT INFORMATION

Company: AECOM
Location: Target Area 4
Test Well: MWKR2260R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR2660R01)

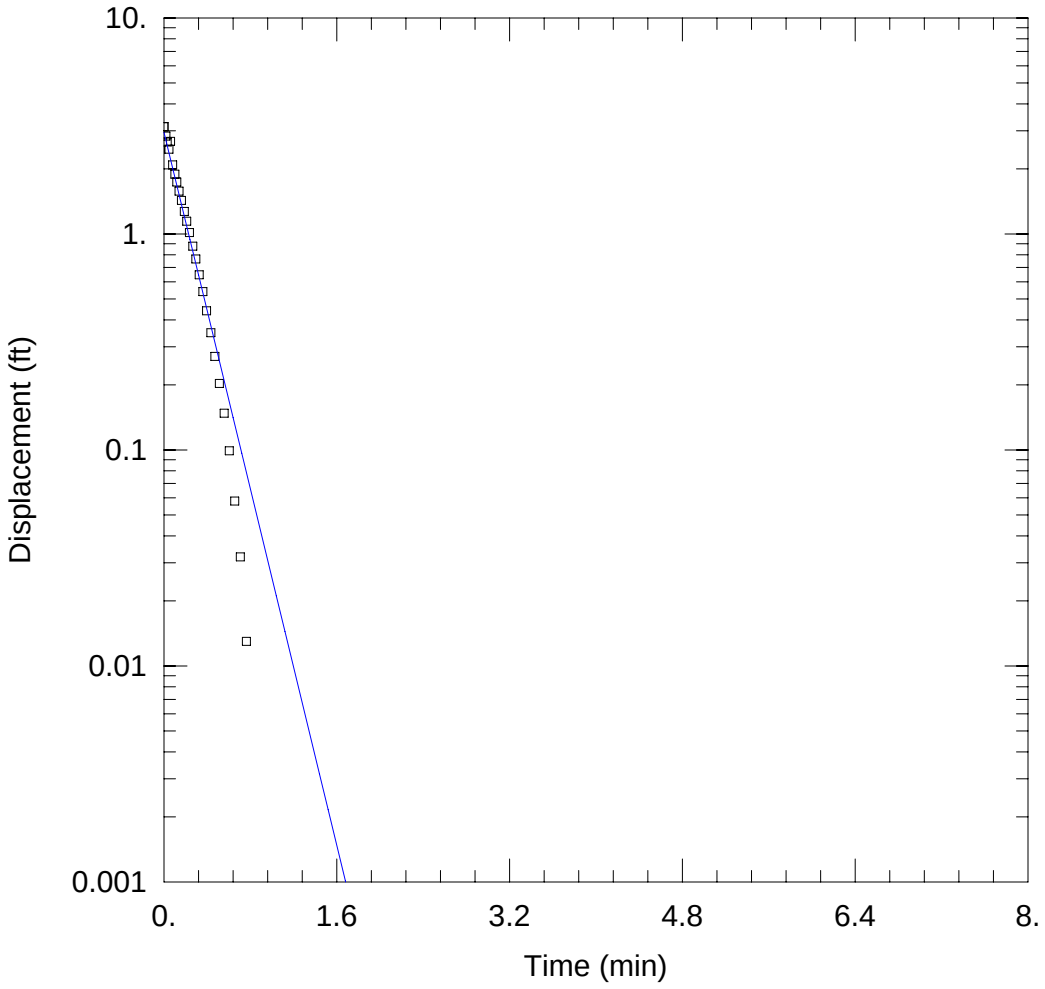
Initial Displacement: 5.31 ft
Total Well Penetration Depth: 15.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 15.89 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 11.79 ft/day
y0 = 2.861 ft

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT



MWKR2260R02 RISING HEAD 1

Data Set: \...\MWKR2260R02Rising01_2010-10-19_16-21-09-828.aqt
Date: 10/26/10 Time: 20:05:08

PROJECT INFORMATION

Company: AECOM
Location: Target Area 4
Test Well: MWKR2260R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 50. ft
Anisotropy Ratio (Kz/Kr): 0.1

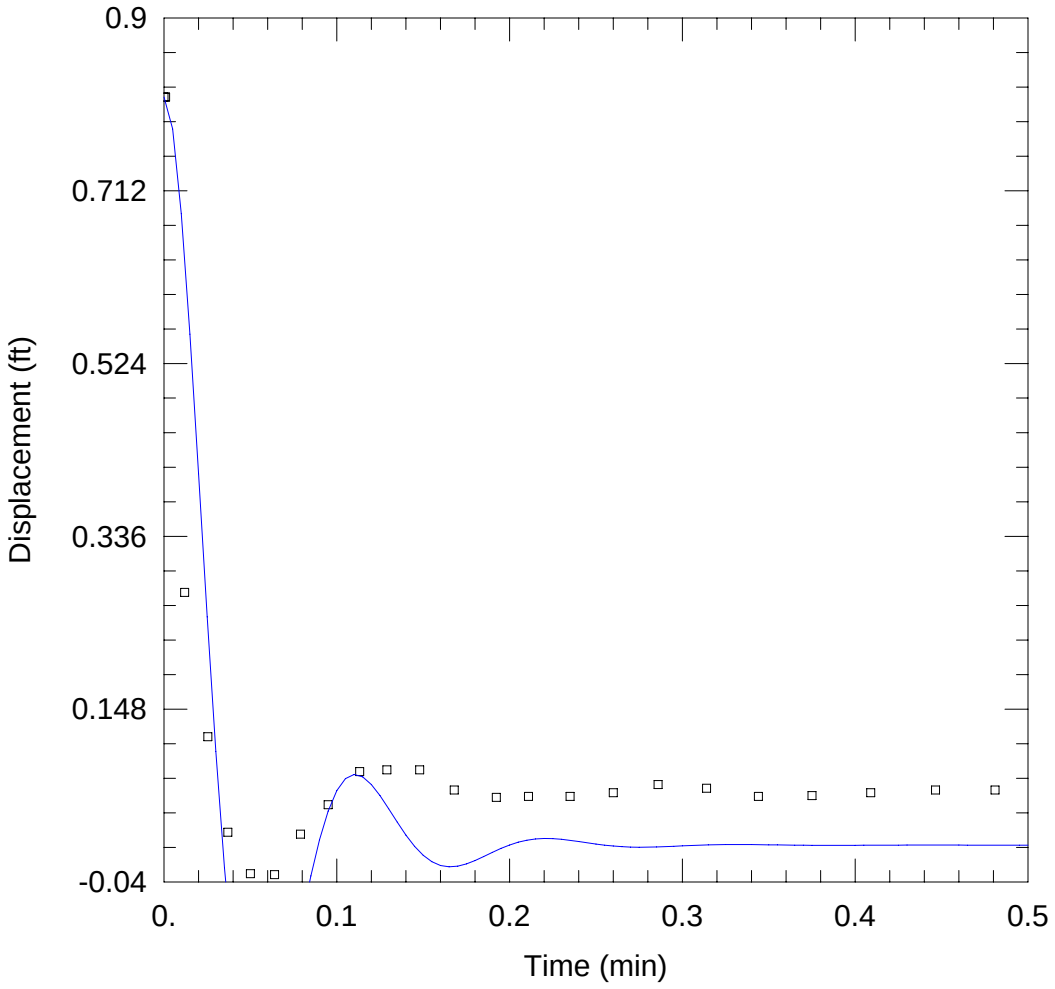
WELL DATA (MWKR2660R01)

Initial Displacement: 3.14 ft
Total Well Penetration Depth: 15.89 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 15.89 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 15.08 ft/day
Solution Method: Bouwer-Rice
y0 = 2.95 ft

US EPA ARCHIVE DOCUMENT



MWKR2700R01 FALLING HEAD 1

Data Set: \...\MWKR2700R01Falling01_2010-10-19_16-55-48-796.aqt
Date: 10/26/10 Time: 20:08:43

PROJECT INFORMATION

Company: AECOM
Location: Target Area 5
Test Well: MWKR2700R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

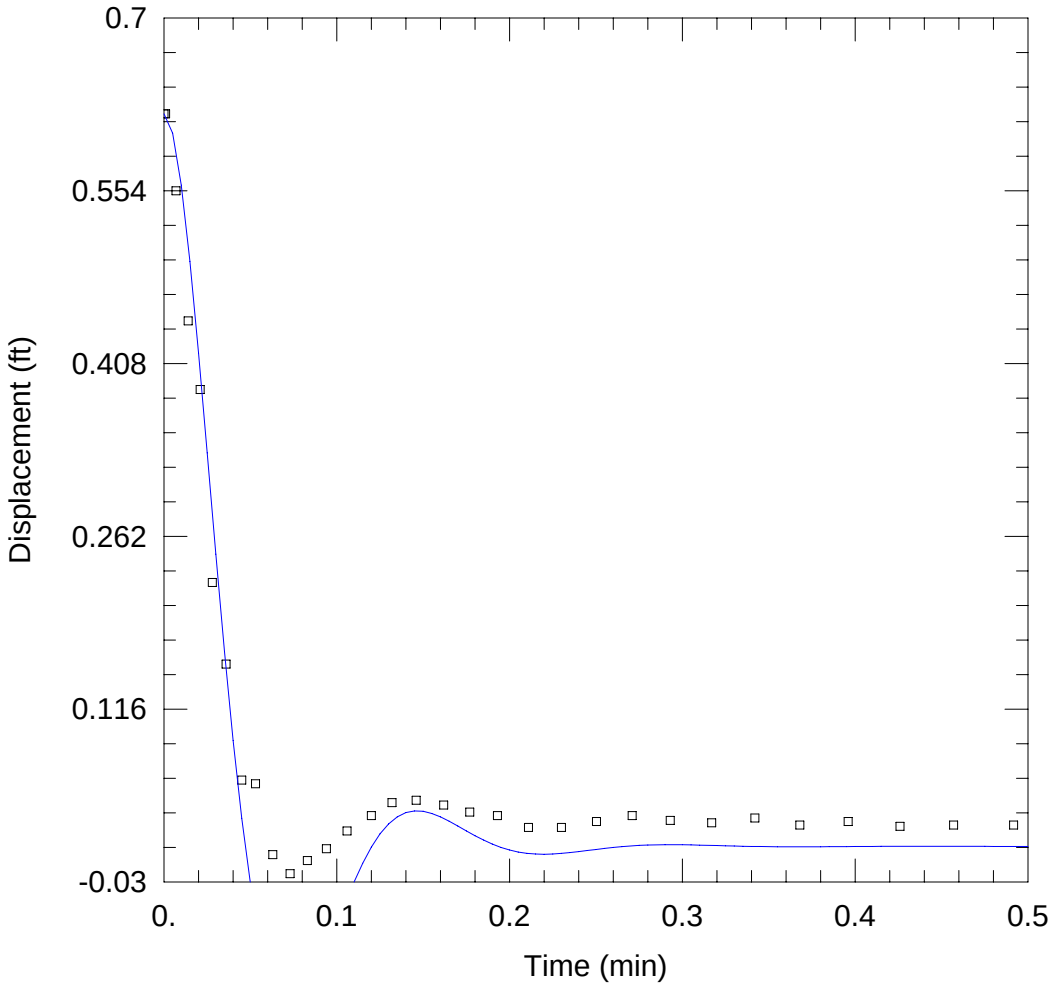
WELL DATA (MWKR2660R01)

Initial Displacement: 0.814 ft
Total Well Penetration Depth: 33.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 33.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 358.2 ft/day
C(D) = 0.3515

US EPA ARCHIVE DOCUMENT



MWKR2700R01 FALLING HEAD 2

Data Set: \...\MWKR2700R01Falling02_2010-10-19_17-10-53-515.aqt
Date: 10/26/10 Time: 20:10:01

PROJECT INFORMATION

Company: AECOM
Location: Target Area 5
Test Well: MWKR2700R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

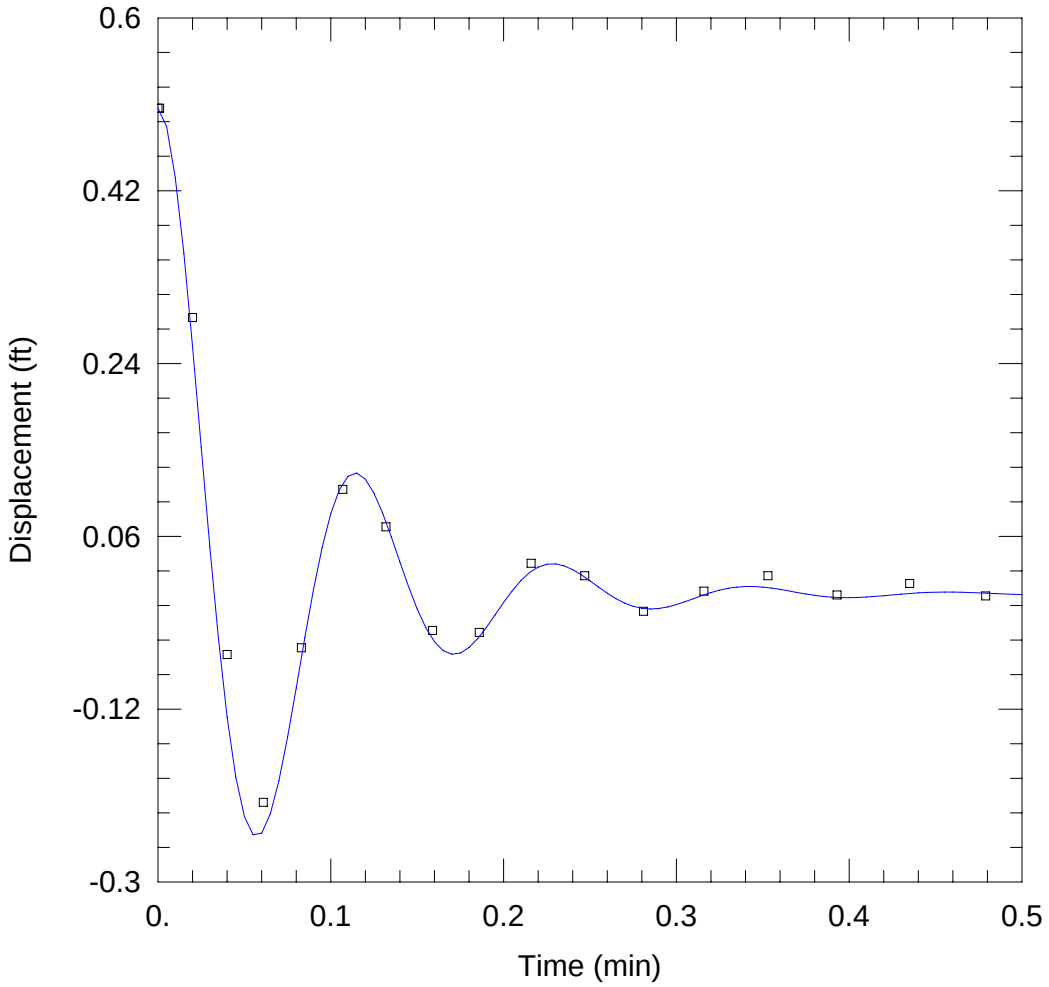
WELL DATA (MWKR2660R01)

Initial Displacement: 0.619 ft
Total Well Penetration Depth: 33.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 33.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 227.7 ft/day
C(D) = 0.4338

US EPA ARCHIVE DOCUMENT



MWKR2700R01 RISING HEAD 1

Data Set: \...\MWKR2700R01Rising01_2010-10-19_17-04-39-468.aqt
Date: 10/26/10 Time: 20:11:19

PROJECT INFORMATION

Company: AECOM
Location: Target Area 5
Test Well: MWKR2700R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

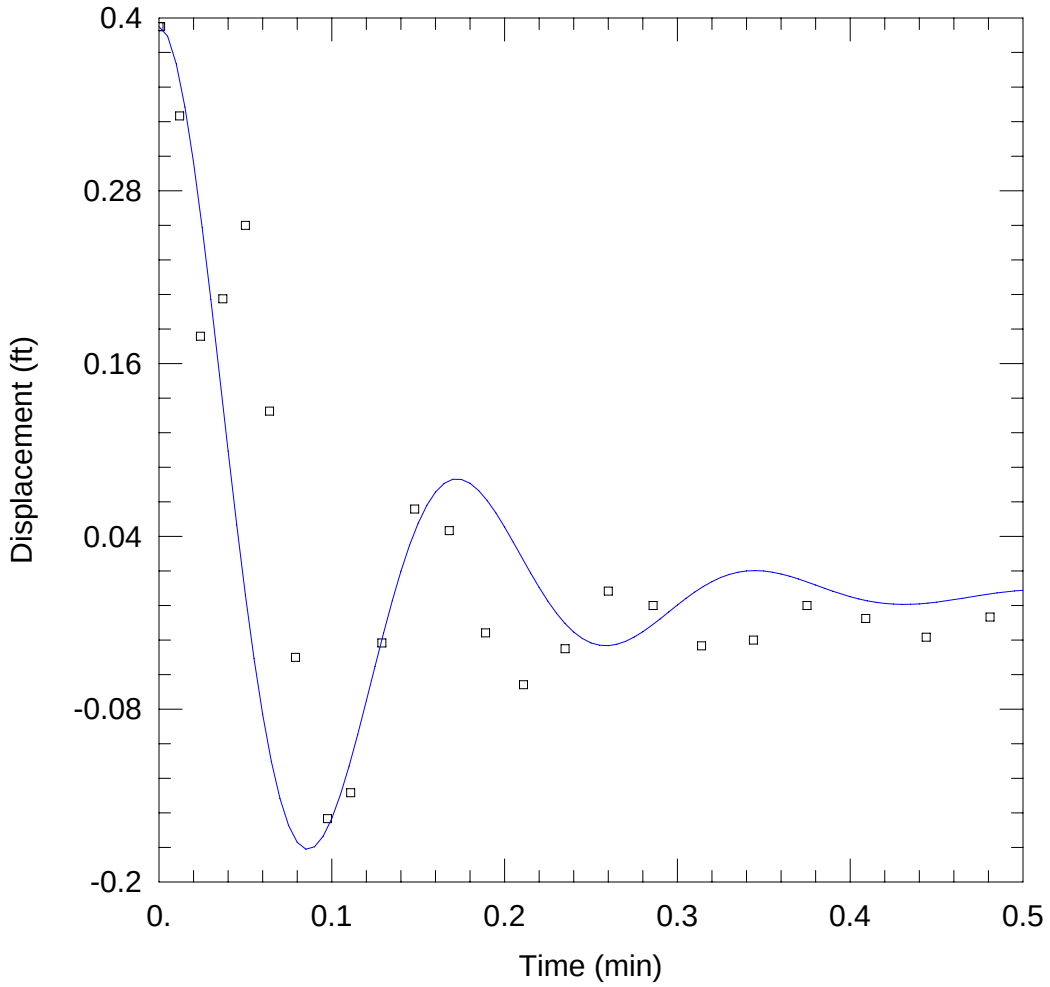
WELL DATA (MWKR2660R01)

Initial Displacement: 0.506 ft
Total Well Penetration Depth: 33.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 33.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 541.7 ft/day
C(D) = 0.2159

US EPA ARCHIVE DOCUMENT



MWKR2700R01 RISING HEAD 2

Data Set: \...\MWKR2700R01Rising02_2010-10-19_17-20-42-937.aqt
Date: 10/26/10 Time: 20:12:40

PROJECT INFORMATION

Company: AECOM
Location: Target Area 5
Test Well: MWKR2700R01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

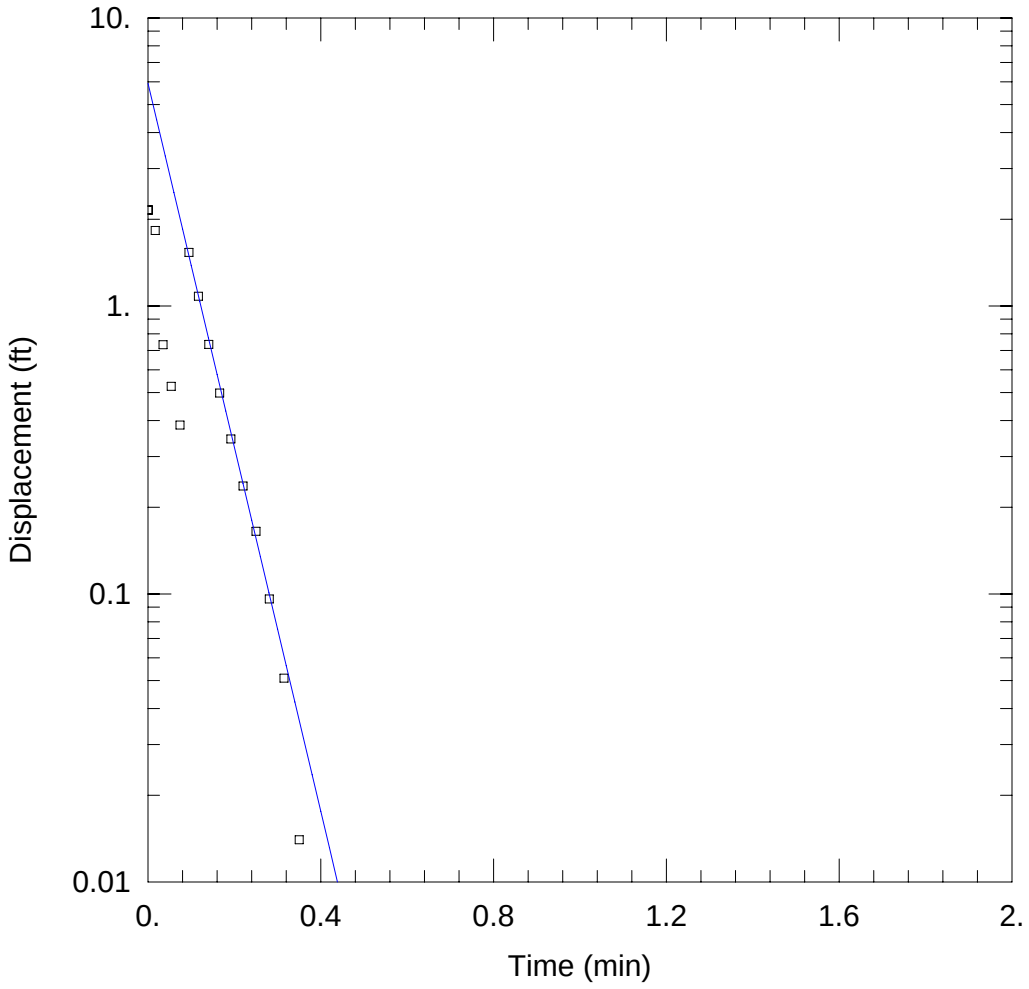
WELL DATA (MWKR2660R01)

Initial Displacement: 0.394 ft
Total Well Penetration Depth: 33.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 33.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler
K = 316.8 ft/day
C(D) = 0.2461

US EPA ARCHIVE DOCUMENT



MWKR2700R02 RISING HEAD 1

Data Set: \...\MWKR2700R02Rising01_2010-10-19_17-37-52-500.aqt
Date: 10/26/10 Time: 20:14:05

PROJECT INFORMATION

Company: AECOM
Location: Target Area 5
Test Well: MWKR2700R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

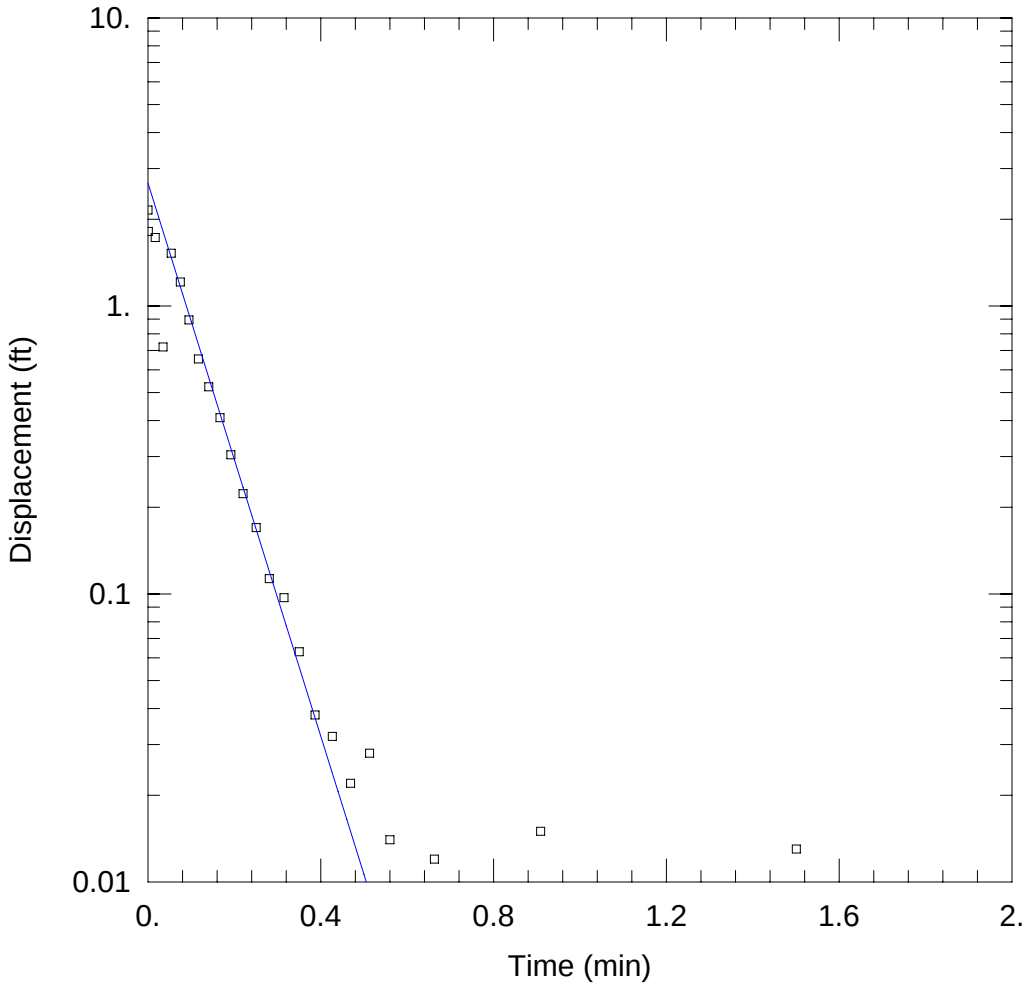
WELL DATA (MWKR2660R02)

Initial Displacement: 2.152 ft
Total Well Penetration Depth: 8.61 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.61 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 23.2 ft/day
y0 = 5.927 ft

US EPA ARCHIVE DOCUMENT



MWKR2700R02 RISING HEAD 2

Data Set: \...\MWKR2700R02Rising02__2010-10-19_17-48-59-031.aqt
Date: 10/26/10 Time: 20:16:21

PROJECT INFORMATION

Company: AECOM
Location: Target Area 5
Test Well: MWKR2700R02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 0.1

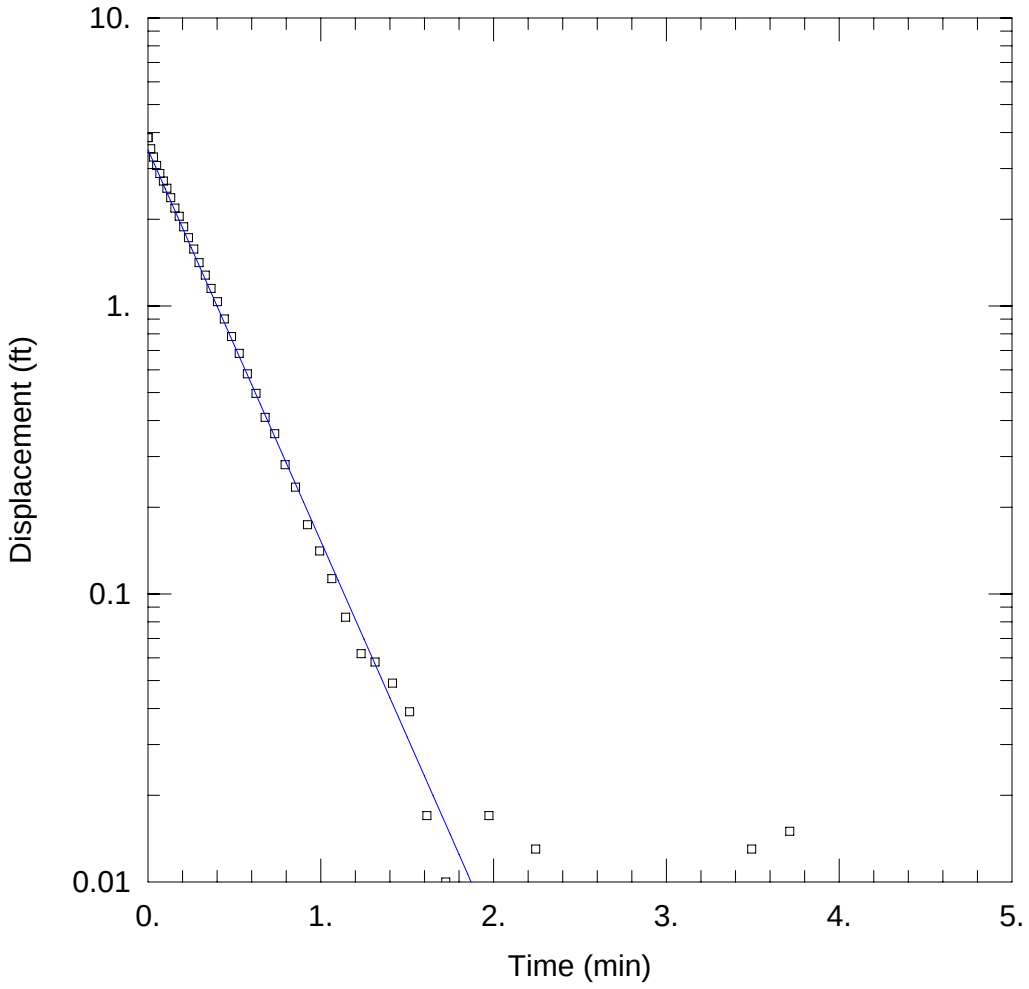
WELL DATA (MWKR2660R02)

Initial Displacement: 2.152 ft
Total Well Penetration Depth: 8.61 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.61 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 17.63 ft/day
Solution Method: Bouwer-Rice
y0 = 2.668 ft

US EPA ARCHIVE DOCUMENT



MWKR3450L03 RISING HEAD 1

Data Set: \...\MWKR3450L03Rising01_2010-10-20_10-32-00-031.aqt
Date: 10/26/10 Time: 20:19:19

PROJECT INFORMATION

Company: AECOM
Location: Target Area 6
Test Well: MWKR3450L03
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

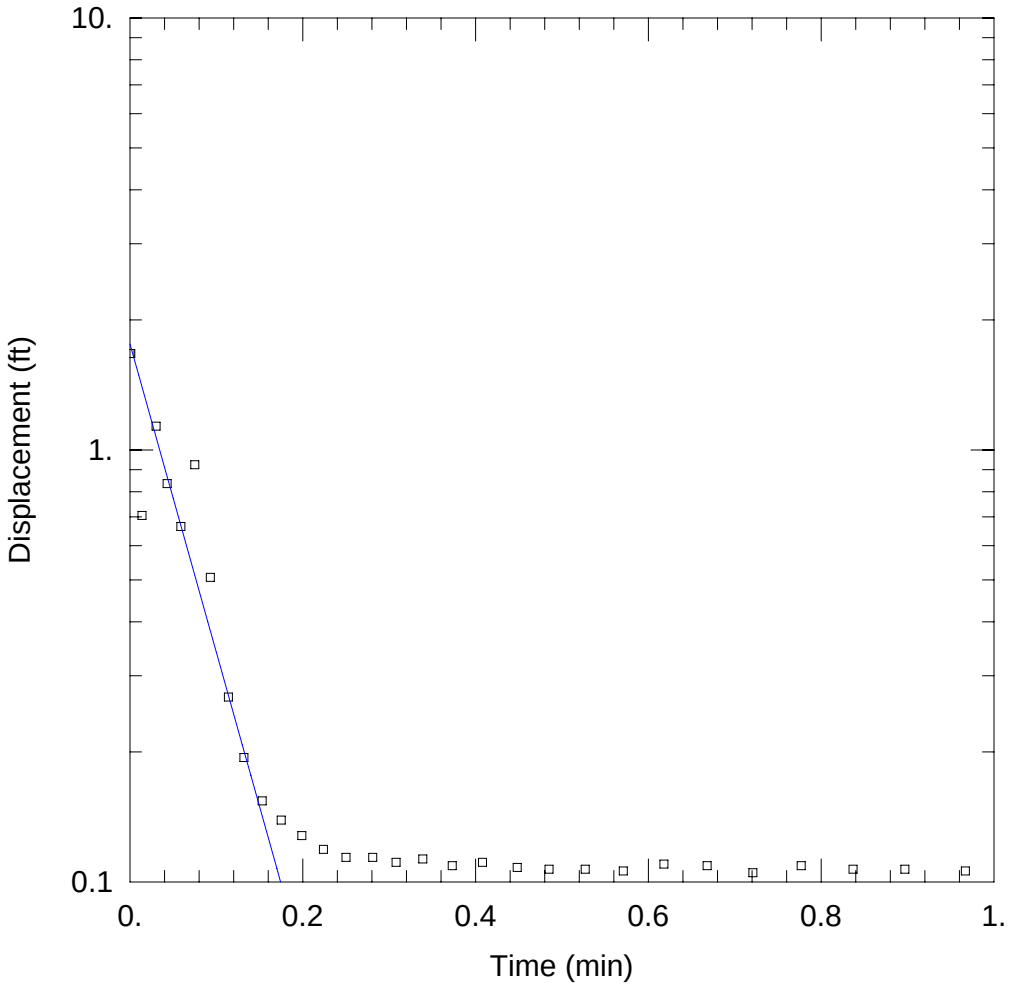
WELL DATA (MWKR3450L03)

Initial Displacement: 3.84 ft
Total Well Penetration Depth: 73.76 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 73.76 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 12.32 ft/day
Solution Method: Bouwer-Rice
y0 = 3.487 ft

US EPA ARCHIVE DOCUMENT



MWKR3450L04 RISING HEAD 1

Data Set: \...\MWKR3450L04Rising01_2010-10-20_09-28-35-546.aqt
Date: 10/26/10 Time: 20:21:49

PROJECT INFORMATION

Company: AECOM
Location: Target Area 6
Test Well: MWKR3450L04
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

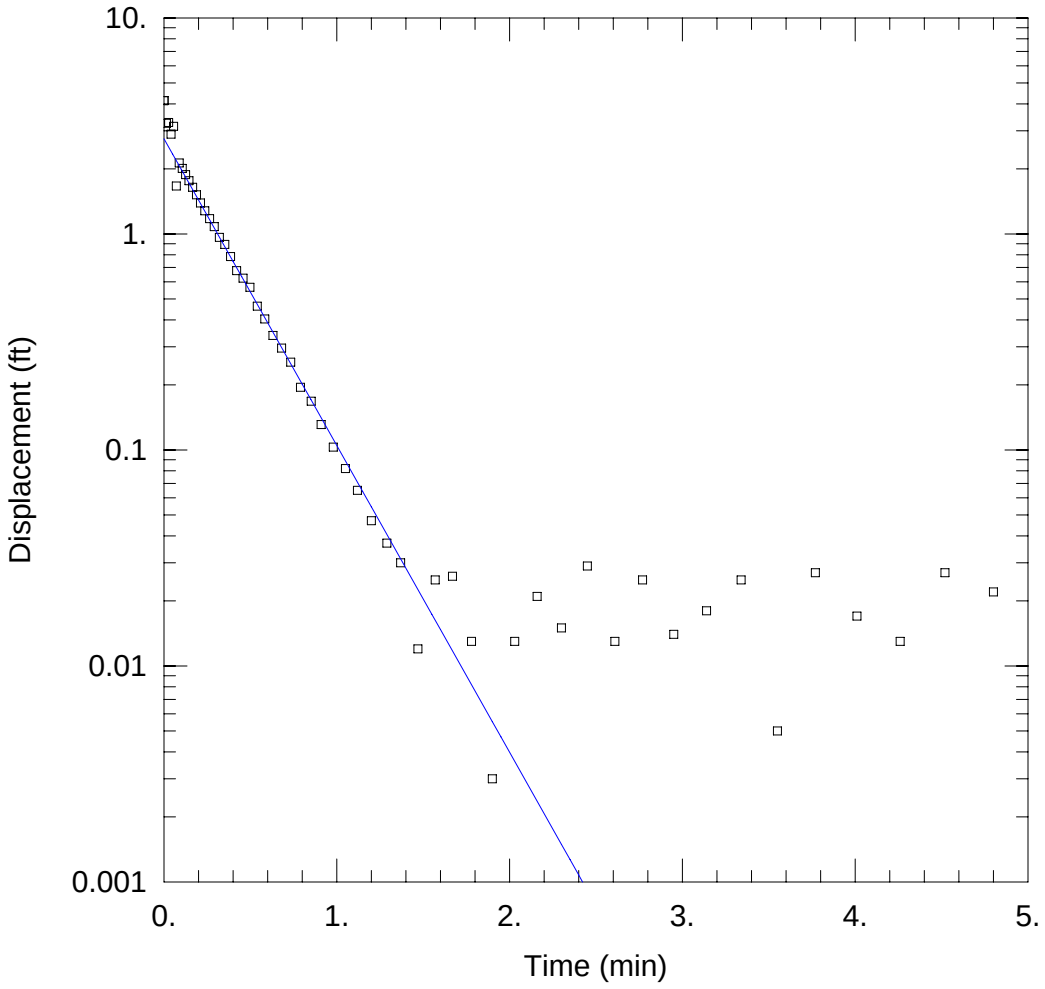
WELL DATA (MWKR3450L04)

Initial Displacement: 1.671 ft
Total Well Penetration Depth: 8.76 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 8.76 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 26.28 ft/day
y0 = 1.758 ft

US EPA ARCHIVE DOCUMENT



MWKR3450L03 FALLING HEAD 1

Data Set: \...\MWKR3450R03Falling01_2010-10-20_10-14-21-921.aqt
Date: 10/26/10 Time: 20:23:51

PROJECT INFORMATION

Company: AECOM
Location: Target Area 6
Test Well: MWKR3450L03
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 80. ft
Anisotropy Ratio (Kz/Kr): 0.1

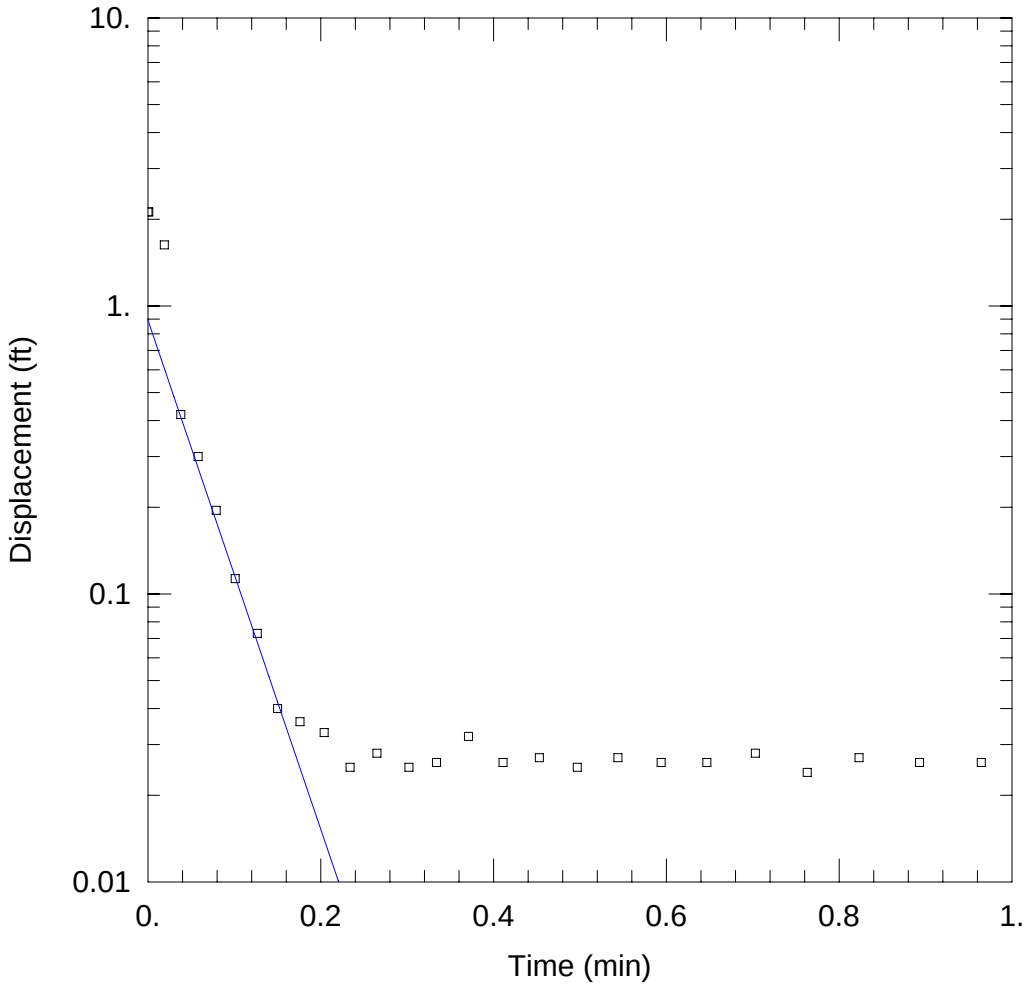
WELL DATA (MWKR3450L03)

Initial Displacement: 4.14 ft
Total Well Penetration Depth: 73.76 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 73.76 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 12.87 ft/day
Solution Method: Bouwer-Rice
y0 = 2.758 ft

US EPA ARCHIVE DOCUMENT



MWKR3620L01 FALLING HEAD 1

Data Set: \...\MWKR3620L01Falling01_2010-10-20_11-06-58-984.aqt
Date: 10/26/10 Time: 20:27:01

PROJECT INFORMATION

Company: AECOM
Location: Target Area 7
Test Well: MWKR3620L01
Test Date: 10/19/10

AQUIFER DATA

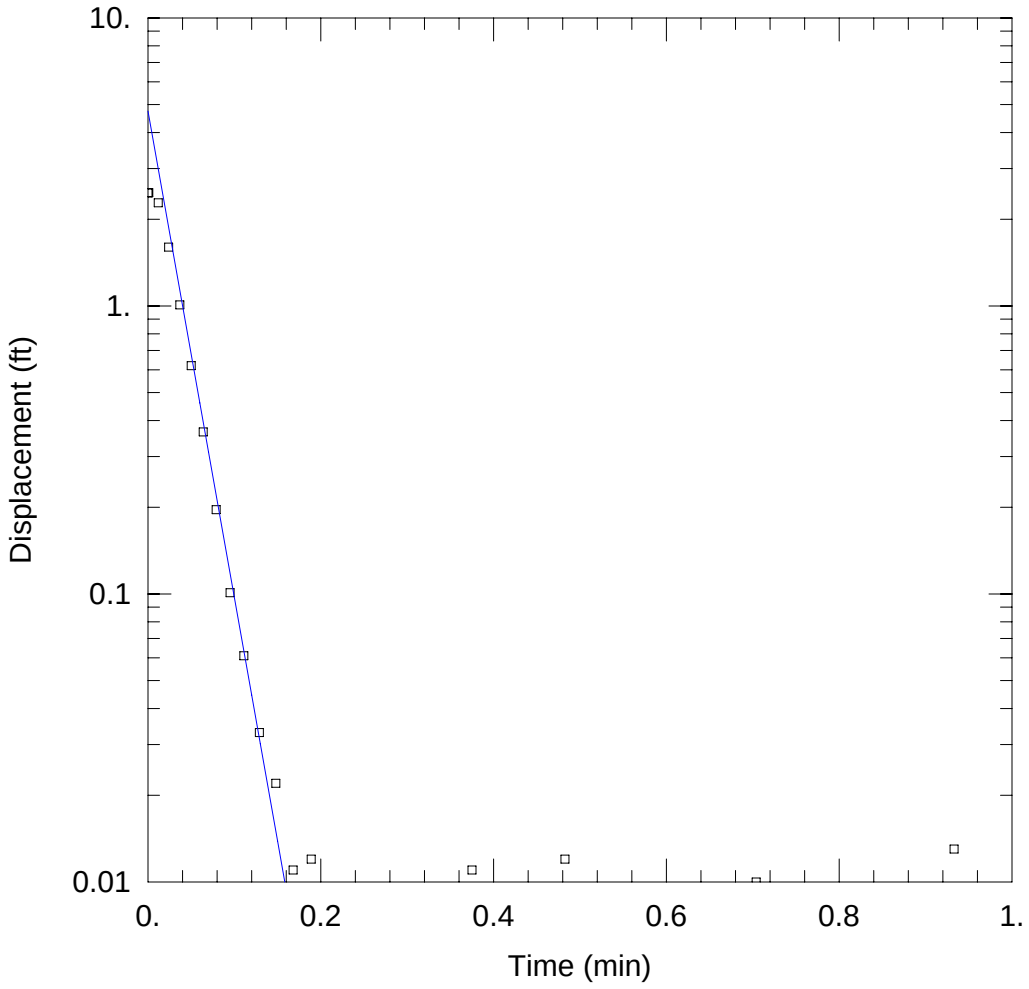
Saturated Thickness: 46. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR3620L01)

Initial Displacement: 2.12 ft
Total Well Penetration Depth: 28.75 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 28.75 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 70.5 ft/day
Solution Method: Bouwer-Rice
y0 = 0.8915 ft



MWKR3620L01 RISING HEAD 1

Data Set: \...\MWKR3620L01Rising01_2010-10-20_11-20-34-343.aqt
Date: 10/26/10 Time: 20:28:17

PROJECT INFORMATION

Company: AECOM
Location: Target Area 7
Test Well: MWKR3620L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 46. ft
Anisotropy Ratio (Kz/Kr): 0.1

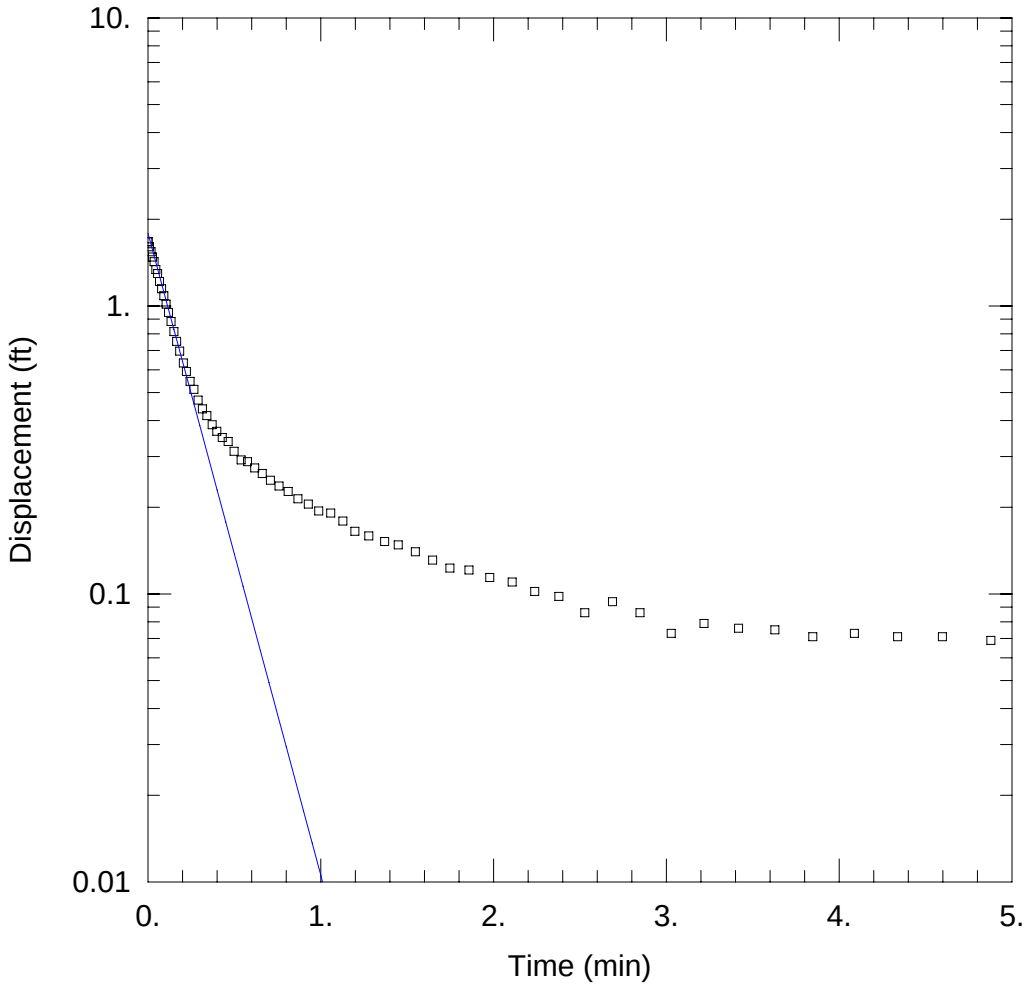
WELL DATA (MWKR3620L01)

Initial Displacement: 2.47 ft
Total Well Penetration Depth: 28.75 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 28.75 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 134.8 ft/day
y0 = 4.749 ft

US EPA ARCHIVE DOCUMENT



MWKR3620L02 RISING HEAD 1

Data Set: \...\MWKR3620L02Rising01_2010-10-20_12-05-47-406.aqt
Date: 10/26/10 Time: 20:30:16

PROJECT INFORMATION

Company: AECOM
Location: Target Area 7
Test Well: MWKR3620L02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 46. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR3620L02)

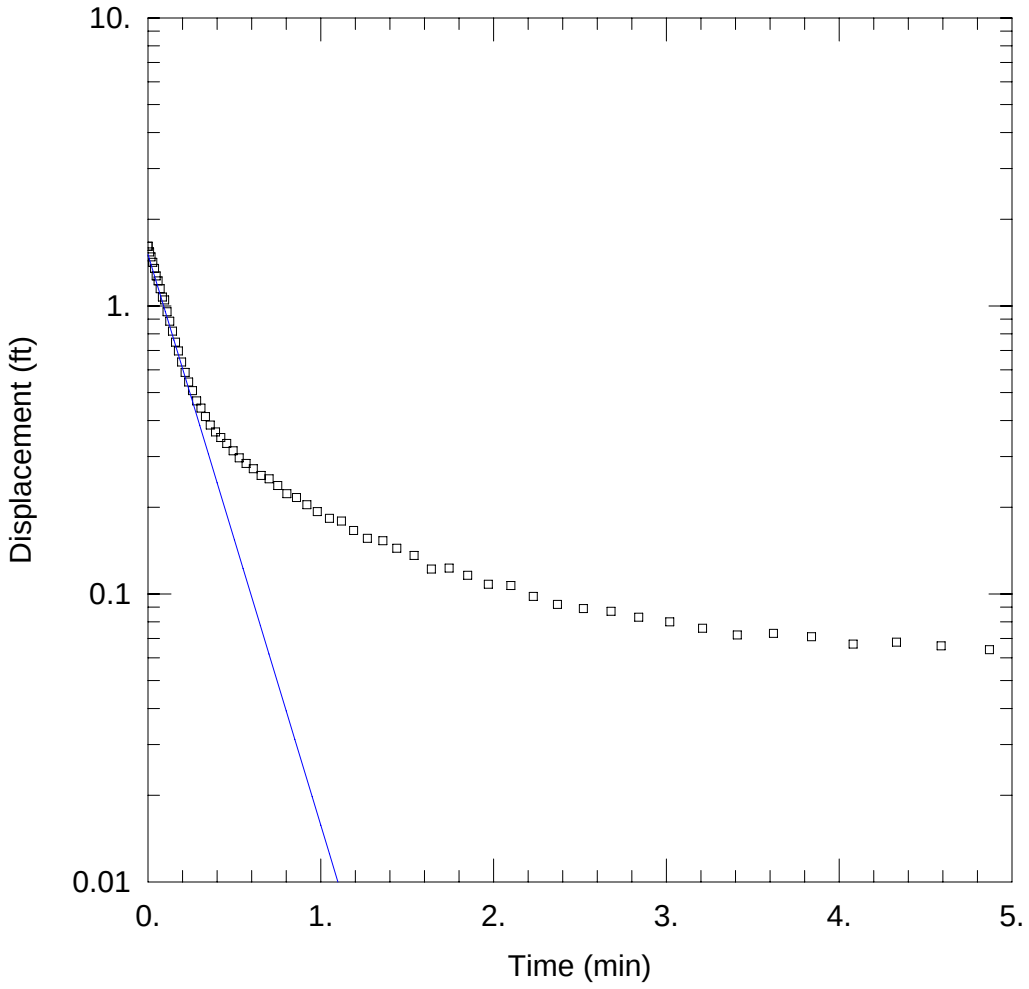
Initial Displacement: 1.67 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 4.7 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 13.62 ft/day
Solution Method: Bouwer-Rice
y0 = 1.789 ft

US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT



MWKR3620L02 RISING HEAD 2

Data Set: \...\MWKR3620L02Rising02_2010-10-20_12-21-47-609.aqt
Date: 10/26/10 Time: 20:31:43

PROJECT INFORMATION

Company: AECOM
Location: Target Area 7
Test Well: MWKR3620L02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 46. ft
Anisotropy Ratio (Kz/Kr): 0.1

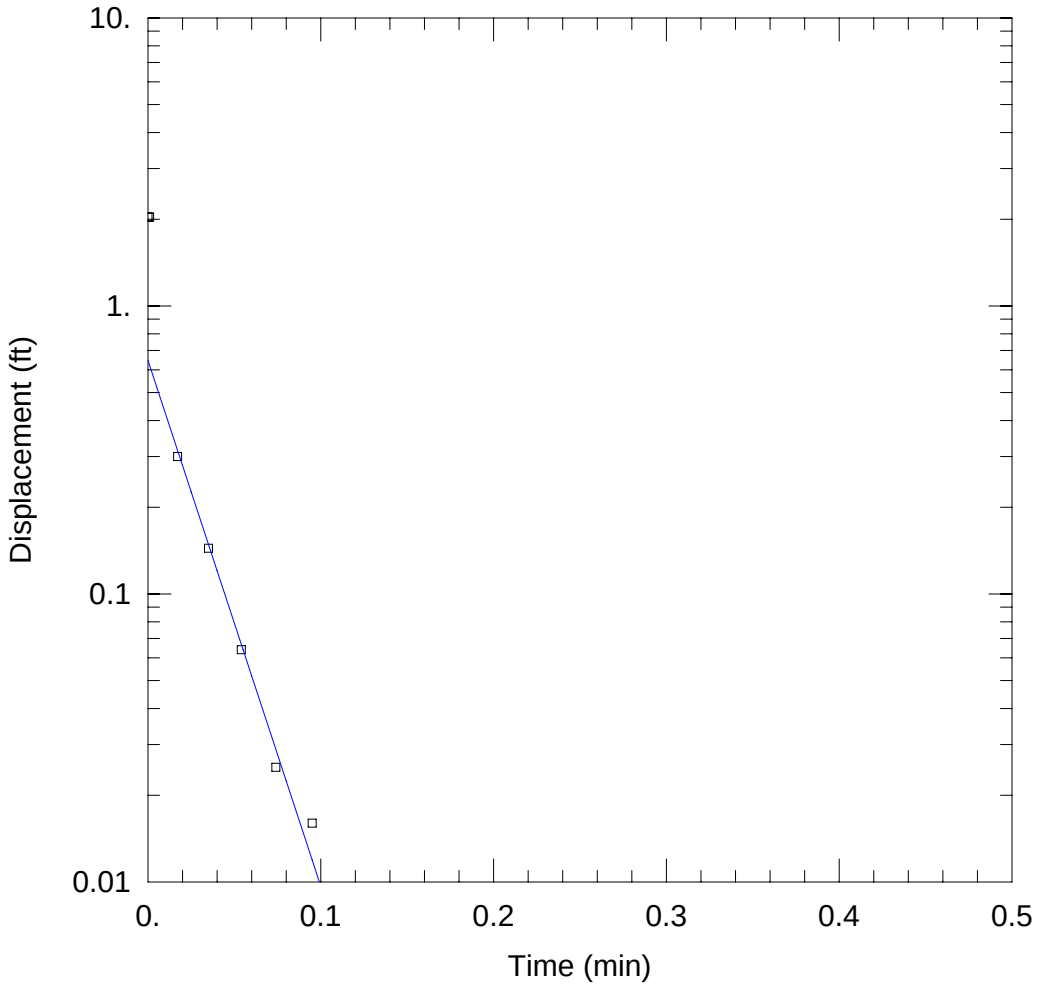
WELL DATA (MWKR3620L02)

Initial Displacement: 1.61 ft
Total Well Penetration Depth: 4.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 4.7 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 12.11 ft/day
y0 = 1.509 ft

US EPA ARCHIVE DOCUMENT



MWKR3680L01 FALLING HEAD 1

Data Set: \...\MWKR3680L01Falling01_2010-10-20_12-51-38-968.aqt
Date: 10/26/10 Time: 20:33:42

PROJECT INFORMATION

Company: AECOM
Location: Target Area 8
Test Well: MWKR3680L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 88. ft
Anisotropy Ratio (Kz/Kr): 0.1

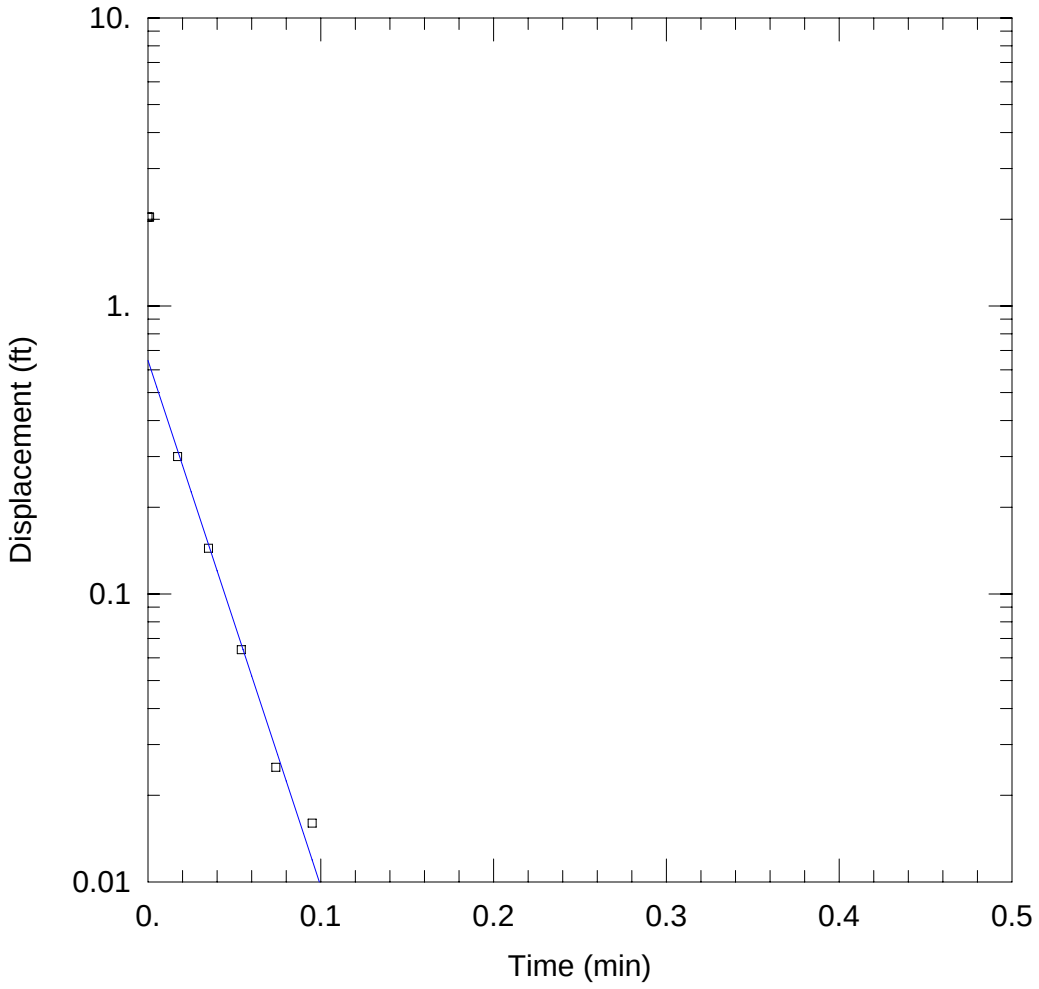
WELL DATA (MWKR3680L01)

Initial Displacement: 2.034 ft
Total Well Penetration Depth: 29.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 29.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 143.4 ft/day
Solution Method: Bouwer-Rice
y0 = 0.6467 ft

US EPA ARCHIVE DOCUMENT



MWKR3680L01 FALLING HEAD 1

Data Set: \...\MWKR3680L01Falling01_2010-10-20_12-51-38-968.aqt
Date: 10/26/10 Time: 20:39:26

PROJECT INFORMATION

Company: AECOM
Location: Target Area 8
Test Well: MWKR3680L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 88. ft
Anisotropy Ratio (Kz/Kr): 0.1

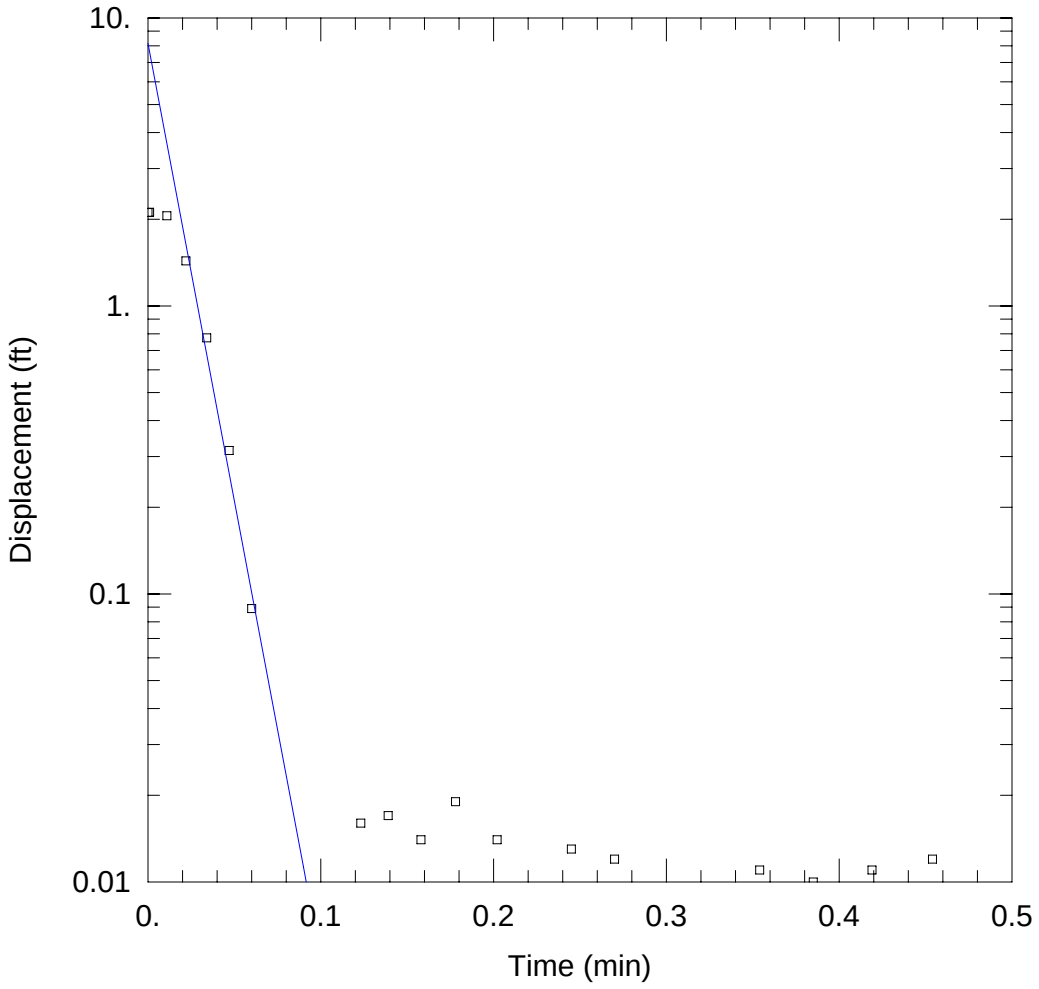
WELL DATA (MWKR3680L01)

Initial Displacement: 2.034 ft
Total Well Penetration Depth: 29.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 29.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 143.4 ft/day
Solution Method: Bouwer-Rice
y0 = 0.6467 ft

US EPA ARCHIVE DOCUMENT



MWKR3680L01 RISING HEAD 1

Data Set: \...\MWKR3680L01Rising01_2010-10-20_12-58-39-625.aqt
Date: 10/26/10 Time: 20:40:54

PROJECT INFORMATION

Company: AECOM
Location: Target Area 8
Test Well: MWKR3680L01
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 88. ft
Anisotropy Ratio (Kz/Kr): 0.1

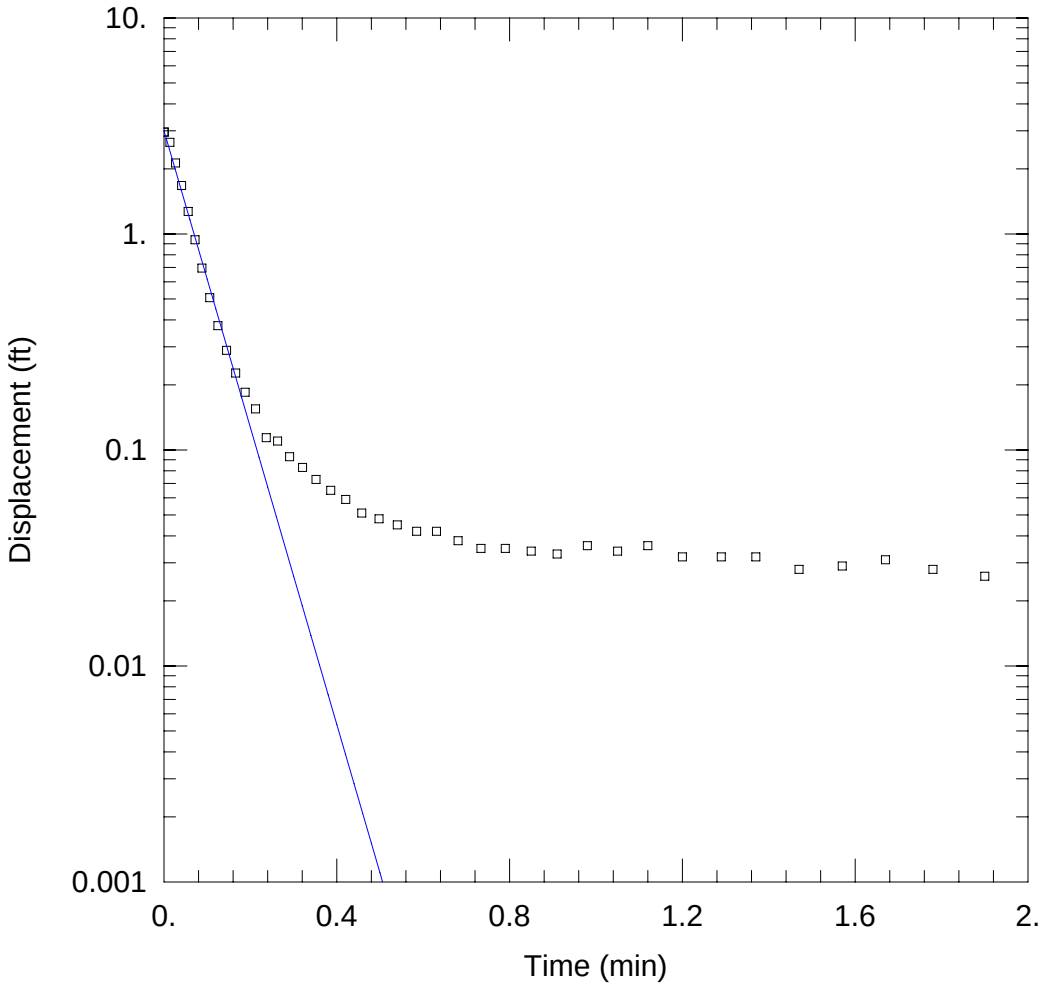
WELL DATA (MWKR3680L01)

Initial Displacement: 2.11 ft
Total Well Penetration Depth: 29.65 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 29.65 ft
Screen Length: 5. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 249.7 ft/day
Solution Method: Bouwer-Rice
y0 = 8.151 ft

US EPA ARCHIVE DOCUMENT



MWKR3680L02 RISING HEAD 1

Data Set: \...\MWKR3680L02Rising01_2010-10-20_13-26-24-328.aqt
Date: 10/26/10 Time: 20:42:15

PROJECT INFORMATION

Company: AECOM
Location: Target Area 8
Test Well: MWKR3680L02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 88. ft
Anisotropy Ratio (Kz/Kr): 0.1

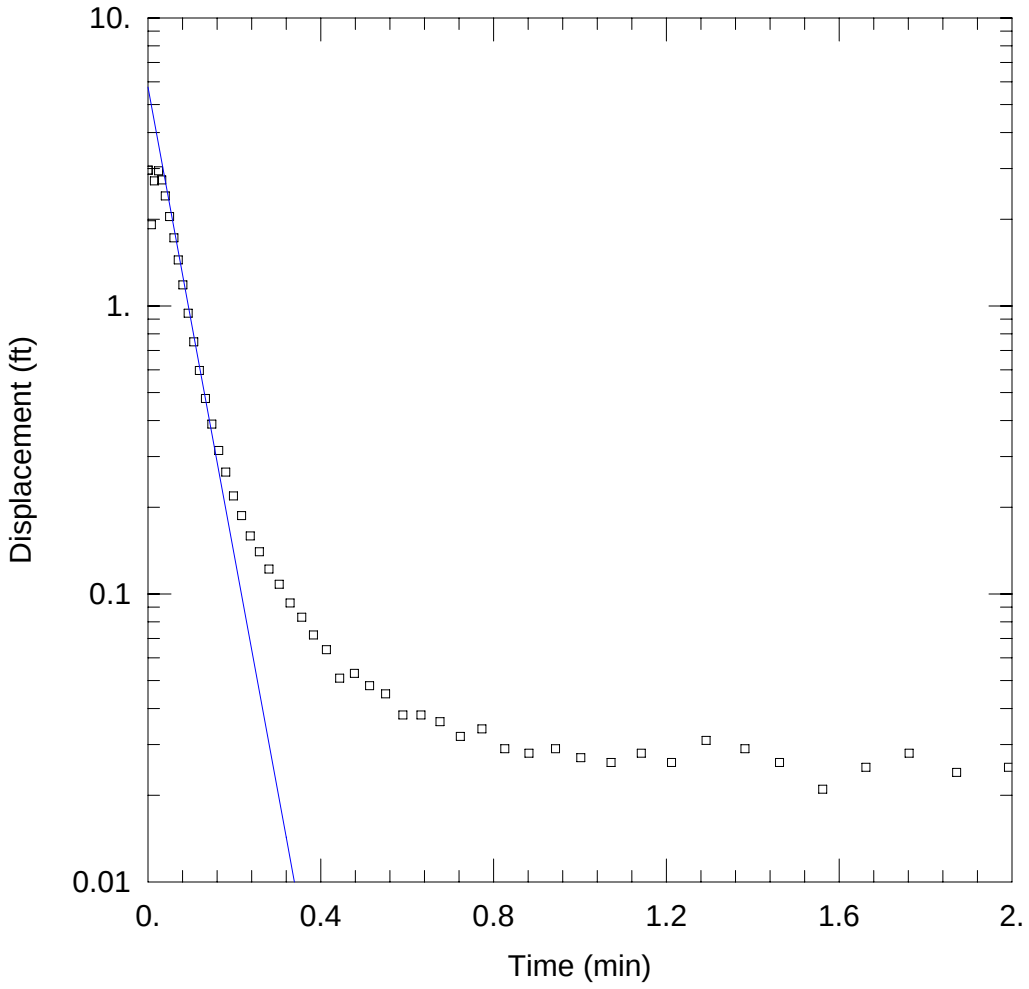
WELL DATA (MWKR3680L02)

Initial Displacement: 2.96 ft
Total Well Penetration Depth: 7.48 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 7.48 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 24.65 ft/day
Solution Method: Bouwer-Rice
y0 = 3.003 ft

US EPA ARCHIVE DOCUMENT



MWKR3680L02 RISING HEAD 2

Data Set: \...\MWKR3680L02Rising02_2010-10-20_13-46-54-156.aqt
Date: 10/26/10 Time: 20:43:28

PROJECT INFORMATION

Company: AECOM
Location: Target Area 8
Test Well: MWKR3680L02
Test Date: 10/19/10

AQUIFER DATA

Saturated Thickness: 88. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MWKR3680L02)

Initial Displacement: 2.96 ft
Total Well Penetration Depth: 7.48 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 7.48 ft
Screen Length: 10. ft
Wellbore Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 29.2 ft/day
y0 = 5.748 ft

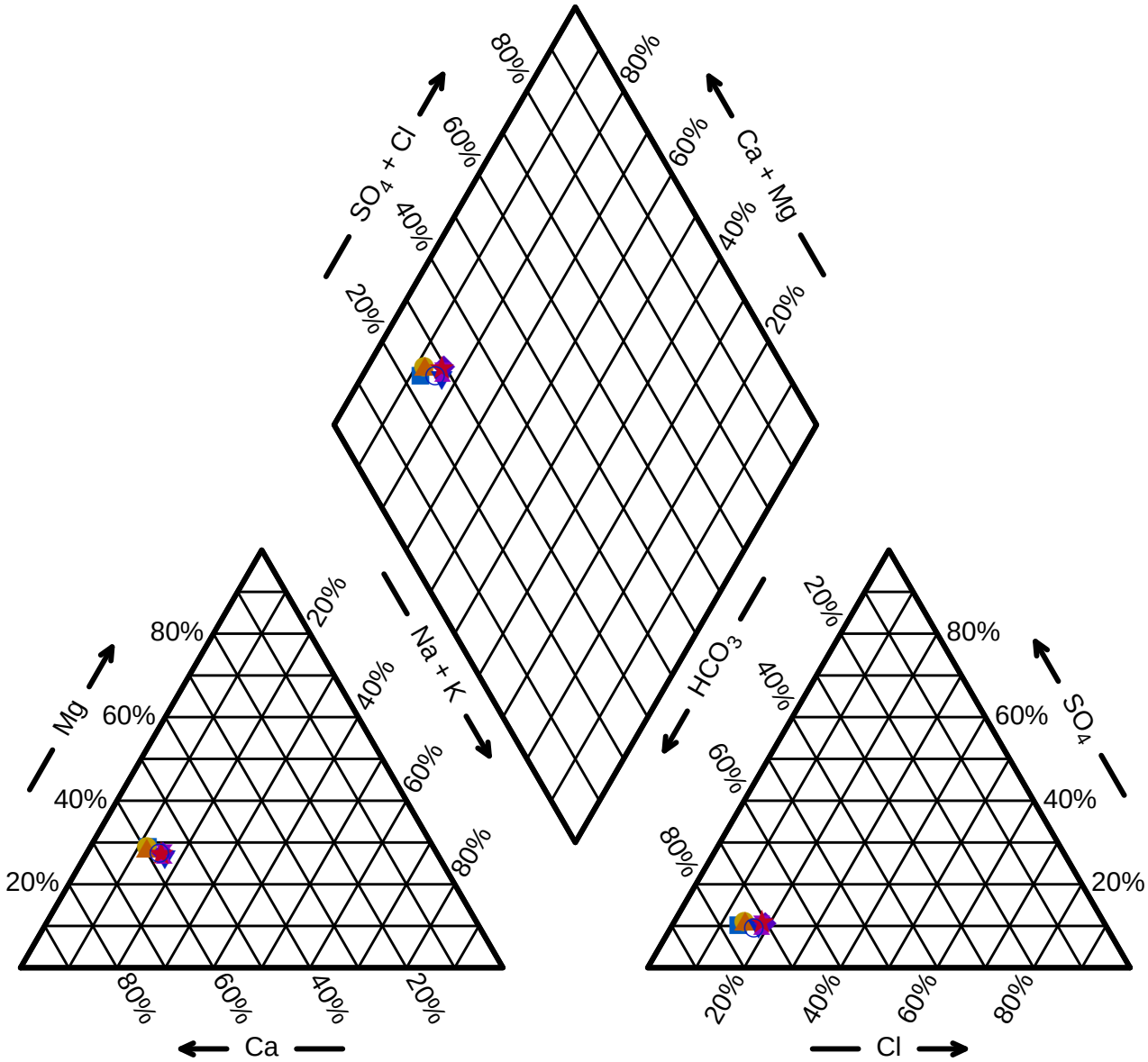
US EPA ARCHIVE DOCUMENT

Appendix H

Stiff and Piper Diagrams

US EPA ARCHIVE DOCUMENT

All Surface Water Samples (8 Areas)

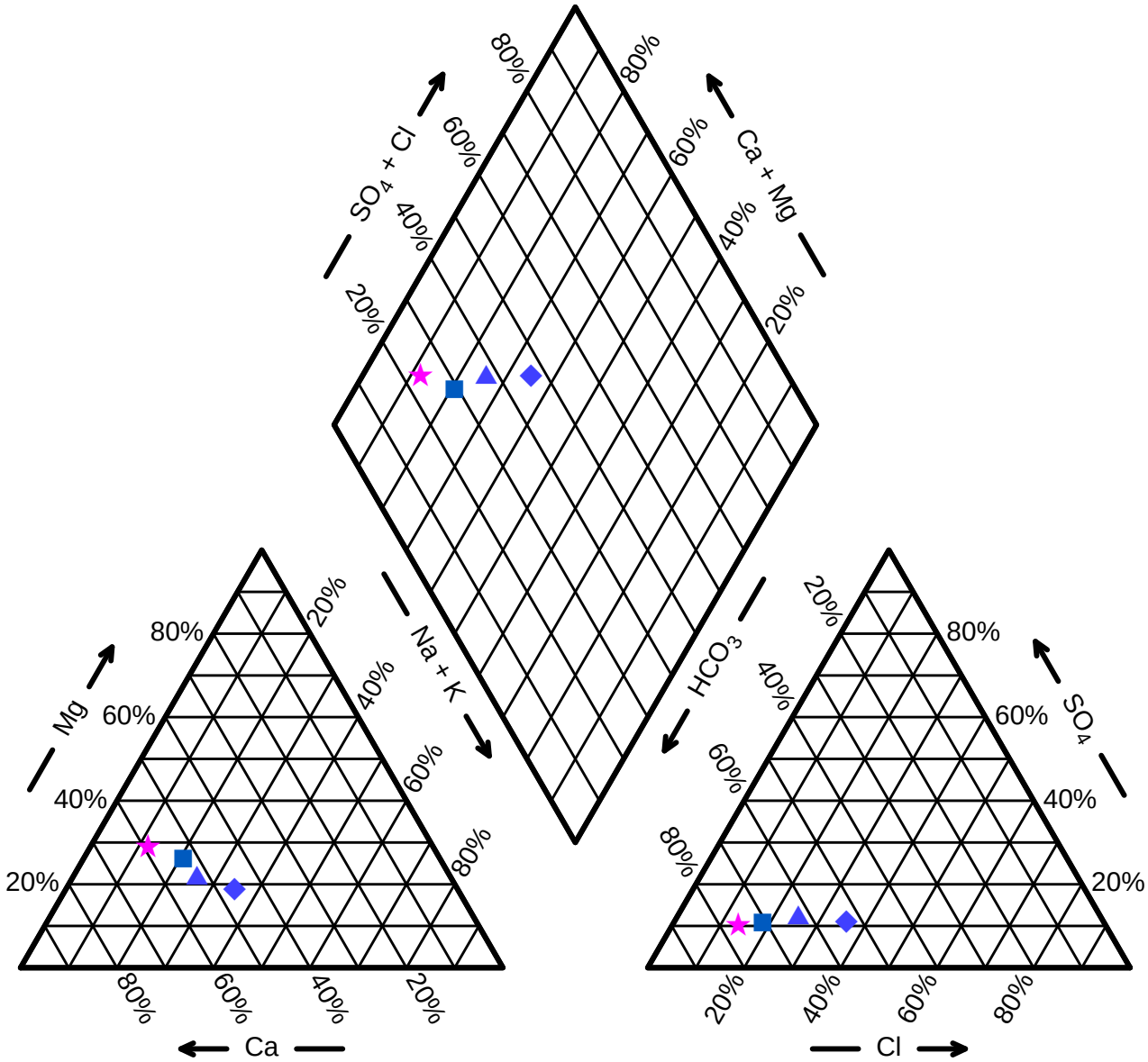


Legend

- A1-SW
- A2-SW
- A3-SW
- A4-SW
- A5-SW
- S6-SW
- A7-SW
- A8-SW

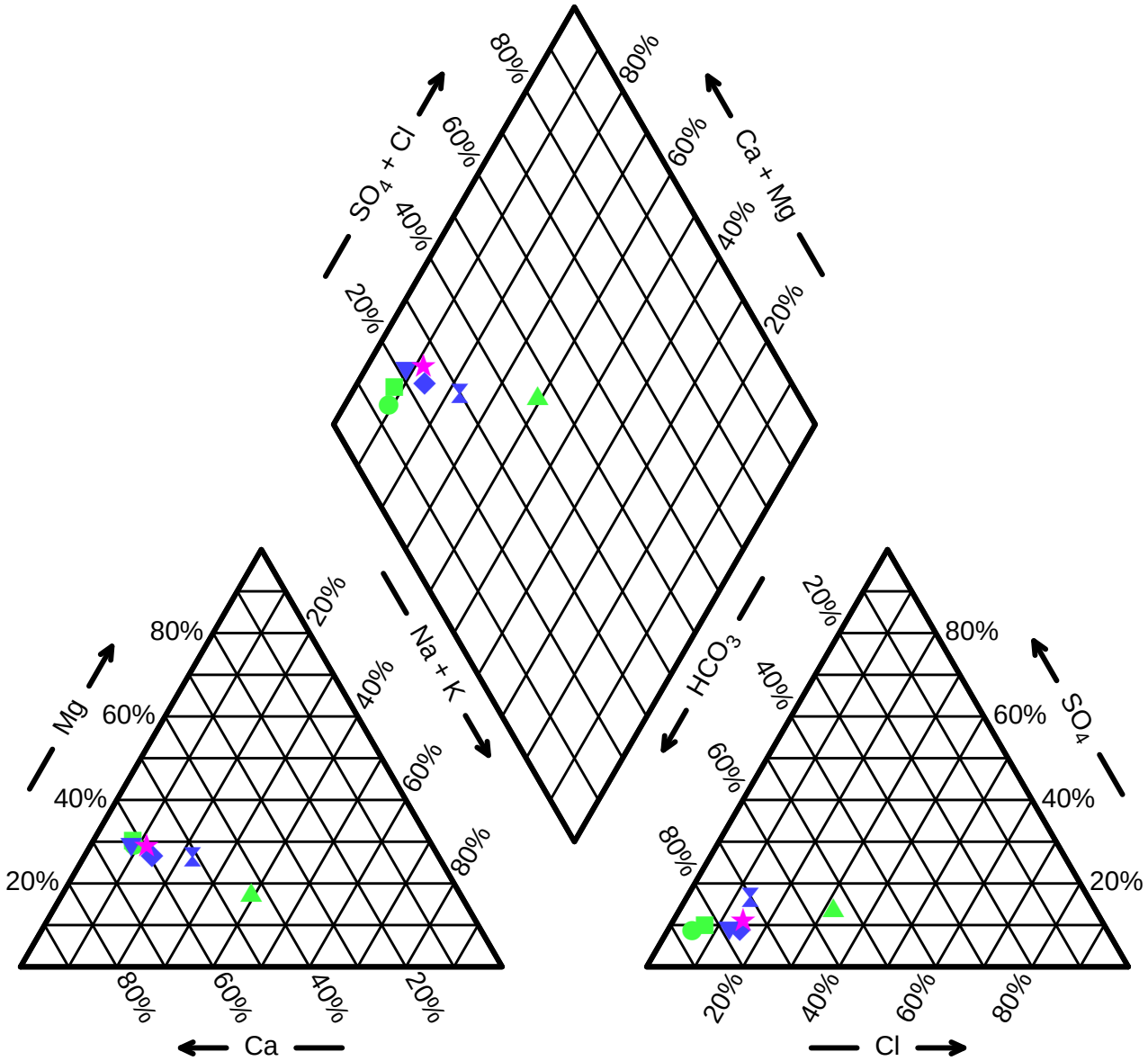
US EPA ARCHIVE DOCUMENT

AREA 1



US EPA ARCHIVE DOCUMENT

AREA 2 PIPER

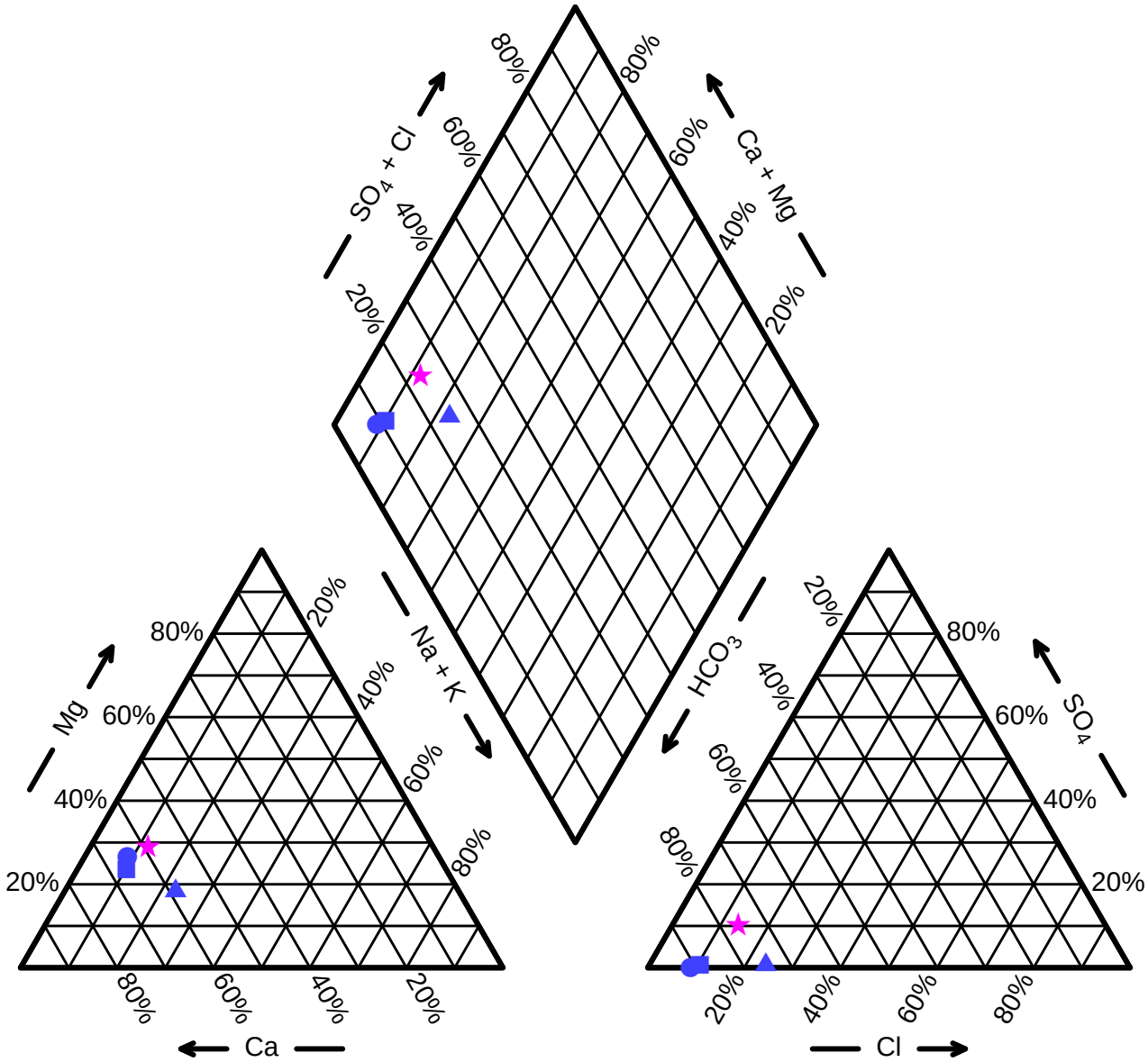


Legend

- 2-MW...R01
- 2-MW...R02
- 2-MW...R03
- 2-MW...L01
- 2-MW...L02
- 2-MW...L03
- 2-SW...R01

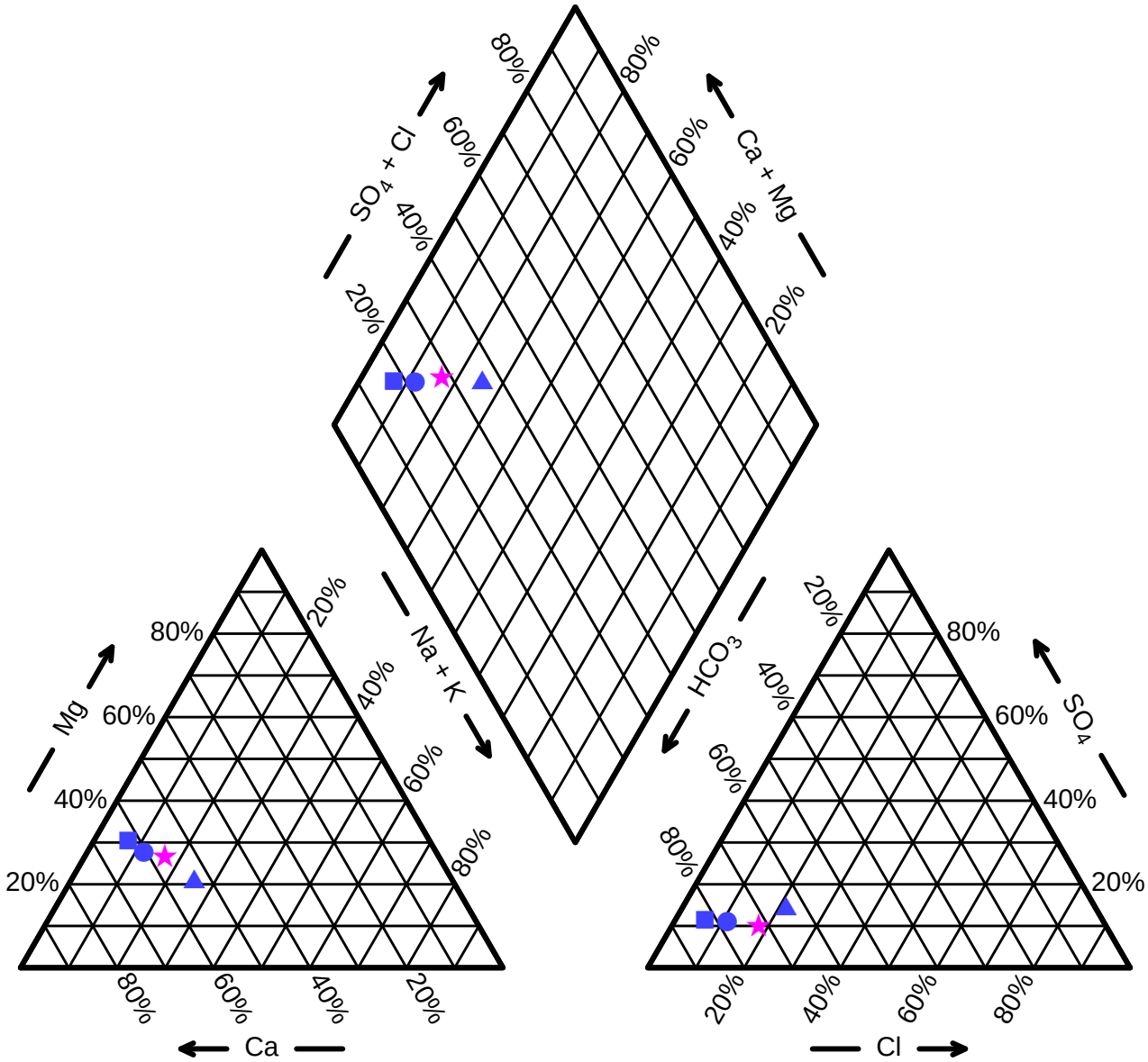
US EPA ARCHIVE DOCUMENT

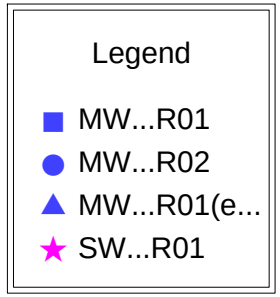
AREA 3



US EPA ARCHIVE DOCUMENT

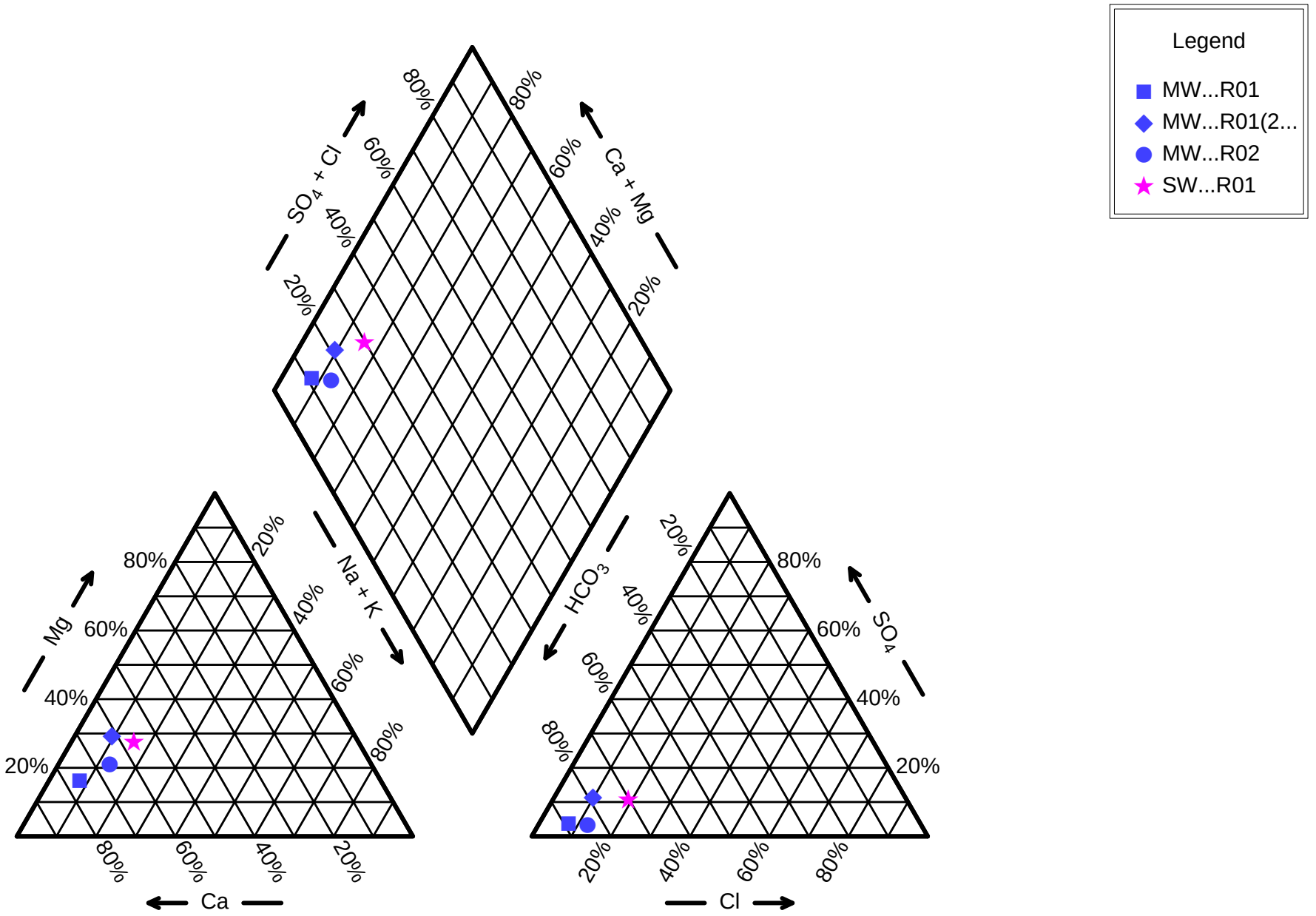
Area 4 Piper





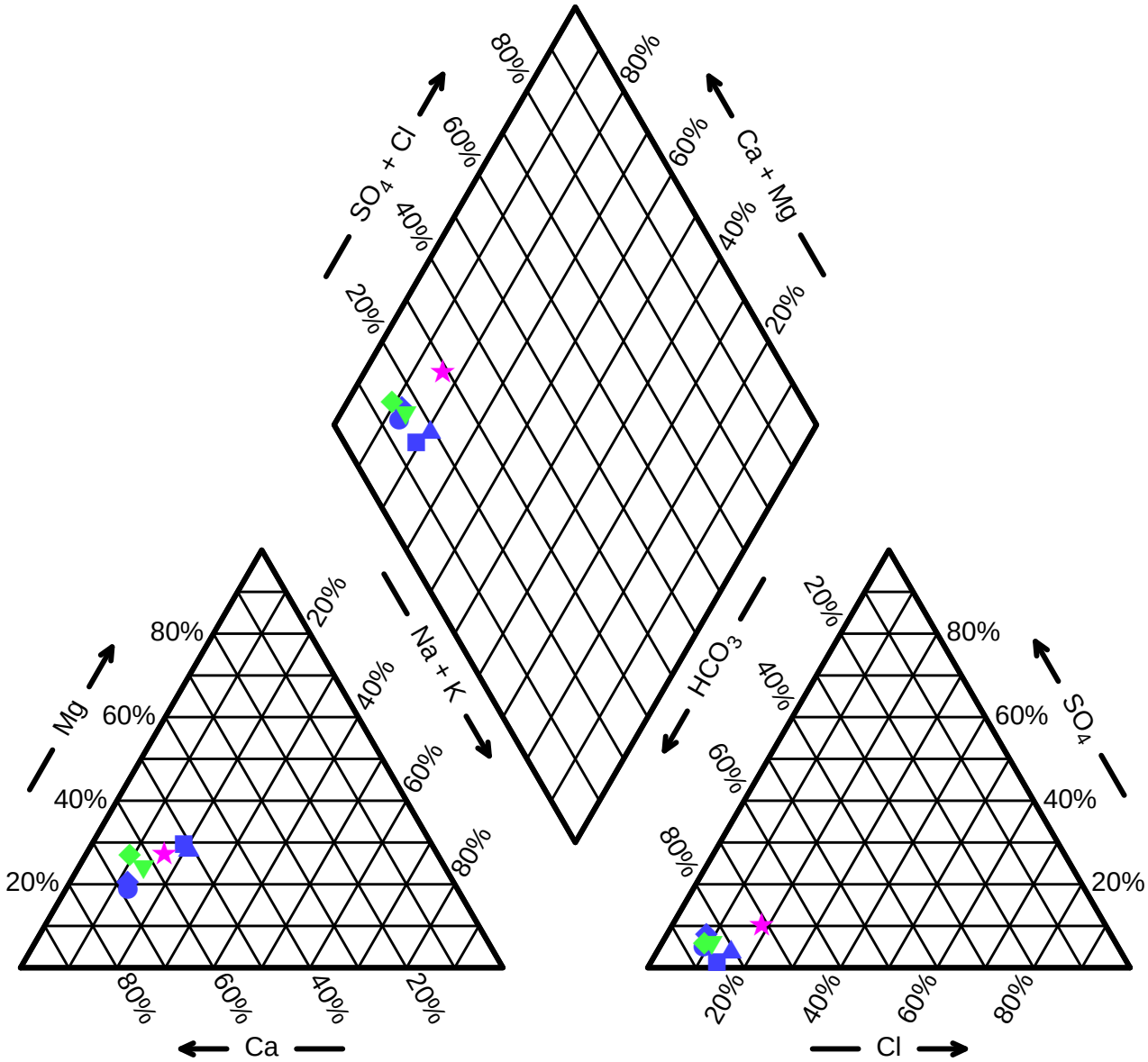
US EPA ARCHIVE DOCUMENT

AREA 5



US EPA ARCHIVE DOCUMENT

Area 6 Piper

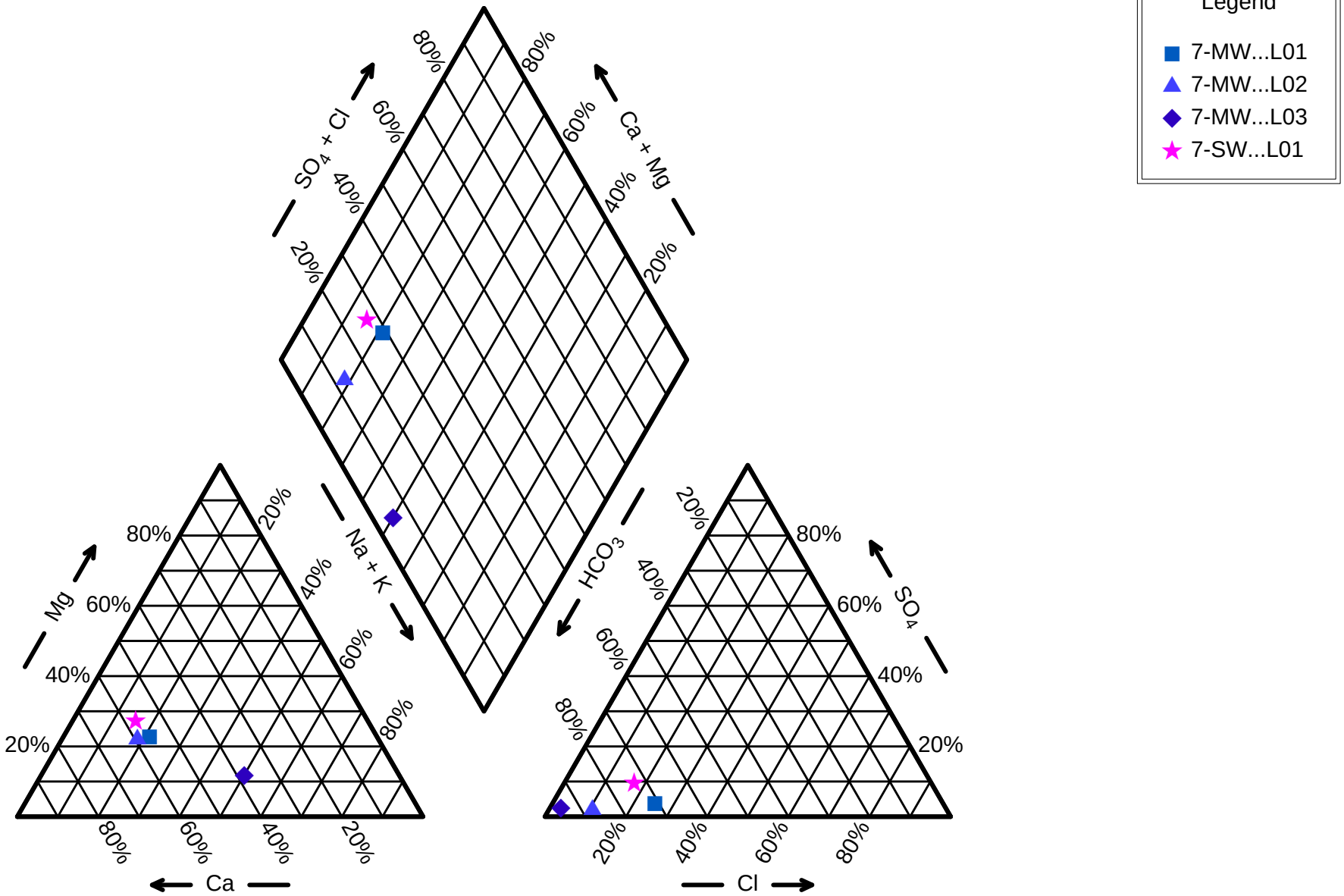


Legend

- MW3450L01
- MW3450L02
- MW3450L03
- MW3450L04
- MW3460L01
- MW3460L02
- SW...L01

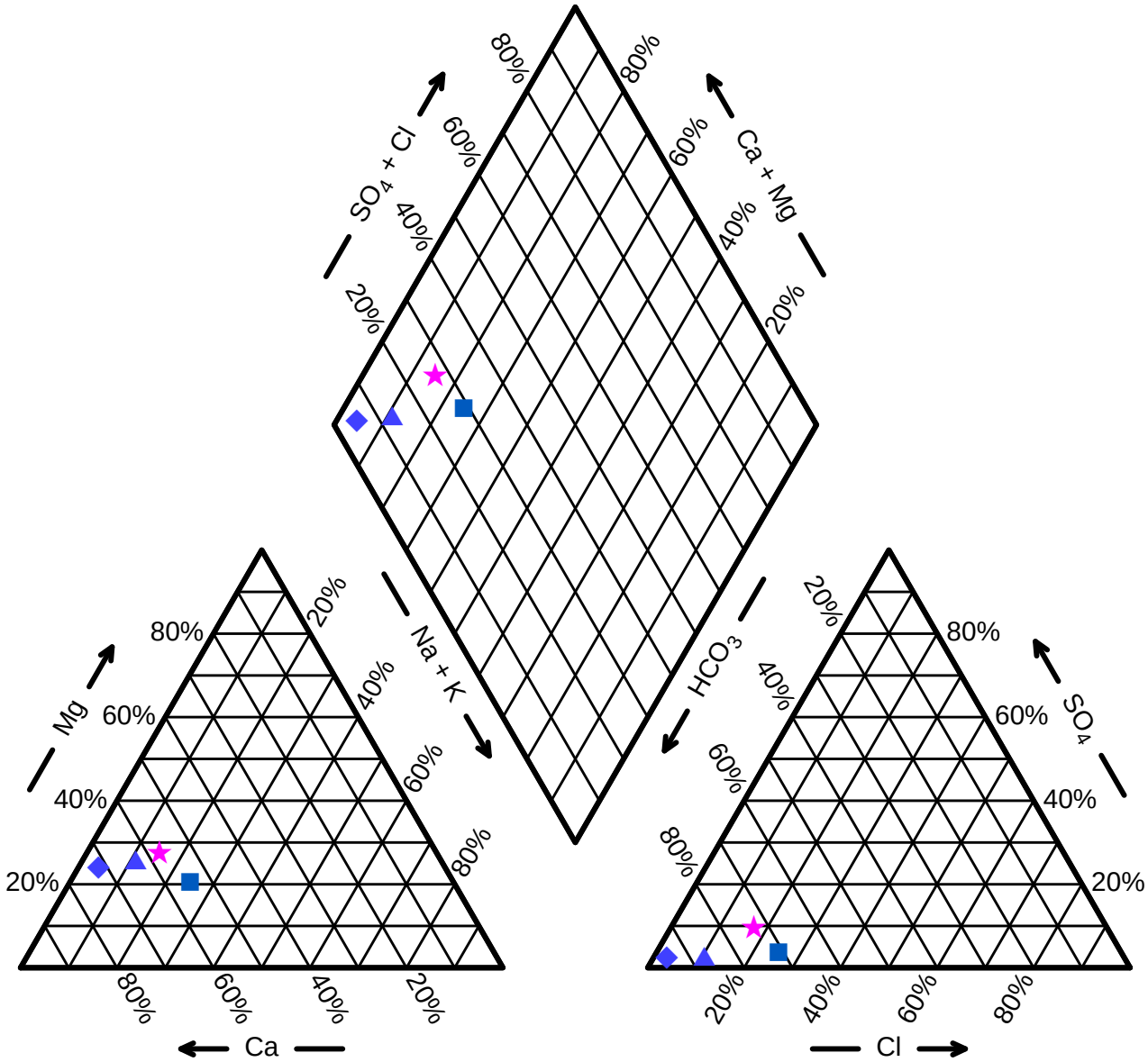
US EPA ARCHIVE DOCUMENT

AREA 7 PIPER



US EPA ARCHIVE DOCUMENT

AREA 8 PIPER

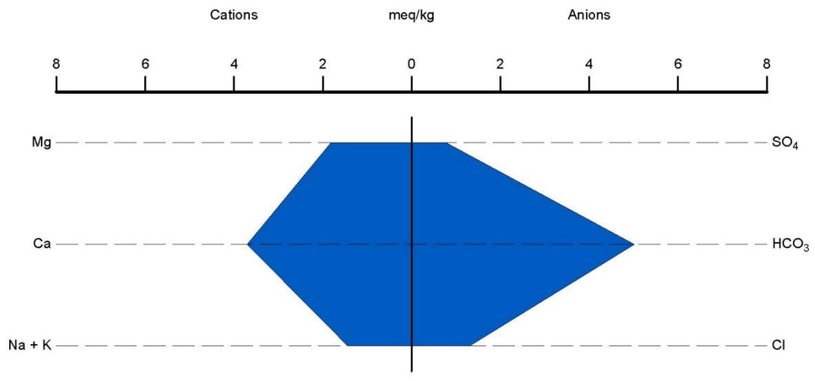


Legend

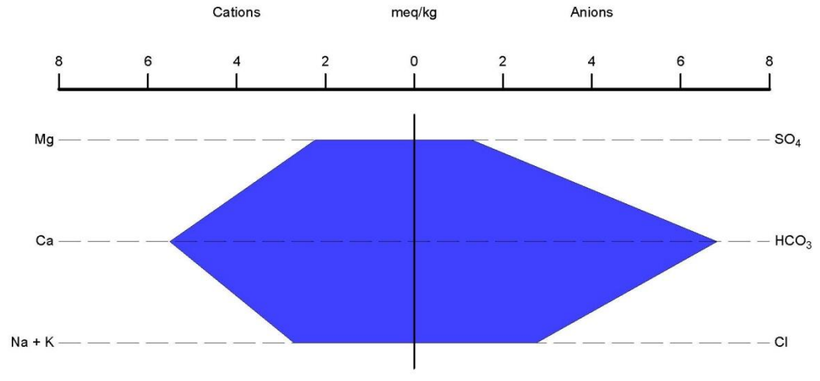
- 8-MW...L01
- 8-MW...L02
- 8-MW...L03
- 8-SW...L01

STIFF DIAGRAMS – AREA 1

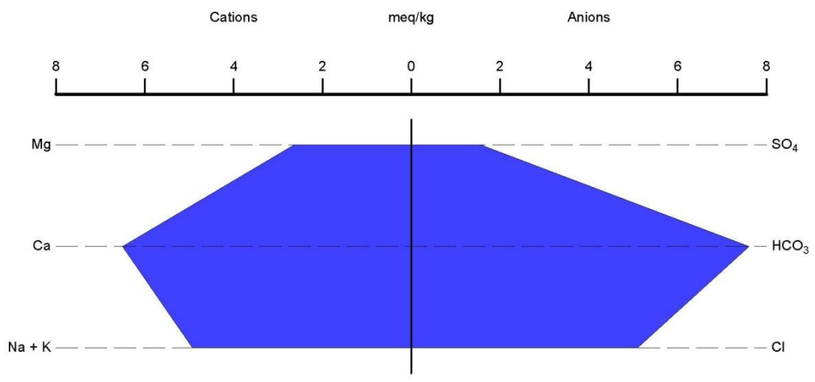
AREA 1 - MW...L01



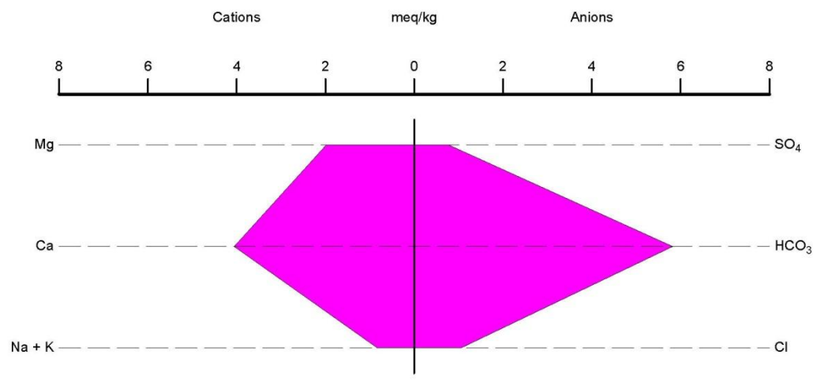
AREA 1 - MW...L02



AREA 1 - MW...L03



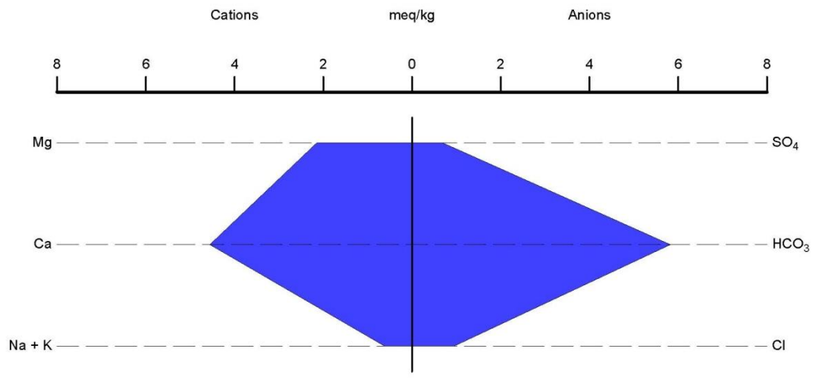
AREA 1 - SW...L01



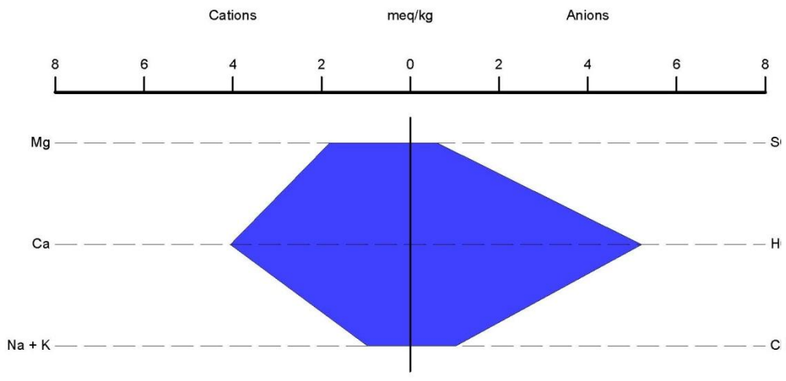
Key
Blue = Groundwater sampled on south side of river
Groundwater from wells screened in glacial material
Magenta = Surface Water

STIFF DIAGRAMS – AREA 2

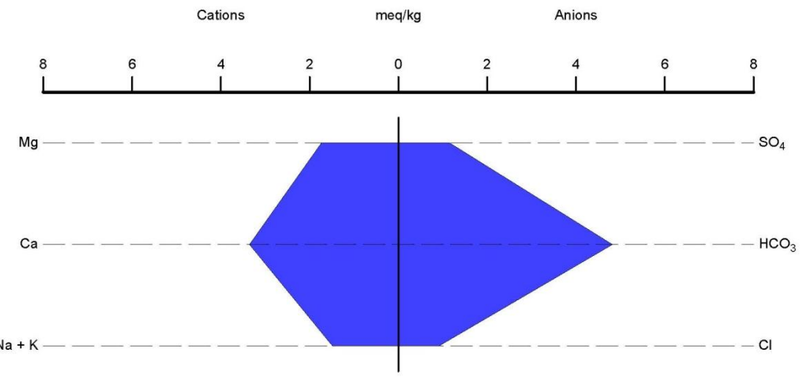
AREA 2 - MW...L01



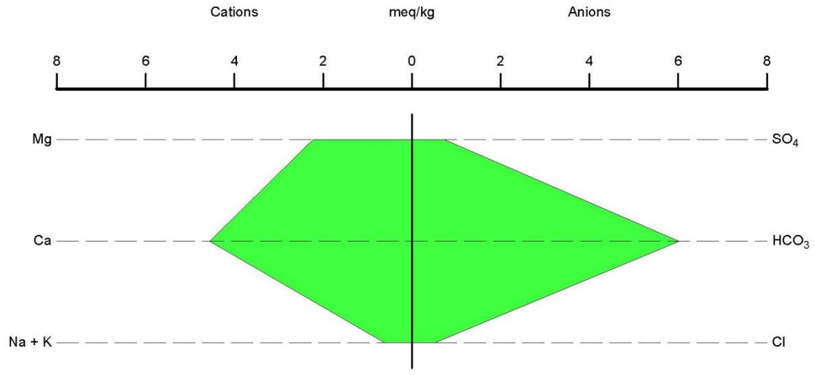
AREA 2 - MW...L02



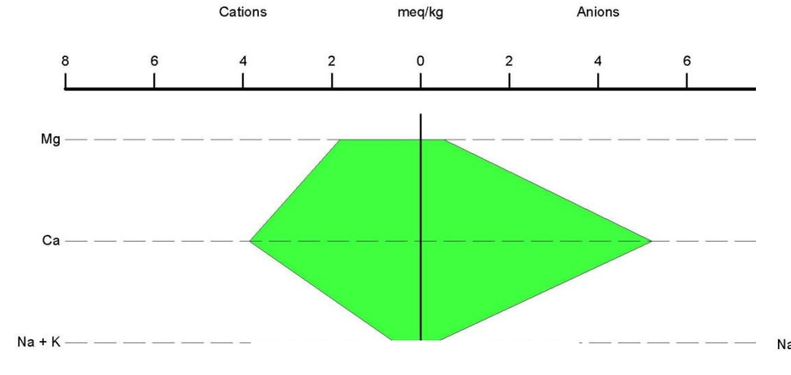
AREA 2 - MW...L03



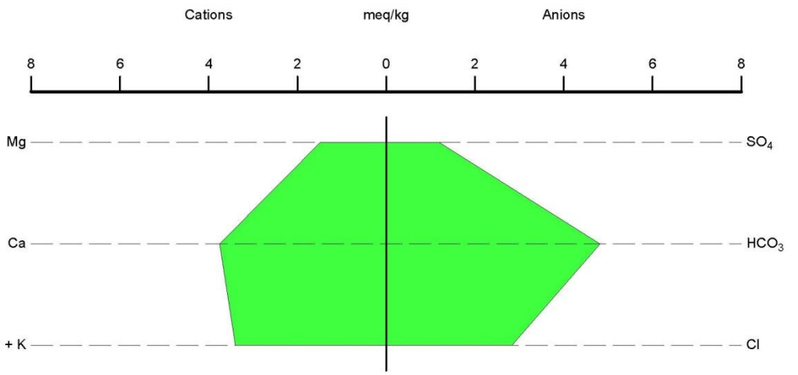
AREA 2 - MW...R01



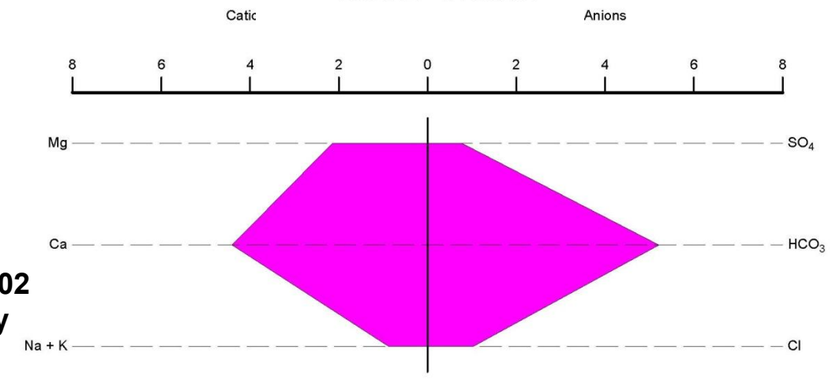
AREA 2 - MW...R02



AREA 2 - MW...R03



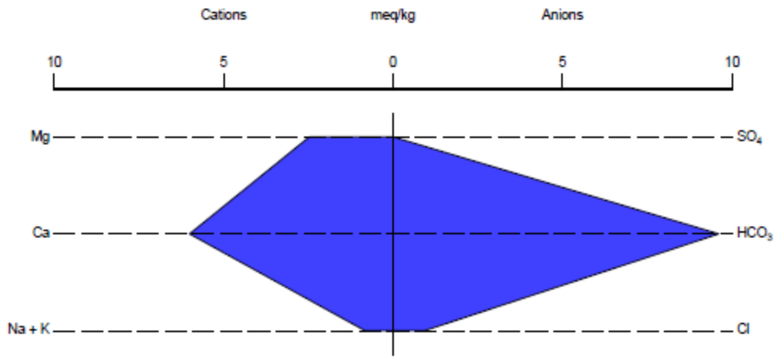
AREA 2 - SW...R01



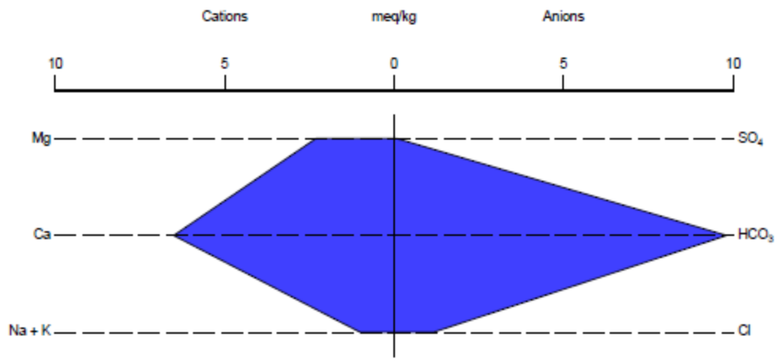
Key
Blue = Groundwater sampled on south side of river
Green = Groundwater sampled on north side of river
Groundwater from wells screened in bedrock, except MW…R02 screened in glacial material and MW…R03 screened partially in glacial material and partially in bedrock.
Magenta = Surface Water

STIFF DIAGRAMS – AREA 3

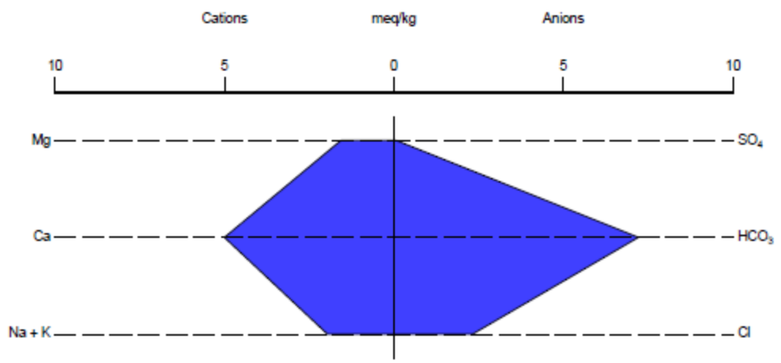
AREA 3 - MW...R01



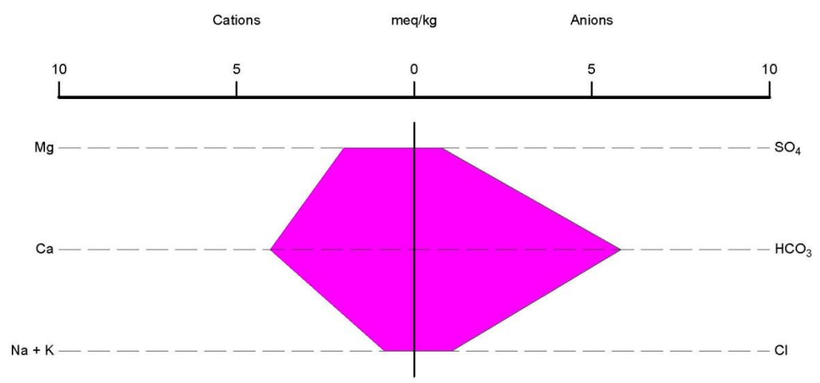
AREA 3 - MW...R02



AREA 3 - MW...R03



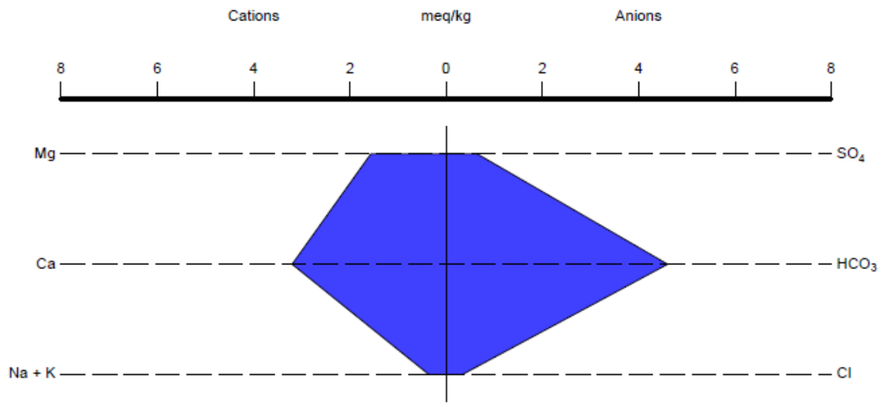
AREA 3 - SW...R01



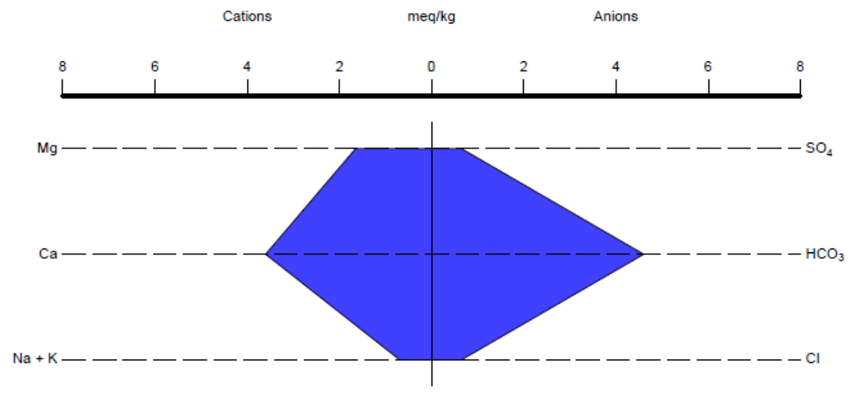
Key
Blue = Groundwater sampled on east side of river
Groundwater from wells screened in glacial material
Magenta = Surface Water

STIFF DIAGRAMS – AREA 4

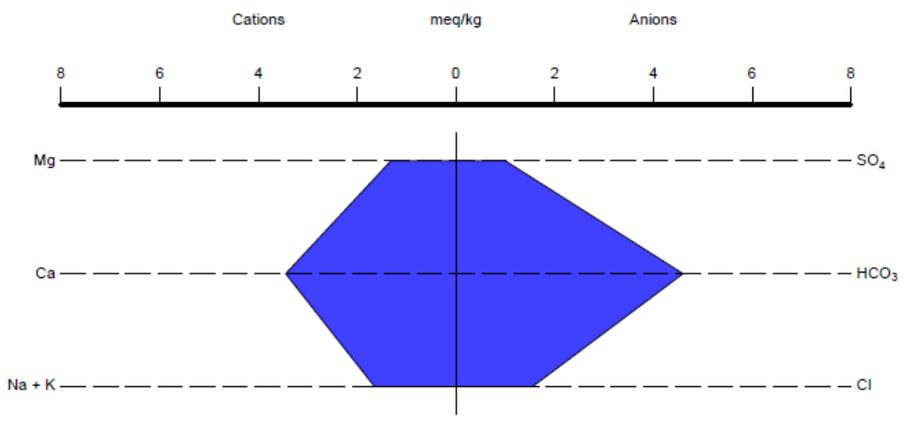
Area 4 - MW...R01



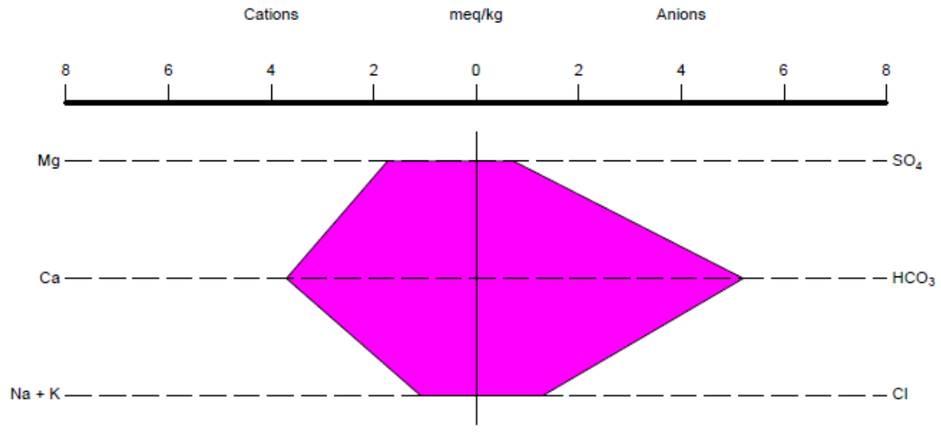
Area 4 - MW...R02



Area 4 - MW...R01(east)



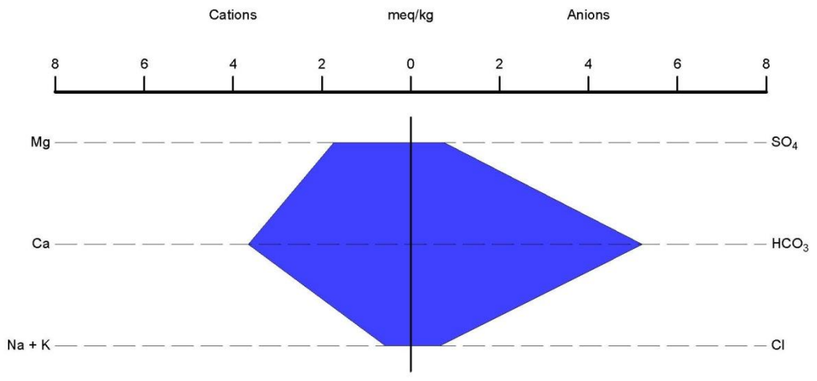
Area 4 - SW...R01



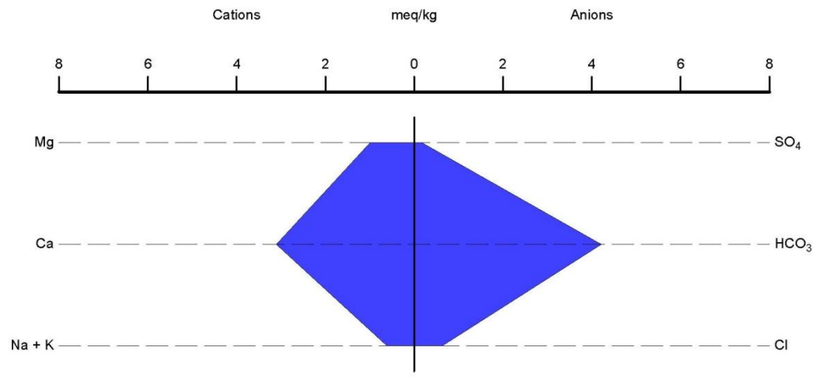
Key
Blue = Groundwater sampled on north side of river
Groundwater from wells screened in glacial material except
Well MW…R01 screened in bedrock
MW…R01(east) refers to well MWKR2275R01
Magenta = Surface Water

STIFF DIAGRAMS – AREA 5

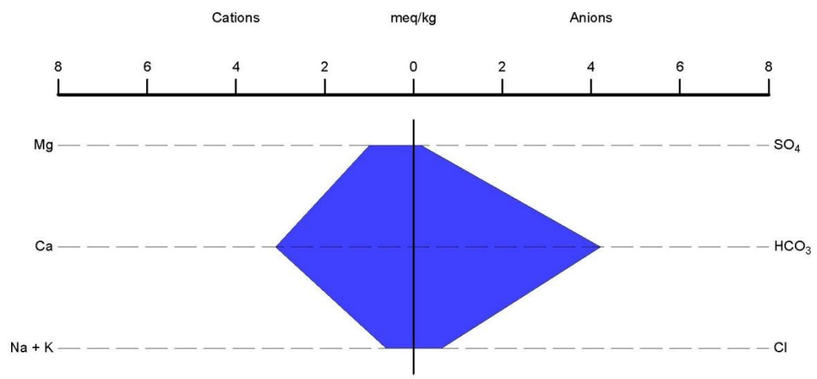
AREA 5 - MW...R01(2700)



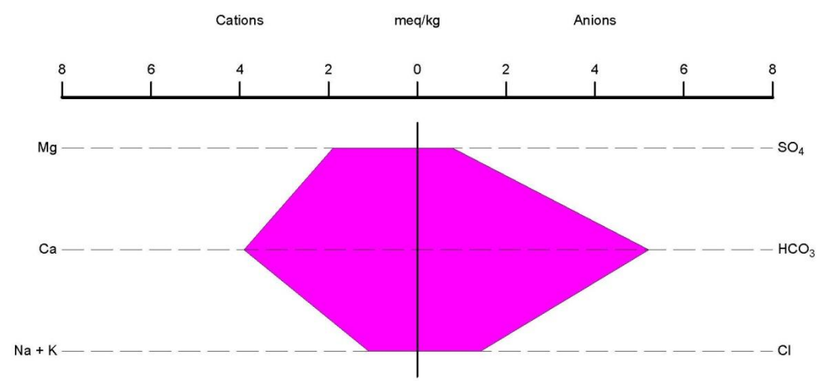
AREA 5 - MW...R01



AREA 5 - MW...R02



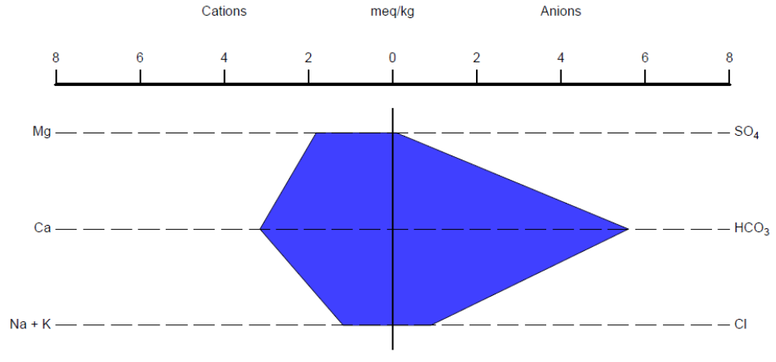
AREA 5 - SW...R01



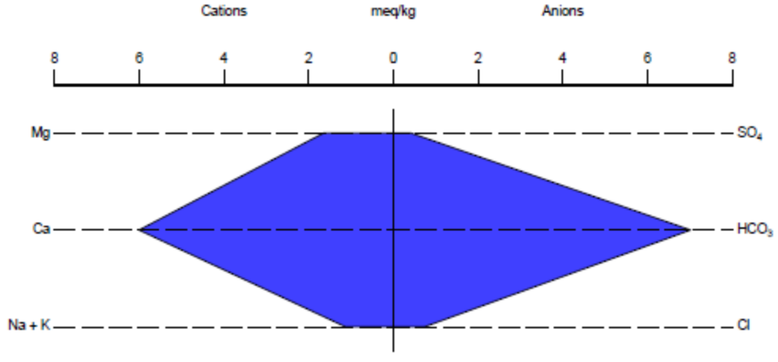
Key
Blue = Groundwater sampled on north side of river
Groundwater from wells screened in glacial material except
Well MW…R01 (2700) screened in bedrock
Magenta = Surface Water

STIFF DIAGRAMS – AREA 6

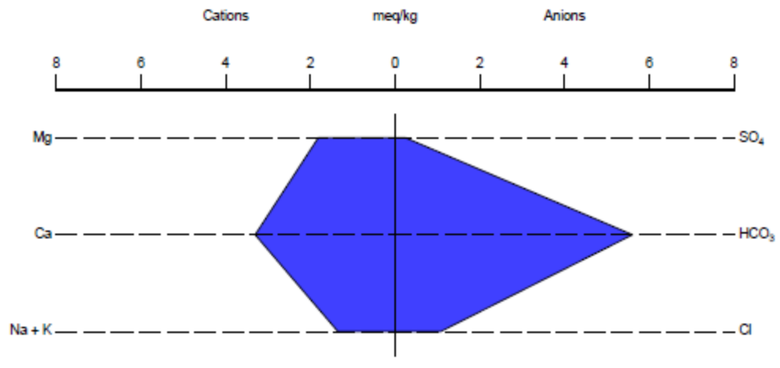
Area 6 - MWKR3450L01



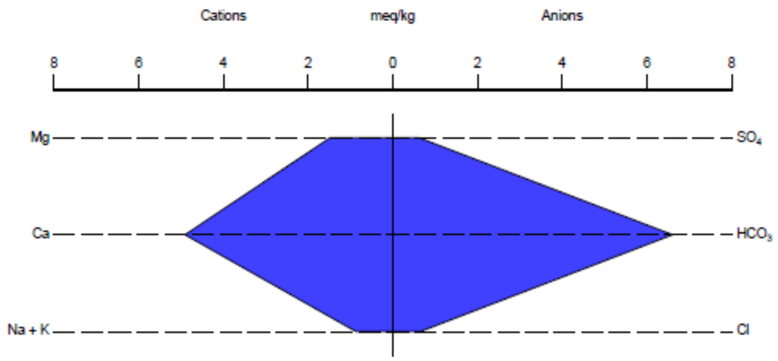
Area 6 - MWKR3450L02



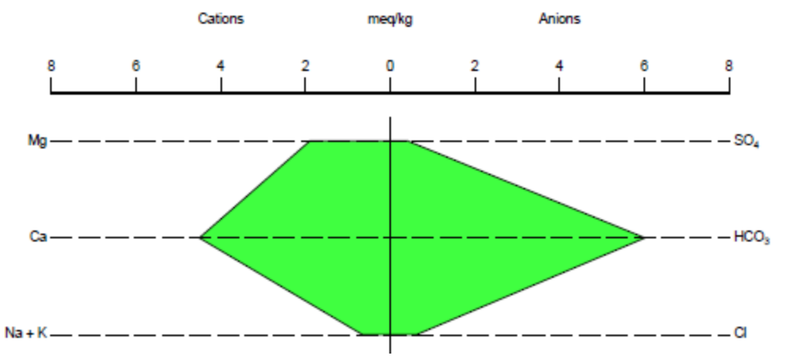
Area 6 - MWKR3450L03



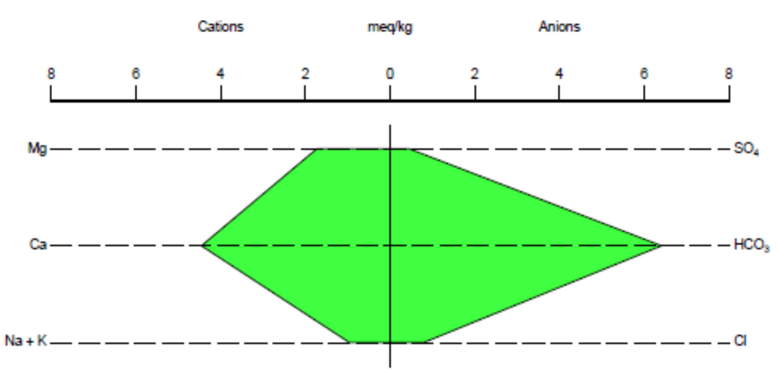
Area 6 - MWKR3450L04



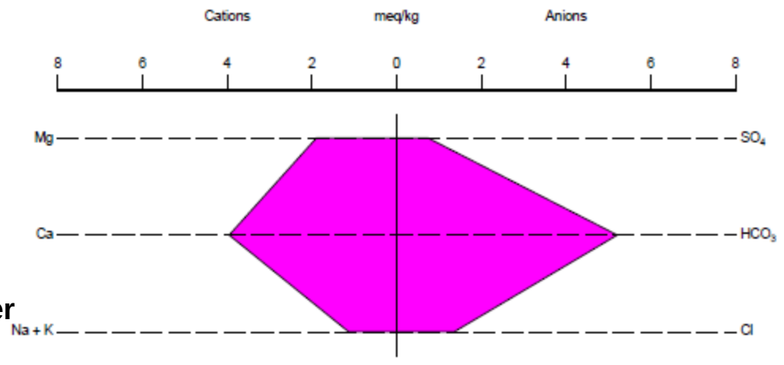
Area 6 - MWKR3460L01



Area 6 - MWKR3460L02



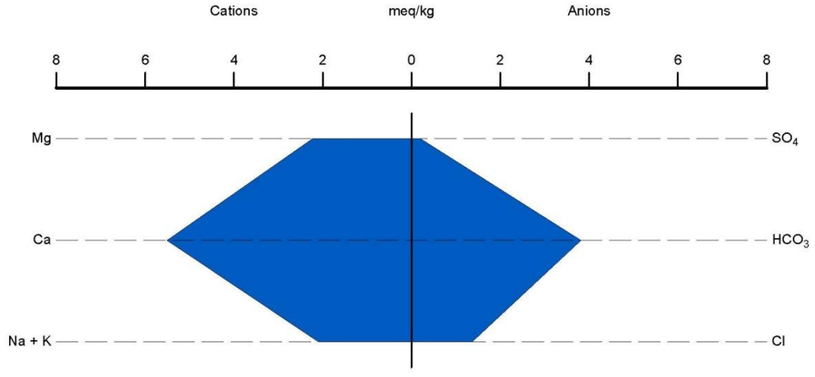
Area 6 - SW...L01



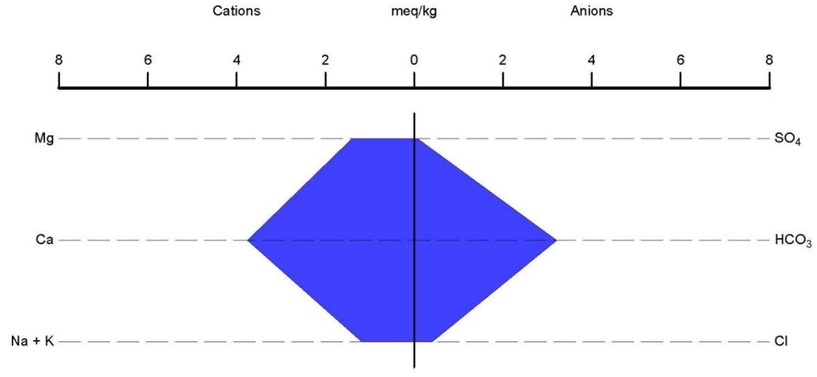
Key
Blue and green = Groundwater sampled on south side of river
Groundwater from wells screened in glacial material
Magenta = Surface Water

STIFF DIAGRAMS – AREA 7

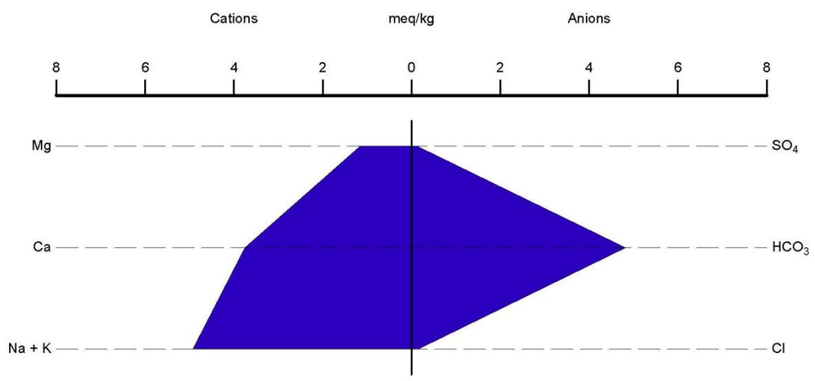
Area 7 - MW...L01



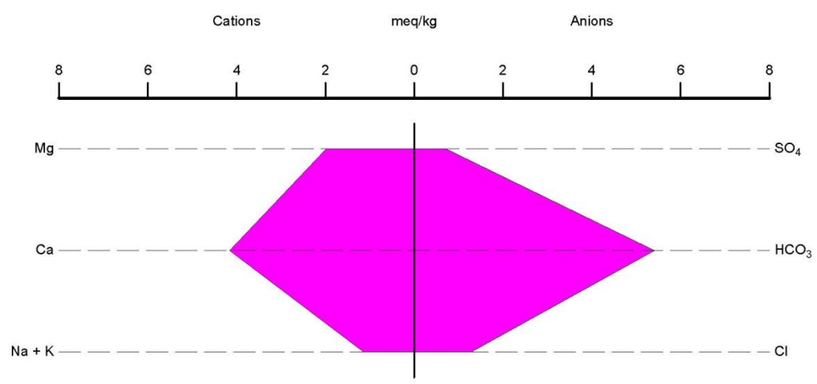
Area 7 - MW...L02



Area 7 - MW...L03



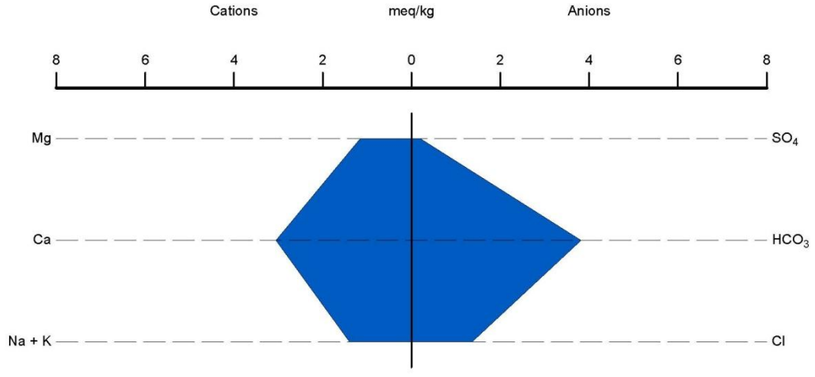
Area 7 - SW...L01



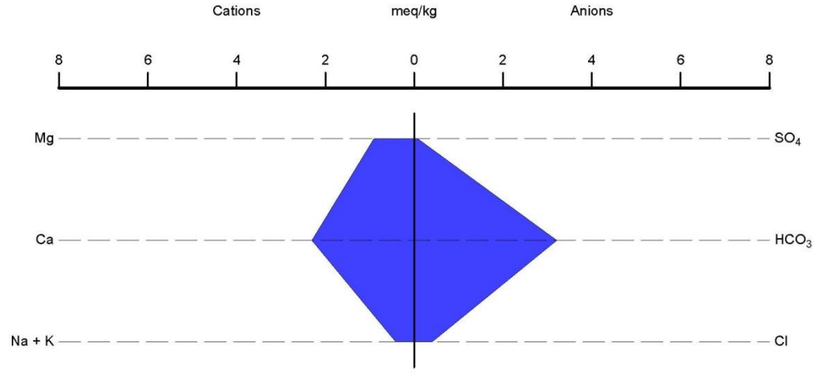
Key
Blue = Groundwater sampled on south side of river
Groundwater from wells screened in glacial material
Magenta = Surface Water

STIFF DIAGRAMS – AREA 8

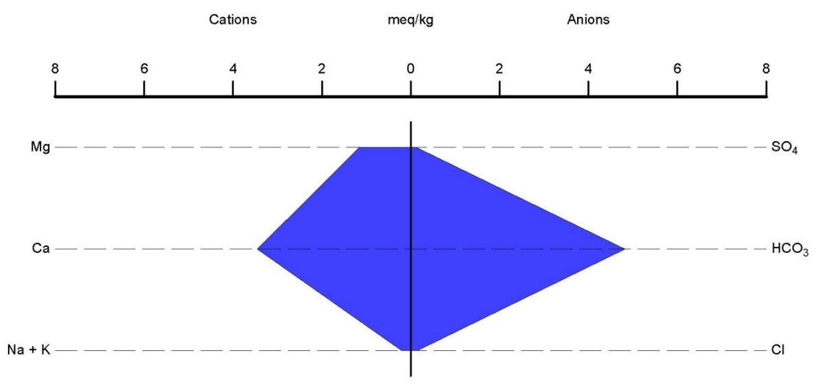
Area 8 - MW...L01



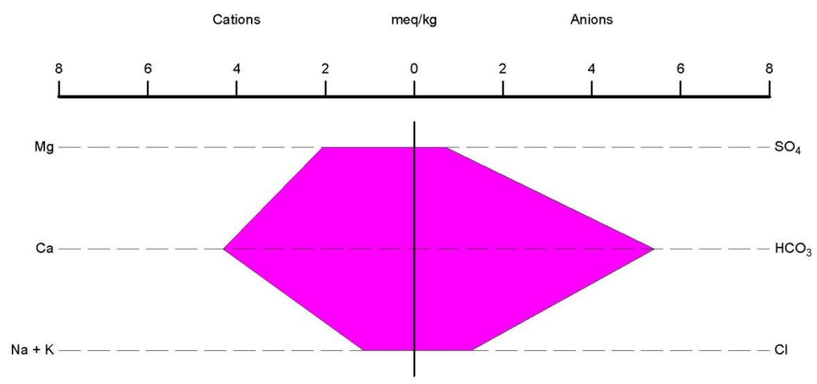
Area 8 - MW...L02



Area 8 - MW...L03



Area 8 - SW...L01



Key
Blue = Groundwater sampled on south side of river
Groundwater from wells screened in glacial material
Magenta = Surface Water