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TECHNICAL MEMORANDUM

To: Andy Mork, IDEQ, Boise

From: Robin Nimmer, TerraGraphics, Moscow
Don Vernon, TerraGraphics, Boise

Date: March 23, 2011

Subject: Fourth Quarter 2010 Groundwater Monitoring at
East Mission Flats Repository

Job Code: 2011-6340-20

This technical memorandum summarizes the data collected during the Fourth Quarter Groundwater Sampling Event at the East Mission Flats (EMF) Repository. Groundwater sampling activities were conducted on November 16, 2010.

General

The EMF site is located approximately two miles west of Cataldo, Idaho east of Exit 39 off of Interstate-90 (Figure 1). Samples were collected from seven EMF monitoring wells, 07-EMF-MW-A, 07-EMF-MW-B, 07-EMF-MW-C, 09-EMF-MW-C Deep, 07-EMF-MW-D, 08-EMF-MW-E, and 08-EMF-MW-F. In addition, groundwater samples were collected from the decontamination (Decon) well, which was sampled for the first time in a quarterly sampling event (Figure 2). Guidelines for groundwater sampling activities were set forth in 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 EMF SAP/QAPP.

Field parameters measured include pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential. Field parameters were recorded on field sheets (Appendix A) and are listed in Table 1. Depth to water was also measured in the monitoring wells. Figure 2 depicts groundwater elevation contours based on measurements from all EMF monitoring wells with the exception of MW-C-Deep and MW-E.

Forty-two (42) groundwater samples were collected from the eight sites, including 10 quality assurance/quality control (QA/QC) samples. All groundwater monitoring wells at EMF were sampled with dedicated low-flow pumps. The Decon well was sampled using the dedicated production pump.

Samples were analyzed by two different laboratories as guided by the EMF SAP/QAPP. Samples were analyzed through the Contract Laboratory Program for the following constituents:

dissolved calcium (Ca) and magnesium (Mg) by EPA 200.7 or ISM01.2; dissolved potassium (K) and sodium (Na) by EPA 200.7 or ISM01.2; total and dissolved antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb), and zinc (Zn) by EPA 200.8 or ISM01.2; total hardness by SM2340B or ISM01.2; and total phosphorus (P) by 200.7 or ISM01.2. The data validation reports are included as Appendix B. Samples were analyzed at SVL Analytical, Inc. (SVL) in Kellogg, Idaho for the following constituents: dissolved chloride (Cl), nitrate (NO₃-N), and sulfate (SO₄) by EPA 300.0 and total alkalinity by SM2320B. This report focuses on the dissolved metal concentrations. The SVL Analytical data report is included as Appendix C.

Groundwater Quality Results

One or more dissolved metals were found in each of groundwater samples collected during the Fourth Quarter Sampling Event. Cumulative groundwater sampling results for dissolved metals are summarized in Table 2; the following discussion focuses on the November analysis results. Dissolved antimony and lead concentrations were below the reporting limits at all eight locations. Dissolved arsenic was only detected in MW-E with a concentration of 0.0177 mg/L, which is above the regulatory threshold. Dissolved cadmium was detected at MW-C with a concentration of 0.0029 mg/L. Dissolved zinc was detected above the reporting limit at all eight locations; the data are qualified as estimates biased low based on the Stage 4A data validation. The highest zinc concentration was 3.370 mg/L measured at MW-F, off-site and about 700 feet down gradient from the property boundary.

Monitoring Well, Cataldo River Stage, and Surface Stage Hydrographs

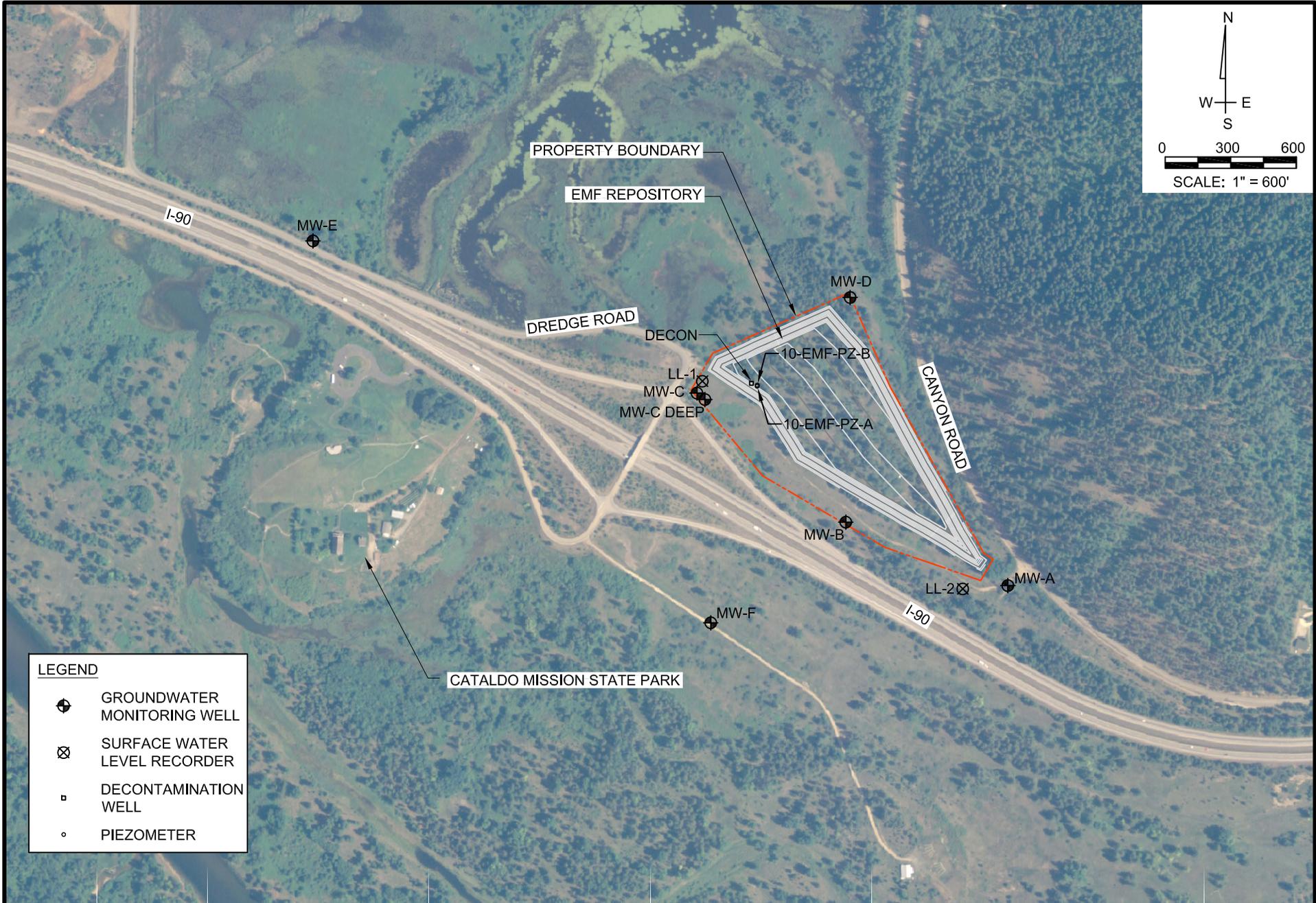
Currently, dataloggers set to record water levels are installed in five groundwater monitoring wells at EMF (MW-A, -B, -C, -C Deep, and -D). The dataloggers in MW-B and MW-D were installed on February 4, 2009. The dataloggers in MW-A and -C were installed on December 14, 2009, and the datalogger in MW-C Deep was installed on February 23, 2010. Dataloggers are downloaded on a quarterly basis. Water level elevations recorded since October 2009 are provided in the attached hydrograph (Figure 3). River stage data for USGS Gage Station 12413500 on the Coeur d'Alene River near Cataldo, Idaho are included on the hydrograph for comparison. Figure 3 shows the hydrographs of the water levels recorded at the five monitoring wells and from the USGS river gage at Cataldo for the period of record.

In addition to the dataloggers installed in the monitoring wells, two dataloggers have been installed at the EMF site to record standing water levels in low areas prone to seasonal inundation. The surface water monitor locations are identified on Figure 2 as LL-1 and LL-2.

The dataloggers were downloaded as part of the sampling activities. The data indicate no standing water in LL-1 during the fourth quarter monitoring period. The dataset from LL-2 was incomplete due to a programming oversight and did not cover the entire quarter; however, this datalogger has not been submerged at any time during the entire period the record. The datalogger was reprogrammed on November 1st and was functioning properly. The available data from November 1st through the 16th indicate no standing water at LL-2.

References

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.



LEGEND	
	GROUNDWATER MONITORING WELL
	SURFACE WATER LEVEL RECORDER
	DECONTAMINATION WELL
	PIEZOMETER

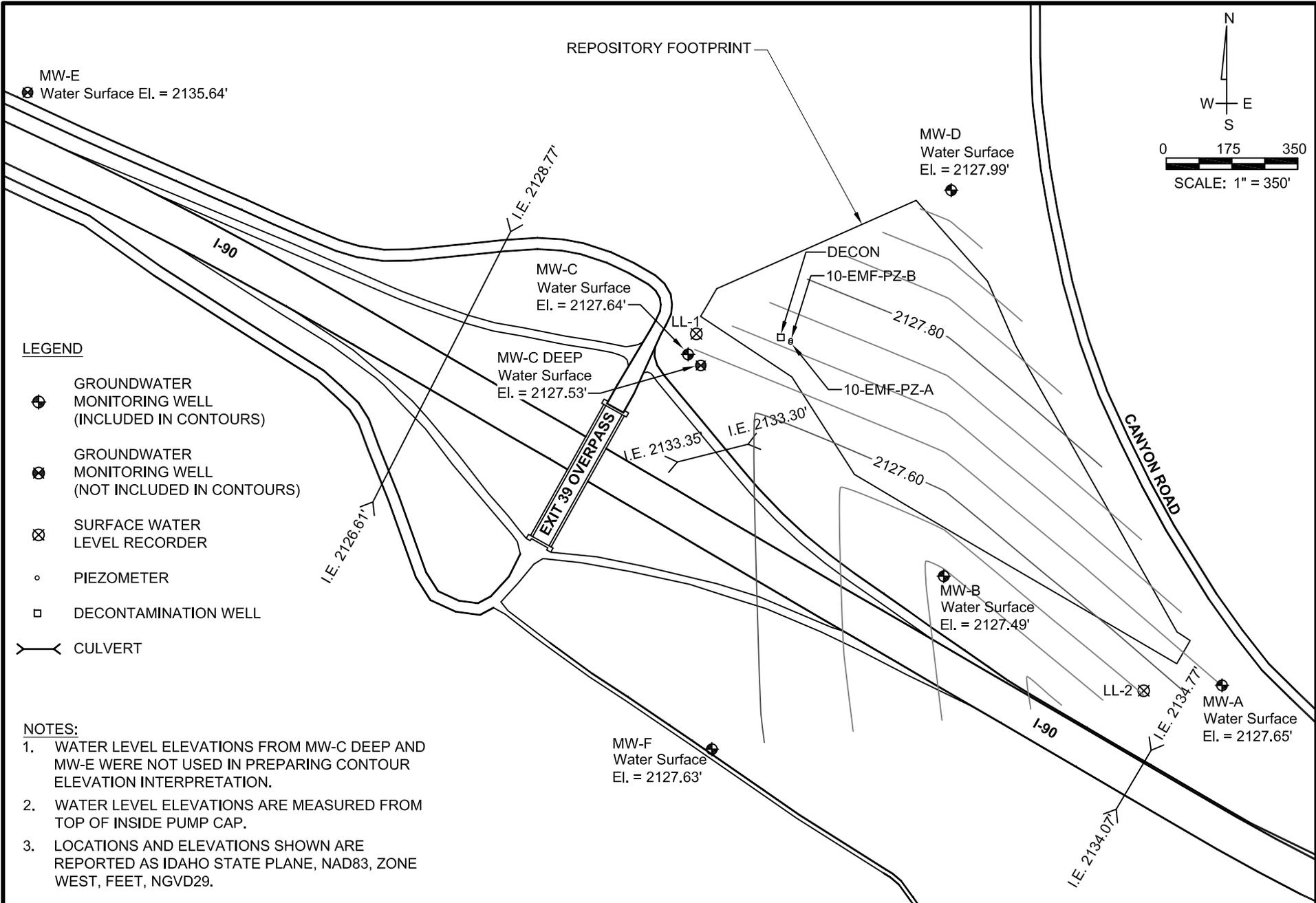
SCALE:	1" = 600' (8.5x11 PRINT)
DRAWN BY:	C.HALEY
ENGINEER:	S.BARKER



EAST MISSION FLATS
CATALDO, IDAHO

FIGURE 1
EMF REPOSITORY SITE

PROJECT NO:	2010-2A-6340-20
DATE:	1/27/2011
FILE NAME:	emf_gw_nov2010_012711.dwg



LEGEND

- ⊕ GROUNDWATER MONITORING WELL (INCLUDED IN CONTOURS)
- ⊗ GROUNDWATER MONITORING WELL (NOT INCLUDED IN CONTOURS)
- ⊠ SURFACE WATER LEVEL RECORDER
- PIEZOMETER
- DECONTAMINATION WELL
- CULVERT

NOTES:

1. WATER LEVEL ELEVATIONS FROM MW-C DEEP AND MW-E WERE NOT USED IN PREPARING CONTOUR ELEVATION INTERPRETATION.
2. WATER LEVEL ELEVATIONS ARE MEASURED FROM TOP OF INSIDE PUMP CAP.
3. LOCATIONS AND ELEVATIONS SHOWN ARE REPORTED AS IDAHO STATE PLANE, NAD83, ZONE WEST, FEET, NGVD29.

SCALE: 1" = 350' (8.5x11 PRINT)
DRAWN BY: C.HALEY
ENGINEER: S.BARKER



EAST MISSION FLATS
CATALDO, IDAHO

FIGURE 2
NOVEMBER 2010 GROUNDWATER
LEVEL ELEVATIONS AND CONTOURS

PROJECT NO: 2010-2A-6340-20
DATE: 1/27/2011
FILE NAME: emf gw_nov2010_012711.dwg

Figure 3. Water Levels at EMF Repository Monitoring Wells Compared to River Stage at Cataldo

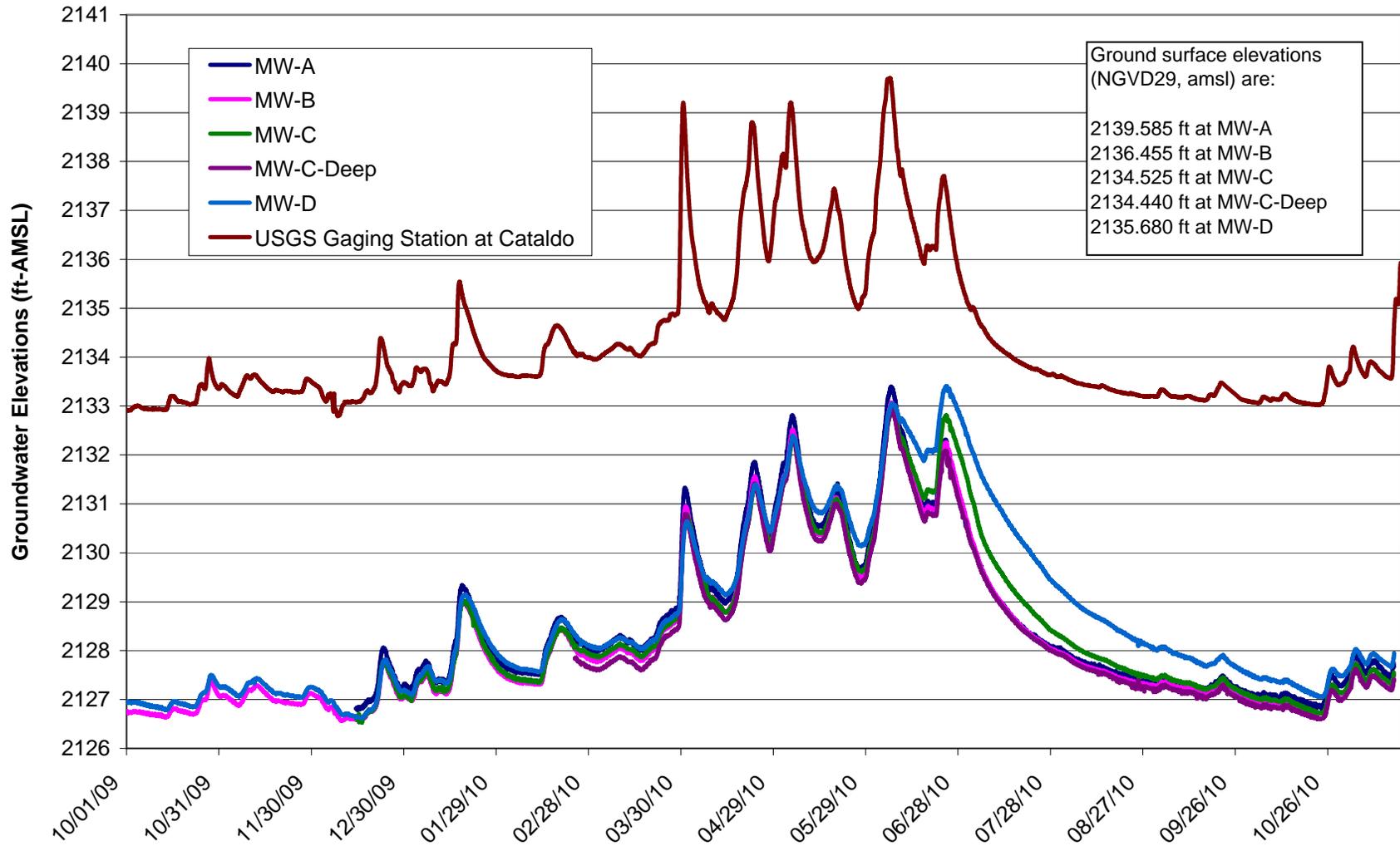


Table 1
Field Parameter Data
East Mission Flats Repository

Well	Date	Parameter				
		pH	Conductivity ¹	Temperature ²	DO ³	ORP ⁴
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
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	5.6	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	5.4	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
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 ⁵	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
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

Well	Date	Parameter				
		pH	Conductivity ¹	Temperature ²	DO ³	ORP ⁴
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
	MW-E	10-Nov-08	6.18	1,332	10.66	0.27
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	
MW-F	11-Nov-08	5.45	144	9.43	0.44	140
	3-Feb-09	5.45	133	9.16	0.5	177
	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
Decon	16-Nov-10	6.13	105	10.12	2.98	190

Notes:

1. Conductivity as measured in microSiemens per centimeter
2. Temperature in degrees Celsius
3. DO = Dissolved oxygen, in milligrams per liter
4. ORP = Oxidation reduction potential, in millivolts
5. NS = Not sampled due to high surface water level at well location
6. J = Estimated; 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.

Table 2
Groundwater Monitoring Results
Dissolved Metals
East Mission Flats Repository

All results in milligrams per liter (mg/L)

Well No.	Sample Date	Constituents				
		Antimony	Arsenic	Cadmium	Lead	Zinc
MW-A	11 Dec 07	ND ¹	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
	MW-B	10 Dec 07	ND	ND	ND	ND
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
MW-C		10 Dec 07	ND	ND	0.0013J	ND
	25 Feb 08	ND	ND	0.00318	ND	2.24J
	3-Jun-08	NS ²	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
	MW-C Deep	25-Feb-10	ND	ND	ND	ND
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

Well No.	Sample Date	Constituents				
		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
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
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
Decon	16-Nov-10	ND	ND	ND	ND	0.504J
Reporting Limit		0.003	0.003	0.0002	0.003	0.0053
Regulatory Threshold		0.006 ⁴	0.01 ⁴	0.005 ⁴	0.015 ⁴	5.0 ⁵

Notes

1. ND - Not detected above method reporting limit
 2. NS - Not sampled due to high surface water level at well location
 3. Reporting Limit (RL) baseline provided; however, RL is higher if a sample dilution is necessary
 4. MCL - Maximum Contaminant Level
 5. NSDWR - National Secondary Drinking Water Regulation
- J** - Reported concentration an estimate based on data quality review

= Value exceeds MCL