

**October 2013 Groundwater Monitoring**

Former Irondale Iron and Steel Plant Site  
Irondale, Washington

*for*

**Washington State Department of Ecology**

December 5, 2014



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Plaza 600 Building  
600 Stewart Street, Suite 1700  
Seattle, Washington 98101  
206-728-2674

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**File No. 0504-042-02**

**December 5, 2014**

Prepared for:

Washington State Department of Ecology  
Toxics Cleanup Program  
300 Desmond Drive  
Lacey, Washington 98504

Attention: Steve Teel

Prepared by:

GeoEngineers, Inc.  
Plaza 600 Building  
600 Stewart Street, Suite 1700  
Seattle, Washington 98101  
206.728.2674



Neil Morton  
Senior Environmental Scientist and Project Lead



David A. Cook, LG, CPG  
Principal and Program Manager

NFM:CB:leh

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## INTRODUCTION

This report summarizes the results of the October 2013 quarterly groundwater monitoring event (Round 4), which also included surface water sampling, at the Former Irondale Iron and Steel Plant Site (Site, also known as Irondale Beach Park) in Irondale, Washington. The Site is a 13-acre property located at 526 East Moore Street in the town of Irondale, latitude 48°2' 38" N longitude 122° 45' 60" W, approximately 5 miles south of Port Townsend, Washington (see Vicinity Map, Figure 1). The Site is owned by Jefferson County and is currently used as an undeveloped day-use park (Irondale Beach Park). It is bounded by Port Townsend Bay to the east, residential properties to the south, southwest and northwest, and parklands to the north. The Site includes both upland and aquatic land. The general Site layout is shown on the attached Groundwater Monitoring Results – Dissolved Metals, Figure 2.

From 1881 to 1919, iron and steel were produced intermittently at the Site by various owners. Steel plant operations during this time resulted in metals, carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and/or petroleum contamination of soil, sediment and/or groundwater. On behalf of Washington State Department of Ecology (Ecology), GeoEngineers oversaw a cleanup action consisting of (1) excavation of upland soil and marine sediment along the shoreline that contained chemicals of concern (COC) concentrations greater than Site-Specific cleanup levels, (2) excavation of slag material outside of remedial excavations to facilitate shoreline habitat restoration, and (3) installation of a multi-component environmental cap in two upland areas where surface soil exceeded Site-Specific cleanup levels. The cleanup action was completed in December 2012.

GeoEngineers, Inc. (GeoEngineers) has been providing site characterization, cleanup and groundwater monitoring services at the Site since 2007.

## SCOPE OF SERVICES

New wells (MW-6 through MW-9) were installed following completion of remedial excavation activities. An existing monitoring well MW-5 located outside of the remedial excavation footprint was also sampled as part of the post-construction groundwater monitoring. The purpose of the groundwater monitoring program is to evaluate the effectiveness of the cleanup action, with respect to protection of groundwater. As outlined in the Engineering Design Report (GeoEngineers, 2012), post-construction groundwater monitoring is being performed on a quarterly basis for a minimum of one year. Surface water sampling was performed at three locations during this monitoring event at the specific request of Ecology.

The specific scope of services for the October 2013 monitoring event included:

1. Measure the depths to groundwater in each well (MW-5 through MW-9). Estimate groundwater flow direction at the site based on the groundwater depths.
2. Purge approximately three well volumes of water from the wells prior to sampling. Obtain groundwater samples using low-flow methodology in accordance with the field procedures outlined in Appendix A from the five wells (MW-5 through MW-9) for chemical analysis.
3. Obtain surface water samples from three locations (SW-1, SW-2, and SW-3) in Port Townsend Bay; one near the creek at the northern end of the park and two near monitoring wells MW-9 and MW-6.

4. Submit the groundwater samples to an Ecology-certified laboratory for chemical analysis of diesel- and heavy oil-range hydrocarbons by Ecology Method NWTPH-Dx, total carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by U.S. Environmental Protection Agency (EPA) Method SW 8270D-SIM, and dissolved metals (copper and nickel) by EPA Method 200.8. Ecology determined that the dissolved cPAH analysis was not required for this event based on the chemical analytical results of the January 2013 groundwater monitoring event.
5. Submit the surface water samples to an Ecology-certified laboratory for chemical analysis of dissolved metals (copper and nickel) by EPA Method 200.8.
6. Evaluate the chemical analytical results relative to Site-Specific groundwater cleanup levels consistent with Model Toxics Control Act (MTCA) requirements. Site-specific groundwater cleanup levels are presented in Table 2.

## **GROUNDWATER MONITORING RESULTS**

### **General**

Monitoring wells MW-5 through MW-9 were used to evaluate groundwater flow direction and obtain groundwater samples. Monitoring well MW-5 was installed prior to the cleanup action during the site characterization phase and is located outside of the cleanup action areas. Monitoring wells MW-6 through MW-8 were installed after cleanup action activities within the limits of petroleum- and metals-contaminated soil remedial excavation areas. Monitoring well MW-9 was installed after cleanup action activities within the limits of the metals-contaminated soil remedial excavation area. The approximate locations of the monitoring wells are shown in Figure 2. Groundwater level measurement and sampling procedures are described in Appendix A. Depth to groundwater measurements are presented in Table 1. Groundwater chemical analytical data is summarized in Table 2. A summary of groundwater elevations and dissolved copper and nickel analytical data is shown on Figure 2. A copy of the laboratory report for the October 2013 groundwater analyses is presented in Appendix B.

Monitoring wells MW-5 through MW-9 were surveyed by Van Aller Surveying during February 2013 for creating the “As-Built Map of the Irondale Iron and Steel Plant Cleanup Action.”

### **Groundwater Conditions**

Groundwater conditions beneath the Site were evaluated by measuring groundwater levels and obtaining groundwater samples from MW-5 through MW-9 on October 4, 2013. Groundwater depths ranged from approximately 3.1 to 5.9 feet below ground surface (bgs) in the monitoring wells. The shallow depths to water in the monitoring wells are attributed to the proximity of Port Townsend Bay located approximately 20 to 60 feet east from the monitoring wells. Based on site topography, the ground surface is relatively flat, though the ground surface elevation is slightly higher in the southern portion of the site (near MW-6 and MW-7) compared to the ground surface in the northern portion of the site. The groundwater flow direction beneath the site based on October 2013 groundwater elevations is to the east toward Port Townsend Bay (see Figure 3).

## Groundwater Sampling

Groundwater samples from MW-5 through MW-9 were submitted to Analytical Resources, Inc. (ARI) an environmental laboratory in Tukwila, Washington for chemical analysis of one or more of the following: diesel- and heavy oil-range hydrocarbons, cPAHs, and dissolved copper and dissolved nickel.

- **Hydrocarbons.** Diesel- and heavy oil-range hydrocarbons were not detected in any of the groundwater samples except one. The detected concentration of diesel-range hydrocarbons (230 micrograms per liter [ $\mu\text{g/L}$ ]) in MW-7 is less than the site specific cleanup level of 500  $\mu\text{g/L}$ .
- **cPAHs.** cPAH constituents were not detected in groundwater samples obtained from MW-6, MW-7, and MW-8. Groundwater samples obtained from MW-5 and MW-9 were not tested for cPAH constituents per Ecology's direction.
- **Dissolved Copper.** Dissolved copper was identified in the sample from MW-9 at an estimated concentration (5  $\mu\text{g/L}$ ) greater than the site-specific cleanup level of 2.4  $\mu\text{g/L}$ . Dissolved copper was detected at concentrations less than the site-specific cleanup level in the remaining wells sampled (MW-5 through MW-8).
- **Dissolved Nickel.** Dissolved nickel was detected in the samples from MW-6 and MW-9 at a concentration (9.3  $\mu\text{g/L}$  and 30  $\mu\text{g/L}$ , respectively) greater than the site-specific cleanup level of 8.2  $\mu\text{g/L}$ . Dissolved nickel was detected at concentrations less than the site-specific cleanup level in the samples from MW-5, MW-7, and MW-8.

A significant amount of reddish-orange precipitate (possibly ferrous oxide) resulting in increased turbidity has been observed during the four monitoring events at MW-9, but not at the other monitoring wells. This precipitate clears up with sufficient purging.

## SURFACE WATER SAMPLING RESULTS

Surface water samples were collected from three locations in Port Townsend Bay upon Ecology's request. Surface water sample SW-01 was obtained near the outfall of the creek at the north-central portion of the park. This location was selected to evaluate surface water quality away from the remedial excavation areas. Surface water samples SW-02 and SW-03 were obtained from near shore of Port Townsend Bay in the vicinity of monitoring wells MW-9 and MW-6, respectively. These locations were selected to evaluate surface water quality adjacent to the remedial excavation areas.

Surface water samples obtained during the October 2013 monitoring event were analyzed only for dissolved copper and dissolved nickel.

- **Dissolved Copper.** Dissolved copper was detected in sample from SW-2 location at a concentration (30  $\mu\text{g/L}$ ) greater than the site-specific cleanup level of 2.4  $\mu\text{g/L}$ . Dissolved copper was identified in the sample from SW-3 location at an estimated concentration (13.5  $\mu\text{g/L}$ ) greater than the site-specific cleanup level. The detected concentration of dissolved copper (1.3  $\mu\text{g/L}$ ) in the sample from SW-1 location is less than the site-specific cleanup level.
- **Dissolved Nickel.** Dissolved nickel was identified in the samples from SW-2 and SW-3 locations at estimated concentrations (8.5  $\mu\text{g/L}$  and 9.0  $\mu\text{g/L}$ ) greater than the site-specific cleanup level of 8.2  $\mu\text{g/L}$ . Dissolved nickel was detected at a concentration (5.2  $\mu\text{g/L}$ ) less than the site-specific cleanup level in the sample from SW-1 location.

Based on chloride levels in the groundwater and surface water samples collected in July and October 2013, it appears that the surface water samples obtained at location SW-01 are more representative of freshwater from the creek than the marine water in Port Townsend Bay. This conclusion is consistent with the copper and nickel surface water analytical results for SW-01, which are consistent with the surface water samples collected from the creek during the RI.

## **SUMMARY AND CONCLUSIONS**

Groundwater monitoring is being conducted at the former Irondale Iron and Steel Plant site to evaluate the post-construction effectiveness of the cleanup action as outlined in the Final Engineering Design Report (GeoEngineers, 2012). Groundwater samples obtained during the October 2013 monitoring event were analyzed for diesel- and heavy oil-range hydrocarbons, cPAHs, and dissolved copper and dissolved nickel. Surface water samples also were collected during the October 2013 monitoring event upon Ecology's request. Surface water samples were analyzed for dissolved copper and dissolved nickel.

The October 2013 groundwater monitoring event is the last of the four planned quarterly groundwater monitoring events and the chemical analytical results were generally consistent with previous monitoring events.

Contaminants of concern were either not detected or were detected at concentrations less than the site specific cleanup levels in groundwater and surface water samples with the exception of the following:

- Dissolved copper and nickel exceedances at groundwater wells MW-6, MW-9 and surface water locations SW-2 and SW-3; which are generally located in the vicinity of the total petroleum hydrocarbons (TPH) remedial excavation area (MW-6 and SW-3) and the metals remedial excavation/slag outcrop removal area (MW-9 and SW-2).
- cPAHs at groundwater well MW-7 during the July 2013 monitoring event only. MW-7 is located in the vicinity of the TPH remedial excavation area.

### **Copper**

The dissolved copper concentrations in MW-9 from the July and October 2013 groundwater monitoring events are lower than the dissolved copper concentrations in surface water sample collected at locations SW-2 and SW-3. This indicates that, while the dissolved copper concentrations in MW-9 are greater than the site-specific groundwater cleanup level for copper, it is unlikely that site groundwater will result in higher dissolved copper concentrations than are already present in Port Townsend Bay.

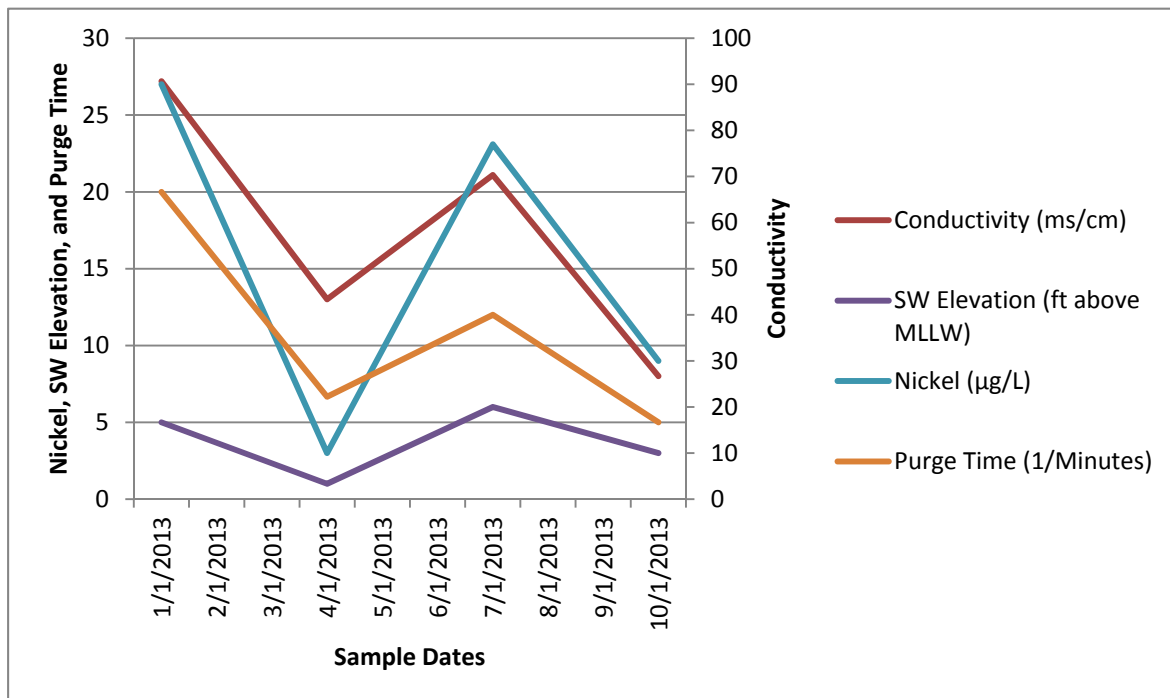
### **Nickel**

The dissolved copper and nickel concentrations in MW-9 are consistently greater than the site-specific cleanup levels and are elevated compared to the dissolved copper and nickel concentrations observed in the other site monitoring wells. In addition, the dissolved nickel concentrations in MW-9 from the July and October 2013 groundwater monitoring events are higher than the dissolved nickel concentrations in surface water samples collected at locations SW-2 and SW-3. Based on our review of the groundwater quality parameter data collected during the January, April, July, and October 2013 monitoring events, it appears that the unexpectedly higher dissolved nickel concentrations at MW-9 may be affected by the following factors (also, see chart below):



- Monitoring well purging time (longer purge times associated with lower nickel concentrations),
- Groundwater quality parameters (higher total dissolved solids, conductivity, and salinity measurements associated with higher nickel concentrations),
- Surface water elevation (higher tides associated with higher nickel concentrations), and
- Saltwater intrusion (indicators of saltwater intrusion, chloride ions in groundwater samples, were higher in MW-9 than in the other four monitoring wells). MW-9 also is the closest groundwater monitoring well to seawater during high and low tides.

**MW-9 QUARTERLY GROUNDWATER MONITORING DATA (POSSIBLE RELATIONSHIP BETWEEN NICKEL CONCENTRATIONS AND CONDUCTIVITY, SURFACE WATER ELEVATION AND PURGE TIME)**



**RECOMMENDATIONS**

We recommend Ecology further evaluate the potential effects of saltwater intrusion and its relationship to elevated copper and nickel concentrations in groundwater samples obtained primarily from the closest wells to both high and low tide cycles (MW-9). Further evaluation will help to explain the higher dissolved copper and nickel concentrations at MW-9, relative to monitoring wells MW-5 through MW-8. The scope of this recommended additional investigation is as follows:

- Collect groundwater samples on an hourly basis from MW-9 over a tidal cycle (from one hour before highest high tide to one hour after lowest low tide).
- Collect surface water samples from proposed locations SW-1A and SW-1B (see Figure 4). These locations will replace location SW-1, which was located at the outfall of a freshwater creek. Surface water samples will also be obtained at locations SW-2 and SW-3.

- Submit groundwater and surface water samples to ARI Laboratory for chemical analysis of dissolved copper and nickel and conductivity. Conductivity will be analyzed to verify the relationship between saltwater and elevated nickel concentrations in groundwater. And be used to confirm field conductivity measurements.

## LIMITATIONS

We have prepared this report for use by the Washington State Department of Ecology. The information contained herein is not intended for use by others and it is not applicable to other sites. No other (third) party may rely on the product of our services unless we agree in advance and in writing to such reliance.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. The conclusions and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, express or implied, should be understood.

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Please refer to Appendix C titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

## REFERENCES

GeoEngineers, 2009, "Revised Draft Remedial Investigation/Feasibility Study Report, Irondale Iron and Steel Plant, Irondale, Washington, Ecology Facility/Site No. 95275518." GEI File No. 0504-042-01, August 13, 2009.

GeoEngineers, 2012, "Final Engineering Design Report, Irondale Iron and Steel Plant, Irondale, Washington." GEI File No. 0504-042-02, May 1, 2012.



**Table 1**  
**Summary of Groundwater Level Measurements**  
Former Irondale Iron and Steel Plant Site  
Irondale, Washington

Groundwater Monitoring Well <sup>1</sup>	Quarterly Groundwater Monitoring Event	Date Measured	Top of Casing Elevation <sup>2</sup> (feet)	Depth to Water from Top of Casing (feet)	Groundwater Elevation <sup>2</sup> (feet)
MW-5	Round 1	1/4/2013	13.97	5.01	8.96
	Round 2	4/10/2013		4.4	9.57
	Round 3	7/16/2013		5.2	8.77
	Round 4	10/4/2013		5.51	8.46
MW-6	Round 1	1/4/2013	17.04	3.23	13.81
	Round 2	4/10/2013		3.16	13.88
	Round 3	7/16/2013		3.05	13.99
	Round 4	10/4/2013		3.11	13.93
MW-7	Round 1	1/4/2013	15.98	5.08	10.90
	Round 2	4/10/2013		5.06	10.92
	Round 3	7/16/2013		5.81	10.17
	Round 4	10/4/2013		5.44	10.54
MW-8	Round 1	1/4/2013	11.93	4.00	7.93
	Round 2	4/10/2013		4.68	7.25
	Round 3	7/16/2013		5.81	6.12
	Round 4	10/4/2013		5.87	6.06
MW-9	Round 1	1/4/2013	11.77	4.83	6.94
	Round 2	4/10/2013		5.52	6.25
	Round 3	7/16/2013		5.51	6.26
	Round 4	10/4/2013		5.81	5.96

**Notes:**

<sup>1</sup>Monitoring well locations are shown on Figure 2.

<sup>2</sup>Elevation is referenced to Mean Lower Low Water (MLLW). Elevation measurements were obtained from "ASBUILT MAP" provided by Van Aller Surveying to Anderson Environmental Contracting, LLC dated February 2013. Top of casing elevations were estimated by subtracting the distance between the top of the monument and the top of the casing at each well.

**Table 2**  
**Summary of Groundwater Chemical Analytical Data - Petroleum Hydrocarbons, cPAHs and Dissolved Metals<sup>1</sup>**  
Former Irondale Iron and Steel Plant Site  
Irondale, Washington

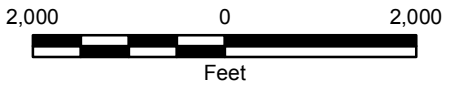
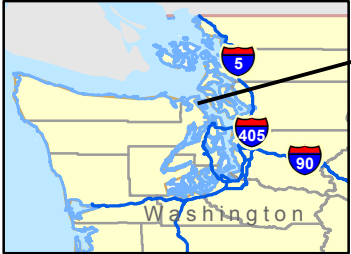
Sample Identification <sup>2</sup>	Quarterly Groundwater Monitoring Event	Sample Date	Petroleum Hydrocarbons <sup>3</sup>		Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) <sup>4</sup>									Dissolved Metals <sup>5</sup>		
			Diesel-Range	Heavy Oil-Range	Total or Dissolved cPAHs	Benzo[a]anthracene	Chrysene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Indeno[1,2,3-c,d]pyrene	Dibenz[a,h]anthracene	Total cPAH - TEQ <sup>4</sup>	Copper	Nickel	
<b>Groundwater Samples</b>																
MW05-130104	Round 1	1/4/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	1.3	5.6	
MW05-130410	Round 2	4/10/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	1.5	5.1	
MW05-130716	Round 3	7/16/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	0.9	4.6	
MW05-131004	Round 4	10/4/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	1.4	5	
MW06-130104 <sup>6</sup>	Round 1	1/4/2013	100 U	200 U	Total	0.010 U	<b>0.0066 J</b>	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	<b>0.00757 J</b>	0.8	5.8
					Dissolved	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U		
MW06-130410 <sup>6</sup>	Round 2	4/10/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.5 U	4.2
MW06-130716 <sup>6</sup>	Round 3	7/16/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.6	4.9
MW06-131004 <sup>6</sup>	Round 4	10/4/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.9	9.3
MW07-130104	Round 1	1/4/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.8	4.4
					Dissolved	0.010 U	<b>0.0072 J</b>	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	<b>0.00757 J</b>	--	--
MW07-130410	Round 2	4/10/2013	160	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	1.4	5.1
MW07-130716	Round 3	7/16/2013	200	200 U	Total	0.087	0.11	0.056	0.042	0.11	0.028	0.012	0.1336	0.5 U	2.7	
MW07-131004	Round 4	10/4/2013	230	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.6	3.6
MW08-130104	Round 1	1/4/2013	100 U	200 U	Total	0.0075 J	0.0094 J	0.0063 J	0.010 U	0.0078 J	0.010 U	0.010 U	0.0108 J	0.5 U	5	
	Round 1	1/4/2013	--	--	Dissolved	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	--	--	
MW08-130410	Round 2	4/10/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	2.2	4.9
MW08-130716	Round 3	7/16/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.9	4.4
MW08-131004	Round 4	10/4/2013	100 U	200 U	Total	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.00755 U	0.9	5.1
MW09-130104 <sup>6</sup>	Round 1	1/4/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	7	90	
MW09-130410 <sup>6</sup>	Round 2	4/10/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	7	10	
MW09-130716 <sup>6</sup>	Round 3	7/16/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	7	77	
MW09-131004 <sup>6</sup>	Round 4	10/4/2013	100 U	200 U	--	--	--	--	--	--	--	--	--	5.00 NJ	30	
<b>Surface Water Samples</b>																
SW01-130716	Round 3	7/16/2013	--	--	--	--	--	--	--	--	--	--	--	1.4	4.8	
SW01-131004	Round 4	10/4/2013	--	--	--	--	--	--	--	--	--	--	--	1.3	5.2	
SW02-130716-DUP <sup>7</sup>	Round 3	7/16/2013	--	--	--	--	--	--	--	--	--	--	--	13	16	
SW02-131004-DUP <sup>7</sup>	Round 4	10/4/2013	--	--	--	--	--	--	--	--	--	--	--	30	8.5 NJ	
SW03-130716	Round 3	7/16/2013	--	--	--	--	--	--	--	--	--	--	--	9	16	
SW03-131004	Round 4	10/4/2013	--	--	--	--	--	--	--	--	--	--	--	13.5 NJ	9.0 NJ	
<b>Site-Specific Groundwater Cleanup Level<sup>8</sup></b>			500	500	--	see TEQ	see TEQ	see TEQ	see TEQ	see TEQ	see TEQ	see TEQ	0.018	2.4	8.2	

**Notes:**  
<sup>1</sup>Reported results are in micrograms per liter (µg/L).  
<sup>2</sup>Groundwater monitoring well locations and surface water sample locations are shown in Figure 2.  
<sup>3</sup>Petroleum Hydrocarbons analyzed using NWTPH-Dx.  
<sup>4</sup>cPAHs analyzed using EPA method 8270D-SIM. Total carcinogenic PAHs (cPAHs) calculated using toxic equivalent (TEQ) methodology relative to benzo(a)pyrene. cPAHs that were not detected were assigned a value of one half of the reporting limit for these calculations. Samples analyzed for dissolved cPAHs were laboratory filtered using a 0.7 µm borosilicate glass, binder free filter.  
<sup>5</sup>Dissolved Metals analyzed using EPA method 200.8 (field filtered).  
<sup>6</sup>A field duplicate groundwater sample was obtained from this monitoring well (diesel- and heavy oil-range and cPAHs for MW-6 and metals for MW-9). Higher of the two detected concentrations (parent and field duplicate) is reported for each of the analyte.  
<sup>7</sup>A field duplicate surface sample was obtained from SW-02 (dissolved metals). Higher of the two detected concentrations (parent and field duplicate) is reported for each of the analyte.  
<sup>8</sup>Site-specific groundwater cleanup level is referenced from Table 1 of the Final Engineering Design Report (GeoEngineers, 2012).  
MTCA = Model Toxics Control Act  
-- = not analyzed. Monitoring wells are located in the area remediated due to metals contamination.  
NJ = Analyte is tentatively identified and the concentration is estimated.  
U = Laboratory qualifier indicating analyte not detected at level above listed reporting limit.  
**Bold** indicates analyte was detected.  
Chemical analyses performed by Analytical Resources, Inc., in Tukwila, Washington.  
Shaded values represent concentrations greater than the Site-Specific cleanup level.



Map Revised: May 24, 2007

Office: SEA Path: P:\0\0504042\100\GIS\050404200 FIG-1.mxd



Notes:

1. The locations of all features shown are approximate.
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Data Sources: ESRI Data & Maps, Street Maps 2005  
 Transverse Mercator, Zone 10 N North, North American Datum 1983  
 North arrow oriented to grid north

<b>Vicinity Map</b>	
Irondale Iron and Steel Plant Irondale, Washington	
	<b>Figure 1</b>

P:\10\0504\04\2\02\CAD\GW MONITORING REPORT - OCT 2013\0504\04\202\_GW MONITORING REPORT OCT 2013.DWG\TAB.FIG 2 MODIFIED BY THICHAUD ON APR II, 2014 - 13:27



**Legend**

- Site Boundary
- Ordinary High Water (Estimated at Elevation 10.5 feet)
- Metals Area - Excavation
- Metals Area - Cap
- TPH Area - Excavation
- Slag Outcrop - Removal
- MW-1 Monitoring Well Location
- SW-1 Surface Water Monitoring Location
- Assumed Groundwater Flow Direction

**Data Box Explanation:**

GW Monit. = Groundwater Monitoring  
 GW Elev = Groundwater Elevation in feet  
 Cu = Dissolved Copper  
 Ni = Dissolved Nickel

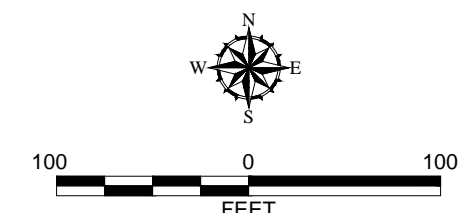
Exceedance of site-specific groundwater cleanup level and surface water criteria (Cu = 2.4 µg/L; Ni = 8.2 µg/L)

NJ = Analyte is tentatively identified; concentration is estimated  
 U = Analyte not detected above method reporting limit  
 Groundwater results in µg/L

\*Surface water samples were collected only during the listed events.

- Notes**
- The locations of all features shown are approximate.
  - This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
  - Dissolved metals (Copper and Nickel) were analyzed using EPA Method 200.8. Samples were field filtered.
  - TPH and PAH results are presented in Table 2. TPH detected in MW-7, not detected in MW-5, MW-6, MW-8 and MW-9. PAH not detected in MW-6, MW-7, and MW-8.
- Reference: Aerial photo (July 2013) from Google Earth Pro.

<b>Groundwater Monitoring Results - Dissolved Metals</b>	
Irondale Iron and Steel Plant Irondale, Washington	
	Figure 2



MW06				
GW Monit. Event	GW Elev	Cu	Ni	
Jan-2013	13.81	0.8	5.8	
Apr-2013	13.88	0.5 U	4.2	
July-2013	13.99	0.6	4.9	
Oct-2013	13.93	0.9	9.3	

MW07				
GW Monit. Event	GW Elev	Cu	Ni	
Jan-2013	10.9	0.8	4.4	
Apr-2013	10.92	1.4	5.1	
July-2013	10.17	0.5 U	2.7	
Oct-2013	10.54	0.6	3.6	

SW03*			
GW Monit. Event	Cu	Ni	
July-2013	9	16	
Oct-2013	13.5 NJ	9.0 NJ	

MW05				
GW Monit. Event	GW Elev	Cu	Ni	
Jan-2013	8.96	1.3	5.6	
Apr-2013	9.57	1.5	5.1	
July-2013	8.77	0.9	4.6	
Oct-2013	8.46	1.4	5	

SW01*			
GW Monit. Event	Cu	Ni	
July-2013	1.4	4.8	
Oct-2013	1.3	5.2	

MW09				
GW Monit. Event	GW Elev	Cu	Ni	
Jan-2013	6.94	7	90	
Apr-2013	6.25	7	10	
July-2013	6.26	7	77	
Oct-2013	5.96	5.0 NJ	30	

MW08				
GW Monit. Event	GW Elev	Cu	Ni	
Jan-2013	7.93	0.5 U	5	
Apr-2013	7.25	2.2	5	
July-2013	6.12	0.9	4	
Oct-2013	6.06	0.9	5	

SW02*			
GW Monit. Event	Cu	Ni	
July-2013	13	16	
Oct-2013	30	8.5 NJ	



P:\10\0504\04\2\02\CAD\2013 GW ELEVATION CONTOUR FIGURES\OCTOBER 2013 GW ELEVATION CONTOURS.DWG\TAB:LAYOUT MODIFIED BY TRICHAUD ON DEC 04, 2014 - 13:43



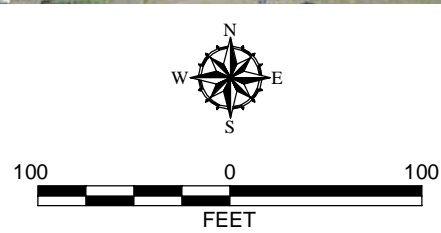
**Legend**

- Site Boundary
- Ordinary High Water (Estimated at Elevation 10.5 feet)
- MW-1 Monitoring Well Location
- (8.46) Groundwater Elevation (feet)
- 8 Groundwater Elevation Contour (feet)
- Groundwater Flow Direction

**Notes**

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.  
GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.  
Reference: Aerial photo (July 2013) from Google Earth Pro.

<b>October 2013</b>	
<b>Groundwater Elevation Contours</b>	
Former Irondale Iron and Steel Plant Irondale, Washington	
	<b>Figure 3</b>



P:\10.0504\04.2\02\CAD\GW MONITORING REPORT - OCT 2013\10.0504\04.202.Fig 3 PROPOSED SW MONITORING LOCATIONS.DWG\TAB:Fig 3 MODIFIED BY TMICHAUD ON APR 11, 2014 - 14:36



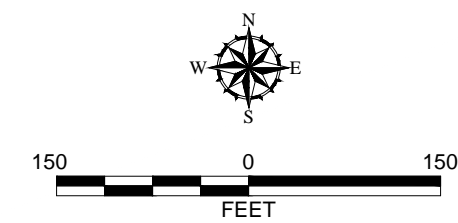
**Legend**

- Site Boundary
- Ordinary High Water (Estimated at Elevation 10.5 feet)
- Metals Area - Excavation
- Metals Area - Cap
- TPH Area - Excavation
- Slag Outcrop - Removal
- MW-1 Monitoring Well Location
- SW-2 Surface Water Monitoring Location
- SW-1A Proposed Surface Water Monitoring Location; replaces SW-1
- Assumed Groundwater Flow Direction

**Notes**

- The locations of all features shown are approximate.
- This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication. Reference: Aerial photo (July 2013) from Google Earth Pro.

<b>Proposed Surface Water Monitoring Locations</b>	
Irondale Iron and Steel Plant Irondale, Washington	
	Figure 4





## **APPENDIX A**

### **Field Procedures**

## **APPENDIX A FIELD PROCEDURES**

### **General**

Monitoring well MW-5 was constructed at the Former Irondale Iron and Steel Plant Site (Site) in June 2007 and MW-6 through MW-9 were constructed at the Site in December 2012 after remedial activities had been completed. The monitoring well construction details for MW-5 through MW-9 are presented in Appendix A of the January 2013 Groundwater Monitoring Report.

### **Depth to Groundwater Measurements**

The depth to groundwater was measured in the monitoring wells using an electric water level indicator. The depth to groundwater was measured relative to the top of the well casings. Water level measurement equipment was washed in a Liqui-Nox® solution, followed by a distilled water rinse prior to use in the well.

### **Groundwater Sample Collection and Handling**

Groundwater samples were obtained from monitoring wells MW-5 through MW-9 in October 2013.

Groundwater samples were obtained from monitoring wells using a peristaltic pump and disposable polyethylene tubing. Groundwater was pumped at approximately 0.5 liter per minute using a peristaltic pump through tubing placed within the screened interval. A Horiba U-5000 water quality measuring system with flow-through cell was used to monitor the following water quality parameters during purging: electrical conductivity, dissolved oxygen, pH, salinity, total dissolved solids, turbidity, and temperature. Groundwater samples were obtained once ambient groundwater conditions were reached. Groundwater conditions were considered ambient once the measured parameters varied by less than 10 percent on three consecutive measurements taken approximately 3 minutes apart. The stabilized field measurements are documented in the attached Groundwater Sample Collection Forms.

Samples for dissolved metals analysis were field filtered by pumping water through a 0.45 micron filter directly into the sample container using a peristaltic pump. Groundwater samples obtained were transferred to laboratory-prepared sample jars. Sample containers were filled to minimize headspace. The samples were placed in a cooler with ice pending transport to the analytical laboratory. Samples requiring preservative (e.g., HCl for diesel- and oil-range hydrocarbon analyses) contained the proper preservative in the laboratory-prepared bottles. Chain-of-custody procedures were followed in transporting the samples to the laboratory.

### **Surface water Sample Collection and Handling**

Surface water samples were collected from three locations in Port Townsend Bay upon Ecology's request during the October 2013 groundwater monitoring event. Surface water sample SW-01 was obtained from near shore in Port Townsend Bay at the northern end of the park. Surface water samples SW-02 and SW-03 were obtained near monitoring wells MW-9 and MW-6, respectively.

Surface water was collected in an amber-glass bottle provided from the laboratory by directly immersing the bottle into the surface water body. A field filtered surface water sample was then collected by pumping water from the amber-bottle through a 0.45 micron filter directly into the sample container using a

peristaltic pump. Sample containers were filled to minimize headspace. The samples were placed in a cooler with ice pending transport to the analytical laboratory.

Samples requiring preservative contained the proper preservative in the laboratory-prepared bottles. Chain-of-custody procedures were followed in transporting the samples to the laboratory.

### **Investigative Wastes**

Purged groundwater (approximately 5 gallons) removed from the monitoring well casings on October 4, 2013 during groundwater sampling was stored in a 5-gallon bucket. Purged groundwater generated during the well sampling activities was disposed in the sanitary sewer at GeoEngineers' office in Redmond, Washington in December 2013.

## GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE Job No. 0542-042-02 Collector FK Casing Elevation \_\_\_\_\_ MW ID 05

### PURGE DATA

Well Condition: Secure  Yes  No Describe Damage NONE  
 (Padlock brand and number) \_\_\_\_\_

Depth to Water (from top of well casing) 5.51 ft  
 Depth to Base of Well 18.75 ft Height of Water Column \_\_\_\_\_

Well Casing Type/Diameter 1-INCH  
 One Casing Volume (gal.) \_\_\_\_\_

Purge Method Pump (type) PERISTALTIC Bailer (type) \_\_\_\_\_  
 Gallons Purged ~1.0 galn  
 (Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal 15-gal bucket  
 (Drum identification, sample analysis, sample results, storage location, etc.)

Diameter (in.)	OD	ID	Volume Gal./Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625"	7.981"	2.6

### SAMPLING DATA

Date Collected (mo/dy/yr) 10/04/2013  
 Sample Location and Depth MW05 Time Collected 1605  
 Tidal Cycle NA High Tide at 1630 Low Tide at 1000 Weather SUNNY  
 Sample type (Groundwater, Product, Other) GW  
 Sample Collected with  Bailer  Pump  Other \_\_\_\_\_  
 Made of  Stainless Steel  PVC  Teflon  Disposable LDPE  Other \_\_\_\_\_  
 Sampler Decon Procedure LISUINOX & DISTILLED WATER RINSE  
 Sample Description (color, free product thickness, odor, turbidity, etc.) \_\_\_\_\_

### FIELD PARAMETERS

Time	Purge Volume (liter) ml	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Temperature (F/C)	Salinity (%)	TDS (g/l)	Sea Water Potential	ORP (mV)	COMMENT
1545	500	7.28	0.599	4.7	6.53	11.95	NM	0.384	0.3	-33	
1550	500	7.25	0.603	0.8	3.53	7.44	NM	0.386	0.3	-52	
1555	500	7.24	0.604	0.1	2.88	11.40	NM	0.386	0.3	-62	NM=
1600	500	7.24	0.603	0.4	2.49	11.39	NM	0.386	0.3	-66	NOT
1605	500	7.23	0.603	0.1	2.47	11.37	NM	0.386	0.3	-69	MEASU
1610	500	7.21	0.603	0.1	2.46	11.38	NM	0.386	0.3	-68	RED

Meters Used for Measurement HORIBA U-5000  
 pH/Con./DO Instrument Calibration  Yes  No Spectrophotometer \_\_\_\_\_ E-Tape

### ADDITIONAL INFORMATION

Samples Composited Overtime, Distance \_\_\_\_\_  
 Analyses, Number and Volume of Sample Containers MW05-13/004  
 Duplicate Sample Number(s) \_\_\_\_\_

Signature [Signature] Date 10/04/2013 Page \_\_\_\_\_ of \_\_\_\_\_

## GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE Job No. 0542-042-02 Collector FK Casing Elevation \_\_\_\_\_ MW ID 06

### PURGE DATA

Well Condition: Secure  Yes  No Describe Damage NONE  
 (Padlock brand and number) \_\_\_\_\_  
 Depth to Water (from top of well casing) 3.11 ft  
 Depth to Base of Well 11.25 ft Height of Water Column \_\_\_\_\_  
 Well Casing Type/Diameter 1-INCH  
 One Casing Volume (gal.) ~ 2 gallon  
 Purge Method Pump (type) PERISTALTIC Bailer (type) \_\_\_\_\_  
 Gallons Purged \_\_\_\_\_  
 (Remove minimum of 3 well volumes or until field parameters stabilize)  
 Purge Water Storage/Disposal 5-gal BUCKET  
 (Drum identification, sample analysis, sample results, storage location, etc.) N/A

Diameter (in.)	OD	ID	Volume Gal./ Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625"	7.981"	2.6

### SAMPLING DATA

Date Collected (mo/dy/yr) 10/04/13  
 Sample Location and Depth MW 06 Time Collected 1225  
 Tidal Cycle NA High Tide at 1630 Low Tide at 1000 Weather SUNNY  
 Sample type (Groundwater, Product, Other) GW  
 Sample Collected with  Bailer  Pump  Other \_\_\_\_\_  
 Made of  Stainless Steel  PVC  Teflon  Disposable LDPE  Other \_\_\_\_\_  
 Sampler Decon Procedure 1:10 UNOX + DISTILLED WATER RINSE  
 Sample Description (color, free product thickness, odor, turbidity, etc.) \_\_\_\_\_

### FIELD PARAMETERS

Time	Purge Volume (liter) ml	pH	Conductivity (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (°C)	Salinity (%)	TDS (g/l)	Sea Water Potential	ORP (mV)	COMMENT
1130	500	6.74	0.538	39	9.10	13.62	NM	0.344	0.3	-14	} NM= NOT MEASU R'D Continues on back page
1135	500	6.83	0.532	28.3	8.25	13.12	NM	0.343	0.3	-34	
1140	500	6.71	0.535	19.1	7.31	13.02	NM	0.342	0.3	-46	
1145	500	6.63	0.534	18.8	7.25	13.12	NM	0.341	0.3	-67	
1155	500	6.62	0.532	18.2	6.25	13.12	NM	0.341	0.3	-84	
1200	500	6.63	0.534	19.2	5.89	13.09	NM	0.342	0.3	-104	
1205	500	6.61	0.540	15.6	6.56	12.98	NM	0.346	0.3	-110	

Meters Used for Measurement HORIBA U-5000  
 pH/Con./DO Instrument Calibration  Yes  No Spectrophotometer \_\_\_\_\_ E-Tape

### ADDITIONAL INFORMATION

Samples Composited Overtime, Distance \_\_\_\_\_  
 Analyses, Number and Volume of Sample Containers MW06-131004 CPAH, DX, Metals  
 Duplicate Sample Number(s) \_\_\_\_\_

Signature \_\_\_\_\_ Date 10/04/13 Page 1 of 2

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# MW 06

# CONTINUED

Time	Probe Vol (ml)	pH	Conduct (µS/cm)	Turb (NTU)	Diss. Oxy (mg/L)	Temp (°C)	Salinity (%)	TDS (µL)	Seawater Potent	ORP (mV)
1210	500	6.62	0.546	14.2	5.52	12.95	NM	0.350	0.3	-109
1215	500	6.62	0.544	14.1	5.43	12.92	NM	0.348	0.3	-108
1220	500	6.64	0.538	14.0	5.19	12.99	NM	0.344	0.3	-109
1225	500	6.65	0.537	14.1	5.26	12.92	NM	0.344	0.3	-108

## GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE Job No. 0542-042-02 Collector FK Casing Elevation \_\_\_\_\_ MW ID 07

### PURGE DATA

Well Condition: Secure  Yes  No Describe Damage None  
 (Padlock brand and number) \_\_\_\_\_

Depth to Water (from top of well casing) 5.44 ft

Depth to Base of Well 11.75 ft Height of Water Column \_\_\_\_\_

Well Casing Type/Diameter 1-INCH

One Casing Volume (gal.) \_\_\_\_\_

Purge Method Pump (type) PERISTALTIC Bailer (type) \_\_\_\_\_

Gallons Purged \_\_\_\_\_

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal 5-gal bucket

(Drum identification, sample analysis, sample results, storage location, etc.) N/A

Diameter (in.)	OD	ID	Volume Gal./Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625"	7.981"	2.6

### SAMPLING DATA

Date Collected (mo/dy/yr) 10/04/2013

Sample Location and Depth MW07

Time Collected 1340

Tidal Cycle NA  High Tide at 1630 Low Tide at 1000

Weather SUNNY

Sample type (Groundwater, Product, Other) GW

Sample Collected with  Bailer  Pump  Other \_\_\_\_\_

Made of  Stainless Steel  PVC  Teflon  Disposable LDPE  Other \_\_\_\_\_

Sampler Decon Procedure LIQUINOK & DISTILLED WATER RINSE

Sample Description (color, free product thickness, odor, turbidity, etc.) \_\_\_\_\_

### FIELD PARAMETERS

Time	Purge Volume (liter) ml	pH	Conductivity (MS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Temperature (°C)	Salinity (%)	TDS (g/l)	Sea Water Potential	ORP (mV)	COMMENT
1305	500	6.98	0.456	37.4	0.38	13.84	NM	0.297	0.2	-119	) NM = NOT MEASU RE)
1310	500	7.0	0.435	28.5	6.54	13.76	NM	0.293	0.2	-123	
1315	500	7.1	0.432	17.2	4.31	13.76	NM	0.295	0.2	-138	
1320	500	7.11	0.430	8.9	2.26	13.73	NM	0.281	0.2	-147	
1325	500	7.03	0.430	3.7	1.64	13.69	NM	0.280	0.2	-156	
1330	500	7.04	0.428	1.53	1.61	13.64	NM	0.298	0.2	-158	
1335	500	7.02	0.428	1.43	1.60	13.71	NM	0.298	0.2	-154	
1340	500	7.05	0.424	1.47	1.61	13.72	NM	0.298	0.2	-159	

Meters Used for Measurement HORIBA U-5000

pH/Con./DO Instrument Calibration  Yes  No Spectrophotometer \_\_\_\_\_ E-Tape

### ADDITIONAL INFORMATION

Samples Composited Overtime, Distance \_\_\_\_\_

Analyses, Number and Volume of Sample Containers MW07-13/004

Duplicate Sample Number(s) \_\_\_\_\_

Signature [Signature] Date 10/04/13 Page 1 of 1

Check if additional information on back

## GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE Job No. 0542-042-02 Collector FK Casing Elevation \_\_\_\_\_ MW ID 08

### PURGE DATA

Well Condition: Secure  Yes  No Describe Damage NONE  
 (Padlock brand and number) \_\_\_\_\_

Depth to Water (from top of well casing) 5.87 ft

Depth to Base of Well 12.15 ft Height of Water Column \_\_\_\_\_

Well Casing Type/Diameter 1-INCH

One Casing Volume (gal.) \_\_\_\_\_

Purge Method Pump (type) PERISTALTIC Bailer (type) \_\_\_\_\_

Gallons Purged \_\_\_\_\_

(Remove minimum of 3 well volumes or until field parameters stabilize)

Purge Water Storage/Disposal 5-gal BUCKET

(Drum identification, sample analysis, sample results, storage location, etc.) 0

Diameter (in.)	OD	ID	Volume Gal./Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625"	7.981"	2.6

### SAMPLING DATA

Date Collected (mo/dy/yr) 10/04/2013

Sample Location and Depth \_\_\_\_\_ Time Collected 1500

Tidal Cycle NA  High Tide at 1630 Low Tide at 1000 Weather OVERCAST

Sample type (Groundwater, Product, Other) GW

Sample Collected with  Bailer  Pump  Other \_\_\_\_\_

Made of  Stainless Steel  PVC  Teflon  Disposable LDPE  Other \_\_\_\_\_

Sampler Decon Procedure LIQUINOK & DISTILLED WATER RINSE

Sample Description (color, free product thickness, odor, turbidity, etc.) \_\_\_\_\_

### FIELD PARAMETERS

Time	Purge Volume (liter) ml	pH	Conductivity (uS/cm)	Turbidity (NTU)	Dissolved Oxygen	Temperature (°C)	Salinity (%)	TDS (g/l)	Sea Water Potential	ORP (mV)	COMMENT
1435	1000	6.71	0.532	38.5	4.56	13.90	NM	0.34	0.3	-134	} NM= NOT MEASU RED
1440	500	6.68	0.532	33.2	2.81	13.89	NM	0.34	0.3	-135	
1445	500	6.67	0.531	19.6	2.0	13.89	NM	0.34	0.3	-137	
1450	500	6.65	0.531	13.1	1.59	13.85	NM	0.34	0.3	-139	
1455	500	6.64	0.531	11.0	1.56	13.88	NM	0.34	0.3	-138	
1500	500	6.62	0.530	12.1	1.50	13.86	NM	0.34	0.3	-139	

Meters Used for Measurement HORIBA U-5000

pH/Con./DO Instrument Calibration  Yes  No Spectrophotometer \_\_\_\_\_ E-Tape

### ADDITIONAL INFORMATION

Samples Composited Overtime, Distance \_\_\_\_\_

Analyses, Number and Volume of Sample Containers \_\_\_\_\_

Duplicate Sample Number(s) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Signature [Signature] Date 10/04/13 Page 1 of 1

Check if additional information on back

## GROUNDWATER SAMPLE COLLECTION FORM

Project IRONDALE Job No. 0504-042-02 Collector EK Casing Elevation \_\_\_\_\_ MW ID 09

### PURGE DATA

Well Condition: Secure  Yes  No Describe Damage None  
 (Padlock brand and number) \_\_\_\_\_  
 Depth to Water (from top of well casing) 5.81 ft  
 Depth to Base of Well 17.05 ft Height of Water Column \_\_\_\_\_  
 Well Casing Type/Diameter 1-inch  
 One Casing Volume (gal.) \_\_\_\_\_  
 Purge Method Pump (type) PERISTALTIC Bailer (type) \_\_\_\_\_  
 Gallons Purged ~ 2.25 gallons  
 (Remove minimum of 3 well volumes or until field parameters stabilize)  
 Purge Water Storage/Disposal 5-gal BUCKET  
 (Drum identification, sample analysis, sample results, storage location, etc.) \_\_\_\_\_

Diameter (in.)	OD	ID	Volume Gal./Linear Ft
2	2.375"	2.067"	0.17
3	3.500"	3.068"	0.38
4	4.500"	4.026"	0.66
6	6.625"	6.065"	1.5
8	8.625"	7.981"	2.6

### SAMPLING DATA

Date Collected (mo/d/yr) 10/04/2013  
 Sample Location and Depth MW09 Time Collected 1030  
 Tidal Cycle NA  High Tide at \_\_\_\_\_ Low Tide at 10:00 am Weather CLOUDY  
 Sample type (Groundwater, Product, Other) GW  
 Sample Collected with  Bailer  Pump  Other \_\_\_\_\_  
 Made of  Stainless Steel  PVC  Teflon  Disposable LDPE  Other \_\_\_\_\_  
 Sampler Decon Procedure LAQUINOX & DISTILLED WATER RINSE  
 Sample Description (color, free product thickness, odor, turbidity, etc.) SIGNIFICANT IRON OXIDE PRECIPITATE

### FIELD PARAMETERS

Time	Purge Volume (liter) ml	pH	Conductivity (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (%)	Temperature (F/C)	Salinity (%)	TDS (g/l)	Sea Water Potential	ORP (mV)	COMMENT
0930	500	7.29	16.8	112	10.02	12.63	NM	11.7	9.5	161	
0935	500	7.42	16.4	84	3.26	13.45	NM	9.93	9.4	152	NM=
0940	500	7.45	15.8	59.1	2.97	13.57	NM	9.78	9.1	149	NOT
0945	500	7.52	13.6	37.2	2.17	13.88	NM	8.42	7.8	140	MEASU
0950	500	7.57	12.1	28.6	1.78	14.07	NM	7.5	6.9	131	RED
0955	500	7.61	11.1	23.8	1.51	14.14	NM	6.88	6.2	124	Continue
1000	500	7.62	10.7	21.0	1.39	14.2	NM	6.63	6.0	120	on back

Meters Used for Measurement (See back of Page) HORIBA U-5000

pH/Con./DO Instrument Calibration  Yes  No Spectrophotometer \_\_\_\_\_ E-Tape

### ADDITIONAL INFORMATION

Samples Composited Overtime, Distance \_\_\_\_\_  
 Analyses, Number and Volume of Sample Containers MW09-13/004  
 Duplicate Sample Number(s) MW09-13/004-DUP DISSOLVED METALS

Signature [Signature] Date 10/24/13 Page 1 of 2

Check if additional information on back

# MW 09

## CONTINUED

Time	RORGE Vol (ml)	pH	Conductivity $\mu S/cm$	Turbidity NTU	Dissolved Oxygen mg/L	Temp $^{\circ}C$	Salinity	TDS g/L	Sea Water Potential	ORP mV
1005	500	7.66	9.87	16.1	1.25	14.35	NM	6.22	5.5	111
1010	500	7.68	9.25	10.3	1.15	14.47	NM	5.83	5.1	101
1015	500	7.72	8.28	4.7	1.01	14.64	NM	5.21	4.6	84
1020	500	7.71	8.18	4.7	0.95	14.68	NM	5.16	4.5	79
1025	500	7.74	8.05	5.8	0.94	14.73	NM	5.04	4.4	74
1030	500	7.73	8.01	6.0	0.93	14.76	NM	5.0	4.4	73

**APPENDIX B**  
**Data Validation Memorandum and**  
**Chemical Analytical Results**

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<b>Project:</b>	Irondale Remedial Cleanup Action, Quarterly Groundwater Monitoring (Round 4)
<b>File:</b>	00504-042-02
<b>Date:</b>	November 5, 2013
<b>Lab Report:</b>	XI67/XI86 (ARI)

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This report presents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2A validation (USEPA Document 540-R-08-005; USEPA, 2009) of analytical data from the analyses of eleven groundwater samples obtained from the Post-Construction Quarterly Groundwater Monitoring Event (Round 4) at the former Irondale Iron and Steel Plant site in Irondale, Washington. Samples obtained were submitted to Analytical Resources Incorporated (ARI) of Tukwila, Washington for chemical analysis of diesel- and heavy oil-range petroleum hydrocarbons (NWTPH-Dx), dissolved and total carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and dissolved metals (copper and nickel).

The objective of the data quality assessment was to review laboratory analytical procedures and QC results to evaluate whether the samples were analyzed using well-defined and acceptable methods that provide quantitation limits below applicable regulatory criteria, the precision and accuracy of the data are well-defined and sufficient to provide defensible data, and the quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

The ARI Sample Delivery Groups (SDGs; noted above) were reviewed for the following quality control (QC) elements:

- Chain-of-Custody Documentation
- Holding Times
- Surrogates/Labeled Compounds
- Method and Equipment Rinsate Blanks
- Laboratory Control Samples/Ongoing Precision and Recovery Samples
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory and Field Duplicates

## **DATA QUALITY ASSESSMENT SUMMARY**

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in two USEPA documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2010) and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 2008).

### **Chain-of-Custody Documentation**

Chain-of-custody forms were provided with the laboratory analytical reports. No transcription errors were found, and the appropriate signatures were applied. There were no anomalies mentioned in the sample receipt forms.

### **Holding Times**

The holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses.

### **Surrogate Recoveries**

A surrogate compound is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added at a known concentration and percent recoveries (%R) are calculated following analysis. All surrogate %R for field samples were within the laboratory control limits.

### **Method Blanks**

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of one per twenty samples. For all sample batches, method blanks for all applicable methods were analyzed at the required frequency. None of the analytes of interest were detected above the contract required quantitation limits.

### **Matrix Spikes/Matrix Spike Duplicates**

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a %R is calculated. Matrix spike duplicates (MSD) analyses are generally performed for organic analyses as a precision check. For some organic analytical methods, such as NWTPH-Dx, a laboratory control sample/ laboratory control sample duplicate (LCS/LCSD) sample set is performed in lieu of a MS/MSD analysis.

For inorganics methods, the matrix spike (referred to as a "spiked sample") is typically followed by a post spike sample if any element recoveries were outside the control limits in the "spike sample".

Matrix spike analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for matrix spikes and laboratory control samples are specified in the laboratory documents as are the relative percent difference (RPD) values. The frequency requirements were met for all analyses and the %R/RPD values were within the proper control limits.

### **Laboratory Control Samples**

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.



Laboratory control sample analyses should be performed once per analytical batch or every twenty field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the RPD values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

#### **Laboratory Duplicates (Metals and Fuels only)**

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met in all cases.

#### **Field Replicates/Duplicates**

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample. In this case, the absolute difference is used instead of the RPD.

The following field duplicate sample sets were collected for this sampling event:

- MW06-131004/MW06-131004-DUP, MW09-131004/MW09-131004-DUP, and SW02-131004/SW02-131004-DUP

The RPD/absolute difference values for the field duplicate sample sets were within their respective control limits.

#### **Miscellaneous**

- SDG XI67: (Metals) Due to the presence of chloride in Samples MW09-131004, MW09-131004-DUP, SW02-131004, SW02-131004-DUP, and SW03-131004, a sample dilution (2X) was required to accurately quantify the concentrations for copper and nickel, which elevated the reporting limits. The positive results for copper in Samples MW09-131004, MW09-131004-DUP, SW02-131004, and SW03-131004 and the positive results for nickel in Samples SW02-131004, SW02-131004-DUP, and SW03-131004 were reported as estimate below the elevated reporting limits. However, due to the presence of chloride, the positive results were qualified as tentatively identified (NJ) in these samples.

### **OVERALL ASSESSMENT**

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogates, LCS/LCSD, and MS/MSD %R values. Precision was acceptable, as demonstrated by the field duplicate, laboratory duplicate, LCS/LCSD and MS/MSD RPD and absolute difference values.

Data were qualified as tentatively identified because of the chemical interference.

Based on this validation, the data were of acceptable quality for their intended use.

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U.S. Environmental Protection Agency (USEPA). "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

U.S. Environmental Protection Agency (USEPA). "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

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<b>Project:</b>	Irondale Remedial Cleanup Action, Quarterly Groundwater Monitoring (Round 4)
<b>File:</b>	00504-042-02
<b>Date:</b>	November 5, 2013
<b>Lab Report:</b>	XI67/XI86 (ARI)

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Client: Geoengineers

Project: 0504-042-02 Former Irondale Iron & Steel Plant

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Signature bc

March-07-2014  
Date



**Analytical Resources, Incorporated**  
Analytical Chemists and Consultants

March 10, 2014

Neil Morton  
GeoEngineers, Inc.  
Plaza 600 Building  
600 Stewart Street, Suite 1700  
Seattle, WA 98101

**RE: Client Project: Former Irondale Iron & Steel Plant, 0542-042-02**  
**ARI Job No.: YA74**

Dear Neil:

Please find enclosed the Chain of Custody records (COCs), sample receipt documentation, and the final data package for samples from the project referenced above.

Sample receipt and analytical details are discussed in the Case Narrative.

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

A handwritten signature in black ink, appearing to read "Cheronne Oreiro".

Cheronne Oreiro  
Project Manager  
(206) 695-6214  
[cheronneo@arilabs.com](mailto:cheronneo@arilabs.com)  
[www.arilabs.com](http://www.arilabs.com)

cc: eFile: YA74

Enclosures



## Chain of Custody Documentation

ARI Job ID: YA74

# Chain of Custody Record & Laboratory Analysis Request

**Analytical Resources, Incorporated**  
 Analytical Chemists and Consultants  
 4611 South 134th Place, Suite 100  
 Tukwila, WA 98168  
 206-695-6200 206-695-6201 (fax)



Page: 1 of 2  
 Date: 2/26/14 Ice Present? YES  
 No. of Coolers: 1 Cooler Temps: 1.7

ARI Assigned Number: YAT4 Turn-around Requested: STANDARD  
 ARI Client Company: GEDENGINEERS Phone: 206.728.2674  
 Client Contact: NEIL MORTON  
 Client Project Name: FORMER IRONDALE IRON & STEEL PLANT  
 Client Project #: 0504-042-02 Samplers: FASIH KHAN

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested			Notes/Comments
					DISCOVERED	CONDUC TIVITY		
MW9-1100	2/26/14	1100	WATER	2	X	X		HOLD
MW9-1200	1200				X	X		<del>ATT</del>
MW9-1300	1300				X	X		<del>SAMPLES</del>
MW9-1300-DUP	1315				X	X		
MW9-1400	1400				X	X		
MW9-1500	1500				X	X		
MW9-1600	1600				X	X		
MW9-1700	1700				X	X		
MW9-1800	1800				X	X		
MW9-1900	1900				X	X		

Comments/Special Instructions: \_\_\_\_\_  
 Relinquished by: [Signature] (Signature) Received by: \_\_\_\_\_ (Signature)  
 Printed Name: FASIH KHAN Company: GEDENGINEERS Printed Name: Rich Hudson Company: \_\_\_\_\_  
 Date & Time: 2/27/14, 1140 Date & Time: 2/27/14 1140

**Limits of Liability:** ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

**Sample Retention Policy:** All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

# Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: **YAT4** Turn-around Requested: **STANDARD**  
 ARI Client Company: **GEOTECHNICAL ENGINEERS** Phone: **206.728.2674**  
 Client Contact: **NEIL MORTON**  
 Client Project Name: **FORMER IRONDALE IRON & STEEL PLANT**  
 Client Project #: **5402-042-001** Samplers: **FASHA KHAN**

Page: **2** of **2**  
 Date: **2/26/14** Ice Present? **Yes**  
 No. of Coolers: **2** Cooler Temps: **1.7**

Analytical Resources, Incorporated  
 Analytical Chemists and Consultants  
 4611 South 134th Place, Suite 100  
 Tukwila, WA 98168  
 206-695-6200 206-695-6201 (fax)



Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested				Notes/Comments
					DISCOVER	CONDUCTIVITY			
MW-2000	2/26/14	2000	WATER	2	X	X			HOED
MW-2100		2100			X	X			ADD
SW-1A		0930			X	X			SAMPLES
SW-1B		0945			X	X			
SW-2		1310			X	X			
SW-2-DUP		1325			X	X			
SW-3		1015			X	X			
Comments/Special Instructions	Relinquished by: <i>[Signature]</i> Date & Time: <b>2/27/14 1140</b>				Received by: <i>[Signature]</i> Date & Time: <b>2/27/14 1140</b>				
	Printed Name: <b>FASHA KHAN</b>				Printed Name: <b>F. S. Mulla</b>				
	Company: <b>GEOTECHNICAL ENGINEERS</b>				Company: <b>ARI</b>				

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YAT4: 00001



# Cooler Receipt Form

ARI Client: Geo Engineers  
 COC No(s): \_\_\_\_\_ (NA)  
 Assigned ARI Job No. YA74

Project Name Former Inondale Iron & Steel Plant  
 Delivered by: Fed-Ex UPS Courier Hand Delivered Other: \_\_\_\_\_  
 Tracking No: \_\_\_\_\_ (NA)

**Preliminary Examination Phase:**

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES (NO)  
 Were custody papers included with the cooler? ... YES (NO)  
 Were custody papers properly filled out (ink, signed, etc) ... YES (NO)

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)  
 Time: 1205

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID# 90877952  
1.7

Cooler Accepted by: \_\_\_\_\_ Date 2/27/14 Time: 1140

**Complete custody forms and attach all shipping documents**

**Log-In Phase:**

Was a temperature blank included in the cooler? ... YES (NO)

What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: \_\_\_\_\_

Was sufficient ice used (if appropriate)? ... NA YES (NO)

Were all bottles sealed in individual plastic bags? ... YES (NO)

Did all bottles arrive in good condition (unbroken)? ... YES (NO)

Were all bottle labels complete and legible? ... YES (NO)

Did the number of containers listed on COC match with the number of containers received? ... YES (NO)

Did all bottle labels and tags agree with custody papers? ... YES (NO)

Were all bottles used correct for the requested analyses? ... YES (NO)

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA YES (NO)

Were all VOC vials free of air bubbles? ... (NA) YES (NO)

Was sufficient amount of sample sent in each bottle? ... YES (NO)

Date VOC Trip Blank was made at ARI ... (NA)

Was Sample Split by ARI (NA) YES Date/Time: \_\_\_\_\_ Equipment: \_\_\_\_\_ Split by: \_\_\_\_\_

Samples Logged by: JM Date: 2/27/14 Time: 1320

**\*\* Notify Project Manager of discrepancies or concerns \*\***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC
MW9-2000	MW-2000		
MW9-2100	MW-2100		

**Additional Notes, Discrepancies, & Resolutions:**

Used ID from Containers

By: JM Date: 2/27/14

			Small → "sm" (< 2 mm)
			Peabubbles → "pb" (2 to < 4 mm)
			Large → "lg" (4 to < 6 mm)
			Headspace → "hs" (> 6 mm)



ARI Job No: YA74

PC: Cheronne  
VTSR: 02/27/14

Inquiry Number: NONE  
Analysis Requested: 02/27/14  
Contact: Morton, Neil  
Client: Geoengineers  
Logged by: JM  
Sample Set Used: Yes-481  
Validatable Package: No  
Deliverables:

Project #: 0504-042-02  
Project: Former Irondale Iron & Steel Plant  
Sample Site:  
SDG No:  
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	Fe2+ <2	DMET DOC FLT FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
14-3248 <b>YA74A</b>	MW9-1100						DIS									Y					
14-3249 <b>YA74B</b>	MW9-1200						DIS									Y					
14-3250 <b>YA74C</b>	MW9-1300						DIS									Y					
14-3251 <b>YA74D</b>	MW9-1300-Dup						DIS									Y					
14-3252 <b>YA74E</b>	MW9-1400						DIS									Y					
14-3253 <b>YA74F</b>	MW9-1500						DIS									Y					
14-3254 <b>YA74G</b>	MW9-1600						DIS									Y					
14-3255 <b>YA74H</b>	MW9-1700						DIS									Y					
14-3256 <b>YA74I</b>	MW9-1800						DIS									Y					
14-3257 <b>YA74J</b>	MW9-1900						DIS									Y					
14-3258 <b>YA74K</b>	MW9-2000						DIS									Y					
14-3259 <b>YA74L</b>	MW9-2100						DIS									Y					
14-3260 <b>YA74M</b>	SW-1A						DIS									Y					
14-3261 <b>YA74N</b>	SW-1B						DIS									Y					

P=Pass

Checked By: JM Date: 2/27/14

Client: Geoenvironmental Engineers



ARI Job No: YA74

Project #: 0504-042-02

Project: Former Irondale Iron & Steel Plant

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	MH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	Fe2+ <2	DMET DOC FLT FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
14-3262 <b>YA74O</b>	SW-2						PLS									Y					
14-3263 <b>YA74P</b>	SW-2-Dup						PLS									Y					
14-3264 <b>YA74Q</b>	SW-3						PLS									Y					

YA74 : 00007

Checked By JM Date 2/27/14

Case Narrative, Data Qualifiers, Control Limits

ARI Job ID: YA74



## **Case Narrative**

**Client: GeoEngineers, Inc.**

**Project: Former Irondale Iron & Steel Plant, 0542-042-02**

**ARI Job No.: YA74**

### **Sample Receipt**

Seventeen water samples were received on February 27, 2014 under ARI job YA74. The cooler temperature measured by IR thermometer following ARI SOP was 1.7°C. For further details regarding sample receipt, please refer to the Cooler Receipt Form.

### **Dissolved Metals by Method 200.8**

The samples and associated laboratory QC were digested and analyzed within recommended holding times.

Samples were analyzed using a UCT (Universal Cell Technology) ICP-MS instrument which includes the capability to run DRC (Dynamic Reaction Cell), KED (Kinetic Energy Discrimination), or standard ICP-MS mode.

The method blank was clean at the reporting limits. The LCS percent recoveries were within control limits.

The matrix spike percent recoveries and duplicate RPDs were within control limits.

### **General Chemistry Parameters (Conductivity)**

The samples and associated laboratory QC were prepared and analyzed within recommended holding times.

The method blank was clean at the reporting limit. The SRM percent recovery was within control limits.

The replicate RPD was within the control limit.



# Sample ID Cross Reference Report



ARI Job No: YA74  
Client: Geoengineers  
Project Event: 0504-042-02  
Project Name: Former Irondale Iron & Steel Plant

Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1. MW9-1100	YA74A	14-3248	Water	02/26/14 11:00	02/27/14 11:40
2. MW9-1200	YA74B	14-3249	Water	02/26/14 12:00	02/27/14 11:40
3. MW9-1300	YA74C	14-3250	Water	02/26/14 13:00	02/27/14 11:40
4. MW9-1300-Dup	YA74D	14-3251	Water	02/26/14 13:15	02/27/14 11:40
5. MW9-1400	YA74E	14-3252	Water	02/26/14 14:00	02/27/14 11:40
6. MW9-1500	YA74F	14-3253	Water	02/26/14 15:00	02/27/14 11:40
7. MW9-1600	YA74G	14-3254	Water	02/26/14 16:00	02/27/14 11:40
8. MW9-1700	YA74H	14-3255	Water	02/26/14 17:00	02/27/14 11:40
9. MW9-1800	YA74I	14-3256	Water	02/26/14 18:00	02/27/14 11:40
10. MW9-1900	YA74J	14-3257	Water	02/26/14 19:00	02/27/14 11:40
11. MW9-2000	YA74K	14-3258	Water	02/26/14 20:00	02/27/14 11:40
12. MW9-2100	YA74L	14-3259	Water	02/26/14 21:00	02/27/14 11:40
13. SW-1A	YA74M	14-3260	Water	02/26/14 09:30	02/27/14 11:40
14. SW-1B	YA74N	14-3261	Water	02/26/14 09:45	02/27/14 11:40
15. SW-2	YA74O	14-3262	Water	02/26/14 13:10	02/27/14 11:40
16. SW-2-Dup	YA74P	14-3263	Water	02/26/14 13:25	02/27/14 11:40
17. SW-3	YA74Q	14-3264	Water	02/26/14 10:15	02/27/14 11:40



Analytical Method Information

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	RPD	Blank Spike / LCS %R	RPD
<b>Met Diss 200.8 (EPA 200.8) in Water</b>								
Preservation: pH<2; HNO3, Cool <6°C								
Container: HDPE NM, 500 mL								
				Amount Required: 500 mL		Hold Time: 180 days		
Aluminum-27	0.00160	0.0200 mg/L		20	75 - 125	20	80 - 120	20
Antimony-121	0.0000100	.000200 mg/L		20	75 - 125	20	80 - 120	20
Antimony-123	0.0000110	.000200 mg/L		20	75 - 125	20	80 - 120	20
Arsenic-75a	0.0000480	.000200 mg/L		20	75 - 125	20	80 - 120	20
Arsenic-75b	0.0000480	.000200 mg/L		20	75 - 125	20	80 - 120	20
Barium-135	0.0000200	.000500 mg/L		20	75 - 125	20	80 - 120	20
Barium-137	0.0000190	.000500 mg/L		20	75 - 125	20	80 - 120	20
Beryllium-9	0.0000210	.000200 mg/L		20	75 - 125	20	80 - 120	20
Cadmium-111	0.000100	.000100 mg/L		20	75 - 125	20	80 - 120	20
Cadmium-114	0.00000500	.000100 mg/L		20	75 - 125	20	80 - 120	20
Calcium-43	0.00398	0.0500 mg/L		20	75 - 125	20	80 - 120	20
Chromium-52	0.0000450	.000500 mg/L		20	75 - 125	20	80 - 120	20
Chromium-53	0.000118	.000500 mg/L		20	75 - 125	20	80 - 120	20
Cobalt-59	0.0000110	.000200 mg/L		20	75 - 125	20	80 - 120	20
Copper-63	0.000158	.000500 mg/L		20	75 - 125	20	80 - 120	20
Copper-65	0.000236	.000500 mg/L		20	75 - 125	20	80 - 120	20
Iron-54	0.00575	0.0200 mg/L		20	75 - 125	20	80 - 120	20
Iron-57	0.00388	0.0200 mg/L		20	75 - 125	20	80 - 120	20
Lead-208	0.0000460	.000100 mg/L		20	75 - 125	20	80 - 120	20
Magnesium-24	0.000297	0.0200 mg/L		20	75 - 125	20	80 - 120	20
Manganese-55	0.0000220	.000500 mg/L		20	75 - 125	20	80 - 120	20
Molybdenum-98	0.0000130	.000200 mg/L		20	75 - 125	20	80 - 120	20
Nickel-60	0.0000790	.000500 mg/L		20	75 - 125	20	80 - 120	20
Nickel-62	0.0000890	.000500 mg/L		20	75 - 125	20	80 - 120	20
Potassium-39	0.00294	0.0200 mg/L		20	75 - 125	20	80 - 120	20
Selenium-82	0.000127	.000500 mg/L		20	75 - 125	20	80 - 120	20
Selenium-78	0.000324	0.00200 mg/L		20	75 - 125	20	80 - 120	20
Silver-107	0.00000800	.000200 mg/L		20	75 - 125	20	80 - 120	20
Sodium-23	0.00283	0.100 mg/L		20	75 - 125	20	80 - 120	20
Thorium-232	0.0000130	.000200 mg/L		20	75 - 125	20	80 - 120	20
Thallium-205	0.00000400	.000200 mg/L		20	75 - 125	20	80 - 120	20
Uranium-238	0.00000300	.000200 mg/L		20	75 - 125	20	80 - 120	20
Vanadium-51a	0.0000430	.000200 mg/L		20	75 - 125	20	80 - 120	20
Vanadium-51b	0.0000430	.000200 mg/L		20	75 - 125	20	80 - 120	20
Zinc-66	0.000497	0.00400 mg/L		20	75 - 125	20	80 - 120	20
Zinc-67	0.000531	0.00400 mg/L		20	75 - 125	20	80 - 120	20
Zinc-68	0.000524	0.00400 mg/L		20	75 - 125	20	80 - 120	20
Lithium								
Scandium								
Germanium								
Indium								
Terbium								



<b>Spike Recovery Control Limits for Conventional Wet Chemistry</b>		
Effective 5/1/09		
Control limits are updated periodically. Assure that you have ARI's current control limits by downloading the files at the time of use. <a href="http://www.arilabs.com/portal/downloads/ARI-CLs.zip">http://www.arilabs.com/portal/downloads/ARI-CLs.zip</a>		
Sample Matrix:	ARI's Control Limits	
	Water	Soil / Sediment
<b>Matrix Spike Recoveries</b>	% Recovery	% Recovery
Ammonia	75 - 125	75 - 125
Bromide	75 - 125	75 - 125
Chloride	75 - 125	75 - 125
Cyanide	75 - 125	75 - 125
Ferrous Iron	75 - 125	75 - 125
Fluoride	75 - 125	75 - 125
Formaldehyde	75 - 125	75 - 125
Hexane Extractable Material	-- --	78 - 114
Hexavalent Chromium	75 - 125	75 - 125
Nitrate/Nitrite	75 - 125	75 - 125
Oil and Grease	75 - 125	75 - 125
Phenol	75 - 125	75 - 125
Phosphorous	75 - 125	75 - 125
Sulfate	75 - 125	75 - 125
Sulfide	75 - 125	75 - 125
Total Kjeldahl Nitrogen	75 - 125	75 - 125
Total Organic Carbon	75 - 125	75 - 125
<b>Duplicate RPDs</b>		
Acidity	±20%	±20%
Alkalinity	±20%	±20%
BOD	±20%	±20%
Cation Exchange	±20%	±20%
COD	±20%	±20%
Conductivity	±20%	±20%
Salinity	±20%	±20%
Solids	±20%	±20%
Turbidity	±20%	±20%

**Metals Analysis  
Report and Summary QC Forms**

**ARI Job ID: YA74**

**Cover Page**  
**INORGANIC ANALYSIS DATA PACKAGE**



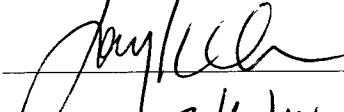
CLIENT: Geoengineers  
 PROJECT: Former Irondale Iron  
 SDG: YA74

CLIENT ID	ARI ID	ARI LIMS ID	REPREP
MW9-1100	YA74A	14-3248	
MW9-1100D	YA74ADUP	14-3248	
MW9-1100S	YA74ASPK	14-3248	
MW9-1200	YA74B	14-3249	
PBW	YA74MB1	14-3249	
LCSW	YA74MB1SPK	14-3249	
MW9-1300	YA74C	14-3250	
MW9-1300-Dup	YA74D	14-3251	
MW9-1400	YA74E	14-3252	
MW9-1500	YA74F	14-3253	
MW9-1600	YA74G	14-3254	
MW9-1700	YA74H	14-3255	
MW9-1800	YA74I	14-3256	
MW9-1900	YA74J	14-3257	
MW9-2000	YA74K	14-3258	
MW9-2100	YA74L	14-3259	
SW-1A	YA74M	14-3260	
SW-1B	YA74N	14-3261	
SW-2	YA74O	14-3262	
SW-2-Dup	YA74P	14-3263	
SW-3	YA74Q	14-3264	

Were ICP interelement corrections applied ?                      Yes/No    YES  
 Were ICP background corrections applied ?                      Yes/No    YES  
 If yes - were raw data generated before  
 application of background corrections ?                      Yes/No    NO

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

THIS DATA PACKAGE HAS BEEN REVIEWED AND AUTHORIZED FOR RELEASE BY:

Signature:                       Name: Jay Kuhn  
 Date: 3/6/14                      Title: Inorganics Director

**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**

Page 1 of 1

Sample ID: MW9-1100  
SAMPLE

Lab Sample ID: YA74A  
LIMS ID: 14-3248  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	1.6	5		6
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.8	5		8


U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

Page 1 of 1

Sample ID: MW9-1200  
SAMPLE

Lab Sample ID: YA74B  
LIMS ID: 14-3249  
Matrix: Water  
Data Release Authorized:   
Reported: 03/06/14

QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.8	2		4
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.4	2		6

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

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**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

**Sample ID: MW9-1300  
SAMPLE**

Page 1 of 1

Lab Sample ID: YA74C  
LIMS ID: 14-3250  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	1.6	5.0	3.9	J
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.8	5	5	

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit


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**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

**Sample ID: MW9-1300-Dup  
SAMPLE**

Page 1 of 1

Lab Sample ID: YA74D  
LIMS ID: 14-3251  
Matrix: Water  
Data Release Authorized:   
Reported: 03/06/14

QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	1.6	5.0	4.7	J
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.8	5	5	

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

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**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**


Page 1 of 1

**Sample ID: MW9-1400  
SAMPLE**

Lab Sample ID: YA74E

LIMS ID: 14-3252

Matrix: Water

Data Release Authorized: 

Reported: 03/06/14

QC Report No: YA74-Geoengineers

Project: Former Irondale Iron & Steel Plant

0504-042-02

Date Sampled: 02/26/14

Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.8	2		5
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.4	2		6

U-Analyte undetected at given DL

J-Analyte detected between DL and LOQ

DL-Detection Limit

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**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

**Sample ID: MW9-1500  
SAMPLE**

Page 1 of 1

Lab Sample ID: YA74F  
LIMS ID: 14-3253  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.8	2		6
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.4	2		5

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

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**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

Sample ID: MW9-1600  
SAMPLE

Page 1 of 1

Lab Sample ID: YA74G  
LIMS ID: 14-3254  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.4	1		4
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.2	1		6

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

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**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

**Sample ID: MW9-1700  
SAMPLE**

Page 1 of 1

Lab Sample ID: YA74H  
LIMS ID: 14-3255  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.4	1		3
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.2	1		7

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**


Page 1 of 1

**Sample ID: MW9-1800  
SAMPLE**

Lab Sample ID: YA74I

LIMS ID: 14-3256

Matrix: Water

Data Release Authorized 

Reported: 03/06/14

QC Report No: YA74-Geoengineers

Project: Former Irondale Iron & Steel Plant

0504-042-02

Date Sampled: 02/26/14

Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.4	1		3
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.2	1		7

U-Analyte undetected at given DL

J-Analyte detected between DL and LOQ

DL-Detection Limit

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**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**

Page 1 of 1

Sample ID: MW9-1900  
SAMPLE

Lab Sample ID: YA74J

LIMS ID: 14-3257

Matrix: Water

Data Release Authorized:

Reported: 03/06/14

QC Report No: YA74-Geoengineers

Project: Former Irondale Iron & Steel Plant

0504-042-02

Date Sampled: 02/26/14

Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.4	1		3
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.2	1		8

U-Analyte undetected at given DL

J-Analyte detected between DL and LOQ

DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**


Page 1 of 1

**Sample ID: MW9-2000  
SAMPLE**

Lab Sample ID: YA74K

LIMS ID: 14-3258

Matrix: Water

Data Release Authorized: 

Reported: 03/06/14

QC Report No: YA74-Geoengineers

Project: Former Irondale Iron & Steel Plant

0504-042-02

Date Sampled: 02/26/14

Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.4	1		3
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.2	1		5

U-Analyte undetected at given DL

J-Analyte detected between DL and LOQ

DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.



**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**  
Page 1 of 1

**Sample ID: MW9-2100  
SAMPLE**

Lab Sample ID: YA74L  
LIMS ID: 14-3259  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.4	1		3
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.2	1		5

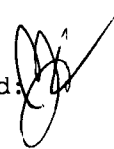
U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**  
**DISSOLVED METALS**  
Page 1 of 1

Sample ID: **SW-1A**  
**SAMPLE**

Lab Sample ID: YA74M  
LIMS ID: 14-3260  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	4	10	10	U
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	2	10	10	U

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**

Page 1 of 1

Sample ID: SW-1B  
SAMPLE

Lab Sample ID: YA74N

LIMS ID: 14-3261

Matrix: Water

Data Release Authorized

Reported: 03/06/14



QC Report No: YA74-Geoengineers

Project: Former Irondale Iron & Steel Plant

0504-042-02

Date Sampled: 02/26/14

Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	4	10	10	U
200.8	02/28/14	200.8	03/04/14	<b>7440-02-0</b>	<b>Nickel</b>	2	12	<b>4</b>	<b>J</b>

U-Analyte undetected at given DL

J-Analyte detected between DL and LOQ

DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**  
Page 1 of 1

**Sample ID: SW-2  
SAMPLE**

Lab Sample ID: YA740  
LIMS ID: 14-3262  
Matrix: Water  
Data Release Authorized  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	4	10	10	U
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	2	12	4	J

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**  
**DISSOLVED METALS**  
Page 1 of 1

Sample ID: SW-2-Dup  
SAMPLE

Lab Sample ID: YA74P  
LIMS ID: 14-3263  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	4	10	10	U
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	2	10	10	U

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**

**DISSOLVED METALS**

Page 1 of 1

Sample ID: SW-3  
SAMPLE

Lab Sample ID: YA74Q  
LIMS ID: 14-3264  
Matrix: Water  
Data Release Authorized  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	4	12	4	J
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	2	10	10	U

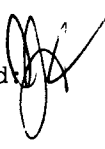
U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit

Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**INORGANICS ANALYSIS DATA SHEET**  
**DISSOLVED METALS**  
Page 1 of 1

Sample ID: MW9-1100  
MATRIX SPIKE

Lab Sample ID: YA74A  
LIMS ID: 14-3248  
Matrix: Water  
Data Release Authorized  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

**MATRIX SPIKE QUALITY CONTROL REPORT**

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Copper	200.8	6	29	25.0	92.0%	
Nickel	200.8	8	34	25.0	104%	

Reported in µg/L

N-Control Limit Not Met  
H-% Recovery Not Applicable, Sample Concentration Too High  
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

**INORGANICS ANALYSIS DATA SHEET**  
**DISSOLVED METALS**  
Page 1 of 1

**Sample ID: MW9-1100**  
**DUPLICATE**

Lab Sample ID: YA74A  
LIMS ID: 14-3248  
Matrix: Water  
Data Release Authorized  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

**MATRIX DUPLICATE QUALITY CONTROL REPORT**

<b>Analyte</b>	<b>Analysis Method</b>	<b>Sample</b>	<b>Duplicate</b>	<b>RPD</b>	<b>Control Limit</b>	<b>Q</b>
Copper	200.8	6	6	0.0%	+/- 5	L
Nickel	200.8	8	8	0.0%	+/- 5	L

Reported in µg/L

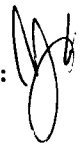
\*-Control Limit Not Met  
L-RPD Invalid, Limit = Detection Limit



**INORGANICS ANALYSIS DATA SHEET**  
**DISSOLVED METALS**  
Page 1 of 1

**Sample ID: LAB CONTROL**

Lab Sample ID: YA74LCS  
LIMS ID: 14-3249  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: NA  
Date Received: NA

**BLANK SPIKE QUALITY CONTROL REPORT**

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Copper	200.8	25.6	25.0	102%	
Nickel	200.8	26.0	25.0	104%	

Reported in µg/L

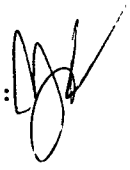
N-Control limit not met  
Control Limits: 80-120%

**INORGANICS ANALYSIS DATA SHEET  
DISSOLVED METALS**

**Sample ID: METHOD BLANK**

Page 1 of 1

Lab Sample ID: YA74MB  
LIMS ID: 14-3249  
Matrix: Water  
Data Release Authorized:  
Reported: 03/06/14



QC Report No: YA74-Geoengineers  
Project: Former Irondale Iron & Steel Plant  
0504-042-02  
Date Sampled: NA  
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	DL	LOQ	µg/L	Q
200.8	02/28/14	200.8	03/04/14	7440-50-8	Copper	0.16	0.5	0.5	U
200.8	02/28/14	200.8	03/04/14	7440-02-0	Nickel	0.08	0.5	0.5	U

U-Analyte undetected at given DL  
J-Analyte detected between DL and LOQ  
DL-Detection Limit


Results reported below the LOQ are for statistical purposes only and have not been evaluated by either an analyst or data reviewer.

**General Chemistry Analysis  
Report and Summary QC Forms**

**ARI Job ID: YA74**

**INORGANICS ANALYSIS DATA SHEET**  
**Conductivity by Method EPA 120.1**



Data Release Authorized:   
 Reported: 03/03/14  
 Date Received: 02/27/14  
 Page 1 of 1

QC Report No: YA74-Geoengineers  
 Project: Former Irondale Iron & Steel Plant  
 0504-042-02

Client/ ARI ID	Date Sampled	Matrix	Analysis Date & Batch	RL	Result
MW9-1100 YA74A 14-3248	02/26/14	Water	02/28/14 022814#1	1.00	39,900
MW9-1200 YA74B 14-3249	02/26/14	Water	02/28/14 022814#1	1.00	12,400
MW9-1300 YA74C 14-3250	02/26/14	Water	02/28/14 022814#1	1.00	15,600
MW9-1300-Dup YA74D 14-3251	02/26/14	Water	02/28/14 022814#1	1.00	42,100
MW9-1400 YA74E 14-3252	02/26/14	Water	02/28/14 022814#1	1.00	14,600
MW9-1500 YA74F 14-3253	02/26/14	Water	02/28/14 022814#1	1.00	16,300
MW9-1600 YA74G 14-3254	02/26/14	Water	02/28/14 022814#1	1.00	8,230
MW9-1700 YA74H 14-3255	02/26/14	Water	02/28/14 022814#1	1.00	4,640
MW9-1800 YA74I 14-3256	02/26/14	Water	02/28/14 022814#1	1.00	3,850
MW9-1900 YA74J 14-3257	02/26/14	Water	02/28/14 022814#1	1.00	3,550
MW9-2000 YA74K 14-3258	02/26/14	Water	02/28/14 022814#1	1.00	3,270
MW9-2100 YA74L 14-3259	02/26/14	Water	02/28/14 022814#1	1.00	3,340
SW-1A YA74M 14-3260	02/26/14	Water	02/28/14 022814#1	1.00	44,700
SW-1B YA74N 14-3261	02/26/14	Water	02/28/14 022814#1	1.00	45,200
SW-2 YA74O 14-3262	02/26/14	Water	02/28/14 022814#1	1.00	43,200
SW-2-Dup YA74P 14-3263	02/26/14	Water	02/28/14 022814#1	1.00	43,100
SW-3 YA74Q 14-3264	02/26/14	Water	02/28/14 022814#1	1.00	45,300

**Reported in umhos/cm**

RL-Analytical reporting limit  
 U-Undetected at reported detection limit  
 Report for YA74

YA74: 00137

REPLICATE RESULTS-CONVENTIONALS  
YA74-Geoengineers



Matrix: Water  
Data Release Authorized:  
Reported: 03/03/14

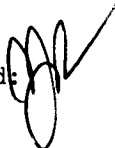
A handwritten signature in black ink, consisting of several loops and a long tail stroke, positioned over the 'Data Release Authorized' text.

Project: Former Irondale Iron & Steel  
Event: 0504-042-02  
Date Sampled: 02/26/14  
Date Received: 02/27/14

Analyte	Date	Units	Sample	Replicate (s)	RPD/RSD
ARI ID: YA74A	Client ID: MW9-1100				
Conductivity	02/28/14	umhos/cm	39,900	40,000	0.3%

METHOD BLANK RESULTS-CONVENTIONALS  
YA74-Geoengineers



Matrix: Water  
Data Release Authorized:   
Reported: 03/03/14

Project: Former Irondale Iron & Steel  
Event: 0504-042-02  
Date Sampled: NA  
Date Received: NA

Analyte	Date/Time	Units	Blank
Conductivity	02/28/14 12:28	umhos/cm	< 1.00 U

STANDARD REFERENCE RESULTS-CONVENTIONALS  
YA74-Geoengineers



Matrix: Water  
Data Release Authorized:  
Reported: 03/03/14

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

Project: Former Irondale Iron & Steel  
Event: 0504-042-02  
Date Sampled: NA  
Date Received: NA

Analyte/SRM ID	Date/Time	Units	SRM	True Value	Recovery
Conductivity Ricca #4110724	02/28/14 12:28	umhos/cm	985	1,000	98.5%

**APPENDIX C**  
**Report Limitations and Guidelines for Use**



## **APPENDIX C REPORT LIMITATIONS AND GUIDELINES FOR USE<sup>1</sup>**

This Appendix provides information to help you manage your risks with respect to the use of this report.

### **Read These Provisions Closely**

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory “limitations” provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these “Report Limitations and Guidelines for Use” apply to your project or site.

### **Environmental Services Are Performed For Specific Purposes, Persons And Projects**

This report has been prepared for the exclusive use by the Washington Department of Ecology. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an environmental site assessment study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and project site. This report should not be applied for any purpose or project except the one originally contemplated.

### **This Environmental Report Is Based On A Unique Set Of Project-Specific Factors**

This report has been prepared for the former Irondale Iron and Steel Plant site at the intersection of East Moore Street and 1<sup>st</sup> Avenue in Irondale, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

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<sup>1</sup> Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; [www.asfe.org](http://www.asfe.org).

### **Reliance Conditions For Third Parties**

No other party may rely on the product of our services unless we agree in advance and in writing to such reliance. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted environmental practices in this area at the time this report was prepared.

### **Environmental Regulations Are Always Evolving**

Some substances may be present in the site vicinity in quantities or under conditions that may have led, or may lead, to contamination of the subject site, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substance change, or if more stringent environmental standards are developed in the future.

### **Uncertainty May Remain Even After This Study Is Completed**

No environmental assessment can wholly eliminate uncertainty regarding the potential for contamination in connection with a property. Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely-spaced sampling locations. It is always possible that contamination exists in areas that were not explored, sampled or analyzed.

### **Subsurface Conditions Can Change**

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, by new releases of hazardous substances, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying this report to determine if it is still applicable.

### **Soil And Groundwater End Use**

The cleanup levels referenced in this report are site- and situation-specific. The cleanup levels may not be applicable for other sites or for other on-site uses of the affected media (soil and/or groundwater). Note that hazardous substances may be present in some of the site soil and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or groundwater from the subject site or reuse of the affected media on site to evaluate the potential for associated environmental liabilities. We cannot be responsible for potential environmental liability arising out of the transfer of soil and/or groundwater from the subject site to another location or its reuse on site in instances that we were not aware of or could not control.

### **Most Environmental Findings Are Professional Opinions**

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Have we delivered World Class Client Service?

Please let us know by visiting [www.geoengineers.com/feedback](http://www.geoengineers.com/feedback).

