

Appendix A

**January and April 2011
Quarterly Groundwater
Monitoring Data, Analytical
Laboratory Reports, and Data
Validation Summaries**

Table A-1. Well Construction Details and Groundwater Elevation Data, Heglar Kronquist Landfill, Mead, Washington

Monitoring Well ID	Completion Date	Total Depth (ft bgs)	Screen Interval (ft bgs)	Well Completion*	Well Elevation North TOC (ft above msl)	25-Apr-11	
						Depth to Groundwater North TOC (ft above msl)	Water level Elevation (ft above msl)
MW-1	13-Sep-10	70	53 - 68	Above-ground, 2-inch PVC	2183.49	54.80	2128.69
MW-2	16-Sep-10	75	58 - 73	Above-ground, 2-inch PVC	2186.19	61.52	2124.67
MW-3	17-Sep-10	60	43 - 58	Above-ground, 2-inch PVC	2176.18	51.03	2125.15
MW-4	14-Sep-10	66	49 - 64	Above-ground, 2-inch PVC	2247.25	51.13	2196.12
MW-5	21-Sep-10	47	30 - 45	Above-ground, 2-inch PVC	2228.26	33.58	2194.68
MW-6	16-Sep-10	55	38 - 53	Above-ground, 2-inch PVC	2167.21	42.19	2125.02
3bcd-1	1-May-80	53	48 - 53	Above-ground, 5-inch steel	2256.07	-	-
3bcd-2	5-May-80	41.78**	31 - 66	Above-ground, 6-inch steel	2217.87	38.70	2179.17
3bcc	Prior to 1980	57.5	Unknown	Above-ground, 6-inch steel	2184.17	-	-

Notes:

bgs below ground surface

ft feet

msl Mean sea level

TOC Top of casing (top of inner PVC casing for MW-1 through MW-6 and top of steel casing for 3bcd-1, 3bcd-2, and 3bcc); surveyed in 2010.

* Wells MW-1 through MW-6 completed with inner 2-in. diameter PVC casings and outer, aboveground steel monuments with locking lids surrounded by three steel protective posts. Wells 3bcd-1, 3bcd-2, and 3bcc completed with 5-in. or 6-in. diameter steel casings extended aboveground with locking lids.

** Sounded well depth in May 2010 measured at 41.78 ft bgs. Total depth on well log prepared in 1980 is 66 ft bgs.

Table A-2. Groundwater Sampling Results for January and April 2011, Heglar Kronquist Landfill, Mead, Washington

Chemical	Method	Units	MW-1		MW-2			MW-3		MW-4			MW-5		MW-6		Federal or State Standard			MTCA Standard ^b
			1/24/2011	4/25/2011	1/24/2011	1/24/2011 Re-analysis	4/25/2011	1/25/2011	4/26/2011	1/24/2011	1/24/2011 Re-analysis	4/26/2011	1/23/2011	4/25/2011	1/23/2011	4/25/2011	Primary MCLs	Secondary MCLs (not health-based)	Action/ Advisory Levels	Method B
Field Data																				
Depth to Water	-	ft bmp	58.76	54.8	65.8	-	61.52	55.21	51.03	51.98	-	51.13	33.96	33.58	46.54	42.19	-	-	-	-
pH	-	s.u.	- ^a	6.93	7.03	-	7.15	- ^a	7.78	- ^a	-	7.33	7.4	6.99	7.32	7.18	-	6.5-8.5	-	-
Specific conductivity	-	µmhos/cm	- ^a	2,010	590	-	906	- ^a	2,787	- ^a	-	3,914	694	780	593	630	-	700	-	-
Temperature	-	C°	- ^a	10.74	7.6	-	10.59	- ^a	10.25	- ^a	-	10.48	8.5	9.86	9.4	9.67	-	-	-	-
Turbidity	-	NTU	5.17	5.09	41.6	-	3.45	4.3	4.81	13.3	-	2.74	3.07	3.67	6.82	4.01	-	-	-	-
General Chemistry																				
Alkalinity, Bicarbonate as CaCO ₃	SM 2320B	mg/L	196	146	268	-	258	176	169	206	-	194	274	301	218	224	-	-	-	-
Alkalinity, Carbonate as CaCO ₃	SM 2320B	mg/L	3.0 U	-	3.0 U	-	-	1.0 U	-	3.0 U	-	-	3.0 U	-	3.0 U	-	-	-	-	-
Alkalinity, Hydroxide as CaCO ₃	SM 2320B	mg/L	3.0 U	-	3.0 U	-	-	1.0 U	-	3.0 U	-	-	3.0 U	-	3.0 U	-	-	-	-	-
Alkalinity, Total as CaCO ₃	SM 2320B	mg/L	196	-	268	-	-	176	-	206	-	-	274	-	218	-	-	-	-	-
Ammonia as Nitrogen	350.1	mg/L	0.020 U	0.02 U	0.020 U	-	0.02 U	0.020 U	0.02 U	2.31	-	4.8	0.020 U	0.02 U	0.020 U	0.02 U	-	-	-	-
Chloride	300.0	mg/L	70.7	425	55.6	-	83.5	656	741	445	433 J	943	17.9	18.9	19.0	19.3	-	250	-	-
Fluoride	300.0	mg/L	0.39	0.29	0.32	-	0.26	0.17 J	0.18	0.17	-	0.17	0.44	0.49	0.30	0.33	4	2	-	0.96
Nitrate + Nitrite as Nitrogen	353.2	mg/L	17.9	31.5	9.36	-	8.13	-	31.1	53.8	-	76.3	14.2	13.2	7.05	7.65	10	-	-	-
Nitrate as Nitrogen	353.2	mg/L	17.9	-	9.33	-	-	-	-	53.8	-	-	14.2	-	7.04	-	10	-	-	-
Nitrate as Nitrogen	353.2/SM 4500NO2B	mg/L	-	31.5	-	-	8.13	-	31.1	-	-	76.3	-	13.2	-	7.65	10	-	-	-
Nitrite as Nitrogen	353.2	mg/L	0.005 U	-	0.032 U	-	-	0.006 J	-	0.021 U	-	-	0.012 U	-	0.011 U	-	1	-	-	-
Nitrite as Nitrogen	SM 4500NO2B	mg/L	-	0.002 U	-	-	0.007 U	-	0.002 U	-	-	0.007 U	-	0.002 U	-	0.002 U	1	-	-	-
Sulfate	300.0	mg/L	31.4	35.1	37.1	-	35	26.7	26.8	45.1	-	40.8	39.5	45.1	36.7	38.8	-	250	-	-
Total Dissolved Solids	SM 2540C	mg/L	532	1,190	457	-	552	1,600 J	1,710	1,550	-	2,210	500	488	425	430	-	500	-	-
Dissolved Metals																				
Aluminum	200.7	µg/L	30 U	-	482	6.7 U	-	30 U	-	30 U	3.5 U	-	30 U	-	30 U	-	-	50-200 ^c	-	-
Arsenic	200.8	µg/L	0.90	-	0.90	0.79	-	0.89	-	0.50 J	0.60	-	0.78	-	2.72	-	10	-	-	5 ^e
Calcium	200.7	µg/L	46,500	111,000	95,700	88,500	97,800	155,000	168,000	178,000	168,000	341,000	82,000	80,300	73,300	70,100	-	-	-	-
Iron	200.7	µg/L	15.5 U	-	941	5.3 U	-	13.3 J	-	9.6 U	3.0 U	-	3.1 U	-	22.0	-	-	300	-	-
Magnesium	200.7	µg/L	12,800	32,400	29,700	28,700	33,500	46,700	51,500	58,200	55,100	103,000	32,500	32,100	22,800	23,800	-	-	-	-
Manganese	200.7	µg/L	3.5 U	-	167	0.80 U	-	3.4 J	-	116	123	-	4.2 J	-	25.1	-	-	50	-	2,200
Potassium	200.7	µg/L	28,300	60,700	5,900	5,710	5,610	27,900	30,100	29,900	29,300	55,100	4,250	4,150	5,090	5,210	-	-	-	-
Sodium	200.7	µg/L	85,500	166,000	24,300	25,500	28,300	258,000	274,000	154,000	158,000	254,000	31,800	32,200	23,600	24,200	-	-	60,000 ^d	-
Volatile Organic Compounds																				
1,1,1-Trichloroethane (TCA)	624	µg/L	-	-	-	-	-	0.16 U	-	-	-	-	-	-	-	-	200	-	-	16,000
1,1,2,2-Tetrachloroethane	624	µg/L	-	-	-	-	-	0.28 U	-	-	-	-	-	-	-	-	-	-	-	0.22
1,1,2-Trichloroethane	624	µg/L	-	-	-	-	-	0.23 U	-	-	-	-	-	-	-	-	5	-	-	0.77
1,1-Dichloroethane (1,1-DCA)	624	µg/L	-	-	-	-	-	0.15 U	-	-	-	-	-	-	-	-	-	-	-	1,600
1,1-Dichloroethene (1,1-DCE)	624	µg/L	-	-	-	-	-	0.18 U	-	-	-	-	-	-	-	-	7	-	-	400
1,2-Dichlorobenzene	624	µg/L	-	-	-	-	-	0.12 U	-	-	-	-	-	-	-	-	600	-	-	720
1,2-Dichloroethane (EDC)	624	µg/L	-	-	-	-	-	0.17 U	-	-	-	-	-	-	-	-	5	-	-	0.48
1,2-Dichloropropane	624	µg/L	-	-	-	-	-	0.16 U	-	-	-	-	-	-	-	-	5	-	-	0.64
1,3-Dichlorobenzene	624	µg/L	-	-	-	-	-	0.13 U	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	624	µg/L	-	-	-	-	-	0.13 U	-	-	-	-	-	-	-	-	75	-	-	1.8
2-Chloroethyl vinyl ether	624	µg/L	-	-	-	-	-	0.31 U	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	624	µg/L	-	-	-	-	-	2.9 U	-	-	-	-	-	-	-	-	-	-	-	160
Acrylonitrile	624	µg/L	-	-	-	-	-	0.43 U	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	624	µg/L	-	-	-	-	-	0.2 U	-	-	-	-	-	-	-	-	5	-	-	0.8
Bromodichloromethane	624	µg/L	-	-	-	-	-	0.15 U	-	-	-	-	-	-	-	-	80 ^f	-	-	0.71
Bromoform	624	µg/L	-	-	-	-	-	0.43 U	-	-	-	-	-	-	-	-	80 ^f	-	-	5.5
Bromomethane	624	µg/L	-	-	-	-	-	0.2 U	-	-	-	-	-	-	-	-	-	-	-	11
Carbon tetrachloride	624	µg/L	-	-	-	-	-	0.13 U	-	-	-	-	-	-	-	-	5	-	-	0.34
Chlorobenzene	624	µg/L	-	-	-	-	-	0.16 U	-	-	-	-	-	-	-	-	100	-	-	160
Chloroethane	624	µg/L	-	-	-	-	-	0.25 U	-	-	-	-	-	-	-	-	-	-	-	15
Chloroform	624	µg/L	-	-	-	-	-	0.19 U	-	-	-	-	-	-	-	-	80 ^f	-	-	7.2
Chloromethane	624	µg/L	-	-	-	-	-	0.2 U	-	-	-	-	-	-	-	-	-	-	-	3.4
cis-1,3-Dichloropropene	624	µg/L	-	-	-	-	-	0.15 U	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	624	µg/L	-	-	-	-	-	0.19 U	-	-	-	-	-	-	-	-	80 ^f	-	-	0.52
Dichloromethane (Methylene Chloride)	624	µg/L	-	-	-	-	-	0.15 U	-	-	-	-	-	-	-	-	5	-	-	5.8
Ethylbenzene	624	µg/L	-	-	-	-	-	0.12 U	-	-	-	-	-	-	-	-	700	-	-	800

Table A-2. Groundwater Sampling Results for January and April 2011, Heglar Kronquist Landfill, Mead, Washington

Chemical	Method	Units	MW-1		MW-2			MW-3		MW-4			MW-5		MW-6		Federal or State Standard			MTCA Standard ^b
			1/24/2011	4/25/2011	1/24/2011	1/24/2011 Re-analysis	4/25/2011	1/25/2011	4/26/2011	1/24/2011	1/24/2011 Re-analysis	4/26/2011	1/23/2011	4/25/2011	1/23/2011	4/25/2011	Primary MCLs	Secondary MCLs (not health-based)	Action/ Advisory Levels	Method B
m,p-Xylenes	624	µg/L	-	-	-	-	-	0.29 <i>U</i>	-	-	-	-	-	-	-	-	10,000 ^g	-	-	16,000
o-Xylene	624	µg/L	-	-	-	-	-	0.15 <i>U</i>	-	-	-	-	-	-	-	-	10,000 ^g	-	-	16,000
Tetrachloroethene (PCE)	624	µg/L	-	-	-	-	-	0.19 <i>U</i>	-	-	-	-	-	-	-	-	5	-	-	0.081
Toluene	624	µg/L	-	-	-	-	-	0.13 <i>U</i>	-	-	-	-	-	-	-	-	1,000	-	-	640
trans-1,2-Dichloroethene	624	µg/L	-	-	-	-	-	0.21 <i>U</i>	-	-	-	-	-	-	-	-	100	-	-	160
trans-1,3-Dichloropropene	624	µg/L	-	-	-	-	-	0.13 <i>U</i>	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene (TCE)	624	µg/L	-	-	-	-	-	0.17 <i>U</i>	-	-	-	-	-	-	-	-	5	-	-	0.49
Trichlorofluoromethane (CFC 11)	624	µg/L	-	-	-	-	-	0.16 <i>U</i>	-	-	-	-	-	-	-	-	-	-	-	2,400
Vinyl chloride	624	µg/L	-	-	-	-	-	0.19 <i>U</i>	-	-	-	-	-	-	-	-	2	-	-	0.029
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	1.1
Aroclor 1221	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	-
Aroclor 1232	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	-
Aroclor 1242	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	-
Aroclor 1248	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	-
Aroclor 1254	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	0.32
Aroclor 1260	8082A	µg/L	-	-	-	-	-	0.00096 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	-
Total Aroclor PCBs	8082A	µg/L	-	-	-	-	-	0 <i>U</i>	-	-	-	-	-	-	-	-	0.5	-	-	0.044

Notes: Underlined and bolded results exceed one or more standard.
 Higher concentrations of sample and field duplicate shown.
 - Not analyzed or not available
 C° Degrees Celsius
 CaCO₃ Calcium carbonate
 ft bmp Feet below measuring point
 J Estimated Value
 MCL Maximum contaminant level
 mg/L Milligrams per liter
 µmhos/cm Micromhos per centimeter
 µg/L Micrograms per liter
 MTCA Model Toxics Control Act
 NTU Nephelometric turbidity units
 s.u. Standard units
 U Not detected by laboratory or qualified as not detected (data validation)

^a Field parameter not measured due to malfunctioning field instrument.

^b Washington State Department of Ecology's MTCA Cleanup Levels and Risk Calculations (CLARC), Washington Administrative Code (WAC 173-340). Lower of carcinogen and non-carcinogen Method B and C cleanup standards shown.

^c Aluminum concentrations over 200 µg/L are shown as secondary MCL exceedances.

^d The state board of health has not established an MCL for sodium. EPA's recommended range for sodium for most individuals is 30,000 to 60,000 µg/L based on aesthetic effects (taste). The EPA recommended level for sodium-sensitive consumers is 20,000 µg/L (see WAC 246-290-310(3)(a)). The upper limit of EPA's recommended range for most individuals of 60,000 µg/L is used for comparison.

^e MTCA Method A cleanup level for arsenic has been selected to account for naturally occurring arsenic in the project area.

^f MCL for total trihalomethanes (bromodichloromethane, bromoform, dibromochloromethane, and chloroform).

^g MCL for total xylenes.

MEMORANDUM

To:
Melissa Kleven and Keri Whetter, Exponent, Inc.

From:
William Huskie, Nankoweep Environmental Consulting,



Golden, Colorado

Date:
March 20, 2011 - **Revised May 15, 2011**

Subject:
Heglar Kronquist Landfill - Quality Control Evaluation – January 2011 Groundwater
Sampling Event – **CAS Laboratory Report K1100661 Dated February 23, 2011**

**Revised Reports –K1100661.01 Dated February 25, 2011, K1100661.02 dated April 12, 2011
and K1102593 dated April 1, 2011**

The purpose of this memorandum is to provide a summary evaluation of data quality associated with groundwater sampling conducted at the Heglar/Kronquist landfill on January 23 and 24, 2011. The review was conducted by a third party Data Validator, Mr. William Huskie, of Nankoweep Environmental Consulting. The review process included evaluation of both field and laboratory quality assurance and quality control (QA/QC) sample results reported. Evaluation criteria for the QA/QC review were based on SW-846 method requirements, EPA data validation guidance, the Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) prepared for the project (ARCADIS 2009), and professional judgment of the third party Data Validator.

Groundwater samples were submitted for analysis to Columbia Analytical Services (CAS) Laboratory located in Kelso, Washington.

A discussion of data quality, in terms of precision, accuracy, completeness, and overall data quality, is presented for the groundwater samples in the following pages. Sample identifications and requested analyses are listed below.

Due to concerns regarding ion balances and discrepancies with previous results for samples MW-2 and MW-4, chloride (MW-4 only) and metals (MW-2 and MW-4) analyses for these samples were re-analyzed.

Sample ID	Lab ID	Matrix	Analyses Requested / Comments
MW-1	K1100661-001	Groundwater	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals
MW-2	K1100661-002	Groundwater	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals (Re-analysis for dissolved metals)
MW-4	K1100661-003	Groundwater	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals (Re-analysis for chloride and dissolved metals)
MW-5	K1100661-004	Groundwater	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals
MW-6	K1100661-005	Groundwater	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals
EB-012311	K1100661-006	Quality Control	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals / Equipment Blank
EB-012411	K1100661-007	Quality Control	Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals / Equipment Blank

Groundwater samples were collected on January 23 and 24, 2011, in association with RI investigation activities for the Heglar-Kronquist landfill. Analyses for the following parameters were completed by the laboratory.

- Chloride, Fluoride, and Sulfate EPA Method 300.0
- Ammonia as (N) EPA Method 350.1
- Nitrite as (N) EPA Method 353.2
- Nitrate+Nitrite as (N) EPA Method 353.2
- Nitrate as (N) (calculation) EPA Method 353.2

- Total Dissolved Solids SM 2540C

- Alkalinity Forms SM 2320B
(total, Bicarbonate, carbonate,
and hydroxide alkalinity as CaCO₃)

- Dissolved Metals EPA Method 200.7 (Aluminum, Calcium, Iron,
Magnesium, Manganese, Potassium, and Sodium)

- Dissolved Metals EPA Method 200.8 (Arsenic)

An evaluation of the groundwater data quality is summarized in the following table and comments.

**VALIDATION CHECKLIST SUMMARY - GROUNDWATER SAMPLING
INORGANICS**

REQUIREMENTS	REPORTED / EVALUATED		PERFORMANCE ACCEPTABLE*		DATA QUALIFIED - COMMENTS
	NO	YES	NO	YES	
VARIOUS EPA AND STANDARD METHODS					
1. Holding times / Preservation		X	X		Yes
2. Detection limits / Dilutions		X		X	
3. Blanks					
A. Method/Prep Blanks		X	X		Yes
B. Equipment/Field/Trip Blanks		X	X		Yes
4. Initial and Continuing Calibration %R		X		X	
5. Matrix Spike (MS) %R		X	X		No
6. MS Duplicate (MSD) %R and RPD		X		X	
7. LCS and LCSD %R and RPD		X		X	
8. Field/Lab Duplicate Comparison (RPD)		X		X	
9. Surrogate Recoveries	X			X	
10. Serial Dilutions		X		X	
11. ICP Interference Check Sample		X		X	
12. CRDL Check Sample		X		X	
13. Results Quantitation		X		X	Yes

%R - percent recovery

RPD - relative percent difference

LCS – Laboratory Control Sample

LCSD – Laboratory Control Sample Duplicate

CRDL - Contract Required Detection Limit

ICP - Inductively Coupled Plasma

* Performance is flagged as not acceptable, if some of the resulting data are qualified. This is not an indication that the laboratory work was unacceptable. Full explanation is provided below with comments for each quality control element.

COMMENTS: Performance was acceptable, with the following exceptions and/or notes:

- Groundwater samples were collected on January 23 and 24, 2011. The groundwater samples were received by CAS at acceptable temperatures ranging from 2 to 4 degrees Celsius, under proper chain-of-custody documentation. The groundwater samples were field filtered with the exception of samples collected for alkalinity and TDS analysis. Samples for dissolved metals were preserved with nitric acid at the time of collection. Samples submitted for analysis of ammonia were preserved with sulfuric acid. The groundwater sample analyses were performed within applicable holding times for all analyses required, as follows:

28 days for chloride, fluoride, sulfate, Nitrate+Nitrite, and ammonia;
48 hours for nitrite,
7 days for TDS,
14 days for alkalinity, and
6 months for metals.

Chloride was re-analyzed for sample MW-4 on April 6, 2011 well past the 28 day holding time. Due to the exceeded holding time, this dissolved chloride re-analysis result is considered to be an estimated value. The re-analysis value is a good match for the result from the initial analysis.

- 2) Several of the inorganic constituent analyses were performed at dilutions to bring analyte concentrations into appropriate linear range. The maximum dilution was required for chloride, at 100 times. Reporting limits are determined to be acceptable.
- 3) Results from one or more method blanks were provided in support of each of the requested analyses. Some inorganic constituents were detected in the method blanks. Nitrate+nitrite was detected in one method blank at a concentration of 0.017 mg/L. Nitrate+nitrite was not detected in the associated groundwater samples at concentration within 5 times the method blank detection, and no action is required. Total alkalinity and bicarbonate alkalinity were detected in method blanks at concentrations one to two orders of magnitude lower than in the associated samples, and no validation action is required.

No dissolved metals were detected in the metals method blanks from the original analyses. Aluminum and calcium were detected in the method blank from the re-analysis at concentrations of 2.0 ug/L and 12.3 ug/L, respectively. **Aluminum concentrations for the reanalysis of both samples (MW-2 and MW-4) are within a factor of 5 times the method blank concentration. Due to potential blank contamination bias, these aluminum results are qualified as U/non-detect at the concentrations reported.**

Results from two equipment blanks (one for each day of sampling) were provided. Target constituents were detected in the equipment blanks, as follows:

<u>Equipment Blank Date</u>	<u>Detections</u>
January 23, 2011	Chloride = 0.38 mg/L
January 23, 2011	Nitrite = 0.01 mg/L
January 23, 2011	Dissolved Calcium = 59.4 ug/L
January 23, 2011	Dissolved Iron = 1.2 ug/L
January 23, 2011	Dissolved Magnesium = 17.4 ug/L
January 23, 2011	Dissolved Sodium = 171 ug/L
January 24, 2011	Chloride = 0.11 mg/L
January 24, 2011	Sulfate = 0.04 mg/L
January 24, 2011	Nitrite = 0.01 mg/L
January 24, 2011	Nitrate = 0.136 mg/L
January 24, 2011	Nitrate+Nitrite = 0.146 mg/L
January 24, 2011	TDS = 6.0 mg/L
January 24, 2011	Alkalinity (total and bicarbonate) = 1.4 mg/L
January 24, 2011	Dissolved Calcium = 177 ug/L
January 24, 2011	Dissolved Iron = 20.4 ug/L
January 24, 2011	Dissolved Magnesium = 58.9 ug/L
January 24, 2011	Dissolved Manganese = 1.9 ug/L
January 24, 2011	Dissolved Sodium = 862 ug/L

Results from calibration blanks were also provided in support of the dissolved metals analyses. Calcium, magnesium, and manganese were detected in the calibration blanks. Detections for these metals in the calibration blanks were lower than those in the associated equipment blanks. Therefore, any data qualifications for dissolved metals will be associated with the equipment blanks.

Several target constituents were detected in groundwater samples at concentrations within 5 times those of the various associated blanks discussed above. Results for these inorganic analytes were qualified as “U/non-detect at the concentrations reported”, due to potential blank contamination bias, as follows:

Sample	Constituent	Concentration	Units	Qualifier
MW-1	Dissolved Iron	15.5	ug/L	U
MW-1	Dissolved Manganese	3.5	ug/L	U
MW-2	Nitrite as Nitrogen	0.032	mg/L	U
MW-4	Dissolved Iron	9.6	ug/L	U
MW-4	Nitrite as Nitrogen	0.021	mg/L	U
MW-5	Dissolved Iron	3.1	ug/L	U
MW-1	Nitrite as Nitrogen	0.005	ug/L	U
MW-5	Nitrite as Nitrogen	0.012	mg/L	U
MW-6	Nitrite as Nitrogen	0.011	mg/L	U
March 31, 2011 Re-analysis data				
MW-2	Dissolved Iron	5.3	ug/L	U
MW-2	Dissolved Manganese	0.80	ug/L	U
MW-2	Dissolved Aluminum	6.7	ug/L	U
MW-4	Dissolved Aluminum	3.5	ug/L	U

- 4) Results from initial and continuing calibration analyses were reviewed for all metals and inorganic constituents. Calibration data was determined to be acceptable. No data qualification was required based on the calibration review.
- 5-6) The laboratory provided results from project specific Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) analyses (MS analyses on project sample MW-1 for initial metals, and on sample MW-2 for the metal re-analyses) and from batch specific MS and MSD analyses. Precision and accuracy, as demonstrated by these analyses were acceptable, with the following consideration. The MS recovery for sodium was high at 165 percent. No action is required, as the sodium concentration in the sample spiked was much higher than four times the spike added amount.
- 7) The laboratory provided results from LCS and/or LCSD analyses in support of the each method requested. Precision and accuracy, as demonstrated by these analyses is acceptable.
- 8) Field duplicate samples were not submitted with the groundwater samples collected on January 23 and 24, 2011. A field duplicate was collected for the sampling program on January 25, 2011 and is included with data package K1100692.

The laboratory provided results from project and batch specific laboratory duplicate analyses for most analytes. Laboratory duplicate precision was acceptable for all analytes, with RPDs less than 25 percent, or with results in agreement within a reporting limit increment.

- 9) Surrogates were not required for the analyses performed.
- 10) Results from serial dilution analyses were provided in support of the metals analyses. All serial dilution recoveries were within control limits for analytes with concentrations at least 50 times the posted method detection limits.
- 11) Results of ICP interference check sample analyses were provided in support of the metals analyses. Check sample recoveries were acceptable, ranging from 83.9 to 105.6 percent.
- 12) Results from one standard analyzed at contract required detection limits (CRDLs) were provided. CRDL standard recoveries were acceptable, ranging from 81 to 115 percent.
- 13) No anomalies were noted with respect to the analytical reporting, with the following considerations. Results for dissolved arsenic in well MW-4 and dissolved manganese in well MW-5 were reported at concentrations between the method detection limit (MDL) and the project reporting limit (RL). **These data were flagged by the laboratory with a “J” flag. Due to limited accuracy in this portion of the calibration range, the results for these analytes were qualified as J/Estimated.**

For the re-analysis, results for dissolved iron and dissolved manganese results were reported at concentrations between the MDL and the RL and given a final U qualifier due to associated blank contamination.

Several other constituent concentrations were reported between the MDL and RL, and were flagged with a final U qualifier due to associated blank contamination.

Summary

Data quality for the groundwater samples collected on January 23 and 24, 2011, was evaluated based on SW-846 method requirements, EPA data validation guidance, the SAP/QAPP prepared for the project (ARCADIS 2009), and professional judgment of the third party Data Validator.

Data quality was determined to be acceptable, with the following considerations.

Dissolved arsenic and dissolved manganese were detected at low concentrations between the laboratory method detection limits (MDL) and standard reporting limits (RL) in two samples. These data were flagged by the laboratory as “J” values, and were validated as estimated concentrations, due to limited accuracy in this portion of the calibration range.

All nitrite (as N) detections for groundwater samples were qualified as “U/non-detect at the concentrations reported” due to associated equipment blank detections. Dissolved iron detections in samples MW-1, MW-4, and MW-5, and dissolved manganese in sample MW-1, were qualified as “U/non-detect at the concentrations reported” due to associated equipment blank detections.


A re-analysis for dissolved chloride was performed for sample MW-4. Re-analyses for dissolved metals was performed for samples MW-2 and MW-4. The chloride result for the re-analysis was flagged as J/Estimated due to a missed holding time. However, the re-analysis result was a good match for the original chloride result, and the missed holding time did not appear to change the sample result.

Re-analysis for dissolved metals was performed within holding times. Detections for dissolved aluminum in samples MW-2 and MW-4 were qualified as U/non-detect at the concentrations reported due to aluminum method blank contamination. Dissolved iron and manganese results were reported between the MDL and RL in sample MW-2, and given a final U qualifier due to associated blank contamination. Detections for dissolved aluminum, iron, and manganese in the re-analysis of sample MW-2 were two orders of magnitude lower than those in the original analyses, confirming possible sediment issues with the initial analyses. Results for the re-analysis of MW-4 were not significantly different than those of the original analysis.

MEMORANDUM

To:
Melissa Kleven and Keri Whetter, Exponent, Inc.

From:
William Huskie, Nankowep Environmental Consulting,



Golden, Colorado

Date:
March 21, 2011

Subject:
Heglar Kronquist Landfill - Quality Control Evaluation – January 2011 Groundwater

Sampling Event – CAS Laboratory Report K1100692 Dated February 28, 2011 and K1100692.01 Dated March 28, 2011

The purpose of this memorandum is to provide a summary evaluation of data quality associated with groundwater sampling conducted at the Heglar/Kronquist landfill during January 2011. The review was conducted by a third party Data Validator, Mr. William Huskie, of Nankowep Environmental Consulting. The review process included evaluation of both field and laboratory quality assurance and quality control (QA/QC) sample results reported. Evaluation criteria for the QA/QC review were based on SW-846 method requirements, EPA data validation guidance, the Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) prepared for the project (ARCADIS 2009), and professional judgment of the third party Data Validator.

Groundwater samples were submitted for analysis to Columbia Analytical Services (CAS) Laboratory located in Kelso, Washington.

A discussion of data quality, in terms of precision, accuracy, completeness, and overall data quality, is presented for the groundwater samples in the following pages. Sample identifications and requested analyses are listed below.

Sample ID	Lab ID	Matrix	Analyses Requested / Comments
MW-3	K1100692-001	Groundwater	VOCs, PCBs, Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals
MW-7	K1100692-002	Groundwater	VOCs, PCBs, Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals / Field duplicate of primary sample MW-3
EB-012511	K1100692-003	Quality Control	VOCs, PCBs, Chloride, Fluoride, Sulfate, Ammonia, Nitrite, Nitrate, Total Dissolved Solids, Alkalinity Forms, and Dissolved metals / Equipment Blank
TB	K1100692-004	Quality Control	VOCs / Trip Blank

Groundwater samples were collected on January 25, 2011, in association with RI investigation activities for the Heglar-Kronquist landfill. Analyses for the following parameters were completed by the laboratory.

- Volatile Organic Compounds EPA Method 624
- Aroclors (PCBs) EPA Method 8082A
- Chloride, Fluoride, and Sulfate EPA Method 300.0
- Ammonia as (N) EPA Method 350.1
- Nitrite as (N) EPA Method 353.2
- Nitrate+Nitrite as (N) EPA Method 353.2
- Nitrate as (N) (calculation) EPA Method 353.2

- Total Dissolved Solids SM 2540C

- Alkalinity Forms SM 2320B
(total, bicarbonate, carbonate,
and hydroxide alkalinity as CaCO₃)

- Dissolved Metals EPA Method 200.7 (Aluminum, Calcium, Iron,
Magnesium, Manganese, Potassium, and Sodium)

- Dissolved Metals EPA Method 200.8 (Arsenic)

An evaluation of the groundwater data quality is summarized in the following table and comments.

**VALIDATION CHECKLIST SUMMARY - GROUNDWATER SAMPLING
ORGANIC ANALYSES (VOCS AND PCBS)**

REQUIREMENTS	REPORTED / EVALUATED		PERFORMANCE ACCEPTABLE*		DATA QUALIFIED - COMMENTS
	NO	YES	NO	YES	
EPA METHODS 624 and 8082A					
1. Holding times / Preservation		X		X	
2. Detection limits / Dilutions		X		X	
3. Blanks					
A. Method/Prep Blanks		X		X	
B. Equipment/Field/Trip Blanks		X	X		No
4. Initial and Continuing Calibration %R		X		X	
5. Matrix Spike (MS) %R		X		X	
6. MS Duplicate (MSD) %R and RPD		X		X	
7. LCS and LCSD %R and RPD		X		X	
8. Field/Lab Duplicate Comparison (RPD)		X		X	
9. Surrogate Recoveries		X		X	
10. Internal standards		X		X	
11. Results Quantitation		X		X	

%R - percent recovery RPD - relative percent difference LCS – Laboratory Control Sample
 LCSD – Laboratory Control Sample Duplicate CRDL - Contract Required Detection Limit
 ICP - Inductively Coupled Plasma

* Performance is flagged as not acceptable, if some of the resulting data are qualified. This is not an indication that the laboratory work was unacceptable. Full explanation is provided below with comments for each quality control element.

COMMENTS: Performance was acceptable, with the following exceptions and/or notes:

- 1) The groundwater samples were received by CAS at an acceptable temperature of 4.2 degrees Celsius, under proper chain-of-custody documentation. Samples submitted for analysis of VOCs were preserved with HCl. The water sample analyses were performed within applicable holding times for all analyses required, as follows:
 - 14 days for VOCs
 - 7 days to extraction and 40 days to analysis for Aroclors
- 2) No dilutions were required to quantitate either VOCs or PCBs. Reporting limits are determined to be acceptable.
- 3) Results from one method blank were provided for the VOC and PCB analyses. No target compounds were detected in the method blanks. One trip blank was analyzed for VOCs, with no VOCs detected.

Results from one equipment blank were provided. Toluene was detected in the equipment blank at an estimated concentration of 0.28 ug/L. Toluene was not detected in the associated groundwater samples, and no action is required.

- 4) Results from initial and continuing calibration analyses were reviewed at a cursory level for the VOC and Aroclor analyses. Response factors and relative standard deviations (RSDs) for the initial calibration were acceptable. Percent differences between response factors in the initial calibration and those of the continuing calibrations were acceptable. No data qualification was required based on the calibration review.
- 5-6) The laboratory provided results from one set of batch specific Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) analyses in support of each the VOC and PCB analyses. Precision and accuracy, as demonstrated by these analyses were acceptable.
- 7) The laboratory provided results from LCS and/or LCSD analyses in support of the VOC and PCB analyses. Precision and accuracy, as demonstrated by these analyses is acceptable.
- 8) Sample MW-7 was submitted as a blind field duplicate of primary sample MW-3. Precision between the results of the field duplicate analyses is acceptable. No VOCs or PCBs were detected in either of the samples.
- 9) Three surrogates were spike into each sample submitted for VOC analyses. One surrogate was spiked into each sample for PCB analyses. All surrogate recoveries were within specified control limits.
- 10) Results from internal standards were reviewed for the VOC analyses. All internal standard recoveries were determined to be acceptable.
- 11) No anomalies were noted with respect to the analytical reporting or results quantitation for PCBs or VOCs.

**VALIDATION CHECKLIST SUMMARY - GROUNDWATER SAMPLING
INORGANIC ANALYSES**

REQUIREMENTS	REPORTED / EVALUATED		PERFORMANCE ACCEPTABLE*		DATA QUALIFIED - COMMENTS
	NO	YES	NO	YES	
VARIOUS EPA AND STANDARD METHODS					
1. Holding times / Preservation		X		X	
2. Detection limits / Dilutions		X		X	
3. Blanks					
A. Method/Prep Blanks		X	X		No
B. Equipment/Field/Trip Blanks		X	X		No
4. Initial and Continuing Calibration %R		X		X	
5. Matrix Spike (MS) %R		X		X	
6. MS Duplicate (MSD) %R and RPD		X		X	
7. LCS and LCSD %R and RPD		X		X	
8. Field/Lab Duplicate Comparison (RPD)		X	X		Yes
9. Surrogate Recoveries	X			X	
10. Serial Dilutions		X		X	
11. ICP Interference Check Sample		X		X	
12. CRDL Check Sample		X		X	
13. Results Quantitation		X		X	Yes

%R - percent recovery RPD - relative percent difference LCS – Laboratory Control Sample
 LCSD – Laboratory Control Sample Duplicate CRDL - Contract Required Detection Limit
 ICP - Inductively Coupled Plasma

* Performance is flagged as not acceptable, if some of the resulting data are qualified. This is not an indication that the laboratory work was unacceptable. Full explanation is provided below with comments for each quality control element.

COMMENTS: Performance was acceptable, with the following exceptions and/or notes:

- 1) The groundwater samples were received by CAS at an acceptable temperature of 4.2 degrees Celsius, under proper chain-of-custody documentation. The water sample analyses were performed within applicable holding times for all analyses required, as follows:
 - 28 days for chloride, fluoride, sulfate, nitrite+nitrate, and ammonia;
 - 48 hours for nitrite,
 - 7 days for TDS,
 - 14 days for alkalinity, and
 - 6 months for metals.

- 2) Several of the inorganic constituent analyses were performed at dilutions to bring analyte concentrations into appropriate linear range. The maximum dilution was required for chloride, at 100 times. Reporting limits are determined to be acceptable.

- 3) Results from one or more method blanks were provided in support of each of the requested analyses. Some inorganic constituents were detected in the method blanks. Nitrate+nitrite was detected in one

method blank at a concentration of 0.009 mg/L. Nitrate+nitrite was not detected in the associated groundwater samples at concentrations within 5 times the method blank detection, and no action is required.

No dissolved metals were detected in the metals method blanks.

Results from one equipment blank were provided. Some target constituents were detected in the equipment blank, as follows:

<u>Equipment Blank Date</u>	<u>Detections</u>
January 25, 2011	Nitrate = 0.02 mg/L
January 25, 2011	Nitrate+nitrite = 0.02 mg/L
January 25, 2011	Dissolved Calcium = 22.3 ug/L
January 25, 2011	Dissolved Magnesium = 4.2 ug/L
January 25, 2011	Dissolved Sodium = 64 ug/L

Results from calibration blanks were also provided in support of the dissolved metals analyses. Calcium, magnesium, and manganese were detected in the calibration blanks. Detections for calcium and magnesium in the calibration blanks were lower than those in the associated equipment blanks. Therefore, any data qualifications for these dissolved metals will be associated with the equipment blanks. Detections for manganese in the calibration blanks are less than 5 times any manganese detections in the associated samples, and no action is required.

No target constituents were detected in the groundwater samples at concentrations within 5 times those of the various associated blanks discussed above, and no action is required.

- 4) Results from initial and continuing calibration analyses were reviewed for all metals and inorganic constituents. Calibration data was determined to be acceptable. No data qualification was required based on the calibration review.
- 5-6) The laboratory provided results from project specific Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) analyses (MS on project sample MW-7 for metals) and from batch specific MS and MSD analyses. Precision and accuracy, as demonstrated by these analyses were acceptable.
- 7) The laboratory provided results from LCS and/or LCSD analyses in support of each method requested. Precision and accuracy, as demonstrated by these analyses is acceptable.
- 8) Sample MW-7 was submitted as a blind field duplicate of primary sample MW-3. Precision between the results of the field duplicate analyses is acceptable, with RPDs less than 40 percent, with the following exception. Precision between field duplicate samples for TDS was poor, with an RPD of 48 percent. Due to the poor precision, TDS results for the primary and duplicate samples are qualified as J/Estimated.

The laboratory provided results from project and batch specific laboratory duplicate analyses for most analytes. Laboratory duplicate precision was acceptable for all analytes, with RPDs less than 25 percent, or with results in agreement within a reporting limit increment.

- 9) Surrogates were not required for the analyses performed.

- 10) Results from serial dilution analyses were provided in support of the metals analyses. All serial dilution recoveries were within control limits for analytes with concentrations at least 50 times the posted method detection limits.
- 11) Results of ICP interference check sample analyses were provided in support of the metals analyses. Check sample recoveries were acceptable, ranging from 83.9 to 105.6 percent.
- 12) Results from one standard analyzed at contract required detection limits (CRDLs) were provided. CRDL standard recoveries were acceptable, ranging from 81 to 115 percent.
- 13) No anomalies were noted with respect to the analytical reporting, with the following considerations. Results for fluoride, dissolved iron, and dissolved manganese in samples MW-3 and MW-7 were reported at concentrations between the method detection limit (MDL) and the project reporting limit (RL). Nitrite was also detected in sample MW-7 at a concentration between the MDL and the RL. **These data were flagged by the laboratory with a “J” flag. Due to limited accuracy in this portion of the calibration range, the results for these analytes were qualified as J/Estimated.**

Summary

Data quality for the groundwater samples collected on January 25, 2011 was evaluated based on SW-846 method requirements, EPA data validation guidance, the SAP/QAPP prepared for the project (ARCADIS 2009), and professional judgment of the third party Data Validator.

Data quality was determined to be acceptable, with the following considerations.

Results for fluoride, dissolved iron, and dissolved manganese in samples MW-3 and MW-7 were reported at concentrations between the method detection limit (MDL) and the project reporting limit (RL). Nitrite was detected in sample MW-7 at a concentration between the MDL and the RL. These results were qualified as J/Estimated due to limited accuracy in this portion of the calibration range. Precision was poor between field duplicate analyses for TDS. TDS results for the primary and duplicate samples were qualified as J/Estimated.

MEMORANDUM

To:
Melissa Kleven and Keri Whetter, Exponent, Inc.

From:
William Huskie, Nankowep Environmental Consulting,

William W. Huskie

Golden, Colorado

Date:
June 26, 2011

Subject:
Heglar Kronquist Landfill - Quality Control Evaluation – April 2011 Groundwater
Sampling Event

CAS Laboratory Report K1103574 Dated June 3, 2011

The purpose of this memorandum is to provide a summary evaluation of data quality associated with groundwater sampling conducted at the Heglar/Kronquist landfill on April 25 and 26, 2011. The review was conducted by a third party Data Validator, Mr. William Huskie, of Nankowep Environmental Consulting. The review process included evaluation of both field and laboratory quality assurance and quality control (QA/QC) sample results reported. Evaluation criteria for the QA/QC review were based on SW-846 method requirements, EPA data validation guidance, the Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) prepared for the project (ARCADIS 2009), and professional judgment of the third party Data Validator.

Groundwater samples were submitted for analysis to Columbia Analytical Services (CAS) Laboratory located in Kelso, Washington.

A discussion of data quality, in terms of precision, accuracy, completeness, and overall data quality, is presented for the groundwater samples in the following pages. Sample identifications and requested analyses are listed below.

Sample ID	Lab ID	Matrix	Analyses Requested / Comments
MW-1	K1103574-001	Groundwater	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals
MW-2	K1103574-002	Groundwater	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals
MW-5	K1103574-003	Groundwater	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals
MW-6	K1103574-004	Groundwater	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals
MW-7	K1103574-005	Quality Control	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals / Field duplicate of primary sample MW-6
MW-3	K1103574-006	Groundwater	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals
MW-4	K1103574-007	Groundwater	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals
EB-042511	K1103574-008	Quality Control	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals / Equipment Blank
EB-042611	K1103574-009	Quality Control	Chloride, Fluoride, Nitrite, Nitrate, Sulfate, Ammonia, Bicarbonate Alkalinity, Total Dissolved Solids, and Dissolved metals / Equipment Blank

Groundwater samples were collected on April 25 and 26, 2011, in association with RI investigation activities at the Heglar-Kronquist landfill. Analyses for the following parameters were completed by the laboratory.

- Chloride, Fluoride, and Sulfate EPA Method 300.0
- Ammonia as (N) EPA Method 350.1
- Nitrite as (N) SM 4500-NO2 B
- Nitrate as (N) (calculation) EPA Method 353.2/ SM 4500-NO2 B
- Nitrate+Nitrite as (N) EPA Method 353.2
- Total Dissolved Solids SM 2540C
- Bicarbonate Alkalinity as CaCO₃ SM 2320B
- Dissolved Metals EPA Method 200.7 (Calcium, Magnesium, Potassium, and Sodium)

An evaluation of the groundwater data quality is summarized in the following table and comments.

**VALIDATION CHECKLIST SUMMARY - GROUNDWATER SAMPLING
INORGANICS**

REQUIREMENTS	REPORTED / EVALUATED		PERFORMANCE ACCEPTABLE*		DATA QUALIFIED - COMMENTS
	NO	YES	NO	YES	
VARIOUS EPA AND STANDARD METHODS					
1. Holding times / Preservation		X	X		No
2. Detection limits / Dilutions		X		X	
3. Blanks					
A. Method/Prep Blanks		X		X	
B. Equipment/Field/Trip Blanks		X	X		Yes
4. Initial and Continuing Calibration %R		X		X	
5. Matrix Spike (MS) %R		X		X	
6. MS Duplicate (MSD) %R and RPD		X		X	
7. LCS and LCSD %R and RPD		X		X	
8. Field/Lab Duplicate Comparison (RPD)		X		X	
9. Surrogate Recoveries	X			X	
10. Serial Dilutions		X		X	
11. ICP Interference Check Sample		X		X	
12. CRDL Check Sample		X		X	
13. Results Quantitation		X		X	

%R - percent recovery RPD - relative percent difference LCS – Laboratory Control Sample
 LCSD – Laboratory Control Sample Duplicate CRDL = Contract Required Detection Limit
 ICP = Inductively Coupled Plasma

* Performance is flagged as not acceptable, if some of the quality control elements are not met. This is not an indication that the laboratory work was unacceptable. Full explanation is provided below with comments for each quality control element.

COMMENTS: Performance was acceptable, with the following exceptions and/or notes:

- 1) Groundwater samples were collected on April 25 and 26, 2011. The groundwater samples were received by CAS at acceptable temperatures ranging from 0.6 to 4.0 degrees Celsius, under proper chain-of-custody documentation. The groundwater samples were field filtered with the exception of samples collected for alkalinity and TDS analysis. Samples for dissolved metals were preserved with nitric acid at the time of collection. Samples submitted for analysis of ammonia were preserved with sulfuric acid. The groundwater sample analyses were performed within applicable holding times for all analyses required, with the following exceptions. Samples MW-6 and MW-7 were analyzed a few hours past the 48-hour holding times for nitrate and nitrite. No action is taken, as nitrite results for these samples were qualified due to blank contamination.

28 days for chloride, fluoride, sulfate, Nitrate+Nitrite, and ammonia;

48 hours for nitrite,
 48 hours for nitrate
 7 days for TDS
 14 days for alkalinity, and
 6 months for metals.

- 2) Several of the inorganic constituent analyses were performed at dilutions to bring analyte concentrations into appropriate linear range. The maximum dilution required was for dissolved chloride, at 200 times. Reporting limits are determined to be acceptable.
- 3) Results from one or more method blanks were provided in support of each of the requested analyses. Bicarbonate alkalinity was the only constituent detected in method blanks. The alkalinity blank detections are one to two orders of magnitude lower than those in the associated samples, and no validation action is required.

Results from calibration blanks were provided in support of the dissolved metals analyses. Calcium and magnesium were detected in the calibration blanks at concentrations ranging from 1.3 to 14.4 micrograms per liter (ug/L). Detections for these metals in the calibration blanks are orders of magnitude lower than those in the associated samples, and no action is required.

Results from two equipment blanks (one for each day of sampling) were provided. Target constituents were detected in the equipment blanks, as follows:

<u>Equipment Blank Date</u>	<u>Detections</u>
April 25, 2011	Dissolved Calcium = 11.1 ug/L
April 25, 2011	Dissolved Magnesium = 0.4 ug/L
April 25, 2011	Dissolved Sodium = 72 ug/L
April 25, 2011	Sulfate = 0.07 milligrams per liter (mg/L)
April 25, 2011	Chloride = 0.34 mg/L
April 25, 2011	Nitrate + Nitrite as Nitrogen = 0.024 mg/L
April 25, 2011	Nitrate as Nitrogen = 0.022 mg/L
April 25, 2011	Total Dissolved Solids = 14 mg/L
April 25, 2011	Nitrite as Nitrogen = 0.002 mg/L
April 26, 2011	Dissolved Sodium = 70 ug/L
April 26, 2011	Dissolved Calcium = 8.3 ug/L
April 26, 2011	Dissolved Magnesium = 1 ug/L
April 26, 2011	Chloride = 0.33 mg/L
April 26, 2011	Nitrate + Nitrite as Nitrogen = 0.063 mg/L
April 26, 2011	Nitrate as Nitrogen = 0.061 mg/L
April 26, 2011	Total Dissolved Solids = 15.5 mg/L
April 26, 2011	Nitrite as Nitrogen = 0.002 mg/L

No target constituents were detected in groundwater samples at concentrations within 5 times those of the various associated blanks discussed above, with the following exceptions. Nitrite detections in groundwater samples were all reported at concentrations within 5 times those of the equipment blank. As a result, all nitrite results are qualified as “U/non-detect at the concentrations reported”, due to potential blank contamination bias, as follows:

Sample	Constituent	Concentration	Units	Qualifier
MW-1	Nitrite as Nitrogen	2	ug/L	U
MW-2	Nitrite as Nitrogen	7	ug/L	U
MW-3	Nitrite as Nitrogen	2	ug/L	U
MW-4	Nitrite as Nitrogen	7	ug/L	U
MW-5	Nitrite as Nitrogen	2	ug/L	U
MW-6	Nitrite as Nitrogen	2	ug/L	U
MW-7	Nitrite as Nitrogen	2	ug/L	U

- 4) Results from initial and continuing calibration analyses were reviewed for all metals and inorganic constituents. Calibration data was determined to be acceptable. Calibration standard recoveries were all within prescribed control limits of 90 to 100 percent.
- 5-6) The laboratory provided results from project specific and batch specific Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) analyses (MS analyses on project sample MW-1 for ammonia and dissolved metals). Precision and accuracy, as demonstrated by these analyses were acceptable, with the following consideration. The MS recovery for calcium was high at 130 percent. No action is required, as the calcium concentration in the sample spiked was much higher than four times the spike added amount.
- 7) The laboratory provided results from LCS and/or LCSD analyses in support of each method requested. Precision and accuracy, as demonstrated by these analyses is acceptable. LCS recoveries ranged from 91 to 108 percent for all analyses.
- 8) Sample MW-7 was submitted as a blind field duplicate of primary sample MW-6. Field duplicate precision between the results of duplicate samples for each target constituent was very good, with all RPDs less than 25 percent.

The laboratory provided results from project and batch specific laboratory duplicate analyses for most analytes. Laboratory duplicate precision was acceptable for all analytes, with RPDs less than 25 percent, or with results in agreement within a reporting limit increment.

- 9) Surrogates were not required for the analyses performed.
- 10) Results from serial dilution analyses were provided in support of the metals analyses. All serial dilution recoveries were within control limits for analytes with concentrations at least 50 times the posted method detection limits. The maximum percent difference between serial dilution results was 3 percent (upper control limit of 10 percent).
- 11) Results of ICP interference check sample analyses were provided in support of the metals analyses. Check sample recoveries were acceptable, ranging from 95.3 to 105 percent.
- 12) Results from one standard analyzed at contract required detection limits (CRDLs) for the metals were provided. CRDL standard recoveries were acceptable, ranging from 83 to 101 percent.
- 13) No anomalies were noted with respect to the analytical reporting, with the following considerations. Accuracy of sample weights was questionable for the TDS analyses. The samples impacted had

TDS concentrations greater than 100 mg/L, and no impact to the samples results is relevant (the impact of the sample accuracy is less than the significant figure determination of the analysis).

Summary

Data quality for the groundwater samples collected on April 25 and 26, 2011, was evaluated based on SW-846 method requirements, EPA data validation guidance, the SAP/QAPP prepared for the project (ARCADIS 2009), and professional judgment of the third party Data Validator.

Data quality was determined to be acceptable, with the following considerations. **All nitrite (as N) detections for groundwater samples were qualified as “U/non-detect at the concentrations reported” due to associated equipment blank detections.**