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TECHNICAL MEMORANDUM

To: Don Carpenter, IDEQ, Boise

From: Robin Nimmer, TerraGraphics, Moscow

Date: March 5, 2013

Job Code: 12025-08-02

Subject: Fourth Groundwater Sampling Event of 2012 at the East Mission Flats Repository

The purpose of this technical memorandum is to summarize the East Mission Flats Repository (EMFR) Fourth Quarter 2012 Groundwater Sampling Event and present the monitoring well data collected. An evaluation and discussion of the quarterly monitoring results will be completed in the 2012 annual report for EMFR. The sampling event was conducted on October 29 and 30, 2012.

1 Sampling Summary

The EMFR site is located approximately 2 miles west of Cataldo, Idaho, east of Exit 39 off of Interstate-90 (Figure 1). There is one decontamination well (Decon Well) and seven groundwater monitoring wells at EMFR: 07-EMF-MW-A (MW-A), 07-EMF-MW-B (MW-B), 07-EMF-MW-C (MW-C), 09-EMF-MW-C-Deep (MW-C Deep), 07-EMF-MW-D (MW-D), 08-EMF-MW-E (MW-E), and 08-EMF-MW-F (MW-F). Samples were collected from all eight wells on October 29 and 30, 2012. Sampling procedures were conducted in accordance with the *Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) for Groundwater and Surface Water Monitoring at the East Mission Flats Repository* (TerraGraphics 2010), hereinafter referred to as the EMFR SAP/QAPP.

The EMFR SAP/QAPP presents a detailed description of the sampling, handling, documentation, and analytical procedures followed. The groundwater monitoring wells were sampled with dedicated low-flow pumps. Field parameters were measured using the QED MicroPurge[®] MP20 Flow Cell meter, which was calibrated according to manufacturer's instructions each morning prior to sampling. All field quality control samples were collected as required. Water-level data within the waste mass were also downloaded from the dataloggers in the two piezometers.

The sampling crew measured the field parameters listed below prior to sample collection and recorded the data on the field sheets (Attachment A). Table 1 lists the field parameter results.

- pH
- Conductivity
- Temperature
- Dissolved oxygen (DO)
- Oxygen-reduction potential (ORP)

The field crew also measured depth to water prior to purging and recorded the data on field sheets. Figure 1 depicts the estimated groundwater elevation contours based on the depth to water measurements in the groundwater monitoring wells except for MW-C Deep and MW-E. MW-C Deep is screened deeper than the other monitoring wells, and MW-E appears to be in a different hydrologic unit than the other wells based on water levels and water quality data. The historical hydraulic gradient is towards the southwest; however, the data from this event indicate a hydraulic gradient is to the southwest as well as the northeast with water flowing towards MW-B.

The field crew recorded the necessary sample information on a chain-of-custody (COC) form and shipped the samples to two different laboratories as guided by the EMFR SAP/QAPP (TerraGraphics 2010). The Contract Laboratory Program (CLP) laboratory analyzed the samples for the following constituents via the CLP Statement of Work ISM01.3 (update to ISM01.2 [USEPA 2010]):

- Dissolved cations (calcium, magnesium, potassium, and sodium) by method U.S. Environmental Protection Agency (USEPA) 200.7 (USEPA 1994a)
- Total and dissolved metals (antimony, arsenic, cadmium, lead, and zinc) by method USEPA 200.8 (USEPA 1994b)
- Total hardness by method SM2340B (SM Committee 1997a)
- Total phosphorus by method USEPA 200.7

Attachment B contains the CLP analytical results. The USEPA-generated data validation reports are available upon request.

SVL Analytical, Inc. (SVL) in Kellogg, Idaho, analyzed samples for the following constituents:

- Dissolved anions (chloride, nitrate as nitrogen, and sulfate) by method USEPA 300.0 (USEPA 1993)
- Total alkalinity by method SM2320B (Standard Committee 1997b)

Attachment C contains the SVL analytical results.

2 Groundwater Quality Results

Table 2 lists the cumulative groundwater sampling results for dissolved metals; the following discussion focuses on the October 2012 analysis results. A discussion of the cations, anions, phosphorus, and alkalinity will be included in the 2012 EMFR annual report. Dissolved antimony was below the reporting limit (i.e., contract required quantitation limit [CRQLs]) in samples from all eight wells. Dissolved arsenic was only detected above the reporting limit at well 08-EMF-MW-E (0.0149 milligrams per liter [mg/L]), which was above the regulatory

threshold of 0.01 mg/L. Dissolved cadmium was detected above the reporting limit at wells 07-EMF-MW-A and 08-EMF-MW-F. The highest dissolved cadmium concentration of 0.00043 mg/L was at well 08-EMF-MW-F, which is below the regulatory threshold. Dissolved lead was not detected above the reporting limit at any of the wells. Dissolved zinc was detected above the reporting limit at all wells except well 09-EMF-MW-C Deep. All of the detected dissolved zinc data were qualified as an estimate (*J*) due to laboratory serial dilution issues. In addition, dissolved zinc at well 08-EMF-MW-E was also qualified because of detections in the field blank at concentrations less than 10 times the field blank concentration. The highest dissolved zinc concentration of 1.730 mg/L, which is below the regulatory threshold, was in a sample from 08-EMF-MW-F.

Regulatory thresholds for antimony, arsenic, cadmium, and lead in groundwater are the National Primary Drinking Water Standards (i.e., maximum contaminant levels) and the regulatory threshold for zinc is the National Secondary Drinking Water Standard. Any analytes that exceeded these thresholds are highlighted in pink in Table 2. These standards are based on total concentrations; however, the dissolved metal concentrations in the groundwater are compared to the regulatory thresholds because it is assumed that dissolved concentrations are indicators of contamination in groundwater under all conditions (CH2M Hill 2006).

3 Monitoring Well and Cataldo River Stage Hydrographs

Dataloggers record water levels in five of the groundwater monitoring wells at EMFR (MW-A, -B, -C, -C Deep, and -D). The dataloggers in wells MW-B and MW-D were installed on February 4, 2009. The dataloggers in wells MW-A and MW-C were installed on December 14, 2009, and the datalogger in well MW-C-Deep was installed on February 23, 2010. Data from the dataloggers are downloaded on a quarterly basis.

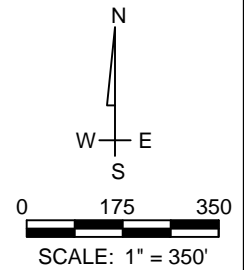
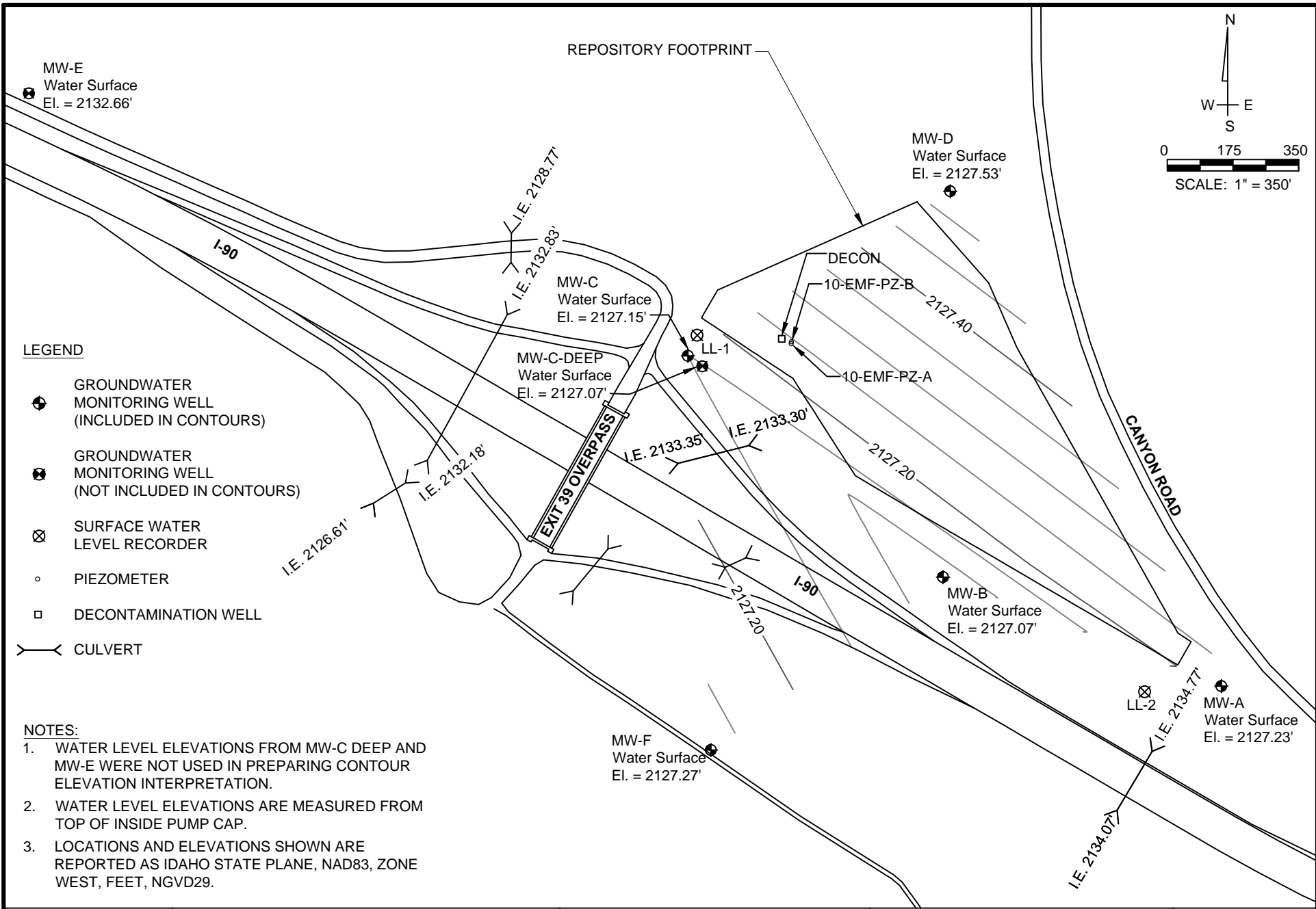
Figure 2 shows hydrographs of the water levels recorded at the five monitoring wells and from the U.S. Geological Survey (USGS) river gage at Cataldo beginning January 1, 2012. River stage data for USGS Gage Station 12413500 on the Coeur d'Alene River near Cataldo, Idaho, are included on the hydrograph for comparison (http://waterdata.usgs.gov/id/nwis/uv/?site_no=12413500).

Two surface water dataloggers record standing water levels in low areas prone to seasonal inundation. The surface water monitoring locations are identified on Figure 1 as LL-1 and LL-2. The dataloggers were downloaded as part of the groundwater sampling activity. There was no standing water at LL-1 or LL-2 during the 2012 fourth quarter monitoring period.

4 References

- CH2M Hill, 2006. Environmental Monitoring Plan, Operable Unit 2, Bunker Hill Mining and Metallurgical Complex Superfund Site. Prepared for USEPA Region 10. January.
- SM Committee, 1997a. Standard Method 2340B Hardness (20th edition): Hardness by Calculation.
- SM Committee, 1997b. Standard Method 2320B Alkalinity: Titration Method.

- TerraGraphics Environmental Engineering, Inc. (TerraGraphics), 2010. Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) for Groundwater and Surface Water Monitoring at the East Mission Flats Repository; Revision No. 1. October.
- United States Environmental Protection Agency (USEPA), 1993. Method 300.0: Determination of Inorganic Anions by Ion Chromatography.
- USEPA, 1994a. Method 200.7: Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry, Revision 4.4.
- USEPA, 1994b. Method 200.8: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry, Revision 5.4.
- USEPA, 2010. USEPA Contract Laboratory Program Inorganic Analysis Statement of Work for Superfund Methods, ISM01.2. January.



SCALE: 1" = 350' (8.5x11 PRINT)
DRAWN BY: S. LARSON



EAST MISSION FLATS
CATALDO, IDAHO

FIGURE 1
OCT 2012 GROUNDWATER LEVEL
ELEVATIONS AND CONTOURS

PROJECT NO: 2010-2F-7170-2
DATE: 2/27/2013
FILE NAME: emf

Figure 2. Water Levels at EMFR Monitoring Wells & Surface Water Sites Compared to River Stage at Cataldo

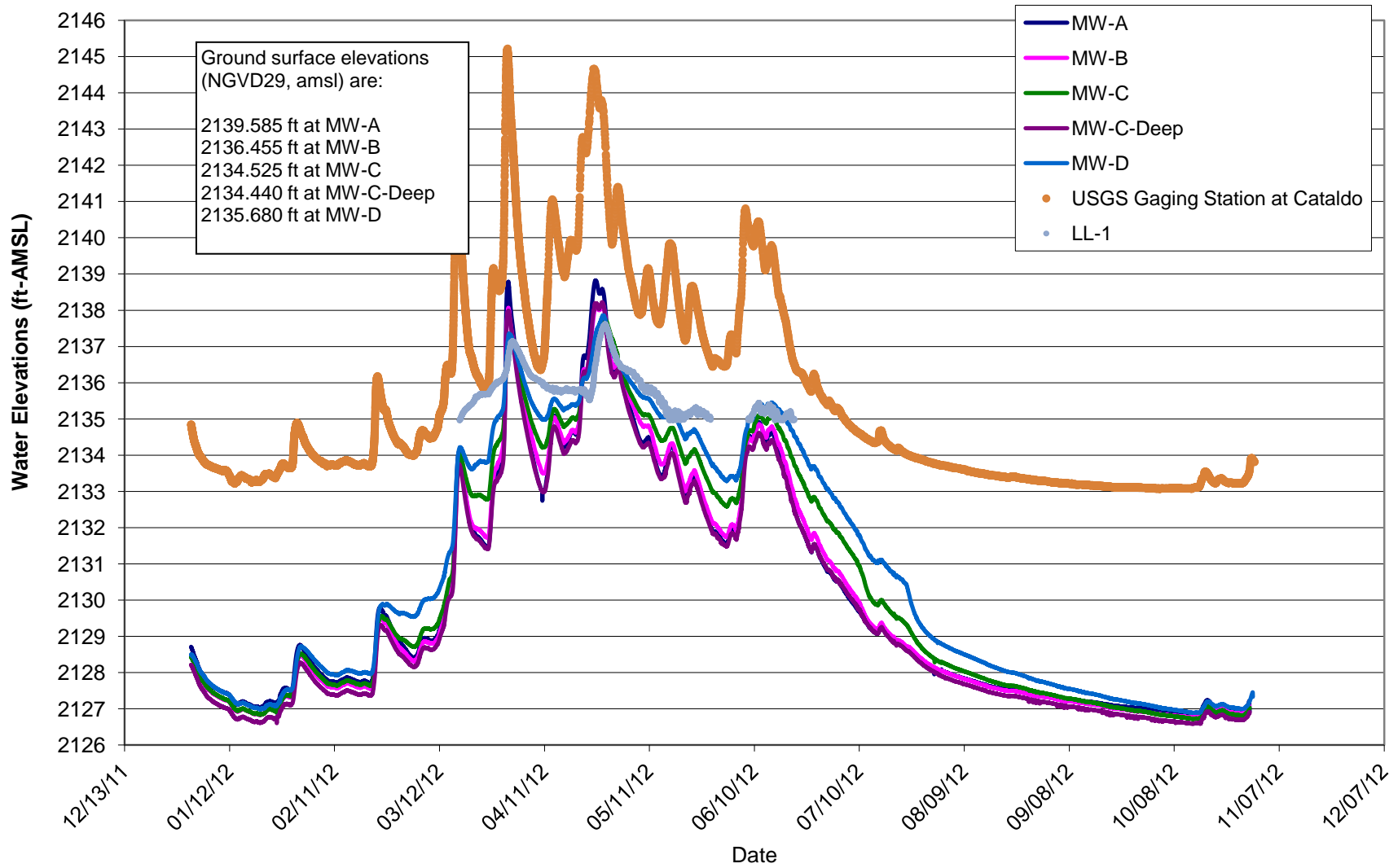


Table 1
Field Parameter Data
East Mission Flats Repository

Well	Date	Parameter				
		pH	Conductivity (uS/cm)	Temperature (°C)	DO (mg/L)	ORP (mV)
MW-A	11 Dec 07	5.63	265	8.21	1.01	280
	25 Feb 08	5.30	328	7.73	0.36	353
	3-Jun-08	5.28	150	9.45	0.51	265
	19-Aug-08	5.57	208	11.05	0.39	225
	10-Nov-08	5.63	163	8.79	0.34	161
	4-Feb-09	5.19	253	7.95	0.39	228
	7-May-09	4.93	202	7.35	0.38	195
	10-Aug-09	5.43	196	9.23	0.24	210
	11-Nov-09	5.62	121	8.49	0.48	131
	25-Feb-10	4.84	209	7.97	0.32	216
	19-May-10	5.53	181	8.21	0.42	147
	25-Aug-10	5.37	149	9.17	0.33	142
	16-Nov-10	5.43	164	8.81	0.43	161
	10-Feb-11	4.92	210	7.69	0.40	190
	6-Jul-11	5.54	229	10.98	0.35	118
	24-Oct-11	5.54	182	9.21	R	136
	25-Jan-12	4.92	239	8.54	0.30	178
	10-Apr-12	5.50	222	8.34	0.26	155
31-Jul-12	4.89	235	9.53	0.26	166	
29-Oct-12	5.39	182	10.35	0.52	157	
MW-B	10 Dec 07	5.63	119	8.71	0.51	279
	25 Feb 08	5.38	115	7.46	0.75	330
	3-Jun-08	5.60	101	10.26	1.32	253
	19-Aug-08	5.57	92	16.92	0.34	220
	10-Nov-08	5.47	103	12.88	0.42	169
	4-Feb-09	5.40	98	10.48	1.98	209
	7-May-09	5.11	69	7.8	3.02	213
	10-Aug-09	5.46	82	11.81	0.55	285
	11-Nov-09	5.39	81	9.24	0.42	184
	25-Feb-10	4.88	97	8.2	0.55	216
	19-May-10	5.59	101	9.37	0.82	135
	25-Aug-10	5.42	85	10.13	0.67	146
	16-Nov-10	5.39	94	9.44	0.32	177
	10-Feb-11	5.25	65	4.24	8.09	183
	6-Jul-11	5.70	56	17.28	0.30	177
	24-Oct-11	5.46	74	13.55	0.37 J	112
	25-Jan-12	5.49	85	11.53	0.47	94
	10-Apr-12	5.83	53	8.61	5.77	97
31-Jul-12	5.12	47	18.55	0.28	181	
29-Oct-12	5.52	82	15.71	0.43	204	

Well	Date	Parameter				
		pH	Conductivity (uS/cm)	Temperature (°C)	DO (mg/L)	ORP (mV)
MW-C	10 Dec 07	5.56	105	8.89	0.75	301
	25 Feb 08	5.34	105	8.07	0.52	329
	3-Jun-08	NS	NS	NS	NS	NS
	19-Aug-08	5.68	84	12.81	0.24	189
	10-Nov-08	5.45	93	11.51	0.3	133
	3-Feb-09	5.56	104	9.76	0.32	144
	7-May-09	NS	NS	NS	NS	NS
	10-Aug-09	5.54	83	12.42	0.7	312
	11-Nov-09	5.46	74	9.91	0.31	198
	25-Feb-10	5.14	102	8.89	0.42	220
	19-May-10	5.66	97	9.33	0.11J	147
	25-Aug-10	5.59	94	13.54	0.35	143
	16-Nov-10	5.49	105	11.94	0.21	194
	10-Feb-11	NS	NS	NS	NS	NS
	6-Jul-11	NS	NS	NS	NS	NS
	24-Oct-11	5.67	88	11.41	0.17J	71
	25-Jan-12	5.33	95	10.03	1.27	160
	10-Apr-12	6.24	81	10.45	2.57	147
	31-Jul-12	5.19	67	16.51	0.2	171
29-Oct-12	5.62	102	14.22	0.20	136	
MW-C Deep	25-Feb-10	5.65	107	9.07	1.06	201
	19-May-10	6.13	93	10.60	1.66	141
	25-Aug-10	5.88	93	13.90	0.21	122
	16-Nov-10	5.84	99	10.79	0.26	172
	10-Feb-11	NS	NS	NS	NS	NS
	6-Jul-11	NS	NS	NS	NS	NS
	24-Oct-11	5.96	98	10.52	0.11	35
	25-Jan-12	6.26	148	9.46	0.23	108
	10-Apr-12	6.34	117	10.03	0.36	100
	31-Jul-12	5.74	99	14.56	0.08	-27
29-Oct-12	5.94	114	13.70	0.20	13	
MW-D	10 Dec 07	5.87	116	8.95	0.5	271
	25 Feb 08	5.64	132	8.26	0.51	315
	3-Jun-08	NS	NS	NS	NS	NS
	19-Aug-08	5.91	108	10.22	0.4	182
	10-Nov-08	5.69	118	9.34	0.38	106
	3-Feb-09	5.69	116	8.43	0.32	161
	7-May-09	NS	NS	NS	NS	NS
	11-Aug-09	5.76	110	9.87	0.43	158
	11-Nov-09	5.75	92	8.72	0.26	115
	25-Feb-10	5.19	107	8.32	0.38	198
	19-May-10	5.85	90	9.13	0.30	138
	25-Aug-10	5.83	107	10.46	0.22	120
	16-Nov-10	5.85	115	9.44	0.25	157
	10-Feb-11	5.50	91	9.07	0.24	170
	6-Jul-11	NS	NS	NS	NS	NS
	25-Oct-11	5.80	116	9	0.57J	79
	26-Jan-12	5.15	102	8.44	0.73	201
	10-Apr-12	6.09	97	9.16	0.23	116
	1-Aug-12	5.56	116	10.95	0.29	94
	30-Oct-12	6.13	129	9.99	0.36	100

Well	Date	Parameter				
		pH	Conductivity (uS/cm)	Temperature (°C)	DO (mg/L)	ORP (mV)
MW-E	10-Nov-08	6.18	1,332	10.66	0.27	126
	3-Feb-09	6.44	1,379	8.29	0.42	188
	7-May-09	6.12	1,461	8.99	0.3	216
	11-Aug-09	6.39	1,435	11.14	0.39	22
	11-Nov-09	6.36	1,228	8.77	0.86	1
	25-Feb-10	6.17	1,540	8.61	0.22	74
	19-May-10	6.57	1,500	9.96	0.20	138
	25-Aug-10	6.45	1,438	12.26	0.25	50
	16-Nov-10	6.50	1,560	10.61	0.29	101
	10-Feb-11	6.33	1,436	8.23	0.31	171
	6-Jul-11	6.72	1,449	11.52	0.21	-48
	24-Oct-11	6.58	1,450	11.1	0.26	-41
	26-Jan-12	6.32	1,790	8.79	0.51	14
	11-Apr-12	6.40	1,720	8.67	0.31	104
	1-Aug-12	6.11	1,740	11.81	0.29	15
29-Dec-12	6.44	1,930	12.53	0.30	-1	
MW-F	11-Nov-08	5.45	144	9.43	0.44	140
	7-May-09	4.83	134	9.37	0.44	219
	10-Aug-09	5.46	117	11.63	1.23	293
	11-Nov-09	5.37	142	9.81	0.33	137
	25-Feb-10	4.96	277	9.07	0.78	241
	19-May-10	5.34	305	8.82	0.49	157
	25-Aug-10	5.49	151	11.08	1.63	155
	16-Nov-10	5.44	222	9.94	0.31	157
	10-Feb-11	5.23	158	8.82	0.75	171
	6-Jul-11	5.76	100	12.72	0.36	197
	25-Oct-11	5.55	157	10.65	0.41J	119
	26-Jan-12	5.34	272	9.70	0.46	122
	11-Apr-12	5.42	142	9.85	0.23	110
	1-Aug-12	5.44	118	12.29	0.17	135
	30-Oct-12	5.68	182	12.59	0.56	253

Well	Date	Parameter				
		pH	Conductivity (uS/cm)	Temperature (°C)	DO (mg/L)	ORP (mV)
Decon	16-Nov-10	6.13	105	10.12	2.98	190
	10-Feb-11	NS	NS	NS	NS	NS
	6-Jul-11	6.59	97	11.14	9.03	5
	25-Oct-11	6.14	67	11.00	3.85	75
	26-Jan-11	NS	NS	NS	NS	NS
	10-Apr-12	NS	NS	NS	NS	NS
	1-Aug-12	5.81	139	23.92	1.12	47
	30-Oct-12	6.19	42	12.40	2.36	160

Notes:

°C = degree Celsius

mg/L = milligram per liter

mV = millivolt

µS/cm = microSiemen per centimeter

DO = Dissolved oxygen

ORP = Oxidation-reduction potential

NS = Not sampled; see text for explanation

R = Rejected; correct stabilization criterion was not correctly entered into the meter to achieve three stable readings per the EMFR SAP/QAPP

J = Estimated; May 2010 DO in mg/L was not recorded on field sheet. The reported value was estimated using the nomograph in Horne and Goldman (1994) based on the observed water temperature and DO% saturation. October 2011 DO estimated; DO stabilization criterion was not correctly entered into meter to achieve three stable readings per the EMFR SAP/QAPP.

Table 2
Groundwater Monitoring Results
Dissolved Metals
East Mission Flats Repository

Well No.	Sample Date	Constituents (mg/L)				
		Antimony	Arsenic	Cadmium	Lead	Zinc
MW-A	11 Dec 07	ND	ND	0.000578J	ND	0.347J
	25 Feb 08	ND	ND	0.0012	ND	1.71J
	3-Jun-08	ND	ND	0.000763	ND	0.582
	19-Aug-08	ND	ND	0.000321	ND	0.683
	10-Nov-08	ND	ND	ND	ND	0.353
	4-Feb-09	ND	ND	0.000777	ND	0.898
	7-May-09	ND	ND	0.000382	ND	0.753
	10-Aug-09	ND	ND	0.000204	ND	0.558
	11-Nov-09	ND	ND	ND	ND	0.368
	25-Feb-10	ND	ND	0.000208	ND	0.657
	19-May-10	ND	ND	0.000225	ND	0.568
	25-Aug-10	ND	ND	0.000210	ND	0.580
	16-Nov-10	ND	ND	ND	ND	0.544J
	10-Feb-11	ND	ND	0.00039	ND	1.220J
	6-Jul-11	ND	0.0073J	0.00063	ND	1.380
	24-Oct-11	ND	ND	ND	ND	0.804
	25-Jan-12	ND	0.0074J	0.00032	ND	1.130
	10-Apr-12	ND	ND	0.00058	ND	1.750
	31-Jul-12	ND	ND	0.00046	ND	1.560
		29-Oct-12	ND	ND	0.00023	ND
MW-B	10 Dec 07	ND	ND	ND	ND	0.0243J
	25 Feb 08	ND	ND	ND	ND	0.0198J
	3-Jun-08	ND	ND	ND	ND	0.0208
	19-Aug-08	ND	ND	ND	ND	0.0244
	10-Nov-08	ND	ND	ND	ND	0.0197
	4-Feb-09	ND	ND	ND	ND	0.021
	7-May-09	ND	ND	ND	ND	0.0168
	10-Aug-09	ND	ND	ND	ND	0.016
	11-Nov-09	ND	ND	ND	ND	0.0264
	25-Feb-10	ND	ND	ND	ND	0.0153
	19-May-10	ND	ND	ND	ND	0.0157
	25-Aug-10	ND	ND	ND	ND	0.0157
	16-Nov-10	ND	ND	ND	ND	0.0187J
	10-Feb-11	ND	ND	ND	ND	0.0091J
	6-Jul-11	ND	0.0077J	ND	ND	0.0126
	24-Oct-11	ND	ND	ND	ND	0.0148J
	25-Jan-12	ND	0.0073J	ND	ND	0.018
	10-Apr-12	ND	ND	ND	ND	0.0162
	31-Jul-12	ND	ND	ND	ND	0.0142
		29-Oct-12	ND	ND	ND	ND

Well No.	Sample Date	Constituents (mg/L)				
		Antimony	Arsenic	Cadmium	Lead	Zinc
MW-C	10 Dec 07	ND	ND	0.0013J	ND	1.45J
	25 Feb 08	ND	ND	0.00318	ND	2.24J
	3-Jun-08	NS	NS	NS	NS	NS
	19-Aug-08	ND	ND	0.00111	ND	1.34
	10-Nov-08	ND	ND	0.000522	ND	1.57
	3-Feb-09	ND	ND	0.00354	ND	1.67
	7-May-09	NS	NS	NS	NS	NS
	10-Aug-09	ND	ND	0.00229	ND	1.45
	11-Nov-09	ND	ND	0.00144	ND	2.03
	25-Feb-10	ND	ND	0.00326	ND	2.02
	19-May-10	ND	ND	0.00346	ND	2.00
	25-Aug-10	ND	ND	0.00364	ND	1.86
	16-Nov-10	ND	ND	0.0029	ND	1.930J
	10-Feb-11	NS	NS	NS	NS	NS
	6-Jul-11	NS	NS	NS	NS	NS
	24-Oct-11	ND	ND	0.00072	ND	1.360
	25-Jan-12	ND	0.0074J	0.0049	ND	1.710
	10-Apr-12	ND	ND	0.00089	ND	0.388
	31-Jul-12	ND	ND	0.00025	ND	1.080
		29-Oct-12	ND	ND	ND	ND
MW-C Deep	25-Feb-10	ND	ND	ND	ND	0.0113
	19-May-10	ND	ND	ND	ND	ND
	25-Aug-10	ND	ND	ND	ND	0.0317
	16-Nov-10	ND	ND	ND	ND	0.0216J
	10-Feb-11	NS	NS	NS	NS	NS
	6-Jul-11	NS	NS	NS	NS	NS
	24-Oct-11	ND	ND	ND	ND	0.0167
	25-Jan-12	ND	0.0075J	ND	ND	0.0191
	10-Apr-12	ND	0.0042J	ND	ND	0.154
	31-Jul-12	ND	ND	ND	ND	0.0116
	29-Oct-12	ND	ND	ND	ND	ND

Well No.	Sample Date	Constituents (mg/L)				
		Antimony	Arsenic	Cadmium	Lead	Zinc
MW-D	10 Dec 07	ND	ND	ND	ND	0.0326J
	25 Feb 08	ND	ND	ND	ND	0.0285J
	3-Jun-08	NS	NS	NS	NS	NS
	19-Aug-08	ND	ND	ND	ND	1.32
	10-Nov-08	ND	ND	ND	ND	0.0794
	3-Feb-09	ND	ND	ND	ND	0.0531
	7-May-09	NS	NS	NS	NS	NS
	11-Aug-09	ND	ND	ND	ND	0.0918
	11-Nov-09	ND	ND	ND	ND	0.103
	25-Feb-10	ND	ND	ND	ND	0.0352
	19-May-10	ND	ND	ND	ND	0.105
	25-Aug-10	ND	ND	ND	ND	0.109
	16-Nov-10	ND	ND	ND	ND	0.0563J
	10-Feb-11	ND	ND	ND	ND	0.127J
	6-Jul-11	NS	NS	NS	NS	NS
	25-Oct-11	ND	ND	ND	ND	0.0395
	26-Jan-12	ND	0.0079J	ND	ND	0.0584
	10-Apr-12	ND	ND	ND	ND	0.184
	1-Aug-12	ND	ND	ND	ND	0.112
		30-Oct-12	ND	ND	ND	ND
MW-E	10 Nov 08	ND	0.0148	ND	ND	0.0141
	3-Feb-09	ND	ND	ND	ND	ND
	7-May-09	ND	0.0035	ND	ND	0.00889
	11-Aug-09	ND	0.0195	ND	ND	0.00848
	11-Nov-09	ND	0.0232	ND	ND	0.00671
	25-Feb-10	ND	ND	ND	ND	0.00599
	19-May-10	ND	0.00447	ND	ND	0.00633
	25-Aug-10	ND	0.0172	ND	ND	0.00687
	16-Nov-10	ND	0.0177	ND	ND	0.0069J
	10-Feb-11	ND	ND	ND	ND	ND
	6-Jul-11	ND	0.0074J	ND	ND	ND
	24-Oct-11	ND	0.020	ND	ND	ND
	26-Jan-12	ND	0.0069J	ND	ND	ND
	11-Apr-12	ND	ND	ND	ND	0.0063 J
	1-Aug-12	ND	0.0063	ND	ND	0.0064
	29-Oct-12	ND	0.0149	ND	ND	0.0071J

Well No.	Sample Date	Constituents (mg/L)				
		Antimony	Arsenic	Cadmium	Lead	Zinc
MW-F	11-Nov-08	ND	ND	0.0002	ND	1.58
	3-Feb-09	ND	ND	0.000304	ND	1.16
	7-May-09	ND	ND	0.000258	ND	1.32
	10-Aug-09	ND	ND	0.00023	ND	1.12
	11-Nov-09	ND	ND	0.000464	ND	2.53
	25-Feb-10	ND	ND	0.000947	ND	3.82
	19-May-10	ND	ND	0.00132	ND	4.47
	25-Aug-10	ND	ND	0.000436	ND	1.93
	16-Nov-10	ND	ND	ND	ND	3.370J
	10-Feb-11	ND	ND	0.00045	ND	1.840J
	6-Jul-11	ND	0.0056J	ND	ND	0.976
	25-Oct-11	ND	ND	0.00031	ND	1.690
	26-Jan-12	ND	0.0041J	0.00094	ND	3.100
	11-Apr-12	ND	ND	0.00031	ND	1.630
	1-Aug-12	ND	ND	ND	ND	1.330
	30-Oct-12	ND	ND	0.00043	ND	1.730J
Decon Well	16-Nov-10	ND	ND	ND	ND	0.504J
	10-Feb-11	NS	NS	NS	NS	NS
	6-Jul-11	ND	0.0068J	ND	ND	0.407
	25-Oct-11	ND	ND	ND	ND	0.449
	26-Jan-12	NS	NS	NS	NS	NS
	10-Apr-12	NS	NS	NS	NS	NS
	1-Aug-12	ND	0.055	ND	ND	5.62
		30-Oct-12	ND	ND	ND	ND
Reporting Limit ^a		0.003	0.003	0.0002	0.003	0.0053
Regulatory Threshold		0.006 ^b	0.01 ^b	0.005 ^b	0.015 ^b	5.0 ^c

Notes:

mg/L = milligrams per liter

ND = Not detected above reporting limit

NS = Not sampled; see text for explanation

J = Reported concentration is an estimate based on data quality review

a. Reporting Limit (RL) baseline provided; however, RL is higher if a sample dilution is necessary.

Method reporting limit was used through August 2010; contract required quantitation limit used November 2010 and after.

b. National Primary Drinking Water Regulation (Maximum Contaminant Level)

c. National Secondary Drinking Water Regulation

= Value exceeds the regulatory threshold

Attachment A

Field Sheets



Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: <i>Decon Well</i>
Project Number:	Sample ID: <i>(Decon Well) 103012</i>
Location: <i>EF EMFR</i>	Weather: <i>overcast 54°F</i>
Date: <i>10/30/12</i>	Sampler(s): <i>GM, CJL</i>

Depth to Bottom (ft): <i>74.28</i>	Purge Time:								
Depth to Water (ft): <i>27.71</i>	Purge Method: <i>Grab 5.3 Well Vol</i>								
DTB-DTW (ft):	Volume Measurement Method:								
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):								
<table border="1"> <tr> <td>Conversion Factors (height x factor = 1 well volume)</td> <td>¾" diameter 0.023</td> <td>1" diameter 0.041</td> <td>1 ½" diameter 0.092</td> <td>2" diameter 0.163</td> <td>4" diameter 0.652</td> <td>6" diameter 1.469</td> <td>8" diameter 2.611</td> </tr> </table>	Conversion Factors (height x factor = 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611	
Conversion Factors (height x factor = 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611		

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (mS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	<i>00:00</i>	<i>6.19</i>	<i>0.042</i>	<i>12.40</i>	<i>2.36</i>	<i>23.3</i>	<i>160</i>

Sampling Date:	Sampling Method:	Time Sampled: <i>13:22</i>																																			
<table border="1"> <tr> <th>Container</th> <th>Volume</th> <th>Preservative</th> <th>Cooled</th> <th>Filtered</th> <th>Analyte</th> <th>Lab Identification</th> </tr> <tr> <td>Poly</td> <td>1 L</td> <td>HNO₃</td> <td>Y</td> <td>Y</td> <td>DM & Dissolved Cations</td> <td>CLP or USEPA Lab</td> </tr> <tr> <td>Poly</td> <td>1 L</td> <td>HNO₃</td> <td>Y</td> <td>N</td> <td>TM, Hard, & TP</td> <td>CLP or USEPA Lab</td> </tr> <tr> <td>Poly</td> <td>500 mL</td> <td>---</td> <td>Y</td> <td>Y</td> <td>Dissolved Anions</td> <td>Local Analytical Lab</td> </tr> <tr> <td>Poly</td> <td>500 mL</td> <td>---</td> <td>Y</td> <td>N</td> <td>Alk</td> <td>Local Analytical Lab</td> </tr> </table>	Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification	Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab	Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab	Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab	Poly	500 mL	---	Y	N	Alk	Local Analytical Lab		
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification																															
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab																															
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab																															
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab																															
Poly	500 mL	---	Y	N	Alk	Local Analytical Lab																															

Chain-of-Custody: Yes/No	Duplicate Sample Number:
Chain-of-Custody Number:	Replicate Sample Number:

Notes: *Grab Sample*
Field Blank: CLP (Decon Well) 103012-FB } 13:35
SVL (Decon Well) 103012-E } Collected at 13:35
CJL 10/30/12



TerraGraphics

Environmental Engineering, Inc.

Groundwater Sampling Record

Project:	EMF Water Monitoring	Well ID:	07-EMF-MW-D
Project Number:		Sample ID:	(07-EMF-MW-D)/03012
Location:	EMFR	Weather:	Overcast 50°F
Date:	10/30/12	Sampler(s):	GIM, C/JL

Depth to Bottom (ft):				30.38				Purge Time:		16:00	
Depth to Water (ft):				10.14				Purge Method:		Low Flow	
DTB-DTW (ft):								Volume Measurement Method:			
1 Well Volume (gal):								Purge Volume (Volume x 3) (gal):			
Conversion Factors (height x factor= 1 well volume)		¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611			

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (mS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	6.24	0.101	10.66	6.82	63.6	160
	12:00	6.12	0.131	10.00	0.42	4.0	101
	14:00	6.11	0.130	10.00	0.39	3.7	101
	16:00	6.13	0.129	9.99	0.36	3.5	100

Sampling Date:		10/30/12		Sampling Method:		LF		Time Sampled:		11:50	
Container	Volume	Preservative	Cooled	Filtered	Analyte		Lab Identification				
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations		CLP or USEPA Lab				
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP		CLP or USEPA Lab				
Poly	500 mL	---	Y	Y	Dissolved Anions		Local Analytical Lab				
Poly	500 mL	---	Y	N	.Alk		Local Analytical Lab				

Chain-of-Custody: Yes/No Duplicate Sample Number:

Chain-of-Custody Number: Replicate Sample Number:

Notes:



TerraGraphics

Environmental Engineering, Inc.

Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: 08-EMF-MW-F
Project Number: 2508-02	Sample ID: (08-EMF-MW-F)103012
Location: EMFR	Weather: overcast 48°F
Date: 10/30/12	Sampler(s): G.M., C.J.L.

Depth to Bottom (ft): 31.66	Purge Time: 12:00								
Depth to Water (ft): 11.80	Purge Method: Low Flow								
DTB-DTW (ft):	Volume Measurement Method:								
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):								
<table border="1"> <tr> <td>Conversion Factors (height x factor= 1 well volume)</td> <td>¾" diameter 0.023</td> <td>1" diameter 0.041</td> <td>1 ½" diameter 0.092</td> <td>2" diameter 0.163</td> <td>4" diameter 0.652</td> <td>6" diameter 1.469</td> <td>8" diameter 2.611</td> </tr> </table>	Conversion Factors (height x factor= 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611	
Conversion Factors (height x factor= 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611		

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (mS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	6.85	0.134	12.46	7.55	76.7	256
	8:00	5.67	0.182	12.51	0.69	7.0	252
	10:00	5.70	0.182	12.56	0.61	6.3	251
	12:00	5.68	0.182	12.59	0.56	5.7	253

Sampling Date: 10/30/12	Sampling Method: LF	Time Sampled: 10:55				
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab
Poly	500 mL	---	Y	N	Alk	Local Analytical Lab

Chain-of-Custody: Yes/No Duplicate Sample Number: ~~(08-EMF-MW-F)103012-DUP~~ for CLP 10/30/12
 Chain-of-Custody Number: Replicate Sample Number:

Notes: Duplicates: for CLP - (08-EMF-MW-F)103012-DUP
 For SVL - (08-EMF-MW-F)103012-C



TerraGraphics
Environmental Engineering, Inc.

Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: OB-EMF-MW-E
Project Number:	Sample ID: (OB-EMF-MW-E)102912
Location: EMFR	Weather: Cloudy 59°F
Date: 10/29/12	Sampler(s): GM, CL

Depth to Bottom (ft): 27.43	Purge Time: 10:00						
Depth to Water (ft): 8.30	Purge Method: Low Flow						
DTB-DTW (ft):	Volume Measurement Method:						
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):						
Conversion Factors (height x factor = 1 well volume)	3/4" diameter 0.023	1" diameter 0.041	1 1/2" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (MS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	6.39	1.83	12.56	5.35	54.8	57
	06:00	6.43	1.93	12.34	0.47	4.8	6
	08:00	6.41	1.93	12.56	0.35	3.6	2
	10:00	6.44	1.93	12.53	0.30	3.0	-1

Sampling Date: 10/29/12	Sampling Method: LF	Time Sampled: 15:00				
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab
Poly	500 mL	---	Y	N	.Alk	Local Analytical Lab

Chain-of-Custody: Yes/No	Duplicate Sample Number:
Chain-of-Custody Number:	Replicate Sample Number:

Notes:

*** FINAL DRAW DOWN: 9.31 FT**



TerraGraphics

Environmental Engineering, Inc.

Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: 07-EMF-MW-C-DEEP
Project Number:	Sample ID: (07-EMF-MW-C-DEEP)102912
Location: EMFL	Weather: CLOUDY 58°F
Date: 10/29/12	Sampler(s): GM, CL

Depth to Bottom (ft): 98.15	Purge Time: 8:00								
Depth to Water (ft): 9.50	Purge Method: LOW FLOW								
DTB-DTW (ft):	Volume Measurement Method:								
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):								
<table border="1"> <tr> <td>Conversion Factors (height x factor= 1 well volume)</td> <td>¾" diameter 0.023</td> <td>1" diameter 0.041</td> <td>1 ½" diameter 0.092</td> <td>2" diameter 0.163</td> <td>4" diameter 0.652</td> <td>6" diameter 1.469</td> <td>8" diameter 2.611</td> </tr> </table>	Conversion Factors (height x factor= 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611	
Conversion Factors (height x factor= 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611		

Purged Volume (gal)	Time	pH	Spec. Cond. (MS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	6.38	0.107	14.85	2.87	30.8	-6
	04:00	6.04	0.112	13.75	0.35	3.6	7
	06:00	5.99	0.113	13.72	0.26	2.7	11
	08:00	5.94	0.114	13.70	0.20	2.1	13

Sampling Date: 10/29/12	Sampling Method: LF	Time Sampled: 14:10				
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab
Poly	500 mL	---	Y	N	.Alk	Local Analytical Lab

Chain-of-Custody: Yes/No	Duplicate Sample Number:
Chain-of-Custody Number:	Replicate Sample Number:

Notes:



TerraGraphics

Environmental Engineering, Inc.

Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: 07-EMF-MW-C
Project Number:	Sample ID: (07-EMF-MW-C)102912
Location: EMFR	Weather: Cloudy 58°F
Date: 10/29/12	Sampler(s): GM, CL

Depth to Bottom (ft): 30.35	Purge Time: 8:00						
Depth to Water (ft): 9.55	Purge Method: Low Flow						
DTB-DTW (ft):	Volume Measurement Method:						
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):						
Conversion Factors (height x factor = 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (MS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	5.76	0.073	14.68	4.67	49.8	186
	04:00	5.57	0.100	14.27	0.37	3.9	150
	06:00	5.60	0.101	14.23	0.26	2.8	144
	08:00	5.62	0.102	14.22	0.20	2.2	136

Sampling Date: 10/29/12	Sampling Method: LF	Time Sampled: 13:40				
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab
Poly	500 mL	---	Y	N	.Alk	Local Analytical Lab

Chain-of-Custody: Yes/No	Duplicate Sample Number:
Chain-of-Custody Number:	Replicate Sample Number:

Notes:



TerraGraphics

Environmental Engineering, Inc.

Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: 07-EMF-MW-B
Project Number:	Sample ID: (07-EMF-MW-B) 102912
Location: EMFR	Weather: CLOUDY 54°F
Date: 10/29/12	Sampler(s): GM, CL

Depth to Bottom (ft): 30.34	Purge Time: 14:00								
Depth to Water (ft): 12.08	Purge Method: Low Flow								
DTB-DTW (ft):	Volume Measurement Method:								
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):								
<table border="1"> <tr> <td>Conversion Factors (height x factor= 1 well volume)</td> <td>¾" diameter 0.023</td> <td>1" diameter 0.041</td> <td>1 ½" diameter 0.092</td> <td>2" diameter 0.163</td> <td>4" diameter 0.652</td> <td>6" diameter 1.469</td> <td>8" diameter 2.611</td> </tr> </table>	Conversion Factors (height x factor= 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611	
Conversion Factors (height x factor= 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611		

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (MS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	6.54	0.053	15.19	6.41	69.1	150
	12:00	5.53	0.083	15.89	0.46	5.0	202
	14:00	5.45	0.083	15.73	0.41	4.5	206
	16:00	5.52	0.082	15.71	0.43	4.7	204

Sampling Date: 10/29/12		Sampling Method: LF		Time Sampled: 12:25			
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification	
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab	
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab	
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab	
Poly	500 mL	---	Y	N	Alk	Local Analytical Lab	

Chain-of-Custody: Yes/No	Duplicate Sample Number:
Chain-of-Custody Number:	Replicate Sample Number:

Notes:



TerraGraphics
Environmental Engineering, Inc.

MS/MSD

Groundwater Sampling Record

Project: EMF Water Monitoring	Well ID: 07-EMF-MW-A
Project Number:	Sample ID: (07-EMF-MW-A) 102912
Location: EMFR	Weather: CLOUDY 55°F
Date: 10/29/12	Sampler(s): GM, CL

Depth to Bottom (ft): 29.60	Purge Time: 14:00						
Depth to Water (ft): 14.35	Purge Method: Low Flow						
DTB-DTW (ft):	Volume Measurement Method:						
1 Well Volume (gal):	Purge Volume (Volume x 3) (gal):						
Conversion Factors (height x factor = 1 well volume)	¾" diameter 0.023	1" diameter 0.041	1 ½" diameter 0.092	2" diameter 0.163	4" diameter 0.652	6" diameter 1.469	8" diameter 2.611

GROUNDWATER DATA

Purged Volume (gal)	Time	pH	Spec. Cond. (µS/cm)	Temp (°C)	Dissolved Oxygen		ORP (mV)
					mg/L	%	
	00:00	5.92	0.216	10.70	6.63	64.7	210
	10:00	5.43	0.183	10.34	0.68	6.6	156
	12:00	5.43	0.183	10.31	0.59	5.7	156
	14:00	5.39	0.182	10.35	0.52	5.0	157

Sampling Date: 10/29/12	Sampling Method: LF	Time Sampled: 11:40				
Container	Volume	Preservative	Cooled	Filtered	Analyte	Lab Identification
Poly	1 L	HNO ₃	Y	Y	DM & Dissolved Cations	CLP or USEPA Lab
Poly	1 L	HNO ₃	Y	N	TM, Hard, & TP	CLP or USEPA Lab
Poly	500 mL	---	Y	Y	Dissolved Anions	Local Analytical Lab
Poly	500 mL	---	Y	N	Alk	Local Analytical Lab

Chain-of-Custody: Yes/No	Duplicate Sample Number:
Chain-of-Custody Number:	Replicate Sample Number:

Notes:

Attachment B

CLP Analytical Results

Attachment C

SVL Analytical Results

CASE	SDG	EPASAMP	LABID	MATRIX	QCCODE	SMPQUAL	ANDATE	ANTIME	CASNUM	ANALYTE	STATE	CONC	UNITS	RLIMIT	MDL	LABQUAL	IDEQQUAL	COMBQUAL	SMPDATE	VALDQAL	PRPDATE	LRDATE	LEVEL	PERSOLD	SMPTWTVL	FINLVL	METHOD	STATLOC	PERCENT_RECTRUE_VALUE	RPD
W244211	W2J0706	(DECON WELL W2J0706-05		WATER	FLD	.	11/2/2012	11:04	471341	(HCO:Alkalinity-HCC Total		1 mg/L		1 .		U	U	10/30/2012 .		11/2/2012	11/9/2012	LOW	0	50		50 SM 23208/23 (DECON WELL		.	.	
W244211	W2J0706	(DECON WELL W2J0706-05		WATER	FLD	.	11/2/2012	11:04	471341	(ALK:Alkalinity-Totc Total		1 mg/L		1 .		U	U	10/30/2012 .		11/2/2012	11/9/2012	LOW	0	50		50 SM 23208/23 (DECON WELL		.	.	

Highlighted columns IDEQQUAL and COMBQUAL entered by TerraGraphics to indicate IDEQ/TG and combined data qualifiers.
 Entire electronic data deliverable is available upon request.